

# QUICK SOLAR ESTIMATES

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What

# *Should I consider getting solar panels?*

Non-expert

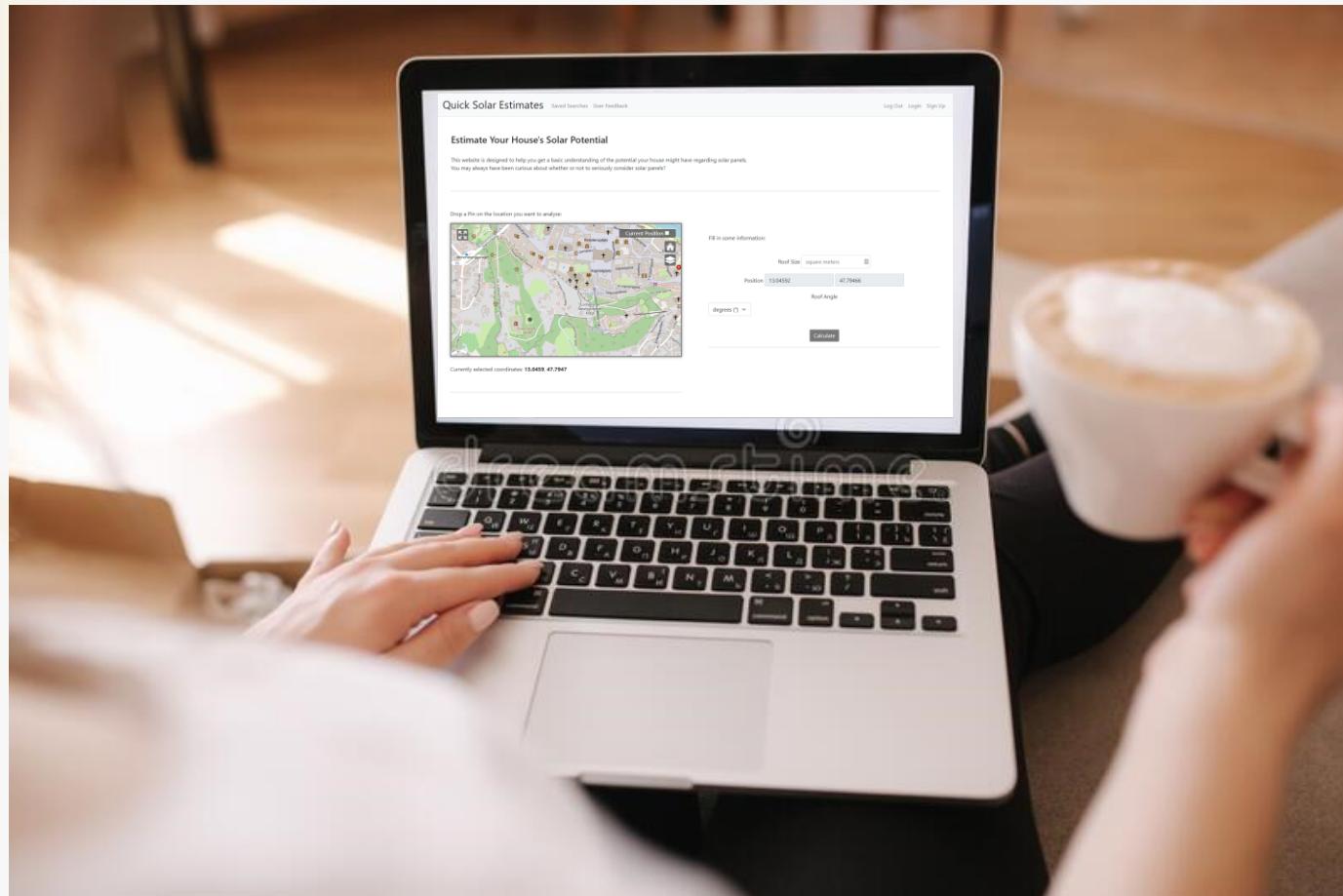


What

*I know where I live* ✓

*I can make a good guess  
about my roof angle* ✓

'click'  
'click'  
'click'



# Why

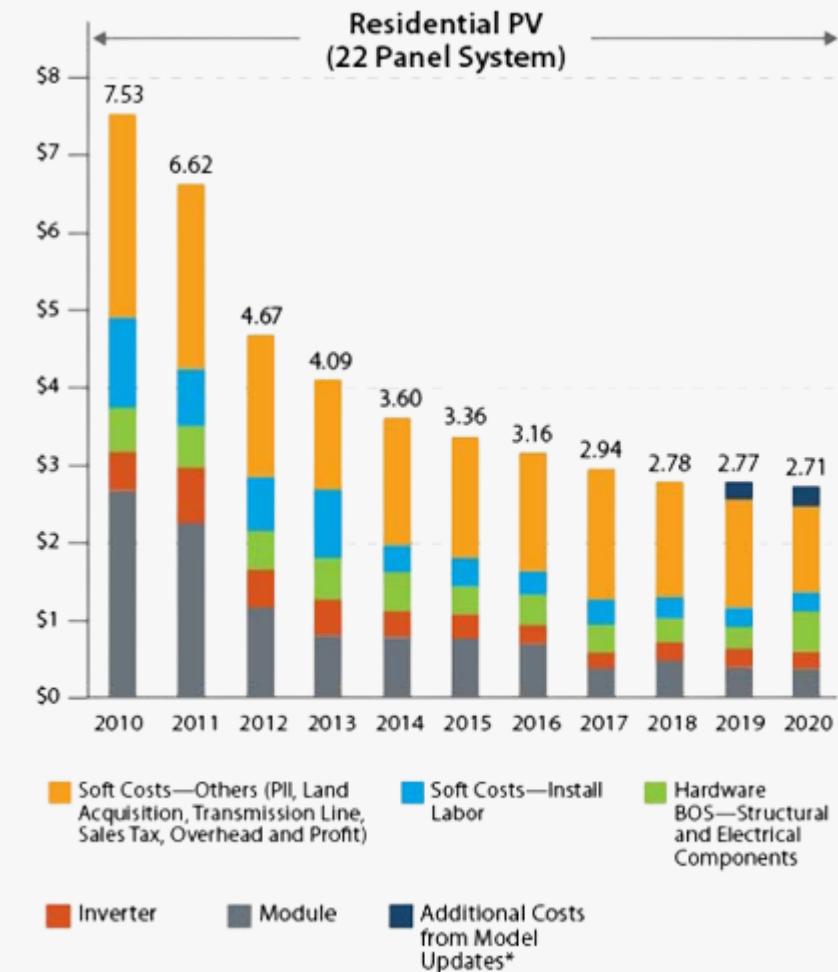
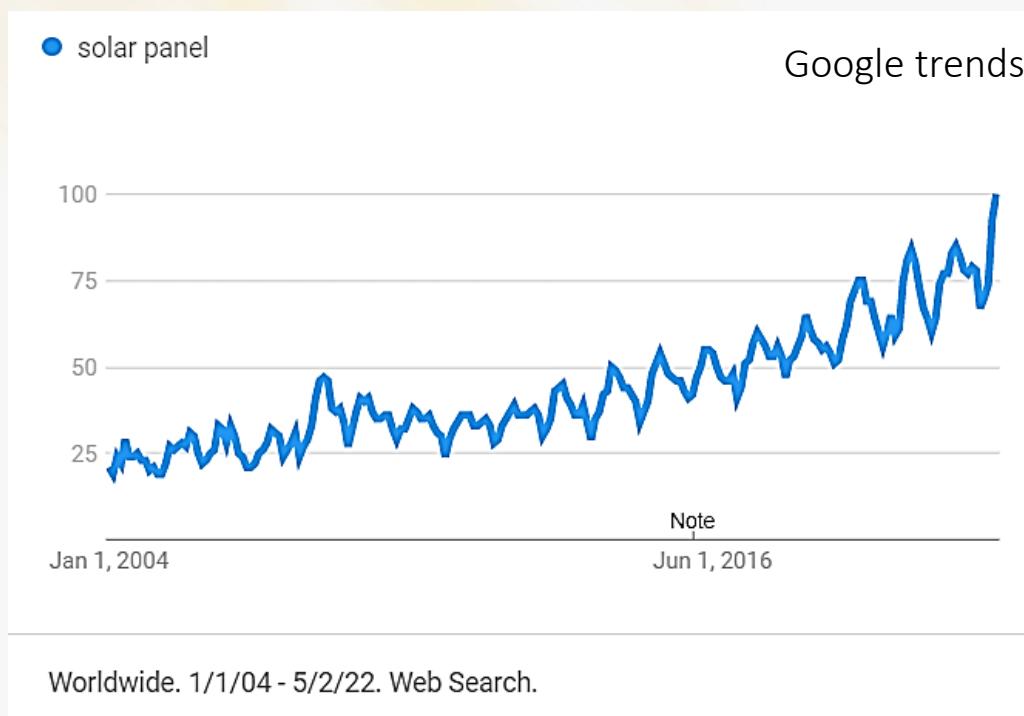
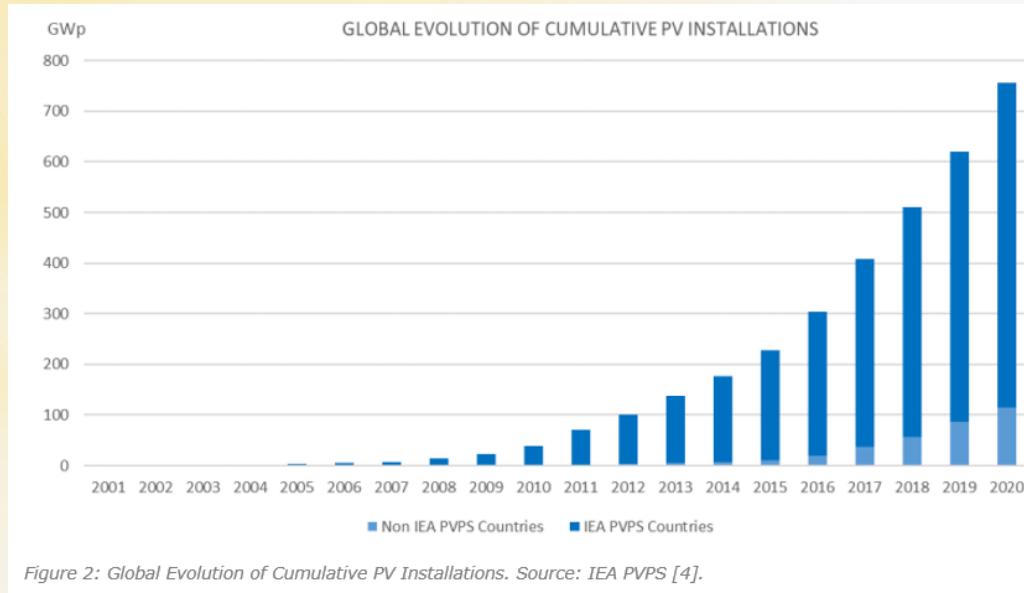


Figure 1: Cost of PV Modules 2010 - 2020.



# Why

Solar resource data site (INTL) SALZBURG, AUSTRIA 3.1 mi

**Resource Data Map**

The blue rectangle on the map indicates the NREL NSRDB grid cell for your location. If your location is outside the NSRDB area, the map shows a pin for the nearest available NREL International data site instead of a rectangle. If you want to use data for a different NSRDB grid cell, double-click the map to move the rectangle. Dragging the rectangle will not move it. Use the Legacy Data Options check boxes to show pins for legacy data sites. Click a legacy data pin to use legacy data instead of the recommended NSRDB data. See [Help](#) for details.

**SYSTEM INFO**

Modify the inputs below to run the simulation.

DC System Size (kW): 4  
Module Type: Standard  
Array Type: Fixed (open rack)  
System Losses (%): 14.08  
Tilt (deg): 20  
Azimuth (deg): 180

+ Advanced Parameters

**RETAIL ELECTRICITY RATE**

To automatically download an average annual retail electricity rate for your location, choose a rate type (residential or commercial). You can change the rate to use a different value by typing a different number.

Rate Type: Residential  
Rate (\$/kWh): No Default - Enter Value

**RESULTS**

Print Results

3,756 kWh/Year\*

Month	Solar Radiation (kWh / m <sup>2</sup> / day)	AC Energy (kWh)	Value (\$)
January	1.33	142	N/A
February	2.01	192	N/A
March	2.99	311	N/A
April	3.87	376	N/A
May	5.21	507	N/A
June	4.67	441	N/A
July	6.30	504	N/A
August	4.70	449	N/A
September	3.54	335	N/A
October	2.37	239	N/A
November	1.32	133	N/A
December	1.23	128	N/A
<b>Annual</b>	<b>3.21</b>	<b>3,757</b>	<b>0</b>

If you are individual Easysolar will help you to design your system easily in minutes for a low price.

If you are professional Easysolar will help you to design and sell solar systems to your customers. Easysolar not only performs an accurate assessment of the production of the system, taking account of the specific position of solar panels on the roof using photos and Google Map, but it offers also a complete CRM to organise yours sales. Easysolar prices are truly affordable for a professional use.

For individuals or professionals : [get a free trial of 7 days with full functionalities of the program.](#)

Main features are :

- Design on photos : take a picture of the roof of the house or building and draw the panels on the software
- Design on Google map and use the radiation database from all over the world
- Validate the components sizing of the solar PV generator
- Evaluate the cost of the system
- Evaluate the return on investment
- Create a pdf report or offer
- Manage Clients and projects
- Use the CRM to organize your sales
- Use the sales analytics module



PHOTOVOLTAIC GEOGRAPHICAL INFORMATION SYSTEM

Welcome to PVGIS 5.2 Beta version with solar data to 2020! Check the release notes

Cursor: Selected: Select location! Use terrain shadows: Calculated horizon (.csv) Upload horizon file (.json) Choose File No file chosen

Elevation (m): PVGIS ver. 5.2 Switch to version 5.1

GRID CONNECTED TRACKING PV OFF-GRID MONTHLY DATA DAILY DATA HOURLY DATA TMY

HOURLY RADIATION DATA

Solar radiation database\* Start year: End year: Mounting type: Fixed (Vertical axis) Slope [°] (0-90) Optimized slope Two axis Azimuth [°] PV power Crystalline silicon Installed peak PV power [kWp] System loss % Radiation components

Address: Eg Ispra, Italy Lat/Lon: Eg. 45.815, Eg. 8.611



# Research Question

## Aims

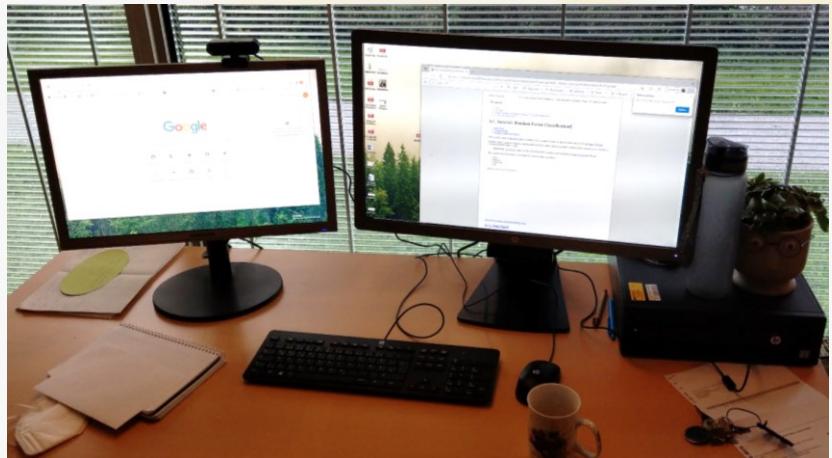
*“Can QSE give a correct solar potential estimate for the roof of the Techno-Z?”*

- |  |                   |   |                   |
|--|-------------------|---|-------------------|
|    | User Friendliness |    | New Solar Methods |
|   | Integration       |   | Complex Reports   |
|  | Accurate Results  |  | TMI               |



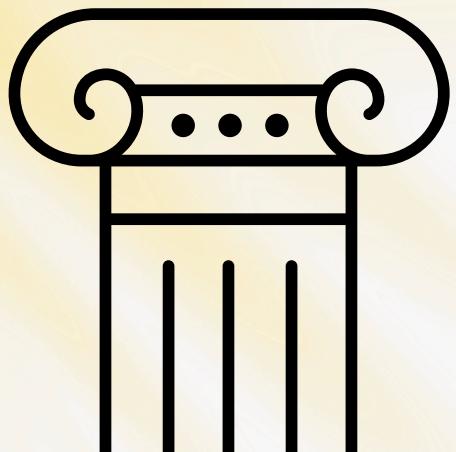
# Hardware

How

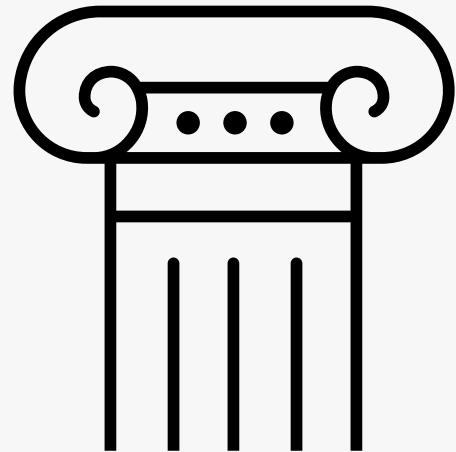


# The Platform

How



# The Solar Calculations

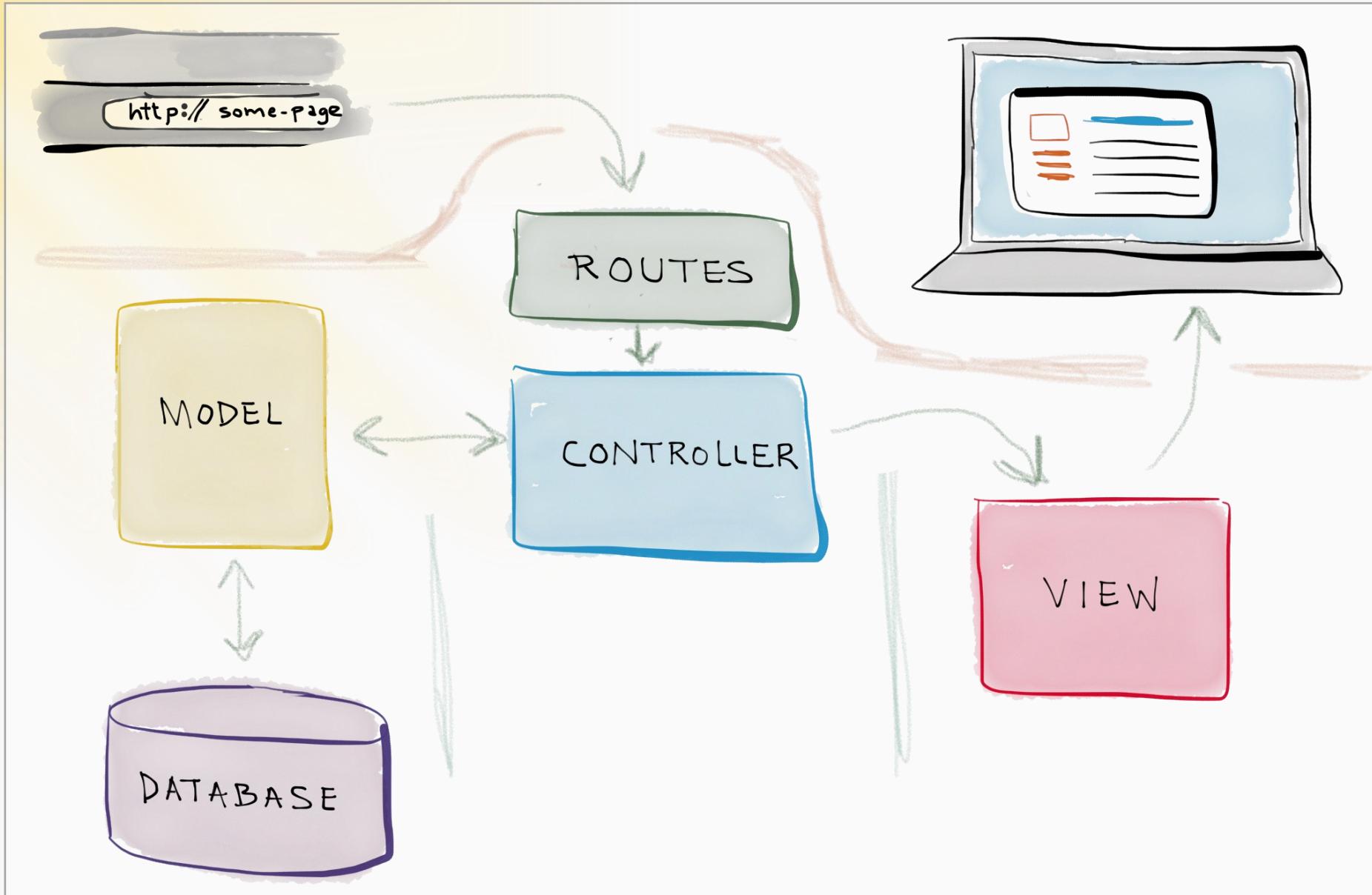


# M-V-C Design



How

The Platform

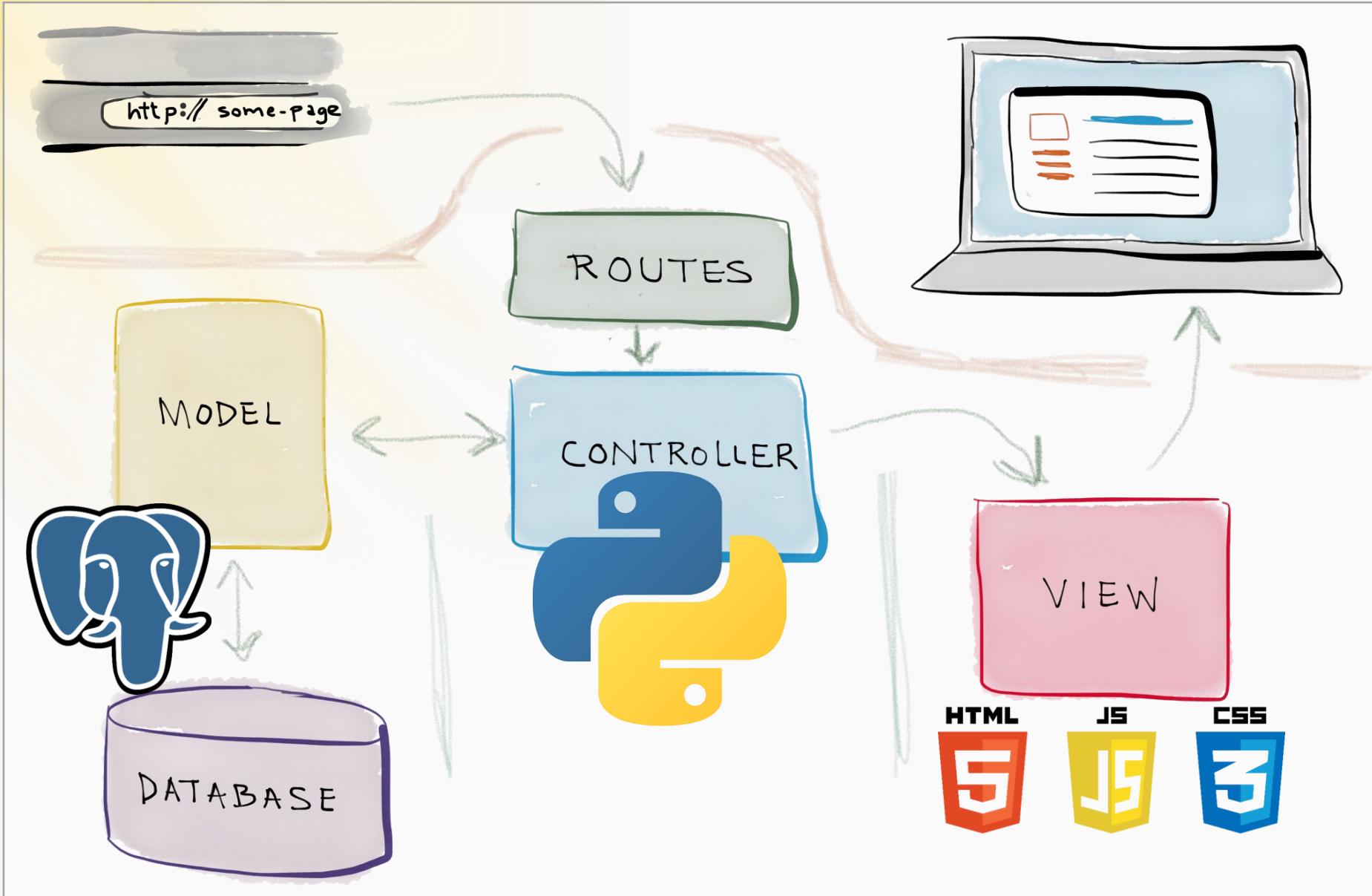


# M-V-C Design



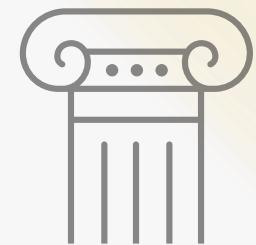
How

The Platform



# How

## The Platform



The screenshot shows the PyCharm IDE interface with a Python Flask project named "flaskProject".

**File Structure:**

- static
- templates
- venv
- External Libraries
- Scratches and Consoles
- Extensions
- Scratches

**Code Editor:**

```
usehorizon=True, use 1 6 6 6 6
startyear=2005, endyear=2015,
url='https://re.jrc.ec.europa.eu/api/',
map_variables=True, timeout=60)

print('df_tmy.head():')
print(df_tmy.head())
print('metadata:')
print(metadata)

# make a Location object corresponding to this TMY
#location = pvlib.location.Location(latitude=metadata['latitude'],
#                                     longitude=metadata['longitude'])
location = pvlib.location.Location(latitude=lat,
                                     longitude=long)

times = df_tmy.index - pd.Timedelta('30min')
print('times.head():')
print(times.head())
solar_position = location.get_solarposition(times)
print('solar_position.head():')
print(solar_position.head())

homepage0 > if request.method == "POST"
```

**Run Tab:**

```
flaskProject
FLASK_APP = app.py
FLASK_ENV = development
FLASK_DEBUG = 0
In folder D:/Users/Christina/Google Drive/Msc AGI/SS22/I3/flaskProject
"D:/Users/Christina/Google Drive/Msc AGI/SS22/I3/venv/Scripts/python.exe" -m flask run
* Serving Flask app "app.py" (Lazy loading)
* Environment: development
* Debug mode: off
* Running on http://127.0.0.1:5000 (Press CTRL+C to quit)
```

**Bottom Status Bar:**

Packages installed successfully: Installed packages: 'pathlib' (today 19:57)

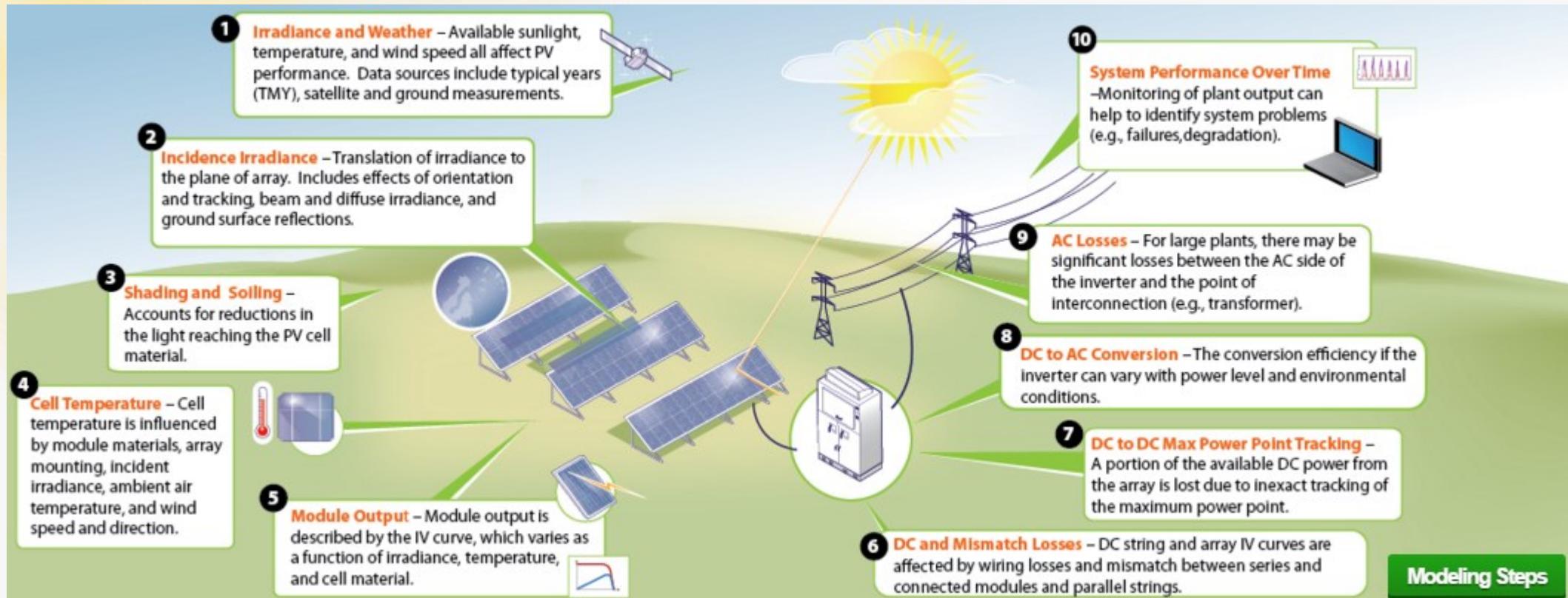
57:99 CRLF UTF-8 4 spaces Python 3.9 (venv) Event Log





## How

### Solar Calculations



# The Goal: Fixed Tilt POA Irradiance

How

Solar Calculations

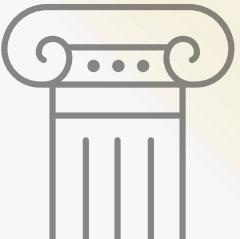
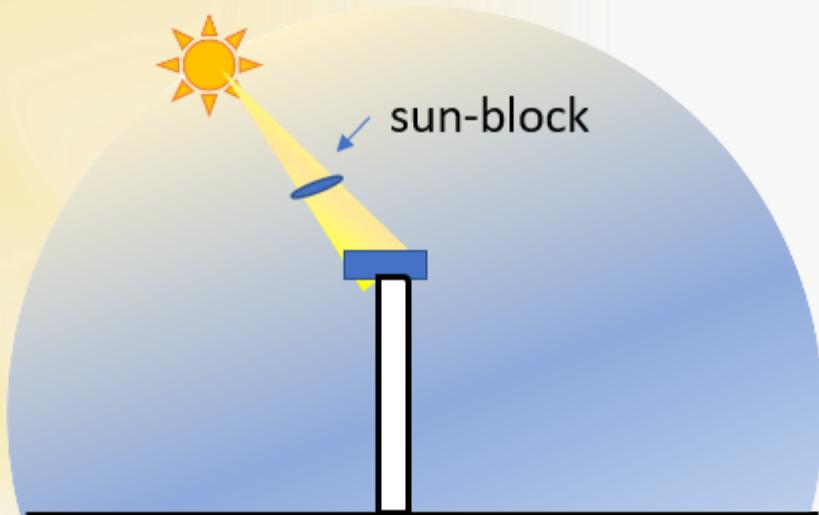
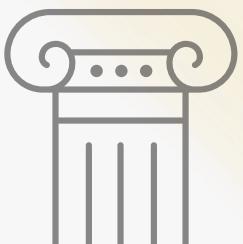


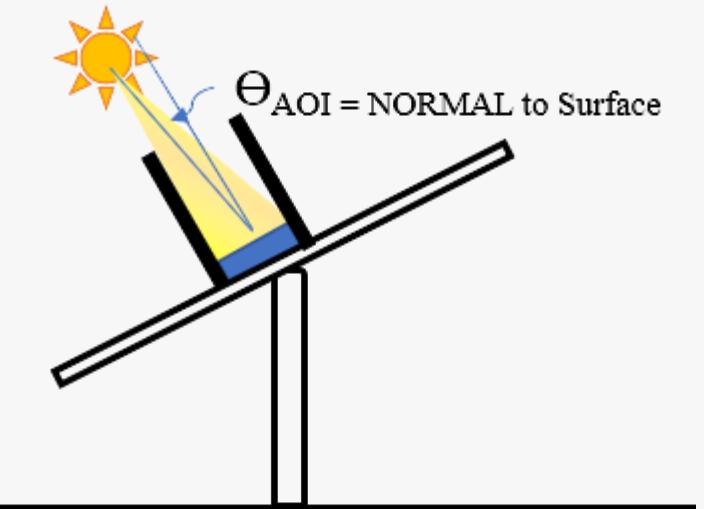
Image from SolarReviews blog, April 25, 2021  
<https://www.solarreviews.com/blog/best-direction-orientation-solar-panels>

# How

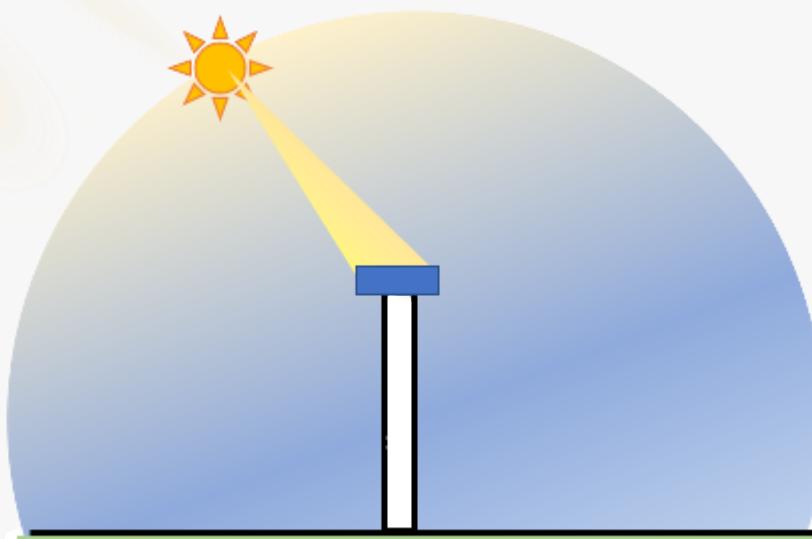
Solar Calculations



Diffuse Horizontal Irradiance (DHI)



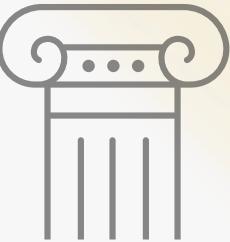
Direct Normal Irradiance (DNI)



Global Horizontal Irradiance (GHI)

# How

## Solar Calculations



PHOTOVOLTAIC GEOGRAPHICAL INFORMATION SYSTEM

European Commission > PVGIS > Tools > Interactive tools

Home Tools Download Documentation About us News

Address: Eg Ispra, Italy Go! Lat/Lon: Eg. 45.815 Eg. 8.611 Go!

Cursor: Selected: Select location! Elevation (m):

Use terrain shadows:  Calculated horizon  Upload horizon file  csv  Browse... No file selected.

GRID CONNECTED

TRACKING PV

OFF-GRID

MONTHLY DATA

DAILY DATA

HOURLY DATA

TMY

PERFORMANCE OF GRID-CONNECTED PV

Solar radiation database\* Crystalline silicon

PV technology\* 1

Installed peak PV power [kWp]\* 14

System loss [%]\*

Fixed mounting options

Mounting position \* Free-standing

Slope [°] 35

Azimuth [°] 0

PV electricity price

PV system cost (your currency)

Interest [%/year]

Lifetime [years]

Visualize results Download csv

Last update: 17/05/2017 Top

The screenshot shows the PVGIS interface. On the left is a map of Europe with color-coded solar radiation levels. A cursor is positioned over the map. To the right is a detailed performance calculator for grid-connected PV systems. It includes fields for PV technology (crystalline silicon), installed peak power (1 kWp), system loss (14%), and various mounting options like free-standing. There are also fields for PV electricity price, system cost, interest rate, and lifetime. Buttons for 'Visualize results' and 'Download csv' are at the bottom.

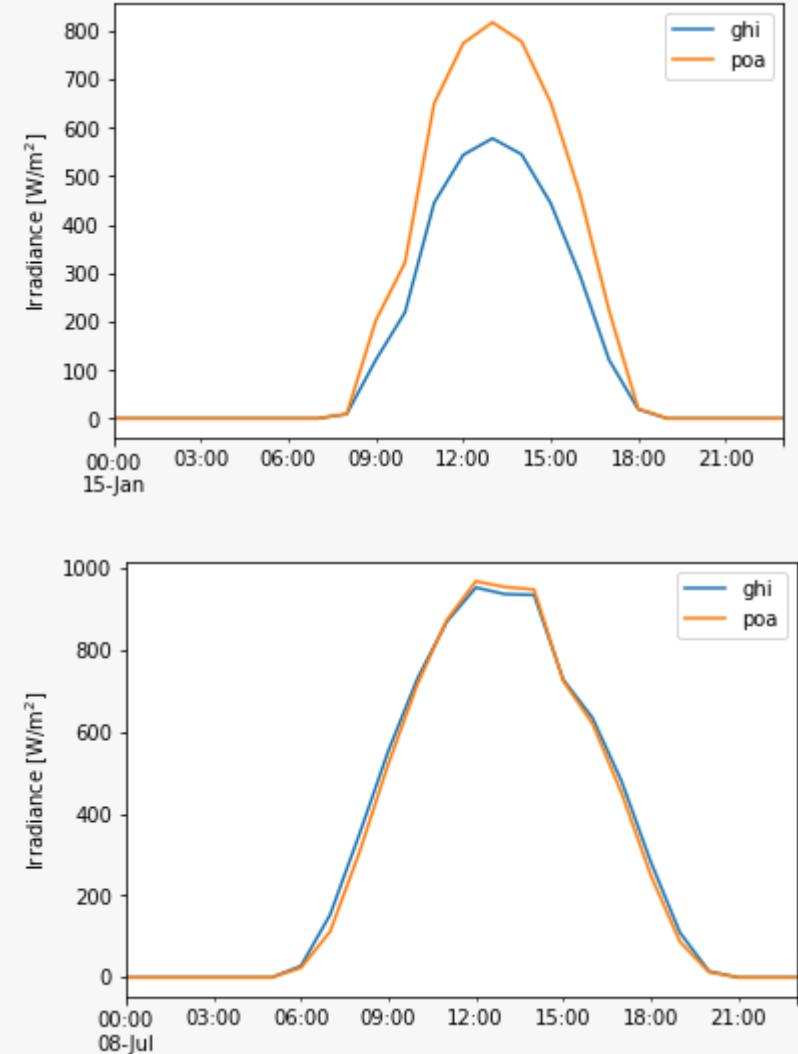
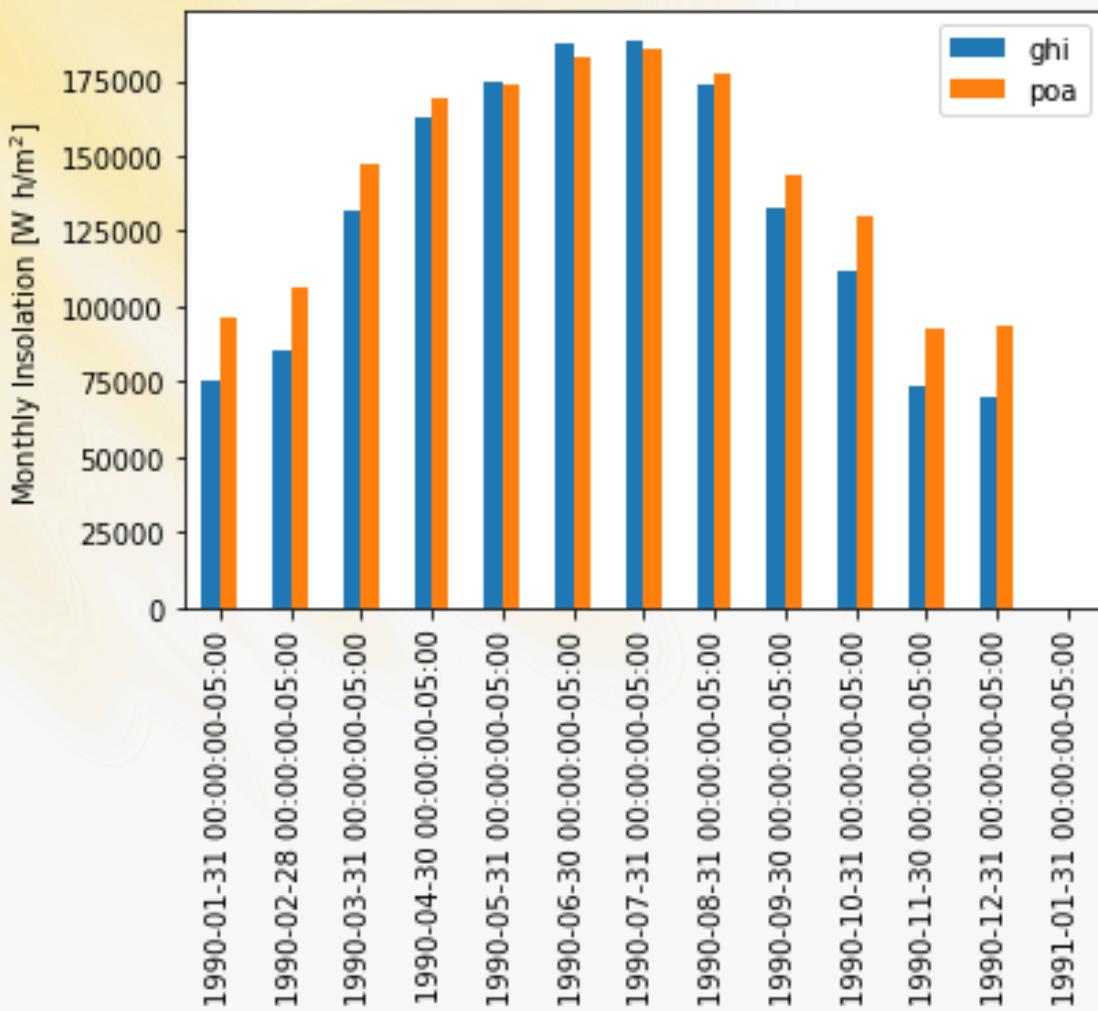
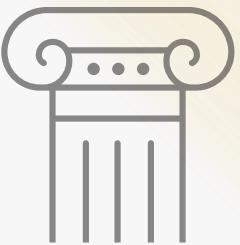
# TMY



# Being able to draw conclusions

How

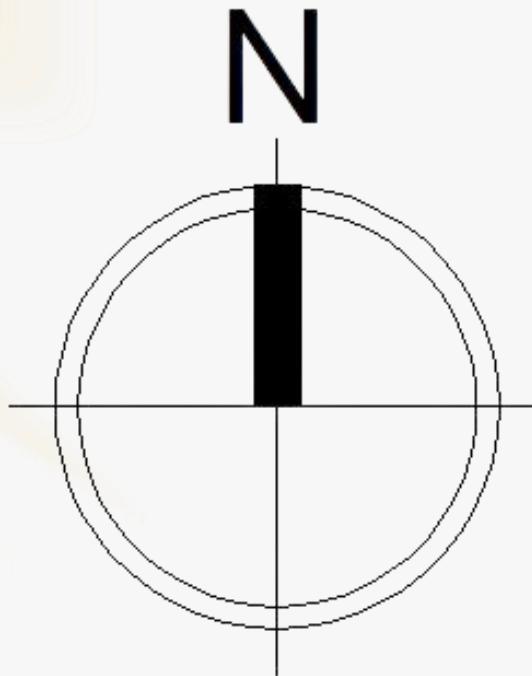
Solar Calculations



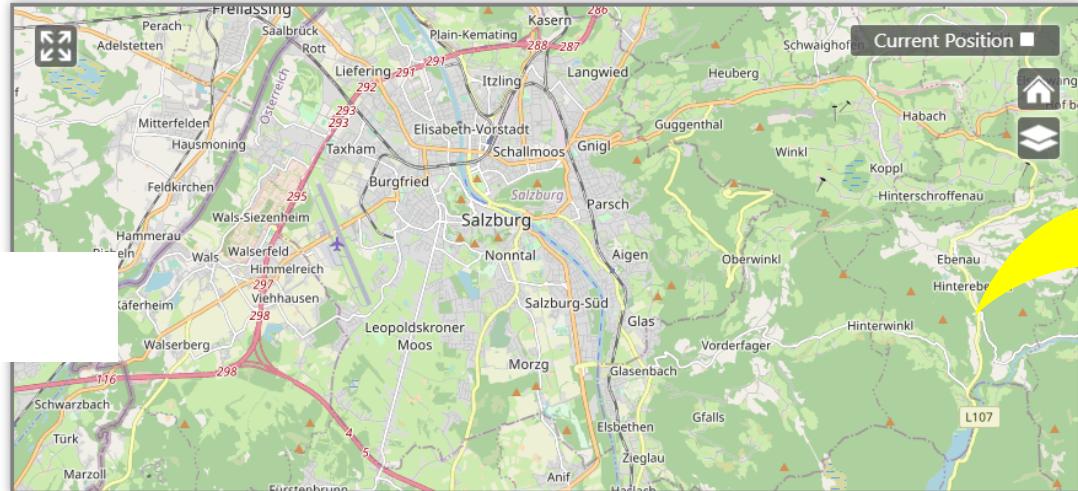
User



X, Y

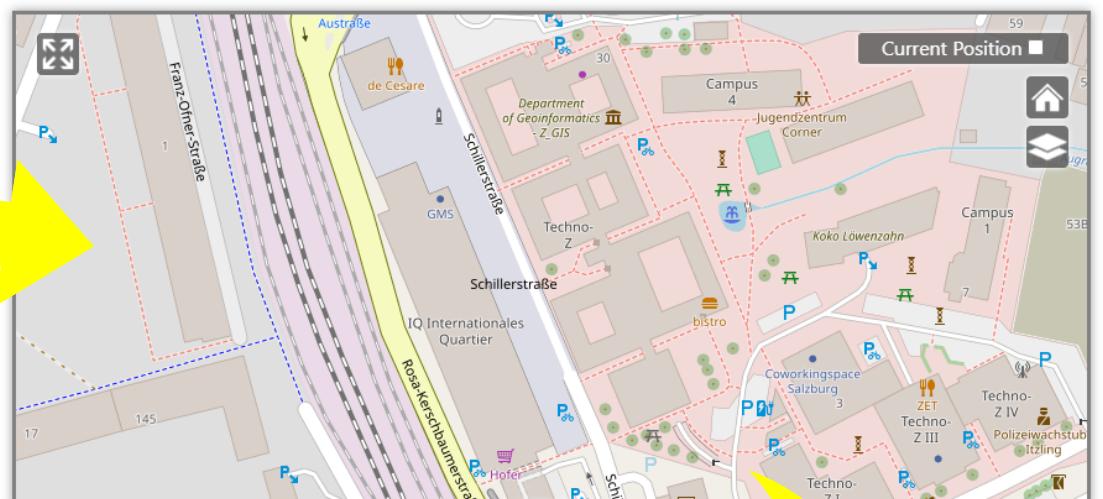


Drop a Pin on the location you want to analyse:

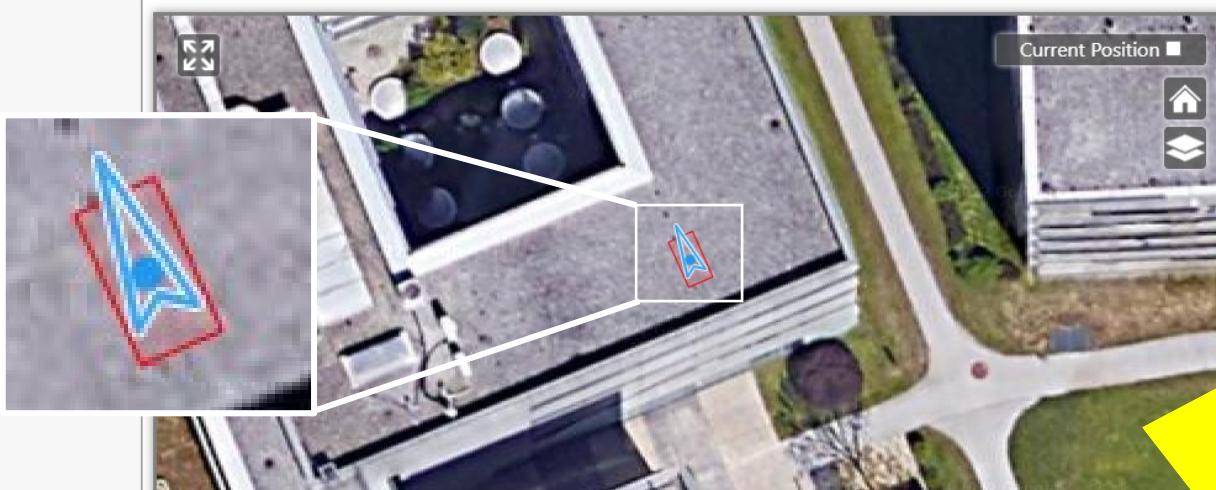


User

Drop a Pin on the location you want to analyse:

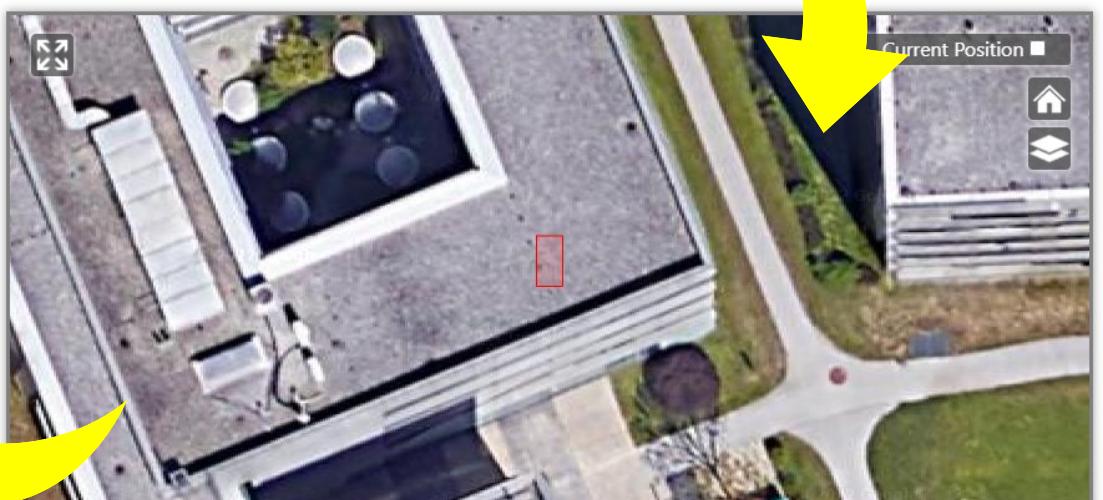


Drop a Pin on the location you want to analyse:



Currently selected coordinates: 13.0397, 47.8236

Drop a Pin on the location you want to analyse:



Currently selected coordinates: 13.0397, 47.8236

Position 13.03965

47.82364

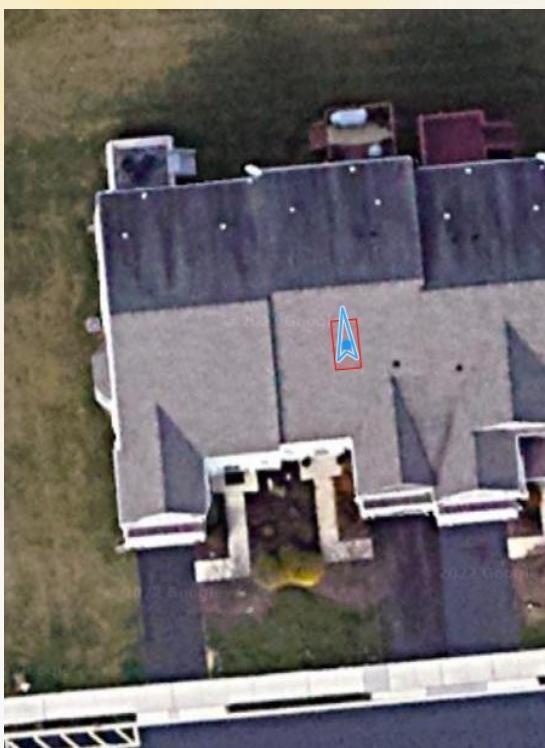
User

AOI

30°

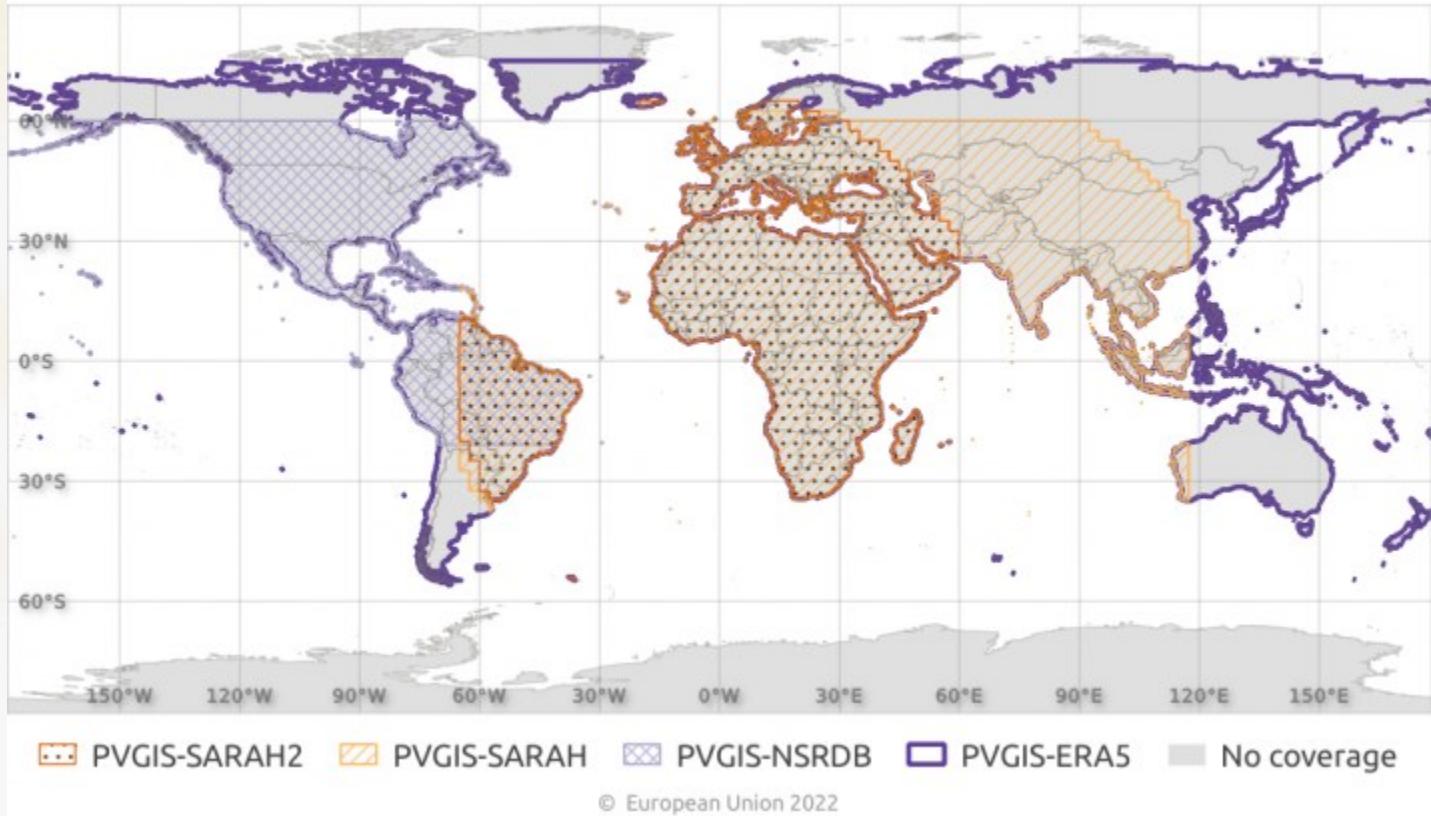
45°

60°

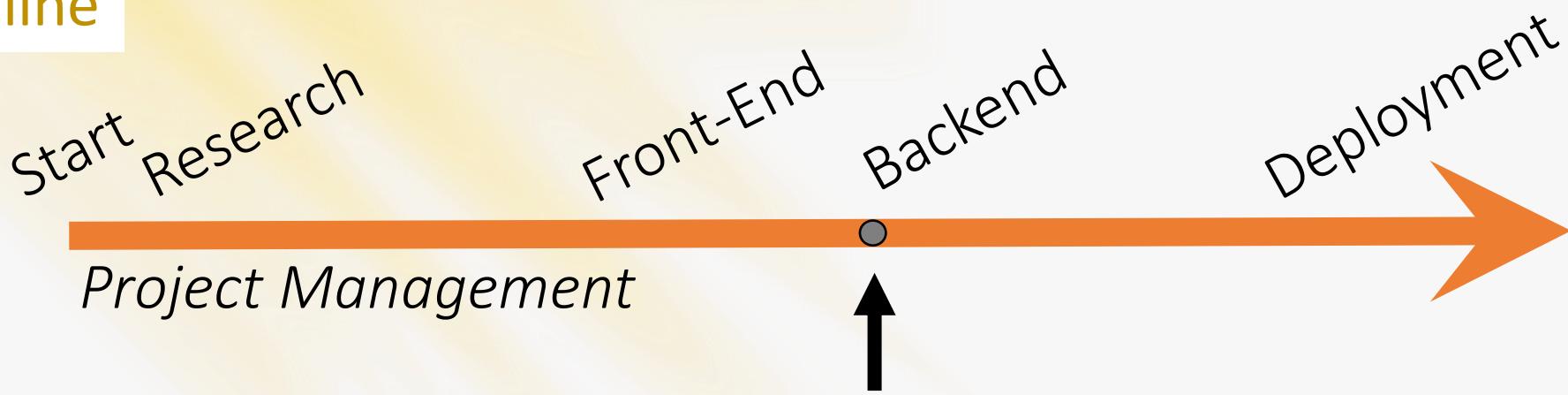


E.g.  
Pennsylvania,  
USA

## Coverage of Solar Radiation Databases



## Timeline



**Current Challenges:** In-browser PDF generation

**Current Task:** Recommendations for Tilt Angle