

# Solar Ready Building Guidelines



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# Overall Solar Project Process

## 1. Team

Assemble your on-site team

## 2. Technology Options

Which are optimal for your site?

## 3. Solar Assessment

Solar project potential at site (what information do you need?)

## 4. General Project

Considerations

## 5. Select Financing/Contracting Option

Dependent on project scope and financing needs. Each option has its own process.

## 6. Implement financing/contracting process



# Technology Options



Photovoltaics



Solar Hot  
Water

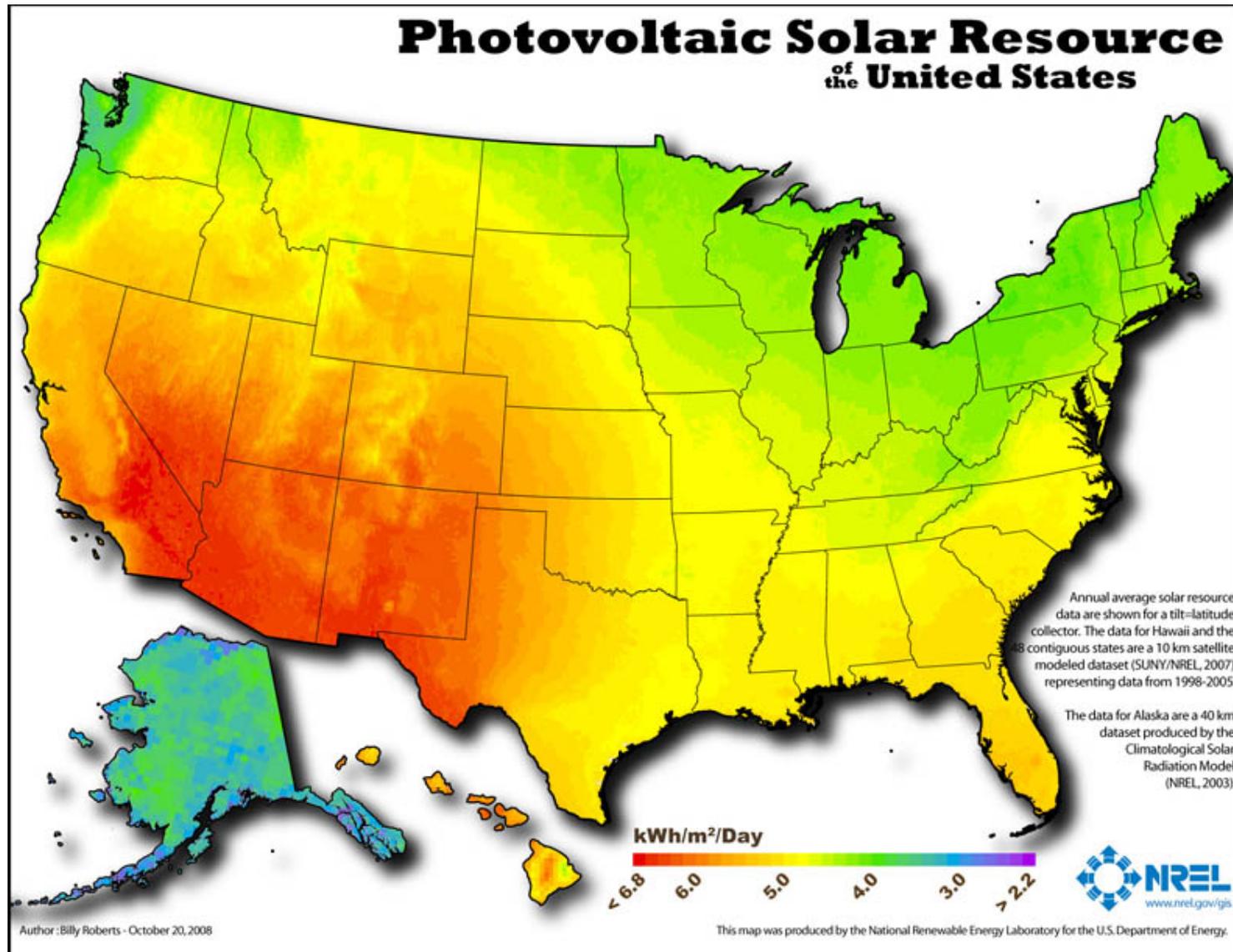


Solar  
Ventilation  
Pre-Heat



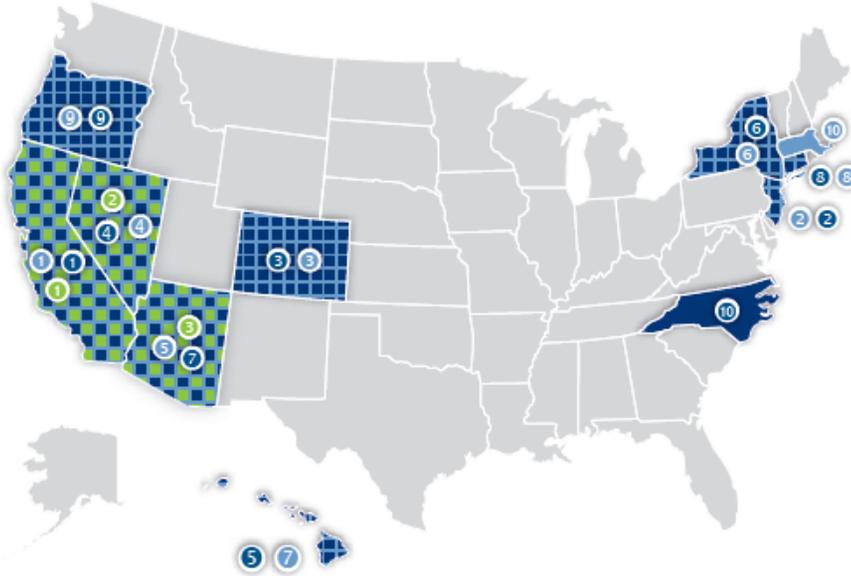
Concentrating  
Solar

# Photovoltaic Solar Resource



# Solar Energy Deployment

## States Leading Solar Energy Development



PV Cumulative Capacity (2008, MW)	
1 California.....	528.3
2 New Jersey ....	70.2
3 Colorado .....	35.7
4 Nevada .....	34.2
5 Arizona .....	25.3
6 New York .....	21.9
7 Hawaii .....	13.5
8 Connecticut ...	8.8
9 Oregon .....	7.7
10 Massachusetts	7.5

PV Annual Capacity Additions (2008, MW)	
1 California.....	178.7
2 New Jersey ....	22.5
3 Colorado .....	21.7
4 Nevada .....	14.9
5 Hawaii .....	8.6
6 New York .....	7.0
7 Arizona .....	6.4
8 Connecticut....	5.3
9 Oregon .....	4.8
10 North Carolina .	4.0

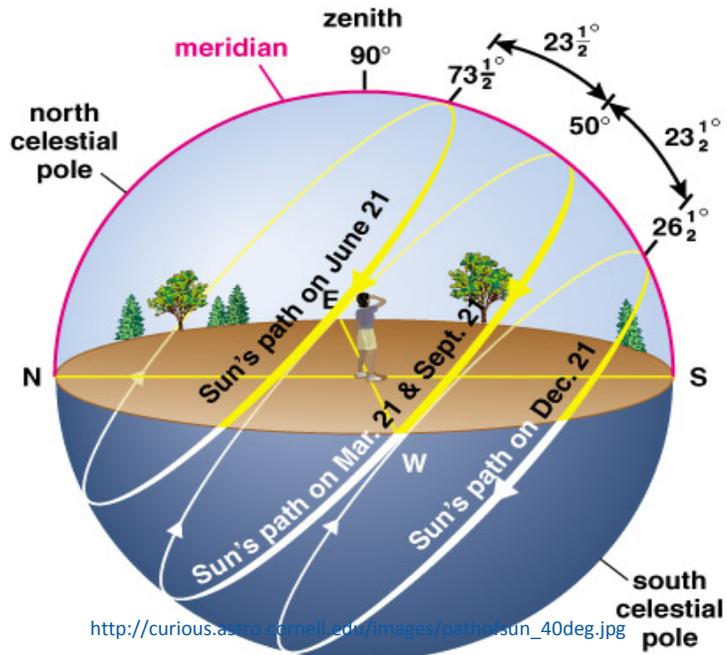
CSP Cumulative Capacity (2008, MW)	
1 California.....	354
2 Nevada .....	64
3 Arizona .....	1

V

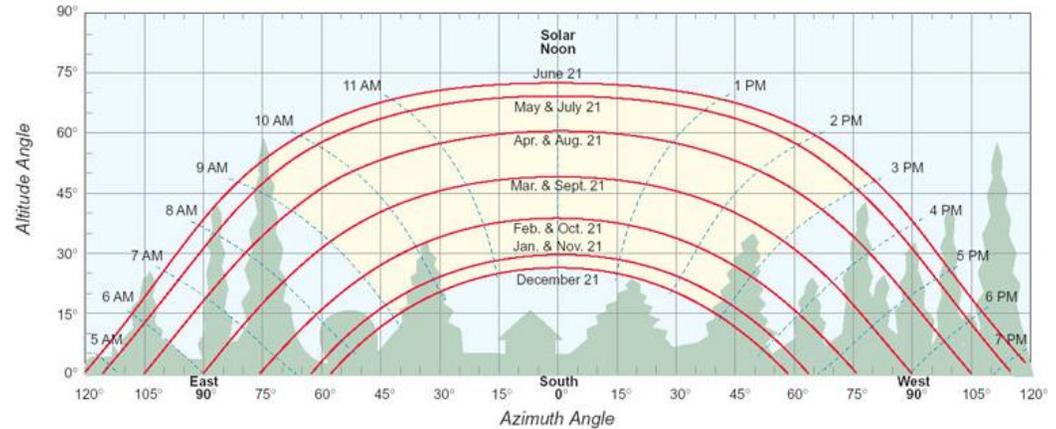
Source: Larry Sherwood/IREC

Note: All installments equal 1% or less of electricity generation in states.

# Solar Angles: Introduction



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[http://www.oksolar.com/images/solar\\_path\\_large.jpg](http://www.oksolar.com/images/solar_path_large.jpg)

- Solar angles are complex and depend on:
  - Time of day, day of the year, orientation, latitude, and longitude

# Solar Assessment – PV is VERY shade sensitive



Once site preliminary assessment has been completed

What you want to know:

Estimated system size

Estimated production (kWh/yr )

Estimated cost

Some economic analysis



# General Solar Guidelines

- ✓ Avoid shading from trees, buildings, etc. (especially during peak sunlight hours)
- ✓ Check the zoning laws for the proposed site to ensure that future, neighboring construction will not cast shade on the array.
- ✓ Determine where a future solar array might be placed.
- ✓ If the roof is sloped, the south-facing section will optimize the system performance; keep the south-facing section obstruction-free if possible.
- ✓ Minimize rooftop equipment to maximize available open area for solar collector placement.



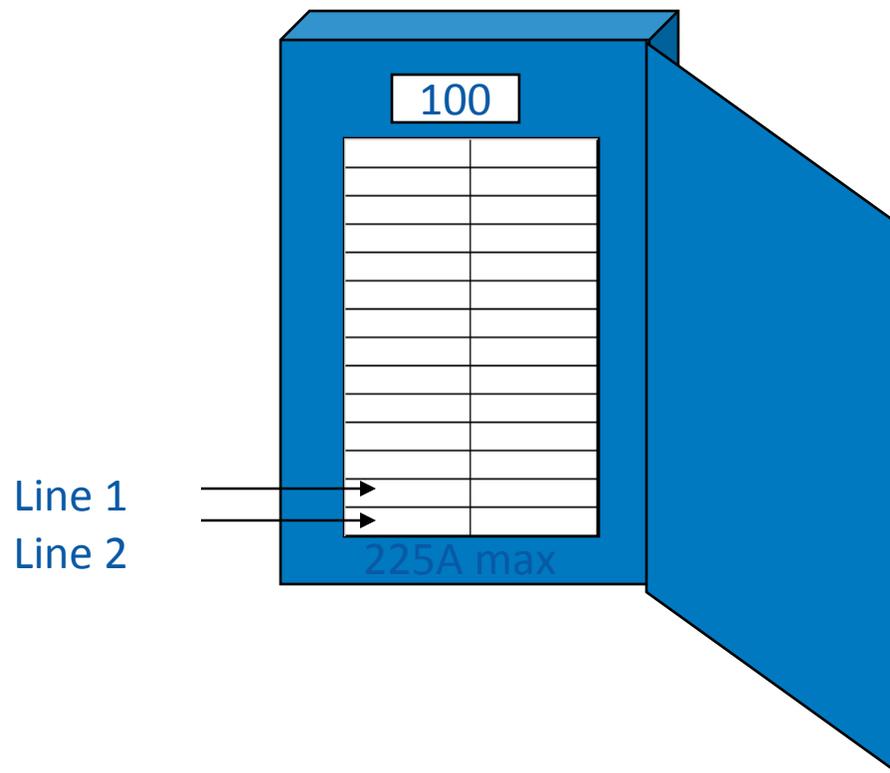
# General Solar Guidelines

- ✓ The type of roof installed can greatly affect the cost of installing solar later.
- ✓ The roof must be capable of carrying the load of the solar equipment.
  - ✓ PV – between 3 and 6 lb/ft<sup>2</sup>
  - ✓ ST – between 2 and 5.5 lb/ft<sup>2</sup>
- ✓ The wind loads on rooftop solar equipment must be analyzed in order to ensure that the roof structure is sufficient.
- ✓ If it is going to be a rack mounted system, consider installing the mounting hardware at the time the roof is installed and use flashings for every penetration.
- ✓ If the collectors will be placed on the roof, check if the roof installation carries a warranty.
  - ✓ Determine if the roof warranty contract has terms involving solar installation.
- ✓ Make sure all equipment is in compliance with the current version of the National Electrical Code.

## Additional Guidelines for PV

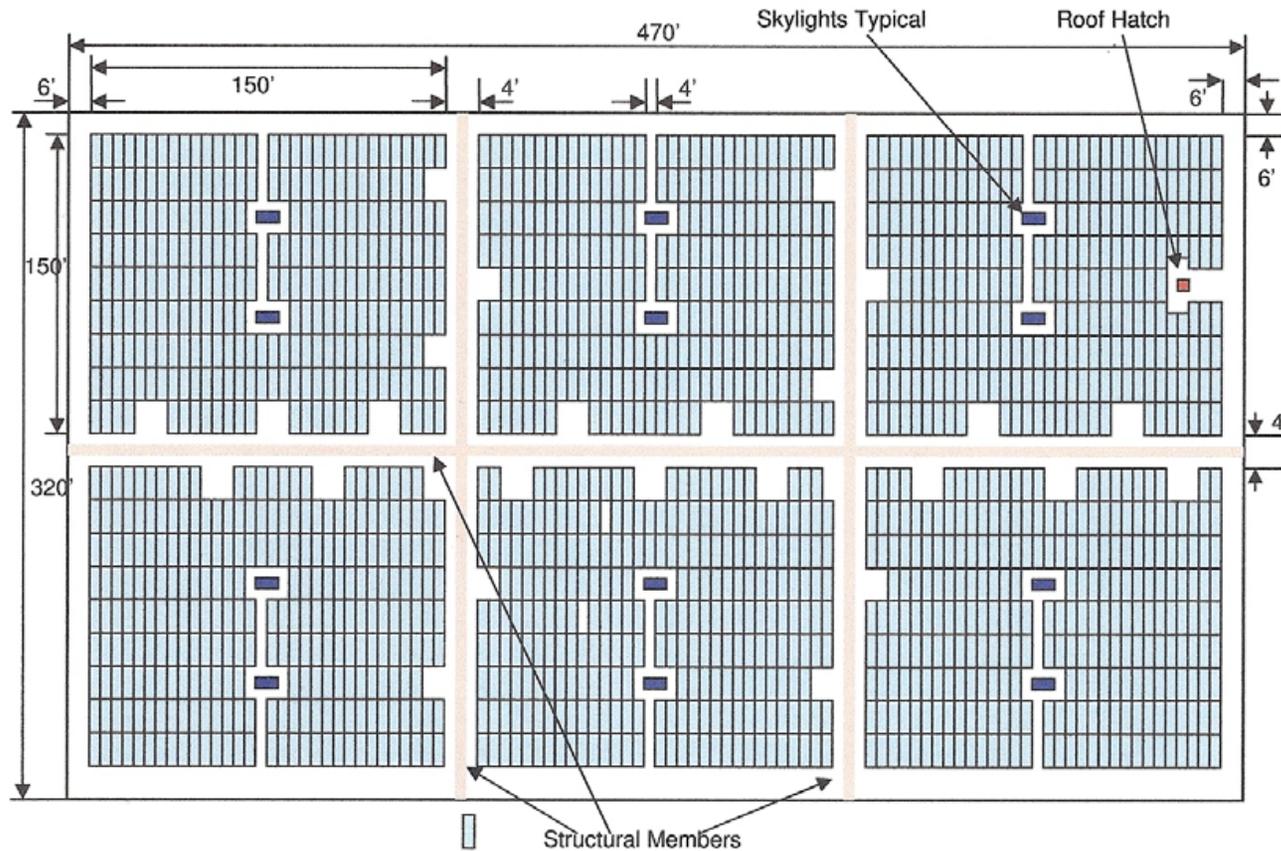
- ✓ Identify electrical panel location for PV system inter-connections, and keep space available in the electrical panel for a PV circuit breaker
- ✓ Specify panel capacity sufficient to accommodate proposed PV system size power generation plus size of breaker protecting main panel.
  - ✓ NEC allows for the sum of these two sources of power to be 20% greater than the panel rating. Consult the local authority having jurisdiction.
- ✓ Lay out the locations for the inverter and the balance of system (BOS) components.
- ✓ Identify the inter-connection restrictions for the location of the building site that apply to grid-tied PV systems. Begin by reviewing interconnection standards at <http://www.dsireusa.org/>

# Utility Interconnection- Where to land the power?



- Backfeed Breaker in Building Panel (Sum of Main Breaker and PV breaker not to exceed 120% of panel rating for commercial building, 100% for residential)
- Too big?- Survey Loads and reduce main breaker rating
- Too big?- Upgrade Panel
- Too big?- Line-side-tap
- Too big?- Upgrade Electrical Service

# Roof Access Issues



**Large Commercial Building (Axis > 250 ft)**

**4 ft Walkways**

**8 ft x 4 ft Venting Opportunities Every 20 ft Along Walkway**

# Solar Water Heating System Guidelines

- ✓ Determine the hot water load and water temperature requirement to size all of the system components.
- ✓ Identify location for controllers, heat storage system, shutoff valves, and other equipment.
- ✓ Plan for all the necessary plumbing and provide pathways for water lines to link the solar collector, the heat storage system, and the rest of the building's hot water system.
  - ✓ Be sure that the water distribution system and mixing valves are laid out to maximize the ST system performance.

# Solar Analysis Tools

- Solar Advisor Model (SAM) – All solar technologies
  - <https://www.nrel.gov/analysis/sam/>
- HOMER – PV, Wind, and hybrid systems
  - <https://analysis.nrel.gov/homer/>
- PVWatts - PV
  - <http://www.nrel.gov/rredc/pvwatts/>
- RETScreen – All RE technologies
  - <http://www.etscreen.net/>
- IMBY – PV and Wind
  - <http://www.nrel.gov/eis/imby/>
- RETScreen - Solar Hot Water
  - [http://www.etscreen.net/anq/q\\_solarw.php](http://www.etscreen.net/anq/q_solarw.php)
- Fchart – Active and Passive Systems Analysis
  - <http://www.fchart.com/fchart/fchart.shtml>

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