



AMERICAN RIVER COLLEGE

Site Surveys



Lesson Plan

- Site Assessments Review

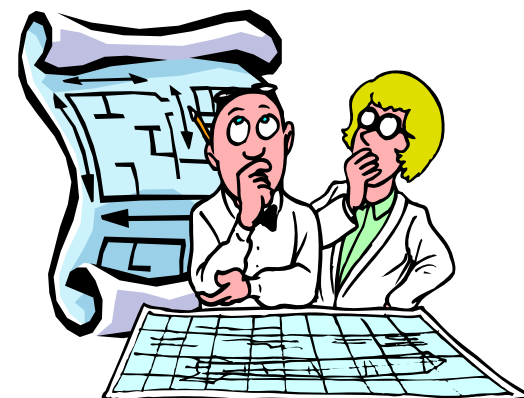
Next Week:

- NABCEP Learning Objective:
PV System Sizing Principles
- Practice NABCEP Exam #2 in a few weeks

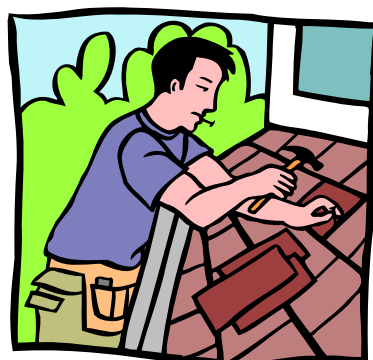
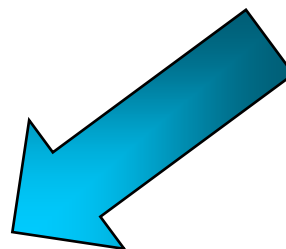
The PV Installation Process



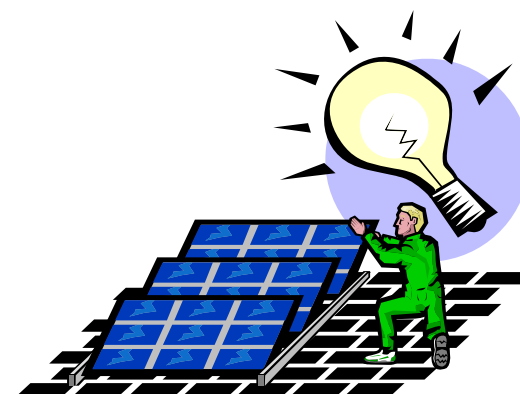
Conducting a Site Survey



Selecting a System



Installing the System



System Checkout & Inspection

Sales, Site Assessment and Estimation

- The installer should meet with each customer to discuss available PV system options.
- Good public relations skills are essential.
- Monthly electricity use, conservation and energy efficiency should be an important part of the discussion.

 Customer Consultation



SolarWorld Industries America

Electricity bill



UNITED ELECTRICITY

Bill period from 29 Dec 2007 to 3 Apr 2008

Tax point date 10 April 2008

6 Your customer account number
26387 234038

Mr and Mrs Smith
 21 Eastern Ave
 Ealing
 London
 W13 100

Meter number(s)
 F03C29801

General Domestic

 For any enquiry, please phone
 0811 744 600

Reading last time	Reading this time	Tariff	Units	Price of each unit in pence	Amount £ p
12224	13423 E	7 Unrestricted units Charges 29 Dec 2007 - 31 Dec 2007 Standard energy 22 9.02 1.98 Discounted energy 19 8.55 1.62 Standard energy at 13.730p for 3 day(s) 0.41	1286		
Charges 1 Jan 2008 - 3 Apr 2008					
Standard energy 705 9.90 69.80 Discounted Energy 540 9.38 50.65 Standard charge at 15.070p for 93 day(s) 14.02					
1 Monthly Direct Debit Discount VAT at 5.00% on charges of £131.04					7.44CR 6.55
Total this Invoice					137.58
2 Balance from previous bill Payment received 20 January 2008 40.17 Payment received 20 February 2008 38.00CR Payment received 20 March 2008 38.00CR					
8 DEBIT BUDGET ACCOUNT BALANCE CARRIED FORWARD					65.78

Using GPS For Initial Site Survey saves time and \$\$\$



Zillow.com



google earth

Phone Survey

- do you own or rent?
- what is your address?
- what is the square footage of your house?
- approximately when was your house built?
- how much is your average utility bill?
- what is your utility company?
- do you expect PV to provide all or part of your electricity?
- are there large trees in your yard?
- other shading issues, buildings, neighbors trees, etc.?
- how is your house oriented N,E,S,W?
- is your roof sloped or flat?
- what condition is your roof?

Site Evaluation Check List

- Utility bills, electricity usage history
- Energy Audit
 - Windows, doors, heat gain/loss
 - Appliances
 - Insulation, ducts, and pipes
- Orientation of structure
- Solar resource
- Shading
- Pitch of roof and available roof area
 - Plumbing vent pipes, skylights, chimney, sat dish
 - AHJ standoffs
- Type of roof material and condition of the roof
- Framing type, condition of framing and decking
- Electrical service, size, location

- Information gathered during a site survey should be carefully documented.
- Roof type and condition
- Roof pitch
- Orientation
- Shading issues
- Structural considerations
- Size & condition of existing
- Electrical service
- etc.

Site Survey

PV SYSTEM SITE SURVEY INFORMATION

GENERAL INFORMATION

Customer Smith Residence
 Site Address 123 Main St., Anytown, IL 60123
 Contact Name John Smith, homeowner
 Phone 555-0123 Fax 555-0124 Email _____
 Utility Regional Power, Inc.
 Contact Name Beverly Jones
 Phone 555-6789 Fax 555-6790 Email jones@regionalpower.com
 Permitting Authority Village of Anytown
 Contact Name Gary Roberts, building inspector
 Phone 555-5215 Fax 555-5235 Email roberts@anytown.vil.us

Type of System Desired Utility-interactive Output (kW) 5.0
 Critical Loads (W) N/A Autonomy (days) N/A

SOLAR RESOURCE & WEATHER

Latitude 41°N Longitude 87°W Basic Wind Speed (mph) 90
 Insolation (kW/m²) AVG 3.9 MAX 6.3 MIN 1.5
 Temperatures (°F) AVG 50 MAX 105 MIN -20
 Potential for Extreme Weather Heavy thunderstorms, heavy snowfall

PROPOSED ARRAY LOCATION

Area (ft²) 1000 Slope (°) 33° Azimuth Orientation (°) 210° (SSW) Height (ft) 10-25
 Accessibility requires extension ladder or aerial lift, fall protection
 Shading Analysis Results tree will shade location from 9 AM to 11 AM November through January

ROOFING

Type of Roofing Asphalt shingle Age (yrs) 10 Thickness (") 1.25
 Surface Condition good, no repairs needed
 Type of Supporting Structure 2 x 6 rafters 12" O.C.
 Structural Concerns none

ELECTRICAL SYSTEM

Primary Service 120/240 V, 1ϕ, 200 A Source Overhead from utility pole
 Other Sources none
 Ratings 200 A main breaker
 Annual Electricity Use (kWh) 10,900 Rate (¢/kWh) 8.6
 Point of Connection Main service panel
 Proposed Inverter Location Basement Accessibility good
 Proposed Battery Location N/A Accessibility N/A
 Proposed Disconnect Locations Basement, exterior wall Accessibility both good
 Electrical Concerns none

Other Comments or Issues Customer wants to be able to easily upgrade and/or expand system in future.
Possibilities include larger array and battery backup system.

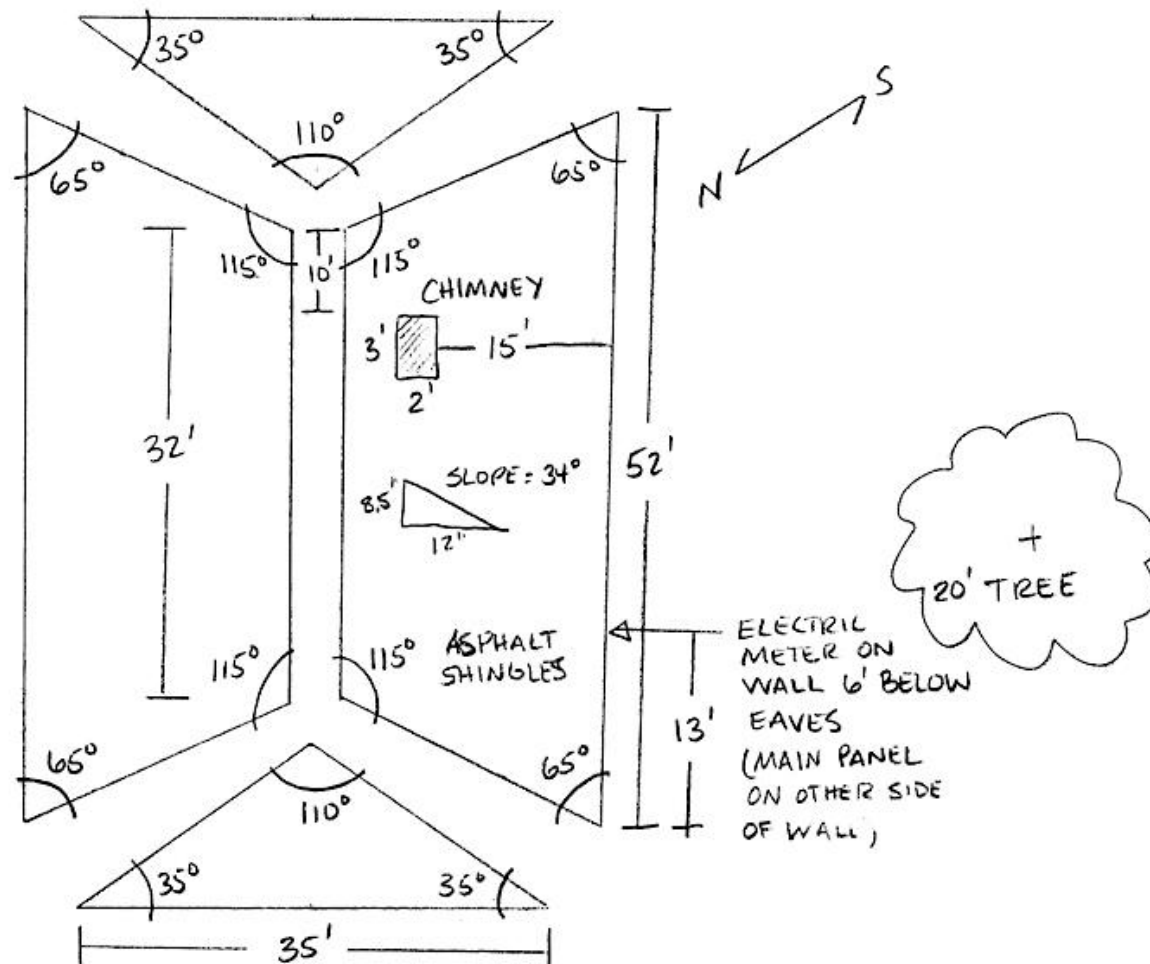
Surveyor Jane Miller Date 7/12
 Signature J. Miller

Load Analysis

AC Load	Quantity		Power Rating (W)		Average Daily Use (hrs/day)		Average Daily Energy Use (Wh/day)
Incandescent Lighting	6	x	60	x	6	=	2160
Refrigerator	1	x	475	x	12	=	5700
Microwave	1	x	1200	x	0.5	=	600
Toaster	1	x	1200	x	0.15	=	180
Dishwasher	1	x	1500	x	0.5	=	750
Furnace Fan	1	x	500	x	2	=	1000
TV	1	x	130	x	3.5	=	455
VCR	1	x	40	x	0.75	=	30
Ceiling Fans	3	x	50		6		900

A load analysis is part of an energy audit, which is used to evaluate a customer's energy use for system sizing.

Site Layout Drawing



A site layout drawing shows basic building dimensions and locations of major components.

Gizmos & Gadgets Of The Trade



Sol Metric Suneye



Deep Framing
Detector



Roof Angle Finder



Irradiance Meter



Solar Path Finder

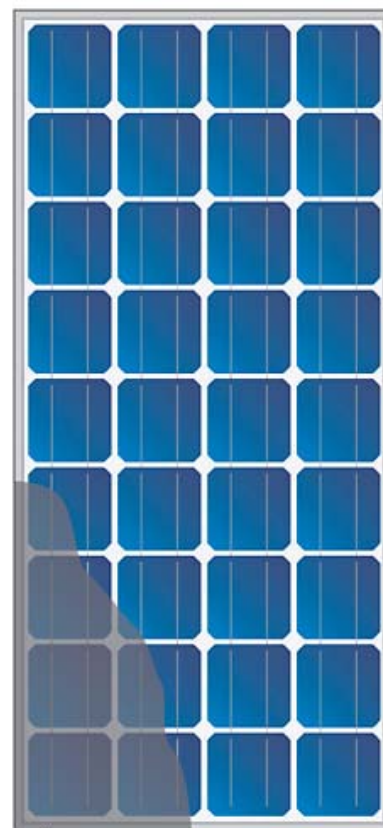
Magnetic Declination Map



Magnetic declination varies by location and changes slightly over time. Up-to-date maps are used to determine the necessary declination adjustment.

Shading Effects

Shading of PV modules and arrays can cause disproportional reductions in power output.



PARTIAL ROW
SHADED

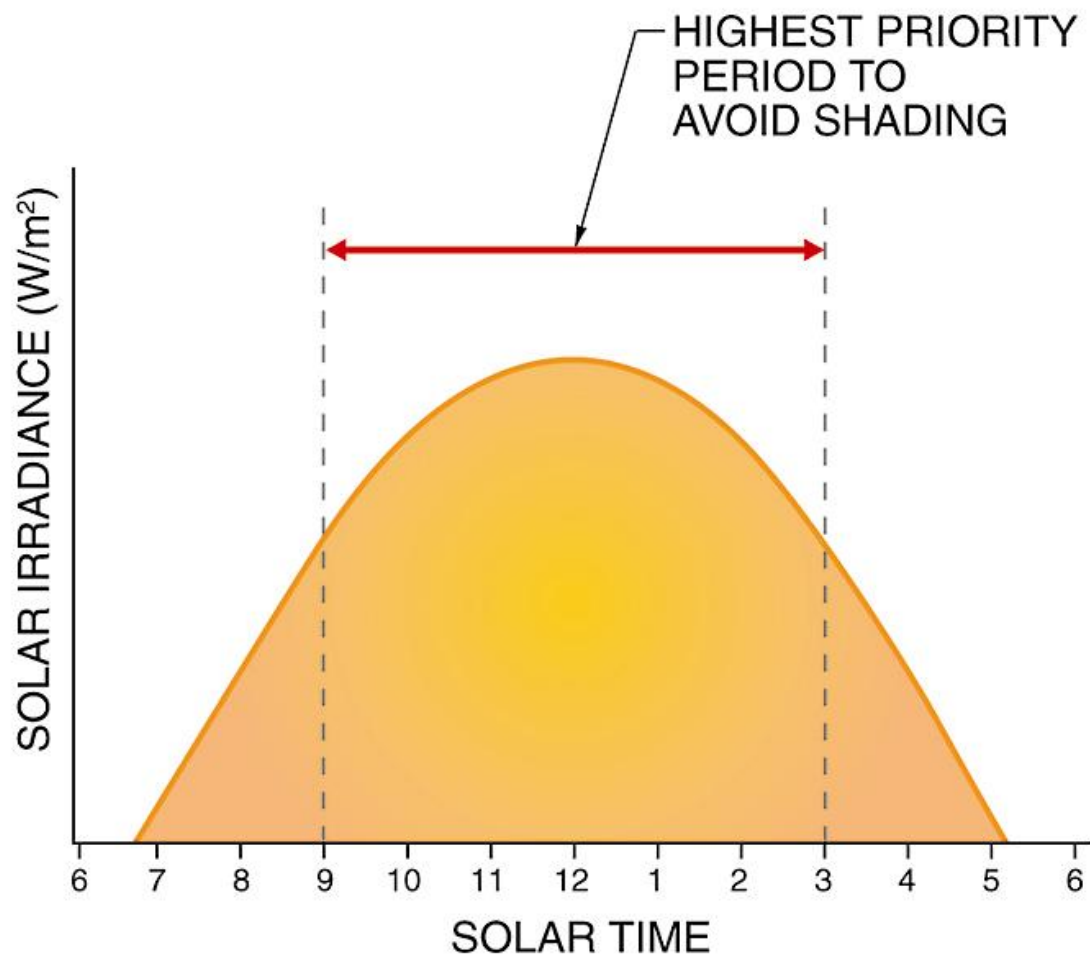
**SUBSTANTIAL
POWER LOSS**



COMPLETE ROW
SHADED

**COMPLETE
POWER LOSS**

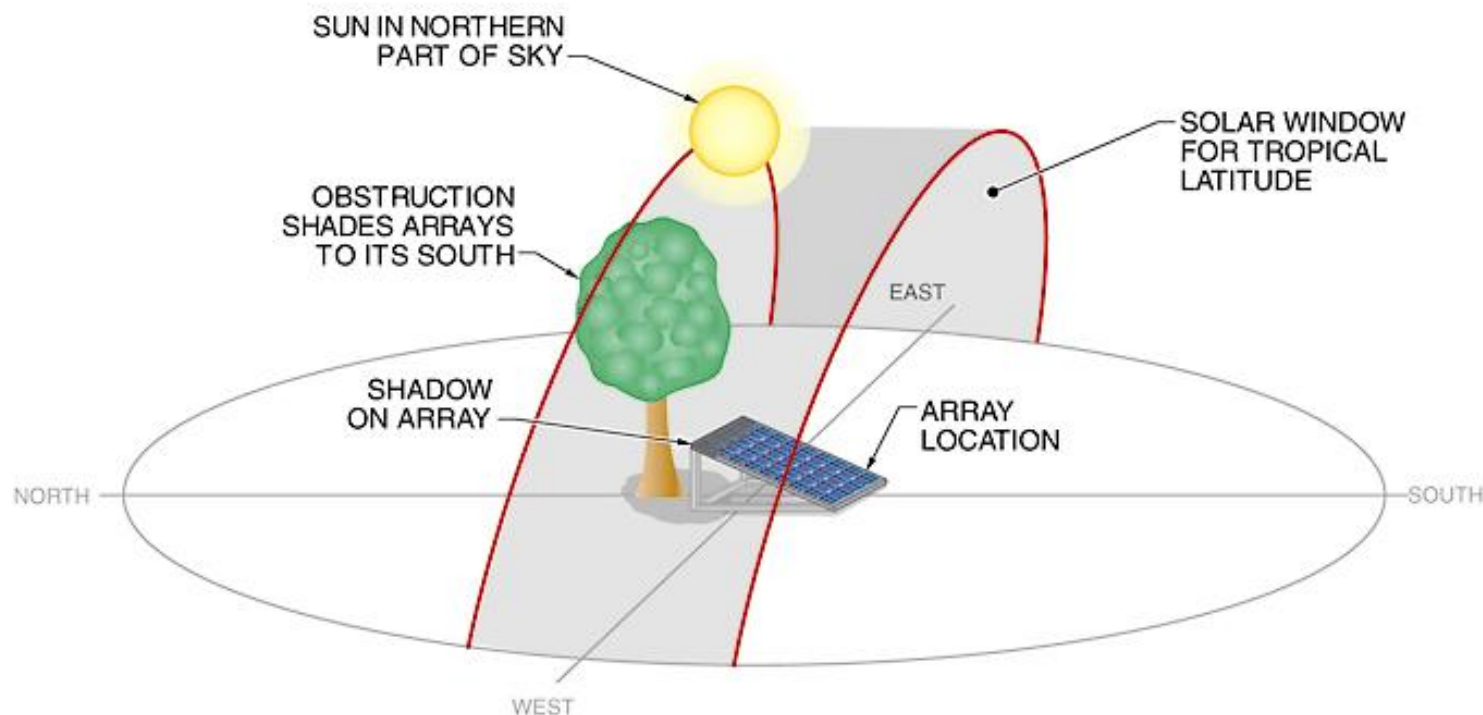
Shading Priority



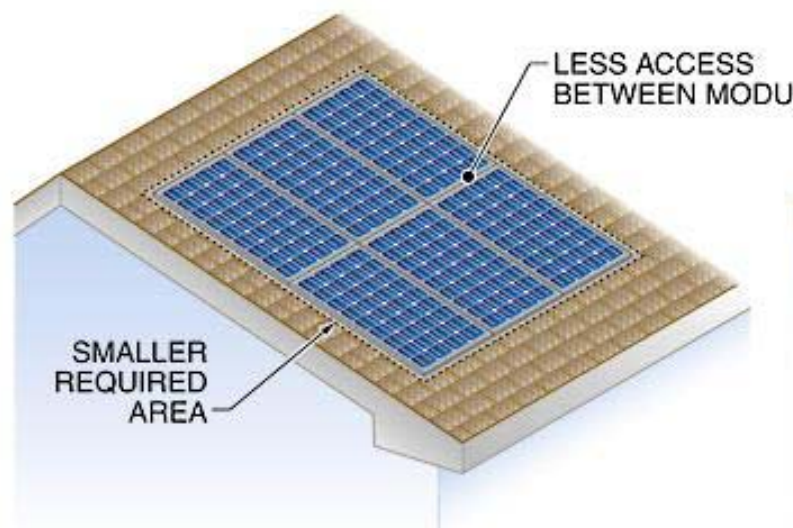
Most of the daily solar radiation occurs between 9 AM and 3 PM, so avoiding shading during this period is high priority.

When the sun is in the northern part of the sky, shading can be caused by obstructions immediately north of an

Shading from the North



Array Area Requirements

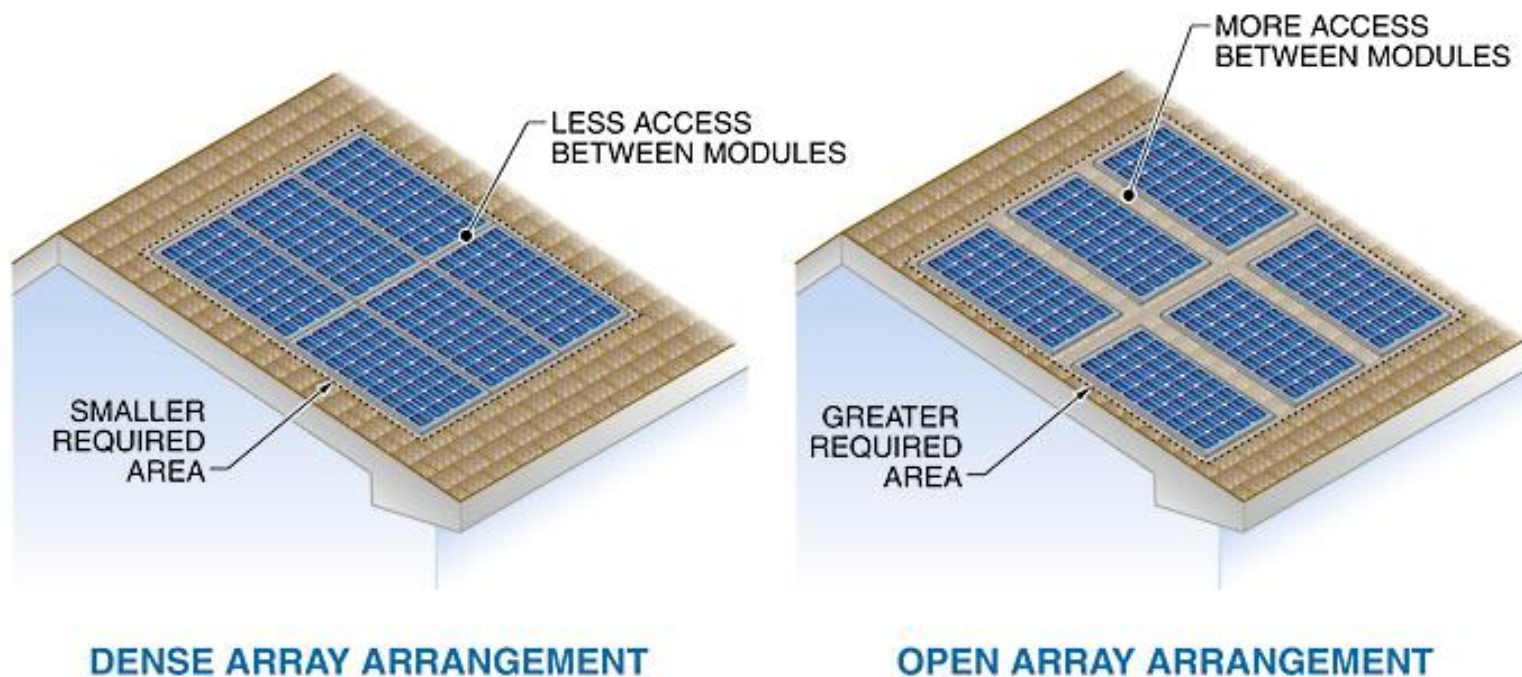


- Length x width = Area
- Area x 10W = apprx power availability
- Only an approximation
- Not a substitute for PV sizing!
- Does not adjust for orientation, tilt, shade, etc

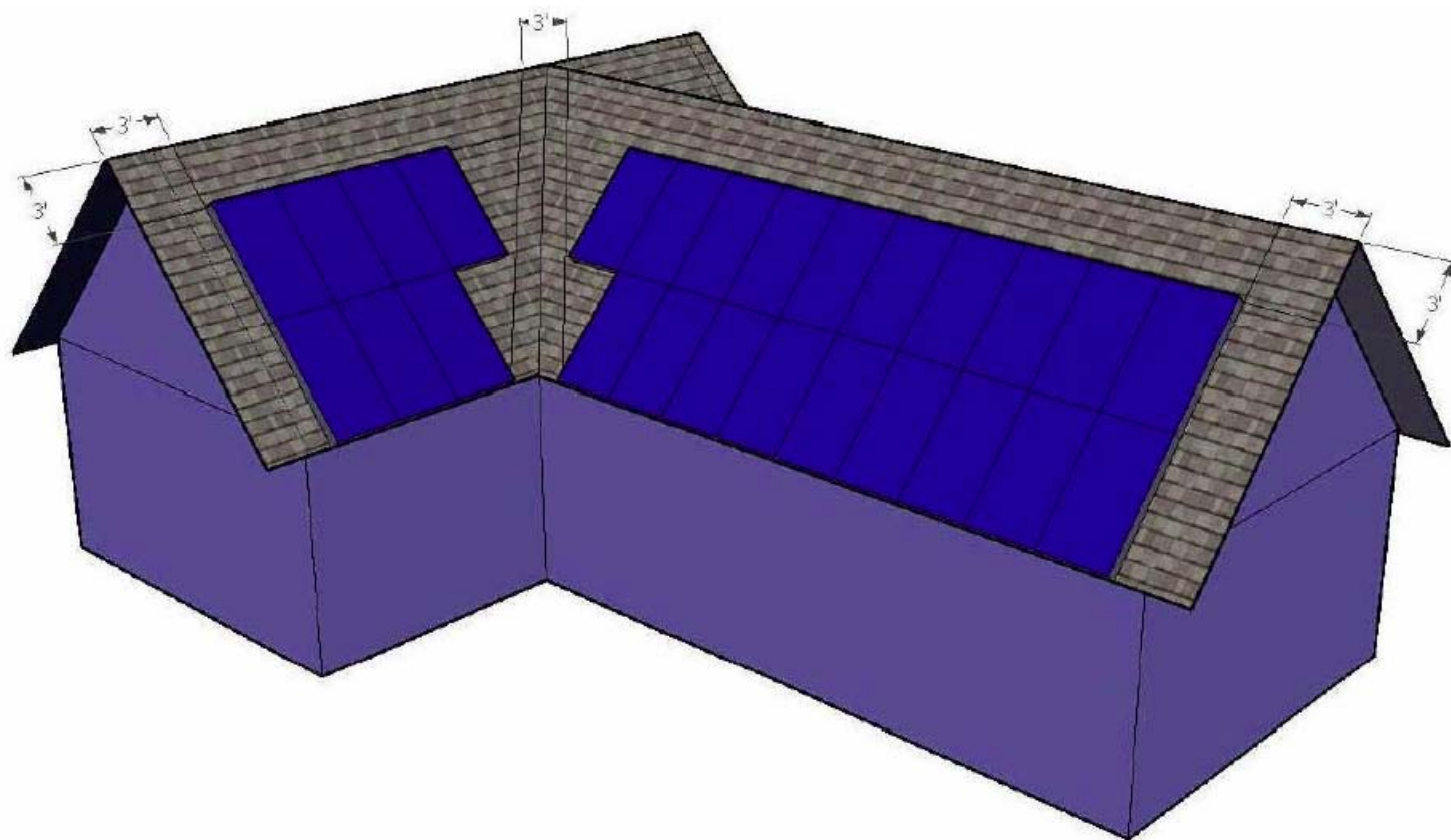
Overall output is based on solar resource, shading, module efficiency, etc. but there is a good site survey rule of thumb:

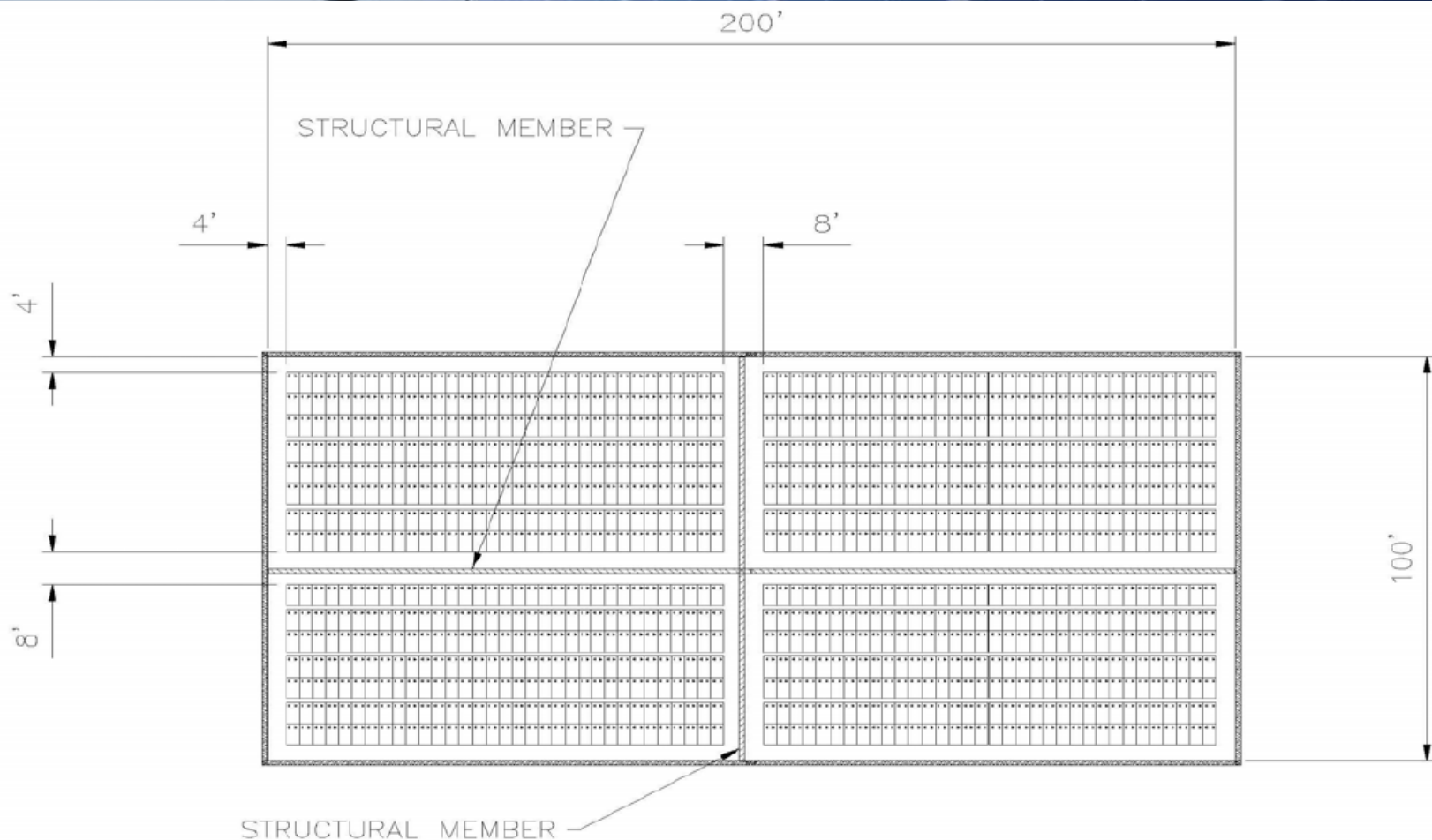
10W per square foot of available area

Array Area Requirements

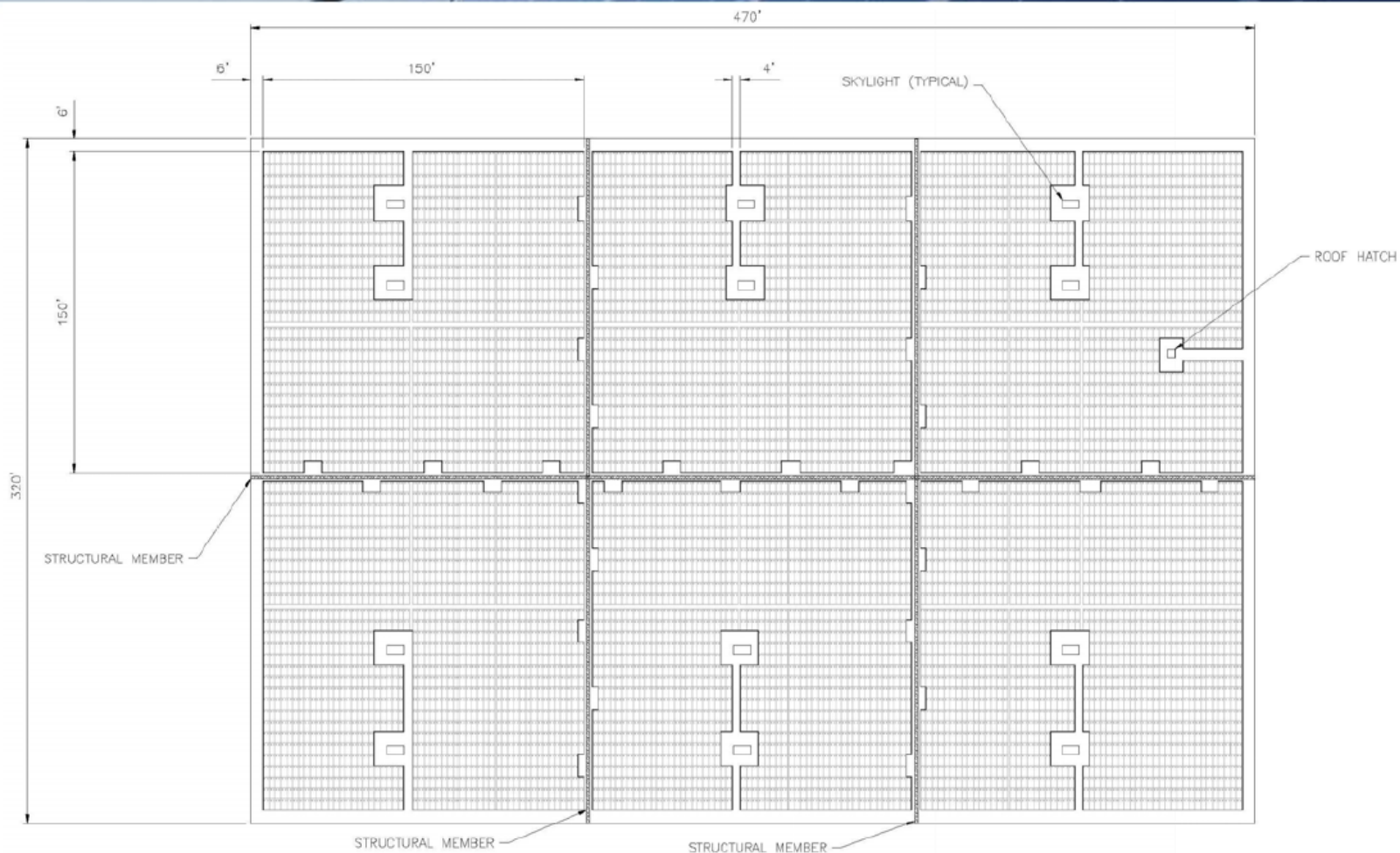


The density of the module arrangement in an array affects the accessibility and the area required to produce a certain amount of power.





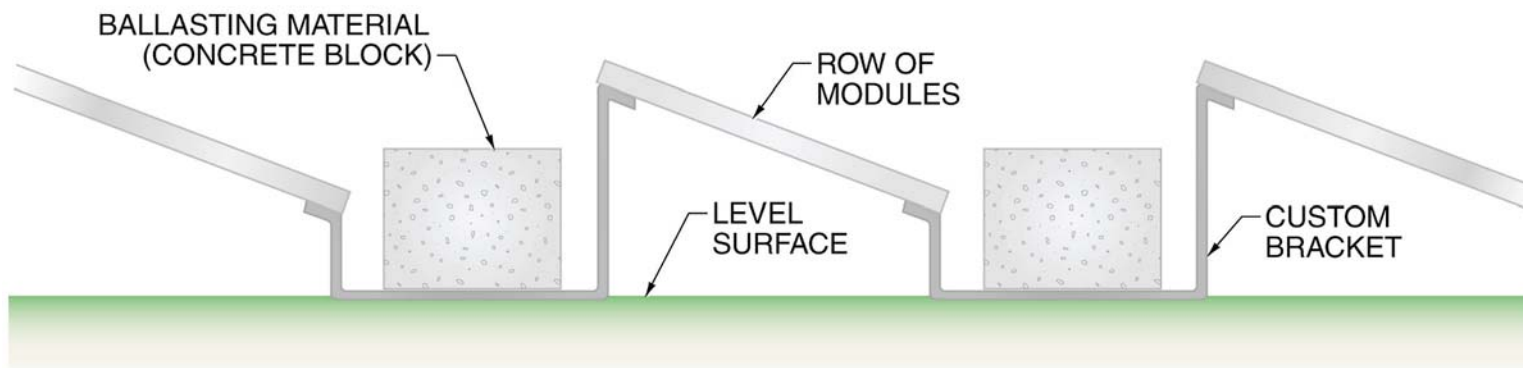
SOLAR ARRAY EXAMPLE — SMALL COMMERCIAL
8' WALKWAYS



SOLAR ARRAY EXAMPLE – LARGE COMMERCIAL

4' WALKWAYS WITH 8' X 4' VENTING OPPORTUNITIES EVERY 20'

Self-Ballasting



Fixed-tilted arrays require additional space considerations.
Why does it matter?
How do we calculate? (math.....)