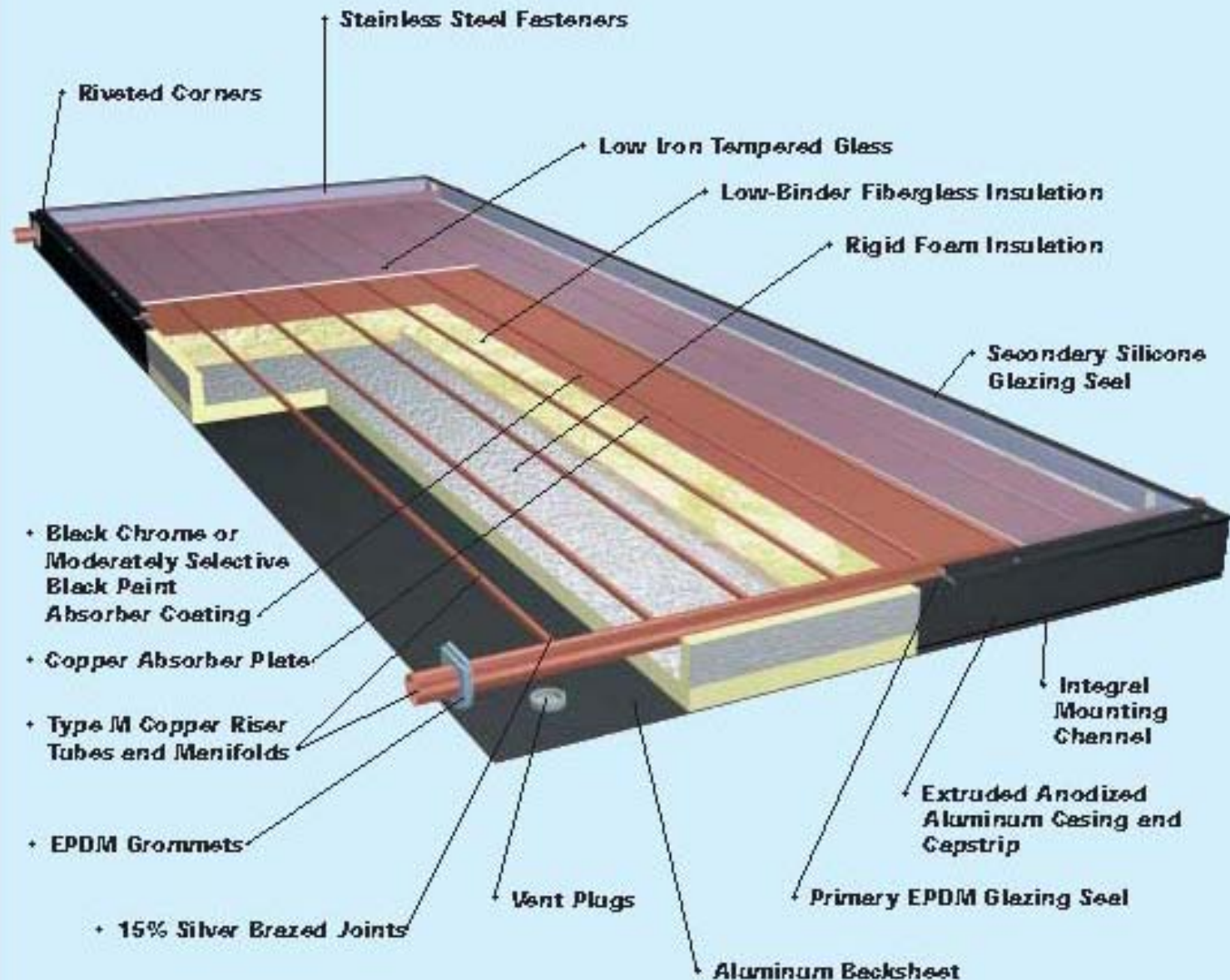
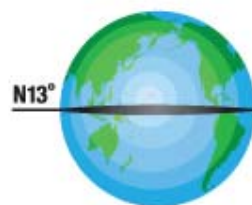


Pacific Solar & Photovoltaics



IN SOLAR WATER HEATING TECHNOLOGY





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	Project Solar Panel - Mr. Hagen Residence		
	Comments : Solar Panel -	Job No. : Designed by : LNB	Sheet No.: Date: Feb. 23, ;
	Subject: Design of Strut and Anchor	Reviewed by : CPA	

Based on Technical specs: Sunmodule SW155/165/175 mono
Solar panel to be installed at Roof of Mr. Hagen's Two storey Residence

length = 63.39 inches
width = 31.89 inches
weight = 33.00 lbs
weight/sqft. = 2.35 psf

Lateral Loads/Wind Load

Assume panel to hold the wind design velocity
Wind Velocity, V = 175 mph
two locations = Flat and slopping roof (96 hor: 14 vert)

Per UBC Code :
WL = Ce Cq qs I

where :

Ce = 1.39 Exposure D at two storey height
Cq = 1.30 For unenclosed structures with slope < 58.3%

slopping roof (96 hor: 14 vert) slope = 14.50% < 58.3%
slopping roof (180 hor: 20 vert) slope = 6.34% < 58.3%

qs = 0.00256 V²
78.65 psf
I = 1.0

∴

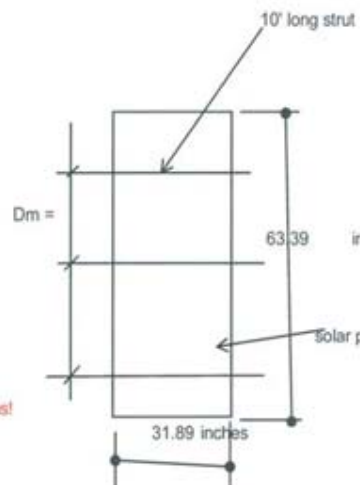
WL = (1.39) (1.30) (78.65) (1.0)
WL = 142.11 psf

Load Combination

Net Working Load = DL - WL = 2.35 - 142.11
-139.76 UPLIFT

Net Upl Load 1 = 0.9DL - 1.3WL = 0.9(2.35) - 1.3(142.11)
-182.63 UPLIFT governs!

Net Upl Load 2 = 1.2DL - 1.3WL = 1.2(2.35) - 1.3(142.11)
-181.92 UPLIFT



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D. Design of Strut spacing holding Solar Panel - use working Load
Trial spacing = 24 inches; also called D_m

From technical specs of Solar Panel:

$F_L = D_m \times P_m$; lbs/ft should not exceed 300lb/ft in any application
where : $P_m = -139.761$ psf pressure the module is exposed, in psf
 $D_m = 24$ inches; height of module being racked, in feet, strut spacing

$$F_L = \frac{(-139.761) (24)}{12}$$

$F_L = -279.522$ lbs/ft > 300 lbs/ft ∴ ok
use 24" on center strut spacing

However; Technical Specs doesnot mentioned if Working Load or Ultimate load to use for design of Strut Spacing
Code says, the most stringent Load should be used if specs is silent.

Trial spacing = 24 inches; also called D_m

therefore, use Ultimate load $P_m = -182.629$ psf pressure the module is exposed, in psf
 $D_m = 24$ inches; height of module being racked, in feet, strut spacing

$$F_L = \frac{(-182.629) (24)}{12}$$

$F_L = -365.259$ lbs/ft > 300 lbs/ft ∴ not ok

DCR : 1.218 21.8% overstressed, and more than 10% therefore not acceptable.

Trial spacing = 20 inches; also called D_m

therefore, use Ultimate load $P_m = -182.629$ psf pressure the module is exposed, in psf
 $D_m = 20$ inches; height of module being racked, in feet, strut spacing

$$F_L = \frac{(-182.629) (20)}{12}$$

$F_L = -304.382$ lbs/ft > 300 lbs/ft ∴ not ok but acceptable
use 20" on center strut spacing

DCR : 1.015 1.5% overstressed, but less than 10% therefore tolerable.

E. Design of Anchor Bolt for Strut Holding Solar Panel using 20" spacing - use Ultimate Load

From technical specs of Solar Panel:

$P_m = -182.629$ psf Governing Net Ultimate pressure
the module is exposed, in psf
use $D_m = 20$ inch designed strut spacing using ultimate load
; psf
where : $F_L = -3652.6$ lbs/ft Linear Load, not exceeding 300lbs/ft
 $D_f = 10$ ft strut free spun, length of strut

$$F_t = 3652.6 \times 10'$$

$$F_t = -36525.9$$
 lbs

Try 22 inches SSTL Anchor Bolt spacing

$$n = 10 \times 12/20"$$

$$n = 5.450$$
 pcs.

$$\text{use } n = 6$$

Check Tension

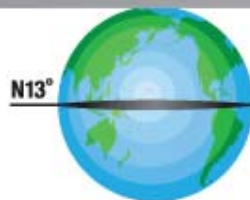
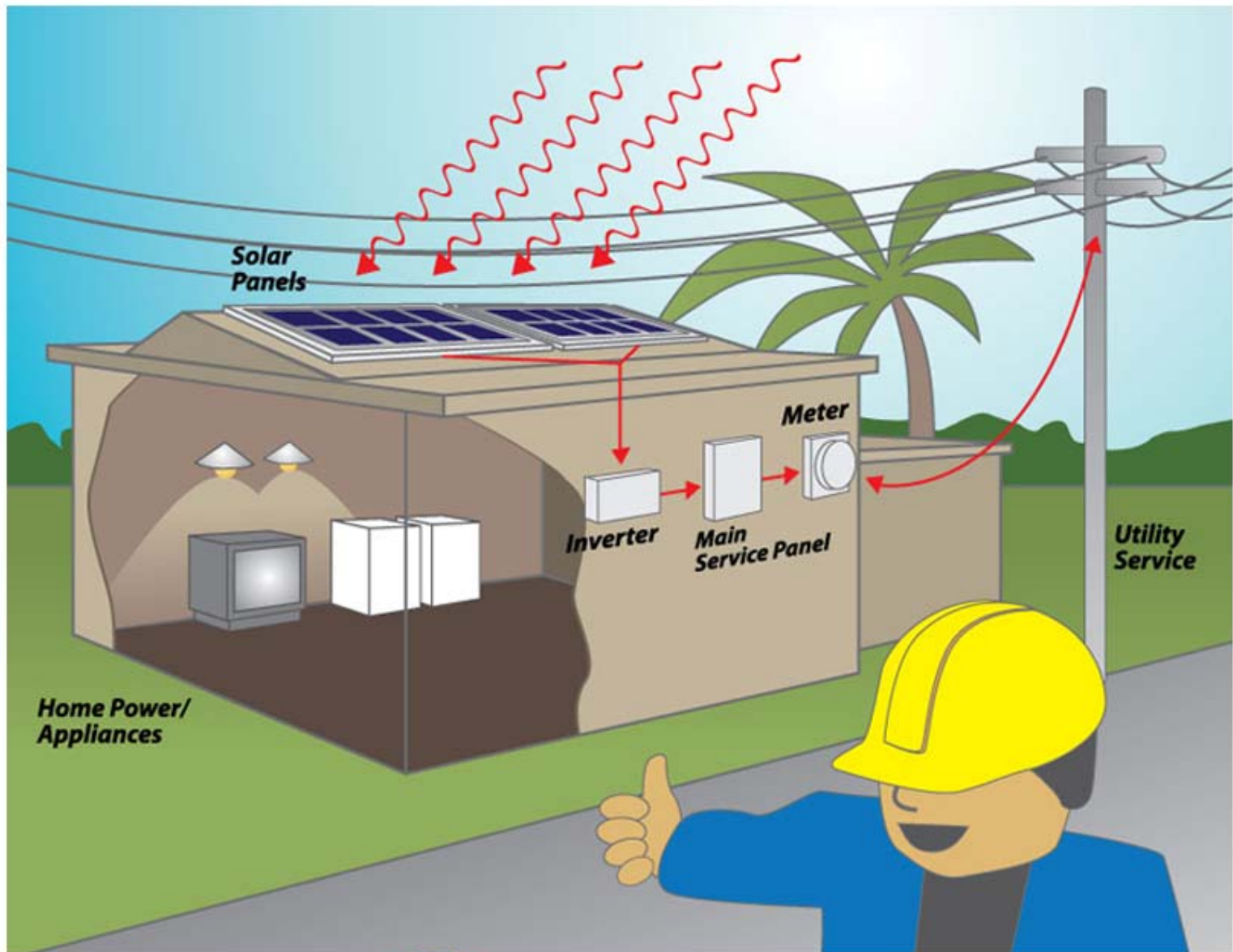
Governing Ultimate Uplift Force per Bolt

$$\text{Uplift Force per Bolt} = \frac{-182.63 \times 20.00 \times 10.00}{12 \times 6} = -507.30 \text{ lbs}$$

$$\text{Technical specs load factor} \times \frac{2.0}{1.014.6} \text{ lbs}$$

$$\text{Factor without inspection} \times \frac{1.5}{1.521.9} \text{ lbs} > 3630 \text{ lbs}$$

∴ use 3/8" SSTL Bolt @ 22" spacing with 3-3/8" embedment with 20 inches strut spacing



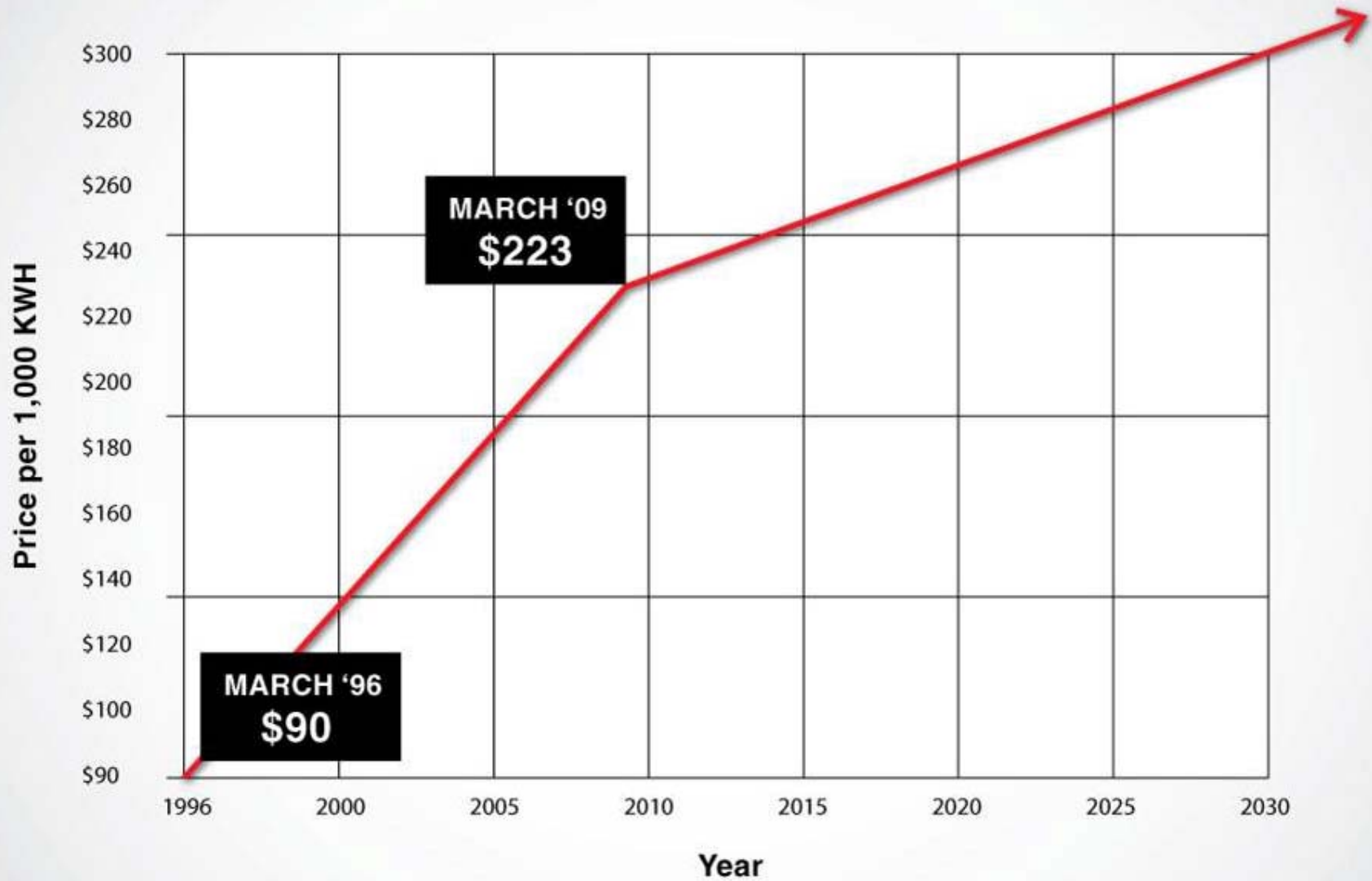
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GPA Rate Increase



Source: Guam Power Authority

TURN YOUR METER **BACKWARDS**



Pacific Solar & Photovoltaics

Scott Hagen

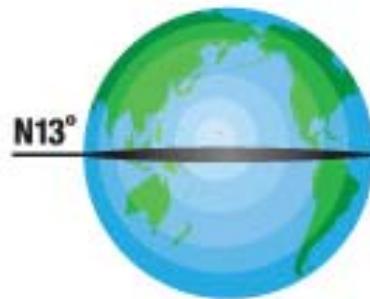
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