

# Solar Panel Project Report

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## Woods Residence

12/05/07

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### Package prepared by:

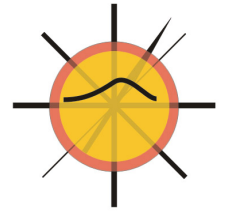
Bob Bruns  
Solar Panel Optimizer  
916-801-7640  
bbruns@sacbizbroker.com



# Solar Panel Optimizer

## Project description

### Woods Residence



The Woods residence faces east, so panels will go on the right side.

**Bill and Joan Woods**  
742 Evergreen Terrace  
Springfield  
KS

**Site latitude 39° N**

mr.woods@solarpaneloptimizer.com

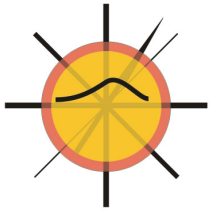
### Electric rates and cloud cover

#### Electric rates

January	February	March	April	May	June	July	August	September	October	November	December
15.50¢	15.50¢	15.50¢	15.50¢	15.50¢	15.50¢	25.00¢	37.00¢	25.00¢	25.00¢	14.00¢	14.00¢

#### Cloud cover

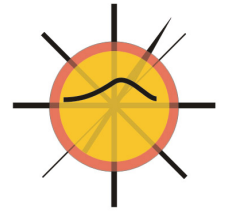
January	February	March	April	May	June	July	August	September	October	November	December
10.0%	5.0%	5.0%	2.0%	1.0%	0.0%	0.0%	0.0%	2.0%	2.0%	5.0%	5.0%



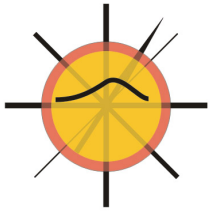
# Solar Panel Optimizer

## Roof section summary

### Woods Residence

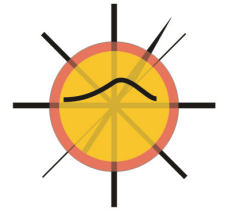


Roof sections used in this site								
Panel #	Name	Angle	Direction	Watts	Cost	Savings	ROI	Payback
2	180 degree roof section at 25 degrees	25°	180°	1000	\$8000	\$482	0.06	16.6 yrs
4	Incremental SW 2 175 Watt panels no inverter	45°	225°	350	\$2000	\$160	0.08	12.5 yrs
5	Southeast no inverter	35°	135°	1000	\$6000	\$466	0.08	12.9 yrs
Totals for roof sections used					\$16000	\$1108	0.07	14.4 yrs
Roof sections not used in this site								
1	180 degree roof section at 45 degrees	45°	180°	1000	\$8000	\$479	0.06	16.7 yrs
3	180 degree roof section at 15 degrees	15°	180°	1000	\$8000	\$469	0.06	17.1 yrs
Totals for roof sections not used					\$16000	\$947	0.06	16.9 yrs



# Solar Panel Optimizer

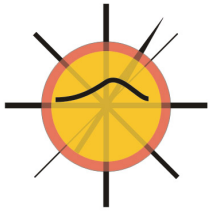
**180 degree roof section at 25 degrees**  
**This roof section is used in the site project**



<b>Roof section 2 installation summary</b>	<b>Project Latitude: 39°</b>
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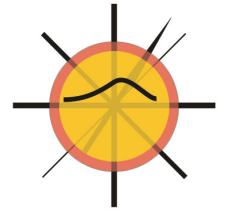
Orientation and cost			
<p style="font-size: small;">Vertical panel = 90° Flat roof = 0°</p>		<p style="font-size: small;">S 180° E 90° W 270° N 0°</p>	
Roof section angle	25°	Roof section direction	180°
Roof section rated power	1000 Watts	<b>Installed cost</b>	<b>\$8000</b>

Annual performance by month					
Month	% shade	% cloudy	Cost/kw-hr	kw-hrs	Savings
<b>January</b>	0	10.0	15.50¢	168.41	\$26.10
<b>February</b>	0	5.0	15.50¢	171.22	\$26.54
<b>March</b>	0	5.0	15.50¢	212.06	\$32.87
<b>April</b>	0	2.0	15.50¢	219.69	\$34.05
<b>May</b>	0	1.0	15.50¢	232.46	\$36.03
<b>June</b>	0	0.0	15.50¢	225.48	\$34.95
<b>July</b>	0	0.0	25.00¢	232.92	\$58.23
<b>August</b>	0	0.0	37.00¢	230.05	\$85.12
<b>September</b>	0	2.0	25.00¢	211.65	\$52.91
<b>October</b>	0	2.0	25.00¢	196.78	\$49.20
<b>November</b>	0	5.0	14.00¢	167.04	\$23.39
<b>December</b>	0	5.0	14.00¢	163.25	\$22.86
				=====	=====
<b>Totals</b>				<b>2431.01</b>	<b>\$482.25</b>



# Solar Panel Optimizer

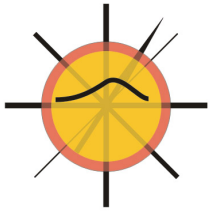
**Incremental SW 2 175 Watt panels no inverter**  
**This roof section is used in the site project**



<b>Roof section 4 installation summary</b>	<b>Project Latitude: 39°</b>
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<b>Orientation and cost</b>			
Roof section angle	45°	Roof section direction	225°
Roof section rated power	350 Watts	<b>Installed cost</b>	<b>\$2000</b>

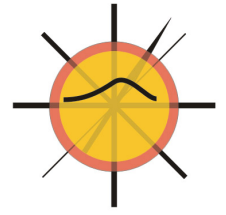
<b>Annual performance by month</b>					
Month	% shade	% cloudy	Cost/kw-hr	kw-hrs	Savings
<b>January</b>	0	10.0	15.50¢	58.71	\$9.10
<b>February</b>	0	5.0	15.50¢	58.81	\$9.12
<b>March</b>	0	5.0	15.50¢	70.89	\$10.99
<b>April</b>	0	2.0	15.50¢	73.28	\$11.36
<b>May</b>	0	1.0	15.50¢	75.18	\$11.65
<b>June</b>	0	0.0	15.50¢	71.26	\$11.05
<b>July</b>	0	0.0	25.00¢	74.38	\$18.59
<b>August</b>	0	0.0	37.00¢	75.15	\$27.81
<b>September</b>	0	2.0	25.00¢	71.52	\$17.88
<b>October</b>	0	2.0	25.00¢	66.28	\$16.57
<b>November</b>	0	5.0	14.00¢	57.63	\$8.07
<b>December</b>	0	5.0	14.00¢	57.65	\$8.07
				=====	=====
<b>Totals</b>				<b>810.74</b>	<b>\$160.26</b>



# Solar Panel Optimizer

## Southeast no inverter

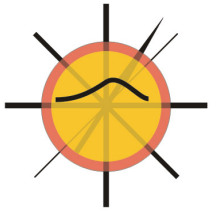
This roof section is used in the site project



<b>Roof section 5 installation summary</b>	<b>Project Latitude: 39°</b>
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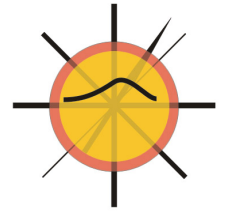
<b>Orientation and cost</b>			
Roof section angle	35°	Roof section direction	135°
Roof section rated power	1000 Watts	<b>Installed cost</b>	<b>\$6000</b>

<b>Annual performance by month</b>					
Month	% shade	% cloudy	Cost/kw-hr	kw-hrs	Savings
<b>January</b>	0	10.0	15.50¢	158.40	\$24.55
<b>February</b>	0	5.0	15.50¢	162.45	\$25.18
<b>March</b>	0	5.0	15.50¢	202.59	\$31.40
<b>April</b>	0	2.0	15.50¢	215.63	\$33.42
<b>May</b>	0	1.0	15.50¢	228.19	\$35.37
<b>June</b>	0	0.0	15.50¢	220.08	\$34.11
<b>July</b>	0	0.0	25.00¢	227.92	\$56.98
<b>August</b>	0	0.0	37.00¢	224.45	\$83.05
<b>September</b>	0	2.0	25.00¢	206.33	\$51.58
<b>October</b>	0	2.0	25.00¢	185.75	\$46.44
<b>November</b>	0	5.0	14.00¢	156.77	\$21.95
<b>December</b>	0	5.0	14.00¢	153.97	\$21.56
				=====	=====
<b>Totals</b>				<b>2342.53</b>	<b>\$465.59</b>



# Solar Panel Optimizer

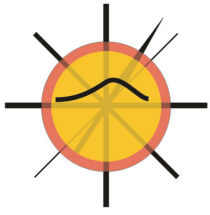
**180 degree roof section at 45 degrees**  
**This roof section is not used in the site project**



<b>Roof section 1 installation summary</b>	<b>Project Latitude: 39°</b>
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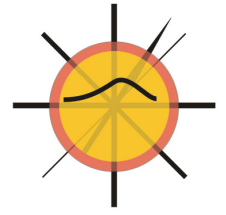
Orientation and cost			
Roof section angle	45°	Roof section direction	180°
Roof section rated power	1000 Watts	<b>Installed cost</b>	<b>\$8000</b>

Annual performance by month					
Month	% shade	% cloudy	Cost/kw-hr	kw-hrs	Savings
<b>January</b>	5	10.0	15.50¢	206.69	\$32.04
<b>February</b>	5	5.0	15.50¢	197.69	\$30.64
<b>March</b>	0	5.0	15.50¢	222.36	\$34.47
<b>April</b>	0	2.0	15.50¢	205.76	\$31.89
<b>May</b>	0	1.0	15.50¢	198.83	\$30.82
<b>June</b>	0	0.0	15.50¢	184.49	\$28.60
<b>July</b>	0	0.0	25.00¢	194.44	\$48.61
<b>August</b>	0	0.0	37.00¢	207.40	\$76.74
<b>September</b>	0	2.0	25.00¢	212.60	\$53.15
<b>October</b>	0	2.0	25.00¢	219.59	\$54.90
<b>November</b>	5	5.0	14.00¢	201.35	\$28.19
<b>December</b>	5	5.0	14.00¢	204.81	\$28.67
				=====	=====
<b>Totals</b>				<b>2456.01</b>	<b>\$478.72</b>



# Solar Panel Optimizer

**180 degree roof section at 15 degrees**  
**This roof section is not used in the site project**



<b>Roof section 3 installation summary</b>	<b>Project Latitude: 39°</b>
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Orientation and cost			
Roof section angle	15°	Roof section direction	180°
Roof section rated power	1000 Watts	<b>Installed cost</b>	<b>\$8000</b>

Annual performance by month					
Month	% shade	% cloudy	Cost/kw-hr	kw-hrs	Savings
<b>January</b>	0	10.0	15.50¢	147.06	\$22.79
<b>February</b>	0	5.0	15.50¢	154.58	\$23.96
<b>March</b>	0	5.0	15.50¢	200.60	\$31.09
<b>April</b>	0	2.0	15.50¢	218.02	\$33.79
<b>May</b>	0	1.0	15.50¢	238.66	\$36.99
<b>June</b>	0	0.0	15.50¢	235.80	\$36.55
<b>July</b>	0	0.0	25.00¢	241.58	\$60.40
<b>August</b>	0	0.0	37.00¢	231.66	\$85.71
<b>September</b>	0	2.0	25.00¢	204.06	\$51.01
<b>October</b>	0	2.0	25.00¢	182.42	\$45.61
<b>November</b>	0	5.0	14.00¢	150.40	\$21.06
<b>December</b>	0	5.0	14.00¢	140.75	\$19.70
				=====	=====
<b>Totals</b>				<b>2345.59</b>	<b>\$468.66</b>



## Solar Panel Optimizer

Bob Bruns  
May 29, 2008

The Solar Panel Optimizer is completely open source: Free!

These notes were written from a northern hemisphere perspective. My apologies to those that live south of the equator. Just reverse directions and you'll be ok.

The solar panel optimizer was developed to help determine the best orientation and angle for photo-voltaic solar panels on structures. It is organized so that you can try up to twenty such panels, and then pick the ones you want to use in your final design based on the installation costs and return on investment. There are many sites on the internet that estimate the return based on rules of thumb, but they all exhibit some shortcomings. I don't have a roof that faces South or Southwest. My roof sections best suited for panels face SSE and WSW. The size of these roof sections may not support 1000 Watts or more of panels and additional panels will not need the additional cost of a second inverter so incrementally they might be worthwhile.

The solar panel optimizer works by simulating the position of the sun for every hour of every day of the year. That's the only way to get an accurate assessment of the actual power available each month. It does millions of calculations for every panel you specify. Electric rates change during the year and with usage. Where I live we have "summer rates," "winter rates," and "Tier 1," "Tier 2," and "Tier 3" to "Tier 6" that cause power rates to vary from as low as 10 cents per kilowatt hour to over 50 cents! This wide variation in rates makes panel alignment important to maximize return on investment.

With up to 20 panels and rates that vary each month, this site stores a tremendous amount of data. For each project there are over 900 individual data points. Most are preloaded -they can be changed but you probably won't need to. All that data is stored securely in a database behind a firewall. Only the originator of the data has access so total privacy is assured. You can access that data again and again, and only changes you need to make can be done individually; all the data you saved before is still there. This convenience comes at a price, you must register for [www.solarpaneloptimizer.com](http://www.solarpaneloptimizer.com) and make a password. After that you can use the site without limitation, and safely store up to four sites for modification and recalculation at any time.

**No rebates or tax credits are currently calculated.** Local rebates and tax credits can increase your return on investment substantially and decrease the amount of time that the panel takes to pay for itself. Remember to check your local area for rebates and to consult

with your tax professional about the taxable benefits of going solar. They are substantial and make a significant difference in the decision to go solar. Remember that once the panel is paid for, the savings are the same as non-taxable net income: money in your pocket!

**Some things you will learn using this site:**

**Two sites, just one hundred miles apart, may have different optimum configurations.** In Fremont California, on the San Francisco Bay, there is little use for air conditioning, as the natural cooling of the bay keeps homes cool in the summer. Just 55 miles away to the east, in Modesto, California the summer heat makes air conditioning very popular in the summer. Even though the site latitude is virtually identical, 37 degrees, the optimum solar panel configuration is different for the two sites. Add the fact that the buildings are not identical and have different orientations and they become even more different. Just fifty miles north of Fremont is the City of San Francisco, which is notoriously cloudy in the summer.

**At the North Pole it doesn't matter what direction your panel points.** Try it. It is just interesting to model a panel at 90° N latitude. Of course the ROI is terrible, you only see sun for six months of the year and don't point the panel down, into the ground.

**Nothing at your house faces south. Is that important?** Almost no home has perfect southern exposure. The solar panel optimizer will tell you which roof sections can be used effectively.

Have fun with your solar exploration. We hope that we have made it easy for you. We welcome any comments or suggestions by email or telephone.

The author may be reached by telephone at 1.800.503.1123 (US Only) or 011.1.916.801.7640. By email Bob can be reached at [bob@solarpaneloptimizer.com](mailto:bob@solarpaneloptimizer.com).