The Future is Clean Energy

Solar Power Basics for Residential Customers

Courtesy of DOE/NREL
Contact Information

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Energy Efficiency First

Solar System

Utility Bill

Energy efficiency measures
Energy Efficiency First

Utility Bill

Solar System

Energy efficiency measures
Agenda

Technology
What is it?
How does it work?

Feasibility
Will it work for me?
Can I afford it?

Next Steps
How can I get one?
Solar Overview

**Light energy**

Photovoltaic (PV)
Electricity produced directly from light

**Heat energy**

Concentrated Solar Power (CSP)
Electricity produced by steam

Solar Pool Heating
Hot water for pools

Solar Water Heating (SWH or Solar Thermal)
Hot water for domestic use (DHW)

All courtesy of DOE/NREL
One-Minute Summary

Rent a portion of utility grid output

Your home needs electricity

Buy your own power plant

The basic economics are just like the “rent vs. buy” of purchasing a home.

Courtesy of DOE/NREL

Source: Pete Shoemaker
One-Minute Takeaway

• It works reliably for a long time.

• It requires good sun access in the middle of the day.

• Our weather is great—fog is a minor factor.

• It is not taxable and will likely raise the value of your house.

• Accurate financial analysis is key.
**Terminology**

**System Sizing**

200 HP engine: means that 200 horsepower is the MAXIMUM it will produce.

4 kW PV system: means that 4,000 watts (4 kW) is the MAXIMUM it will produce in full sunlight.
Solar Electric

Photovoltaic Effect

- photo = light; voltaic = produces voltage
- Photovoltaic (PV) systems convert light directly into electricity (using semi-conductor technology)
PV Terminology

Cell

Module or Panel

Array

Courtesy of DOE/NREL
Crystalline Silicon PV Products

• Firm, like crystals
• Longest track record, over 50 years
• Most common, over 85% of the market
• Highest efficiencies: avg. 15%, up to 22%
• Requires about 100 sf. per kilowatt

Source: DOE National Renewable Energy Laboratory
Thin Film PV Products

- Can be applied on many different materials
- Longevity still to be proven
- Production growing at high rate
- Lower efficiencies: avg. 7%, up to 15%
- Has potential for big cost reduction
- Requires about 200 sf. per kilowatt

Source: DOE National Renewable Energy Laboratory
Thin-film needs about twice as much space for the same-size system, but the total cost is about the same.
Efficiency vs. Capacity

1.2 kW (1,200 w)
75 square feet
16w per sq.ft.

Capacity = total power
Efficiency = power per sq.ft.

1.2 kW (1,200 w)
150 square feet
8w per sq.ft.
Inverter

System Inverter

Changes Direct Current (DC) to Alternating Current (AC)
Micro Inverter
One per module
Inverts DC to AC right there

Panel & meter
Combiner box & communicator
Typical System Components

Array

Inverter

Balance of System (BOS)

Meter

Panel

Loads

Source: Darren Bouton
PV Monitoring

- Extra hardware sends inverter data to internet
- Inverter company or 3rd party hosts website
- Customer can view system from home or remotely
- Current and historical data can be displayed

Can cost extra but some companies are offering it as standard package.
PV Monitoring

Total system history.

Real-time, per panel.

Courtesy Enphase http://enlighten.enphaseenergy.com/public/systems/LWtm4844
Typical System Components

1. Solar array
2. Inverter
3. House electrical panel

Source: PG&E
It works during the day, but what about at night?

Previously, there was only one solution:

Store the excess in batteries during the day, then draw off the batteries at night, or when it’s cloudy.

But now?
The utility grid is a two-way street!

Electricity can be “sent back” to the grid by the customer.

- Eliminates the need for batteries.
- Reduces cost and maintenance.
- Ensures a constant supply of electricity.
Sell Power to the Utility by Day

Buy Power at Night and Winter
- Exchange at retail
- Annual billing cycle
Net Metering

• The grid is like your “big battery”.

• Your meter keeps track of the storage (debits or credits).

• You “buy and sell” at the going rate.

• You can reduce your yearly electric bill to a small amount, but you cannot make a profit.

“Spin your meter backwards”
Net Metering

Customer side

Utility side

Meter
Net Metering

Customer side

Generation: 3 kWh

Load: 1 kWh

Utility side

Surplus: 2 kWh

Meter

Cash credit: $ .60
2 kWh @ $(going rate)
**Net Metering**

- **Generation**: 1 kWh  
- **Load**: 1 kWh  
- **Surplus**: 0 kWh  
- **Cash credit**: $0.00
Net Metering

Customer side

Generation: 0 kWh
Load: 1 kWh

Utility side

Need: 1 kWh
Meter
Cash debit: $.09
1 kWh @ $(going rate)
Net Metering

- Average monthly usage
- PV system production

Roll over

May
“SUMMER”
October
“WINTER”
April

kWh/mo
250
500
750
Net Metering

The surplus covers the shortfall, and your yearly bill is minimal.
Net Metering

PV system produces less than your yearly usage.

You pay this amount

Average monthly usage
PV system production

kWh/mo

May
“SUMMER”

October
“WINTER”

April
Net Metering

PV system produces more than your yearly usage.

You are paid a different rate for this amount – about 4¢ per kWh.
Net Metering

Why don’t you get paid if your system over-produces?

Cost of power at $.16/Kwh

- Wholesale cost: $.10/kwh
- Markup to cover grid maintenance: $.06/kwh

- CPUC rule—PG&E must comply
- The “full retail” rate that PV owners get paid for their power includes a subsidy (markup) that comes from all rate payers
- The CPUC determined that this subsidy would only be allowed to cover your usage, not for you to go into the power-generation business
Net Metering – No Blackout Protection

Unsafe to send live power into grid while workers repairing downed lines.

No “voltage reservoir” means house current could fluctuate and damage appliances.
Stand-Alone ("Off-Grid")
- With batteries

Grid Interactive ("On-Grid")
- Grid-tied only <=Today’s Focus
  - no batteries needed
- Grid-tied with battery backup
Grid-Tied System

• Green energy from your own PV system.

• The reliability and security of the utility company.

• Best of both worlds.
Rooftop – Residential

Courtesy of DOE/NREL
Rooftop – Solar Roof Tiles

Courtesy of DOE/NREL
Ground Mounted – Residential

Source: Pete Shoemaker

Courtesy of DOE/NREL
Reliability

Source: NASA
Reliability

- Mature technology—over 50 years old
- Essential to the space program
- Millions in use
- Long warranties backed by large, stable companies
- Products tested and approved by CEC
Environmental “Footprint”

• Best overall estimates from 1 to 2.5 years
• Depends on site and power production--in California is about 1.1 years.
• Shrinking as costs drop and production gets “greener”
• Pays back 10 to 30 times or more its environmental cost

Most PV manufacturing plants will have their own PV system on the roof.

Source: January 2008 Environmental Science & Technology
http://sustenergy.blogactiv.eu/2008/05/29/emissions-from-photovoltaic-manufacturing/
Technology Summary

- No moving parts
- Reliable with long warranties
- Very widespread
- Scalable, adaptable
- Low footprint
- Big environmental benefits
Agenda

Technology
What is it?
How does it work?

Feasibility
Will it work for me?
Can I afford it?

Next Steps
How can I get one?
Will it work for me?

Criteria, in order of importance:
1. Shading
2. Shading
3. Shading
4. Orientation (north-south)
5. Tilt (from horizontal)
6. Weather
Shading

Solar Window

“Shade-free from 9 to 3”

Sunrise

Sunset

Good chance for PV
Shading

Bad chance for PV
For tilted roof:

- Not good
- Good
- Very good
- OK
Tilt

Typical roof in this area is 4:12. For every 12 feet horizontal, it drops 4 feet. This equals 18 degrees up from horizontal.

Normal roof pitch is a very good mounting angle.
Trackers

For most home systems, the extra expense and maintenance of tracking motors is not worth the efficiency gain. Better to buy a few extra panels.
Weather

• California climate ideal for solar
• Panels produce in all light
• Fog has cooling effect, which raises efficiency
• Microclimates likely less than 15% loss from normal
Don’t put a new PV system on an old roof!

- Minimum roof life should be 5 – 7 years.
- Good idea to do PV and roof at same time
- Estimate for panel removal/replacement is $1,000 per Kw of system size.
Will it work for me?

- Need ‘solar window’
- Need area facing S, W or E
- Tilt is usually fine, even flat OK
- Weather is generally good
Can I afford it?

Is it too expensive?

Compared to what?

Let’s see what you have now …
Current Situation

PG&E monthly electric bill for a large home user:

<table>
<thead>
<tr>
<th>Usage Comparison</th>
<th>Days Billed</th>
<th>Kwh Billed</th>
<th>Kwh per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>This Year</td>
<td>33</td>
<td>978</td>
<td>29.6</td>
</tr>
<tr>
<td>Last Year</td>
<td>31</td>
<td>900</td>
<td>29.0</td>
</tr>
</tbody>
</table>

**Charges**

11/04/2010 - 12/06/2010

<table>
<thead>
<tr>
<th>Electric Charges</th>
<th>323.40000 Kwh</th>
<th>$0.11877</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Quantity</td>
<td>323.40000 Kwh</td>
<td>$0.11877</td>
</tr>
<tr>
<td>Baseline Usage</td>
<td>97.02000 Kwh</td>
<td>$0.13502</td>
</tr>
<tr>
<td>101-130% of Baseline</td>
<td>226.38000 Kwh</td>
<td>$0.29062</td>
</tr>
<tr>
<td>131-200% of Baseline</td>
<td>323.40000 Kwh</td>
<td>$0.40029</td>
</tr>
<tr>
<td>201-300% of Baseline</td>
<td>7.80000 Kwh</td>
<td>$0.40029</td>
</tr>
</tbody>
</table>

5 rate tiers

1. = $ 38.41
2. = $ 13.10
3. = $ 65.79
4. = $ 129.46
5. = $ 3.12

Total: $ 249.88

Used 978 Kwh costing $ 249.88
The less you use, the more you eliminate the expensive upper tiers:

Current Situation

<table>
<thead>
<tr>
<th>Charges</th>
<th>5 rate tiers</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/04/2010 - 12/06/2010</td>
<td></td>
</tr>
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<td></td>
</tr>
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<tr>
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<td>$ 129.46</td>
</tr>
<tr>
<td>201-300% of Baseline</td>
<td>$ 3.12</td>
</tr>
<tr>
<td>Over 300% of Baseline</td>
<td>$ 249.88</td>
</tr>
<tr>
<td>323.40000 Kwh</td>
<td></td>
</tr>
<tr>
<td>97.02000 Kwh @ $0.11877</td>
<td></td>
</tr>
<tr>
<td>226.38000 Kwh @ $0.29062</td>
<td></td>
</tr>
<tr>
<td>323.40000 Kwh @ $0.40029</td>
<td></td>
</tr>
<tr>
<td>7.80000 Kwh @ $0.40029</td>
<td></td>
</tr>
<tr>
<td>978.00</td>
<td></td>
</tr>
</tbody>
</table>
The less you use, the more you eliminate the expensive upper tiers:

From 978 Kwh to 421 Kwh -- from $250 to $50.
Lowering the usage 57% lowers the bill 80%.
E-1 / PG&E Standard Rate Schedule (Residential)

As of 7/1/12

- Less than 100%
  - Cents per kWh: 12.8

- 101% - 130%
  - Cents per kWh: 14.6

- 131% - 200%
  - Cents per kWh: 29.5

- 201% - 300%
  - Cents per kWh: 33.5

- Over 300%
  - Cents per kWh: 33.5

Cents per kWh vs. Percentage of baseline allocation
E-1 / PG&E Standard Rate Schedule (Residential)

As of 7/1/12

Solar reverses the rate tier effect

Lower ROI → Higher ROI

Percentage of baseline allocation

Cents per kWh

Less than 100% 101% - 130% 131% - 200% 201% - 300% Over 300%

Lower ROI → Higher ROI
Case study

Electric bill: $100/month = $1200/year

After 10 years you will have paid $12,000 ... if rates do not rise.

Is this a reasonable assumption?
Current Situation

Case study

Electric bill: $100/month = $1200/year

*With annual inflation increases, after 10 years you will have paid around $13,000 to $16,000 ...

- No equity
- Nothing “paid off”

So the real question is

Can solar be less expensive than this?
Initial cost is high . . . because you are paying for 30 to 40 years of electricity up front.

*But after that the costs are very low because the fuel is free!*

There are ways to reduce the cost and eliminate the sticker shock . . .
The CSI makes PV

- **Economical:**
  Gives financial incentives to lower the cost

- **Secure**
  Screens and tests equipment
  Requires long warranties
  Helps screen and check installers
  Standardizes production estimates

- **Easy**
  Helps installers handle everything
California Solar Initiative (CSI)

CPUC (California Public Utilities Commission)
- Existing Residential
- Existing Commercial
- Commercial New Construction

CSI (California Solar Initiative)
- Program Administrator
- PG&E

CEC (California Energy Commission)
- Residential New Construction

NSHP (New Solar Homes Partnership)
- Program Administrator
- PG&E

SB 1

California Energy Commission (CEC)
CSI Financial Incentives—numbers

EPBB = Expected Performance-Based Buydown
PBI = Performance-Based Incentive

| Step | Statewide MW in Step | EPBB Payments (per Watt) | | | | PBI Payments (per kWh) | | |
|------|---------------------|-------------------------|------|-------------------------|------|-------------------------|------|
|      | Residential | Commercial | Government/ Non-Profit | Residential | Commercial | Government/ Non-Profit |
| 1    | n/a      | n/a          | n/a | n/a      | n/a          | n/a |
| 2    | $2.50    | $2.50        | $3.25 | $0.39    | $0.39        | $0.50 |
| 3    | $2.20    | $2.20        | $2.95 | $0.34    | $0.34        | $0.46 |
| 4    | $1.90    | $1.90        | $2.65 | $0.26    | $0.26        | $0.37 |
| 5    | $1.55    | $1.55        | $2.30 | $0.22    | $0.22        | $0.32 |
| 6    | $1.10    | $1.10        | $1.85 | $0.15    | $0.15        | $0.26 |
| 7    | $0.65    | $0.65        | $1.40 | $0.09    | $0.09        | $0.19 |
| 8    | $0.35    | $0.35        | $1.10 | $0.05    | $0.05        | $0.15 |
| 9    | $0.25    | $0.25        | $0.92 | $0.03    | $0.03        | $0.12 |
| 10   | $0.20    | $0.20        | $0.70 | $0.03    | $0.03        | $0.10 |

Overall outline:

Incentives step down according to amount of PV installed (MW)
CSI Financial Incentives—numbers

Data as of 9/7/12

<table>
<thead>
<tr>
<th>Administrator</th>
<th>Customer Class</th>
<th>Current Step</th>
<th>Initial MW in Step</th>
<th>Unused MW from Previous Steps</th>
<th>Revised Total MW in Step</th>
<th>Issued Conditional Reservation Letters (MW)</th>
<th>MW Remaining</th>
<th>MW Under Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG&amp;E</td>
<td>Residential</td>
<td>10</td>
<td>50.50</td>
<td>0.14</td>
<td>50.64</td>
<td>9.56</td>
<td>41.08</td>
<td>2.26</td>
</tr>
<tr>
<td></td>
<td>Non-Residential</td>
<td>10</td>
<td>102.50</td>
<td>7.41</td>
<td>109.91</td>
<td>25.81</td>
<td>84.11</td>
<td>6.39</td>
</tr>
<tr>
<td>SCE</td>
<td>Residential</td>
<td>8</td>
<td>38.00</td>
<td>2.30</td>
<td>40.30</td>
<td>28.43</td>
<td>11.87</td>
<td>1.49</td>
</tr>
<tr>
<td></td>
<td>Non-Residential</td>
<td>8</td>
<td>77.10</td>
<td>43.32</td>
<td>120.42</td>
<td>76.06</td>
<td>44.36</td>
<td>1.04</td>
</tr>
<tr>
<td>CCSE</td>
<td>Residential</td>
<td>10</td>
<td>11.90</td>
<td>0.39</td>
<td>12.29</td>
<td>7.65</td>
<td>4.64</td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td>Non-Residential</td>
<td>8</td>
<td>17.30</td>
<td>7.04</td>
<td>24.34</td>
<td>12.56</td>
<td>11.78</td>
<td>0.01</td>
</tr>
</tbody>
</table>

MW remaining – MW under review = best estimate of how much left. For PG&E residential: 41.08 – 2.26 = 38.82 MW.

**Trigger Tracker.** Helps determine when incentives drop.

http://www.csi-trigger.com/
Federal Incentives

• Federal Tax Credit
  – 30% of net cost
  – No cap
  – Extended through 2016.

• Tax Incentives for Businesses
  – Accelerated Depreciation (first 5 years)

• Resources
  – SEIA Guide to Federal Tax Credits
    http://calseia.org/News/General/Tax-Credit.html
PV Statistics & Performance for the “Average” Family of Four
(monthly electrical bill $100-$200)

4.0 Kw_{AC} System

- COST (before rebate = $6,500 / kW) $26,000
- REBATE (est. $180 / kW) $720
- TAX CREDIT $7584
- NET COST $17,696
- Maintenance (25 – 40 yrs.) $5,000
- Total Lifecycle Cost $22,696

- kWh Production ~ 6,500 kWh / year
- Space requirements ~ 350 - 500 s.f.

- Avg. cost of power now ($150/mo) $.18/Kwh
- 25-yr. cost of power (est.) $.14/Kwh
- 40-yr. cost of power (est.) $.09/Kwh
San Francisco Additional Rebate

http://sfwater.org/index.aspx?page=133

Basic amount $2,000 per home for SF residents. $750 more if the installer is an SF-based company. In addition to the utility rebate and federal tax credit.
# San Francisco Additional Rebate

## Residential Incentives

Select one base incentive and then add on supplemental incentives if applicable.

### Base Incentives

Select one:

<table>
<thead>
<tr>
<th>Incentive</th>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic</strong></td>
<td>Available to any resident installing solar generation on his/her own property located within San Francisco.</td>
<td>$2000</td>
</tr>
<tr>
<td><strong>Environmental Justice</strong></td>
<td>Available to residential installations located in San Francisco’s environmental justice zip codes, 94107 and 94124, PG&amp;E CARE customers, and CalHome loan enrollees.</td>
<td>$3000</td>
</tr>
</tbody>
</table>

### City Installer Supplemental Incentive

If applicable, this incentive is added to one of the base incentives above.

| City Installer | Installers with principal place of business in San Francisco as explained in the Application Package.                                                                                     | $750   |

### Low-Income Supplemental Incentives

If applicable, a low income incentive is added to one of the base incentives above.

| Low-Income SASH (Single-Family Affordable Solar Homes Program) | Available to SASH applicants. SASH is the State’s CSI low-income program under which applicants may be eligible for a free system or a highly subsidized system. Households that qualify for SASH must apply for a Low-Income SASH incentive and may not apply for a GoSolarSF Low-Income Non-SASH incentive. To qualify, the household must be below median income and the home must be located in the San Francisco Enterprise Zone or in a Neighborhood Revitalization Area. Please see Determination of SASH Eligibility. | Up to $7000 |

## PV Statistics & Performance for the “SF Average” Family of Four
(monthly electrical bill $75-$150)

### 3.0 Kw \textsubscript{AC} System

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>COST (before rebate = $6500 / kW)</td>
<td>$19,500</td>
</tr>
<tr>
<td>CSI REBATE (est. $180 / kW)</td>
<td>- $540</td>
</tr>
<tr>
<td>TAX CREDIT</td>
<td>- $5,688</td>
</tr>
<tr>
<td>SF REBATE</td>
<td>- $2,750</td>
</tr>
<tr>
<td>Taxability of SF rebate</td>
<td>+$550</td>
</tr>
<tr>
<td>NET COST</td>
<td>$11,072</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$4,000</td>
</tr>
<tr>
<td>Total Lifecycle Cost</td>
<td>$15,072</td>
</tr>
<tr>
<td>kWh Production</td>
<td>~ 5000 kWh / year</td>
</tr>
<tr>
<td>Space requirements</td>
<td>~ 300 s.f.</td>
</tr>
</tbody>
</table>

Avg. cost of power now ($100/mo) $0.15/Kwh
25-yr. cost of power (est.) $0.13/Kwh
40-yr. cost of power (est.) $0.08/Kwh
Three Ways to Buy

1. Full purchase (cash or borrowing)

**You**
- Owner of system
- Borrow money or pay cash
- Full payment up front
- Maintain and monitor system
- **Economics:**
  - Cash / total savings
  - Loan pmt. / monthly savings

**PV Vendor**
- Design and install
- Sell
- Honor warranties (equipment & labor)
Three Ways to Buy

2. Solar Lease

**You**
- Low or no money down
- Fixed lease payment
- Possible buyout in the future
- **Economics:** Lease pmt. / monthly savings

**PV Vendor**
- Owner of system
- Design and install
- Lease
- Maintain and monitor system
- Honor warranties (equipment & labor)
- Remove system at end if needed
Three Ways to Buy

3. Power Purchase Agreement (PPA)

You

- Low or no money down
- Monthly power payment
- Possible buyout in the future
- **Economics:** Monthly pmt. / monthly savings

PV Vendor

- Owner of system
- Design and install
- Sell power
- Maintain and monitor system
- Honor warranties (equipment & labor)
- Remove system at end if needed

$ $
Time of Use Rates

Seasonal load

PG&E 2006 Annual Usage
Time of Use Rates

MAY 1 THROUGH OCTOBER 31
(SUMMER)

NOVEMBER 1 THROUGH APRIL 30
(WINTER)

**ON PEAK-HIGHEST ENERGY COST**
(AVOID ENERGY USE WHENEVER POSSIBLE)

**PARTIAL PEAK-MEDIUM ENERGY COST**
(MINIMIZE ENERGY USE WHENEVER POSSIBLE)

**OFF PEAK-LOWEST ENERGY COST**
(ALL DAY SATURDAY, SUNDAY & HOLIDAYS)
### Residential "E6" Time-of-Use Pricing Periods

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 6am</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
</tr>
<tr>
<td>6am - 10am</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
</tr>
<tr>
<td>10am - 1pm</td>
<td>Off-Peak</td>
<td>Part-Peak</td>
<td>Part-Peak</td>
<td>Part-Peak</td>
<td>Part-Peak</td>
<td>Part-Peak</td>
<td>Off-Peak</td>
</tr>
<tr>
<td>1pm - 7pm</td>
<td>Off-Peak</td>
<td>Peak</td>
<td>Peak</td>
<td>Peak</td>
<td>Peak</td>
<td>Peak</td>
<td>Off-Peak</td>
</tr>
<tr>
<td>7pm - 9pm</td>
<td>Part-Peak</td>
<td>Part-Peak</td>
<td>Part-Peak</td>
<td>Part-Peak</td>
<td>Part-Peak</td>
<td>Part-Peak</td>
<td>Part-Peak</td>
</tr>
<tr>
<td>9pm - Midnight</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
<td>Off-Peak</td>
</tr>
</tbody>
</table>

- Peak rates in Summer Afternoons 29¢/kWh + tier surcharges
- Part-Peak rates: 14¢/kWh + tiers
- Off-Peak rates (Nights & Weekends) 8.5-10¢/kWh + tiers
Time of Use Rates

E-6 summer rates (May – October)
Time of Use Rates

Typical summer production
Time of Use Rates

Summer pattern (May – October)
Buying low and selling high adds value.
Should I go on a TOU rate with my PV system?

- **On-peak usage**
  - High:
  - Med: **No**
  - Low: **Yes**

**Percentage of yearly usage covered by solar**

0 25% 50% 75% 100%
Return on Investment

Monthly Cash Flow:
• Financed by a home-secured loan
• Loan interest is tax-deductible
• Or lease program—no financing, low down pmt.
• Assuming historical rate escalation continues

Monthly cash flow can be immediately positive for many people.
*They can start making money from day one and continue for over 30 years!*

Solar lease programs can lower or eliminate the down payment and be cash-positive as well.
Maintenance: Replacing Inverter

- Minimum inverter warranty is 10 years.
- Probable lifetime 15 years or more.
- Replacement is typically factored in economic analysis.
- Trend in electronics is to get smaller and cheaper.

Source: DOE / NREL
Maintenance: Washing Panels

• Three basic categories for rainy / dry season areas
  – Washed as often as necessary ~ 1.0
  – Washed once in July ~ 0.96
  – Never washed ~ 0.93

• Factors affecting number
  – Rainy / dry seasons
  – Dirt roads
  – Near agricultural activity
  – Close to road surface of busy street
  – In airport flight path

Bottom line: Washing panels helps, but is not crucial unless area is particularly dusty or there are other unusual factors (birds).
Increase in Home Value

Appraisal Value
- Will likely go up
- Less utility cost means more money available for mortgage payment
- Data so far is small, but supportive
- Much more to come as solar houses turn over

Solar Rights Act
- California law that supports solar
- Keeps HOAs and other CC&Rs from prohibiting solar systems
- Forbids increased property taxes on owner’s system
- Restriction ends when home is sold, and assessment can go up to reflect system
Agenda

- Technology
  - What is it?
  - How does it work?
- Feasibility
  - Will it work for me?
  - Can I afford it?

Next Steps
- How can I get one?
Installing Solar PV at Your Home

• STEP 1: Complete an Energy Audit
• STEP 2: Contact and Choose an Installer
  INSTALLER HANDLES THE REST
• STEP 3: Complete and Submit Applications for CSI
• STEP 4: Get city Permits and Install System
• STEP 5: Schedule Final Building Inspection
• STEP 6: Schedule Final Utility Inspection
• STEP 7: Claim Incentives
Contact & Choose an Installer

- Find installers
- Choose which ones to contact
- Obtain bids
- Evaluate bids and pick best one
- Arrange financing (if necessary)
Find Installers

- **www.gosolarcalifornia.org**
  best site for both PV and solar thermal

- **California Energy Commission**
  www.consumerenergycenter.org/erprebate/database/index.html

- **NorCal Solar Business Members**
  www.norcalsolar.org/biz_members_list/busmembers.php

- **CalSEIA Members**
  http://calseia.org/, “Find an Expert” link

- **Personal references**
Analyzing Bids: Production estimates

- Everyone must use EPBB online calculator

- Helps standardize estimates, eliminate “over promising”

- EPBB requires tilt, orientation, and shading data

- Shading is the most difficult to assess and can vary in bid estimates. If it varies widely ask about it.

- EPBB printout must be included in CSI application
Analyzing Bids: Key Information

1. Full price, *before* incentives. This includes all “adders” (such as extra roof charges), and extras (such as monitoring), an estimate for permit fees (around $300), and taxes.

2. The system size in CEC AC watts (industry standard). Do not accept just the DC system size.

3. The *per-watt price*. This is determined by dividing the full price by the system size. This is the “unit price” that allows you to compare “apples to apples”. It will typically be around $8 to $9 per watt.
Base price:  $20,000  
Roof adder:  $2,000  
Permit fee:  $500  
Total:  $22,500  

System Size:  
4.0 Kw DC  
3.38 Kw AC (CEC)  
(3,380 watts)  

Per-watt price: 

$22,500 / 3,380 = $6.65/watt
Comparing Bids

Three options:

1. 20 Sharp 185 panels, 3.19 Kw AC, $6.35/watt
2. 20 Evergreen 180 panels, 3.12 Kw AC, $6.22/watt
3. 20 Kyocera 190 panels, 3.28 Kw AC, $6.45/watt

*If target of 100 Kw is met, price will drop to $5.75/watt.*
Final Word: Don’t forget the bottom line
For more information on PG&E’s environmental efforts, please visit our website www.pge.com/environment

- **PG&E’s Solar Website**
  www.pge.com/solar

- **PG&E Email**
  smarter-energy@pge.com

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