

# Solar Simplified – Getting Started – 6/10/2017

Ecology Center & Sierra Club Bay Chapter

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## Solar Financing

### Homeowner owns the system – pros and cons

**Pros:** Eligible for the 30% federal tax credit on the total system cost. Known, fixed cost for electricity for 25+ years. You probably don't need to insure your system (check with your insurer).

**Con:** Homeowner is responsible for system production, maintenance & repairs\*

Cash purchase

Excellent return on investment

High upfront cost (\$10,000 to \$16,000 for a 4 kW system)

Home Equity Loan

Good interest rate\*\* (4+%) = good ROI. Can be minimal upfront cost

Low interest rate depends on good credit score. Home is at risk on default

Unsecured Solar Loan

Home is not at risk on default. Minimal upfront cost

Need good credit. High interest rates\*\* (~7-14%\*\*\* = lower ROI

Property-Tax Loan (PACE - Property Assessed Clean Energy)

Low upfront cost. Good credit is not needed. Repayment is transferable to new owners

Higher interest rates (5 yr: ~6.75% ... 20 year: ~8.4%\*\*\*\* = lower ROI

\* However, almost all installers provide at least a 10 year workmanship warranty

\*\* Interest may be tax deductible

\*\*\* One source (Lightstream): <https://www.lightstream.com/solar-financing>

\*\*\*\* ABAG: [http://abag.ca.gov/bayren/pace/pdfs/PACEcomparison\\_060315.pdf](http://abag.ca.gov/bayren/pace/pdfs/PACEcomparison_060315.pdf)

### Homeowner does not own the system\* – pros and cons

- Power Purchase Agreement (PPA): Pay per kWh for energy generated by the system (monthly payment is not fixed)
- Lease: Pay a set monthly fee for energy generated by the system
- PPAs and Leases may be \$zero down, fully pre-paid, or partial-down

**Pros (PPAs and Leases)**

- Not responsible for any system maintenance
- Can be zero upfront cost to go solar
- Payback for lower cost of electricity is immediate (for \$0 down systems)

**Cons (PPAs and Leases)**

- Not eligible for the 30% federal tax credit
- Home may become encumbered with a lien (commonly 20 years)
- May complicate sale of home
- PPAs and leases may have an “escalator” clause increasing your payments over time

\* Known as “Third Party Ownership” or TPO

# Solar Economics

## Terms

### Simple Payback (in years)

*Total investment divided by annual savings*

### Simple Return on Investment (in percent)

*Annual savings divided by total investment, times 100*

### Simple Lifetime Cost per kilowatt-hour (in ¢/kWh - cents per kilowatt-hour)

*Total investment divided by total lifetime energy generated*

## Assumptions

Usage: 6000 kilowatt-hours (kWh) per year

Bay Area cost of electricity: 24¢ per kWh

Electricity bill:  $6000 * \$0.24 \approx \$1440/\text{year}$  (\$120/mo)

Bay Area cost of solar: \$2.50 to \$4 per watt DC, before receiving the 30% federal tax credit

## Cash Purchase Example

4 kW (DC) system: Offsets ~90% of usage and bill

\$10,000 to \$16,000 (before 30% tax credit)

\$7000 to \$11,200 after the credit

Add \$1000 for inverter replacement

Total (lifetime) cost: \$8000 to \$12,200

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Electricity bill: \$1440/yr

4 kW system, total cost: \$8000 to \$12,200 Solar system energy output

~1400 kWh per kW per year

$4 * 1400 \approx 5600$  kWh (year 1)

0.5% panel degradation per year

126,000 kWh lifetime energy output

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Electricity bill: \$1440/yr

4 kW system, total cost: \$8000 to \$12,200 126,000 kWh lifetime output

Simple Lifetime Cost per kWh

$\$8000 / 126,000 \approx 6.3\text{¢}/\text{kWh}$  (\$2.50/watt)

$\$12,200 / 126,000 \approx 9.7\text{¢}/\text{kWh}$  (\$4/watt)

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Electricity bill: \$1440/yr

4 kW system, total cost: \$8000 to \$12,200

126,000 kWh lifetime output

Simple Lifetime Cost/kWh: 6.3 to 9.7¢/kWh

Yearly savings: kWh \* per-kWh savings / 25

•  $126,000 * (24\text{¢} - 9.7\text{¢}) / 25 \approx \mathbf{\$721}$  (\$4/watt)

•  $126,000 * (24\text{¢} - 6.3\text{¢}) / 25 \approx \mathbf{\$892}$  (\$2.50/watt)

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Simple Payback

$\$12,200 / \$721 \approx 17$  years (\$4/watt)

$\$8000 / \$892 \approx 9$  years (\$2.50/watt)

Simple Return on Investment

$\$721 / \$12,200 \approx 5.9\%$  (\$4/watt)

$\$892 / \$8000 \approx 11.2\%$  (\$2.50/watt)

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\$4/watt  $\approx$  17 year payback  $\Rightarrow$  5.9% ROI

\$2.50/watt  $\approx$  9 year payback  $\Rightarrow$  11.2% ROI

- Assumes NO rise in the price of grid energy
- Internal Rate of Return (IRR) is higher
- Solar ROI is *not taxable*
- 5-year CD: 2.25% taxable
- 10 year treasuries:  $\sim$ 2.2% taxable
- Stock Market:  $\sim$ 7% (look out below!) taxable

## Free Online PV Economics Spreadsheet

PV Calc – [pvcalc.org](http://pvcalc.org)

## Solar + PV Economics

Solar cash purchase example

5.9% to 11.2% ROI

Cost to drive a gasoline (“ICE”) car

- **10¢/mile** (at 30 mpg and \$3/gallon)

Cost to drive an electric car powered by solar

- **1.8¢/mile** (at 3.4 miles/kWh and 6.3¢/kWh)
- **2.8¢/mile** (at 3.4 miles/kWh and 9.7¢/kWh)

Savings (EV versus ICE): 7.2¢ to 8.3¢/mile

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\$ 1521/yr to \$1692 /yr total savings

Simple Payback

$\$12,200 / \$1521 \approx 8$  years (\$4/watt)

$\$8000 / \$1692 \approx 4.7$  years (\$2.50/watt)

Simple ROI (not taxable)

$\$1521 / \$12,200 \approx 12.5\%$  (\$4/watt)

$\$1692 / \$8000 \approx 21.1\%$  (\$2.50/watt)

## Solar Environmental Benefits

Reduces fossil fuel dependence

Reliable, safe, clean energy

Enables clean transportation (solar-powered EVs)

Reduces need for utility equipment and maintenance

Reduces need for remote power plants, substations and transmission lines

Fast-growing labor-intensive industry creates many jobs

Increases voter awareness about energy

Enables clean home appliances (oven, cooktop, clothes dryer, A/C, space & water heat)

Starts conversations, enables clean power bragging rights

## Find a Great Installer

Referrals from friends, neighbors, [Nextdoor.com](http://Nextdoor.com), [Yelp.com](http://Yelp.com), [SolarReviews.com](http://SolarReviews.com), [EnergySage.com](http://EnergySage.com)

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Ask about

- Equipment choices, especially panels and inverters
  - Reputable equipment manufacturers?
  - Lower cost or higher efficiency panels?
  - String inverters or microinverters or DC optimizers?
- Panel layout on your roof and system size suggestions
- Financing alternatives offered
- Aesthetics
- Warranties

Few construction projects go perfectly.

Great contractors know how to build, but also how to resolve all problems to your satisfaction

**Tony Seba:** “Your next oil well makes my next oil well more expensive. Your next solar panel makes my next solar panel cheaper”

**The Sun:** Less than two hours of sunlight reaching the earth contains enough energy to provide all of humanity’s energy needs for a full year

## Upcoming Events

### NorCal Solar ([NorCalSolar.org](http://NorCalSolar.org))

Clarifying the New PV Value Proposition: The ABCs of NEM 2, NBCs, and CCAs

June 20 – 5:30pm – 8:30pm

The Energy Foundation

301 Battery St, 5<sup>th</sup> Floor, San Francisco, 94111

### Ecology Center and Sierra Club Bay Chapter ([EcologyCenter.org](http://EcologyCenter.org) & [SierraClub.org/san-francisco-bay](http://SierraClub.org/san-francisco-bay))

Solar Simplified – The Deeper Dive

June 24 – 1:00pm - 2:30pm

Ecology Center Classroom

2530 San Pablo Ave, Berkeley 94702

### Intersolar ([Intersolar.us/en/home.html](http://Intersolar.us/en/home.html))

One of the two largest solar conferences in the US

Moscone Center

July 9 through July 14