


Solar Electric Energy for Irrigation

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You know Solar is good for the Earth

- **Increase Profits** - Reduce operating costs
- **Decrease Risks** - Hedge against rising prices
- **Increase Cash Flow** - Financing options powerful
- **Minimize Investment** - Financial incentives still high

Solar PV for Irrigation

- DC Direct Pumping **Off-Grid**
- *Hybrid* AC/DC using VFD
- AC Grid Connected PV
 - PV Module Technologies
 - Mounting Applications
 - Net-Metering Law
- Government Incentives
 - California Solar Initiative
 - Federal Incentives
- Examples

DC Direct Solar water pumps



- DC Surface (non-submersible) pumps are most economical
- Reduce pumping energy by half



DC Direct Solar water pumps

- Specially designed
- DC power direct from PV

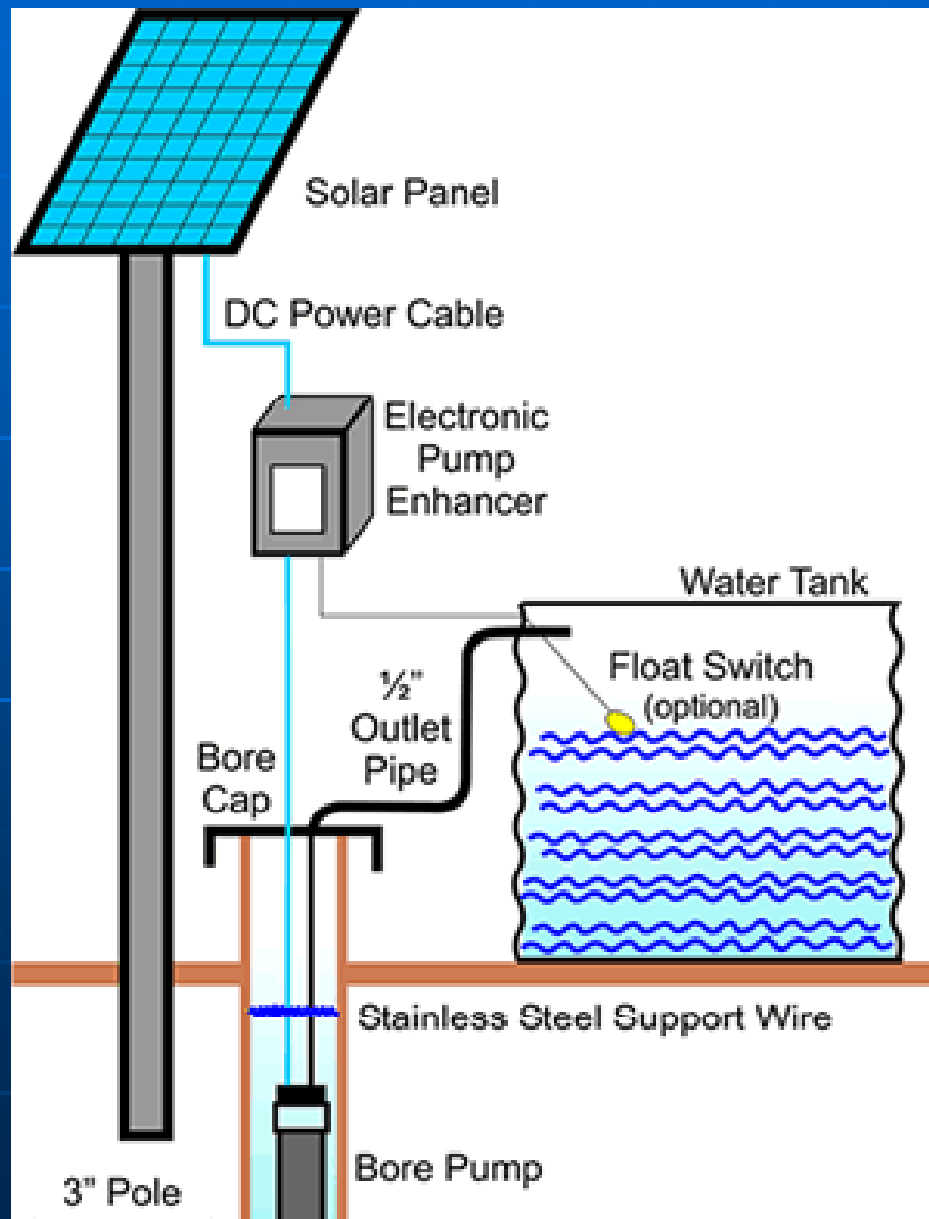


- Operate on reduced power, no stalling during low sun
- Low volume positive displacement (volumetric) include diaphragm, vane and piston pumps.

DC Direct Solar water pumps

- Used on small pumps.
 - Pump from PV array-direct (without battery)
 - Pump only during strong sun hours
 - Store water in a tank
 - Distribute by gravity flow.
 - Storage batteries can stabilize voltage for consistent flow and may eliminate storage need.

DC Direct Solar water pumps



- Pump controller (current booster) helps pump start and not to stall in weak sunlight.

DC Direct Solar water pumps

Example: Surface Solar Pumping System

Model: Solar Force Surface Pump 302024-PV

Solar Modules: (3) BP 150W. 24VDC

Total Lift: 165 ft.

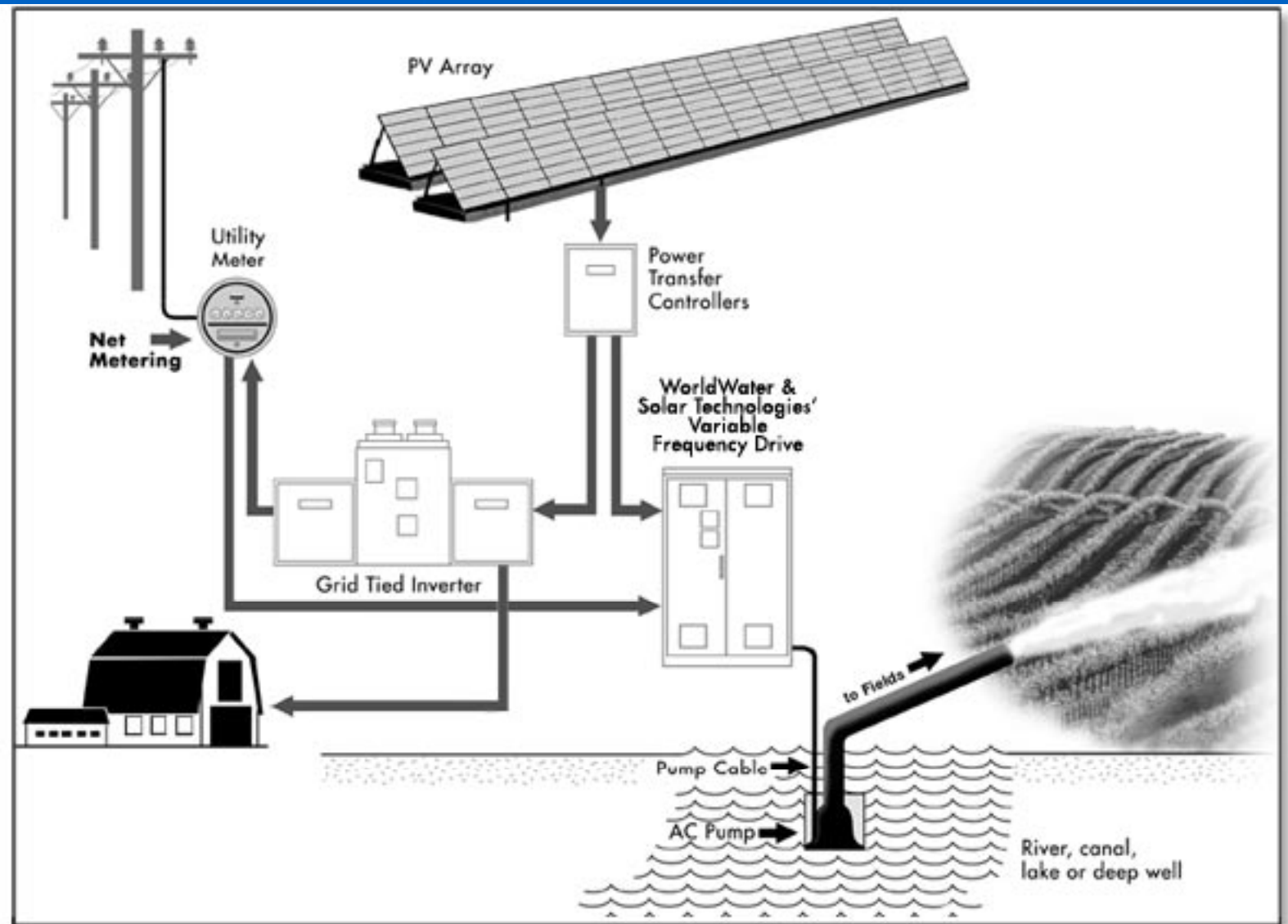
Pipeline Distance: 5,800 ft.

Total Daily Volume: 2,100 Gallons

range of application: 0.5 GPM up to 70 GPM.

Surface pumps must be protected from weather and freezing situations.

Variable Frequency Drive up to 600 HP



PV Technology

- **Crystalline silicon Flat Plate PV modules**
 - **Strengths:** greatest overall output (per area).
 - **Weaknesses:** Crystalline silicon cells are rigid and prone to breaking under physical stress.



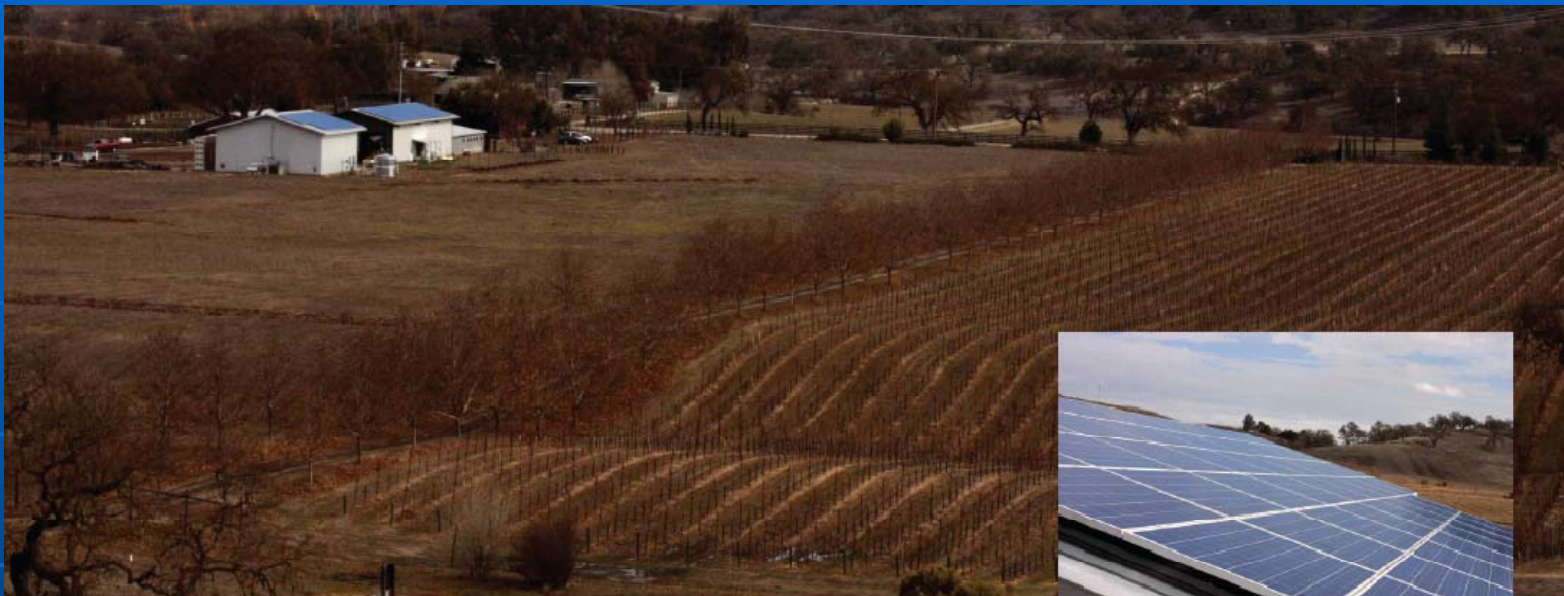
Technology

■ Thin Film systems

- thin layer of photovoltaic material deposited on a substrate like glass or metal.
- **Strengths:** cheaper than crystalline
- **Weaknesses:** lower efficiency, require more space



30 kWp system, producing 80% of power needs



CLAUTIERE VINEYARDS

PASO ROBLES, CA

The creative forces behind Clautiere Vineyard are Claudine Blackwell and Terry Brady. The couple has passionately rejuvenated and transformed a local ranch into a place of vibrant color and energy. This small winery in California's Central Coast region is reducing their electric bill by 80% with a SunTechnics 30 kWp photovoltaic system.



Angled towards South on Roof,
Increase 5% over flat install



Thin Film reduces costs 20% for same energy



Track the sun for 20% increase energy

East to West tracking follows the sun every day



Solar energy reduces peak demand on the grid

- **California's net energy metering (NEM) Law**
 - Produce during the daylight
 - Draw from grid at night.
 - During peak demand hours, electric meter spins backwards delivering excess energy to the grid.
- **Time-of-use rates favor off-peak usage**
 - At night, when demand and rates are lower, the electric meter spins forward as it draws electricity from the grid.

Overview – California Solar Initiative (CSI)

- Performance Based Incentive (PBI)
- Incentive Levels
- Eligibility Criteria and Requirements

CSI - Performance Based Incentives

- **PBI - Performance Based Incentive**
 - Paid monthly on the **actual** energy produced over **5 years**
- **1 MW Cap**
 - Incentives only up to the **1st Megawatt** of AC



Go Solar California!

www.gosolarcalifornia.com

CSI - Levels of Incentives

- PBI Payment levels decrease as MWs installed in California
- Current Level: \$0.22 / kW-hr
 - Next step (6): \$0.15 /kW-hr
 - Decrease of \$0.07 / kW-hr = **\$630,000** / MW

Eligibility Criteria and Requirements

- Customers of **PG&E, SCE, SDG&E**
- Energy Efficiency audit requirement
- **New** equipment
- Equipment Must Serve **On-Site** Electrical Load
- Incentives will be paid for 1kW **up to 1 MW**
- Permanently installed systems - to be in place for the duration of its useful life (at least 10 years)
- Insurance requirements
- 10 year warranty requirement

Federal Incentives

- Investment Tax Credit
 - 30% of System Cost
- Accelerated Depreciation (MACRS)
 - 5 Years

45 kW PV System

ELECTRICAL ENERGY USAGE

4,609 kWh	Average Winter Monthly Historic Usage
<u>12,132 kWh</u>	<u>Average Summer Monthly Historic Usage</u>
100,447 kWh	Total Annual Historic Usage

ELECTRICAL ENERGY PRODUCTION from Solar PV

82,626 kWh/year estimated production

Offsets **82%** of usage

ENERGY COSTS/SAVINGS

45 kW PV System

ENERGY COSTS Current:

\$ 1,677 Average Monthly Charges

PG&E AG-1 Rate B -- Agricultural Non-TOU, Demand

ENERGY COSTS with SOLAR

\$ 632 Average Monthly Charges with Solar

SAVINGS USING SOLAR:

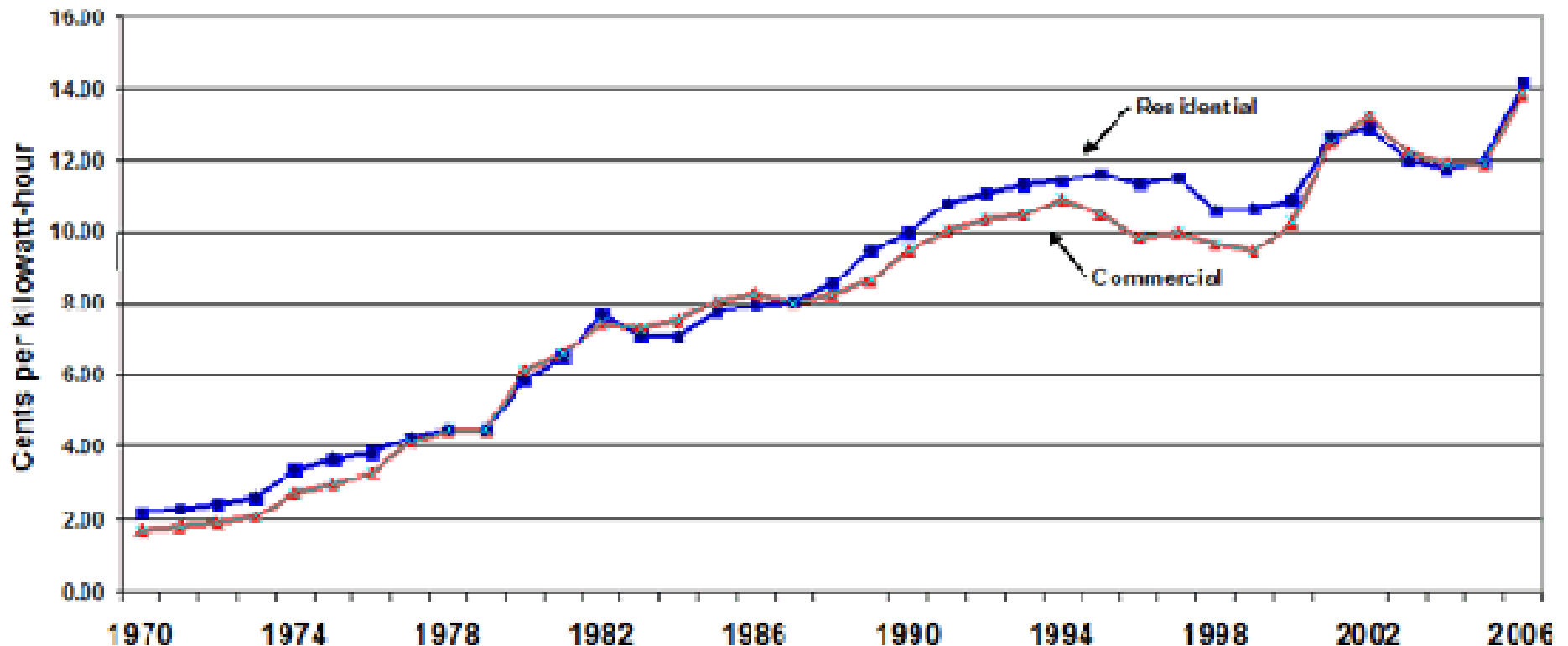
\$ 1,045 1st month Savings

\$ 12,540 First year savings due to solar

Savings will increase over time as electric rates rise

Utility Rates rise 5-6% annually

California Electricity Rates 1970 - 2006

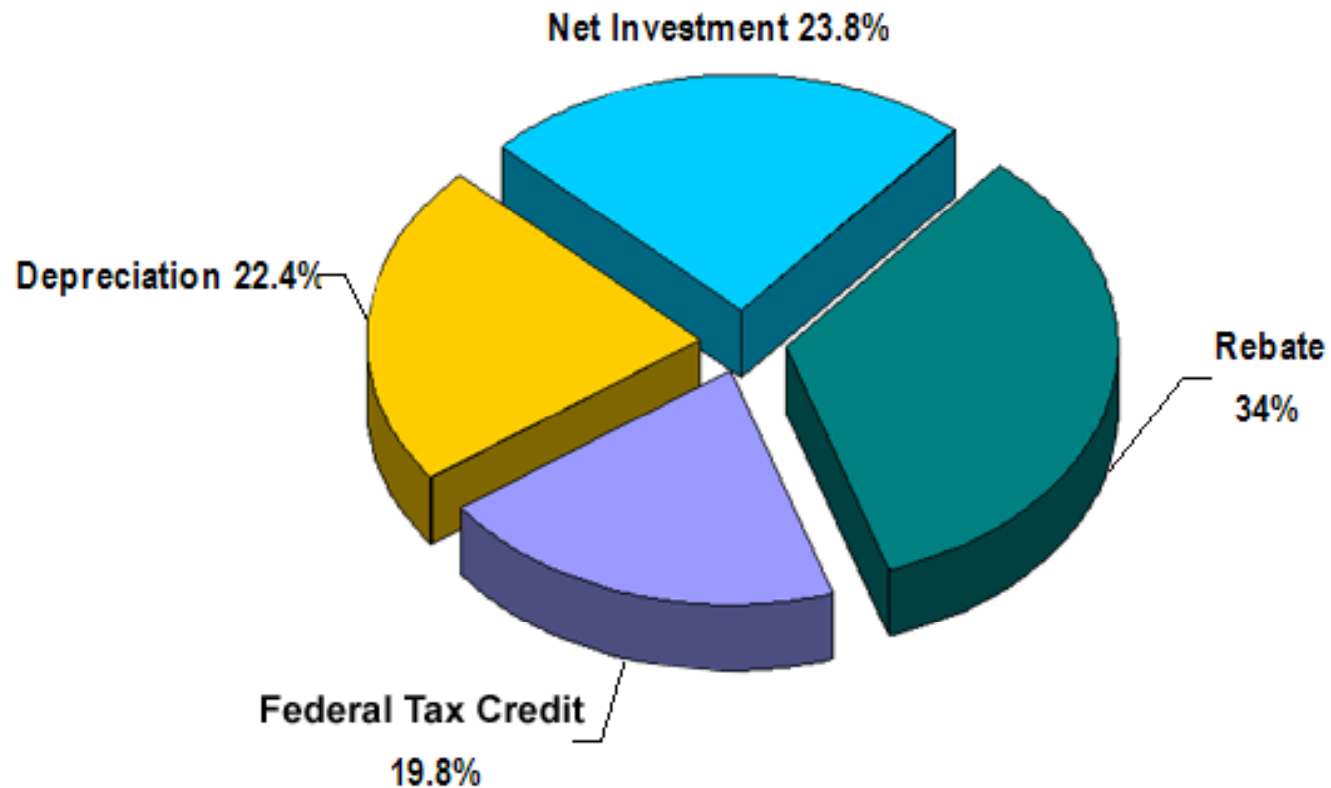


Sources: Department of Energy, Energy Information Administration (EIA), 1970-1999 EIA State Energy and Price Report 2001, California Tables 2-4; 1990-2003 EIA Electric Power Annual, 2003 Historical Spreadsheets, Average Price by State by Provider (EIA-861); 2004 EIA Electric Power Monthly, March 2005, Table 56.B; 2005 EIA Electric Power Monthly, October 2005, Table 5.6.B; 2006 PG&E Advice Letter 2705-E E-7, A-6, and E-19 Requested Increases

PG&E changes in 2008

- Residential - 0.8 %
- Agriculture 5.7 %
- Small Business 2.9 %
- Medium Business - 3.6 %
- E-19 - 6.5 %
- E-20 - 0.7 %

Solar PV Investment Commercial System



Federal Internal Revenue Code (IRC section 179) special depreciation for solar systems on a 5-year accelerated schedule.

77% Discount

SYSTEM CAPITAL COST SUMMARY

45 KW PV System

\$ 371,031	Total System
\$ (68,942)	<i>EPPB Rebate (\$1,533/kW)</i>
\$ 302,089	System Price after Rebate
\$ 1,050	Estimated Permit Fees NOT in price
\$ 303,138	Cost After Fees
\$ 24,130	Federal Tax on Rebate
\$ (111,624)	30% Federal Tax Credit
\$ (128,867)	MACRS Depreciation (5 yrs)
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\$ 86,777	Net System Cost with Tax Benefits

80% Discount

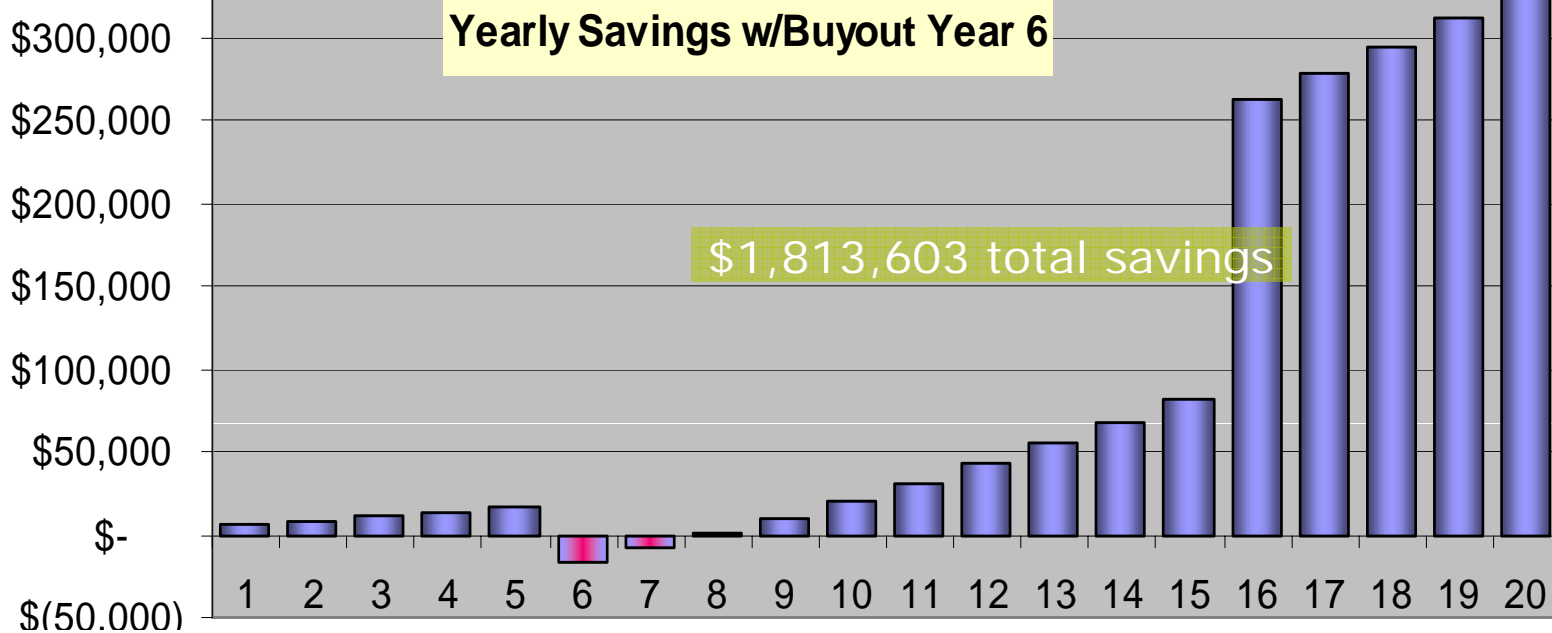
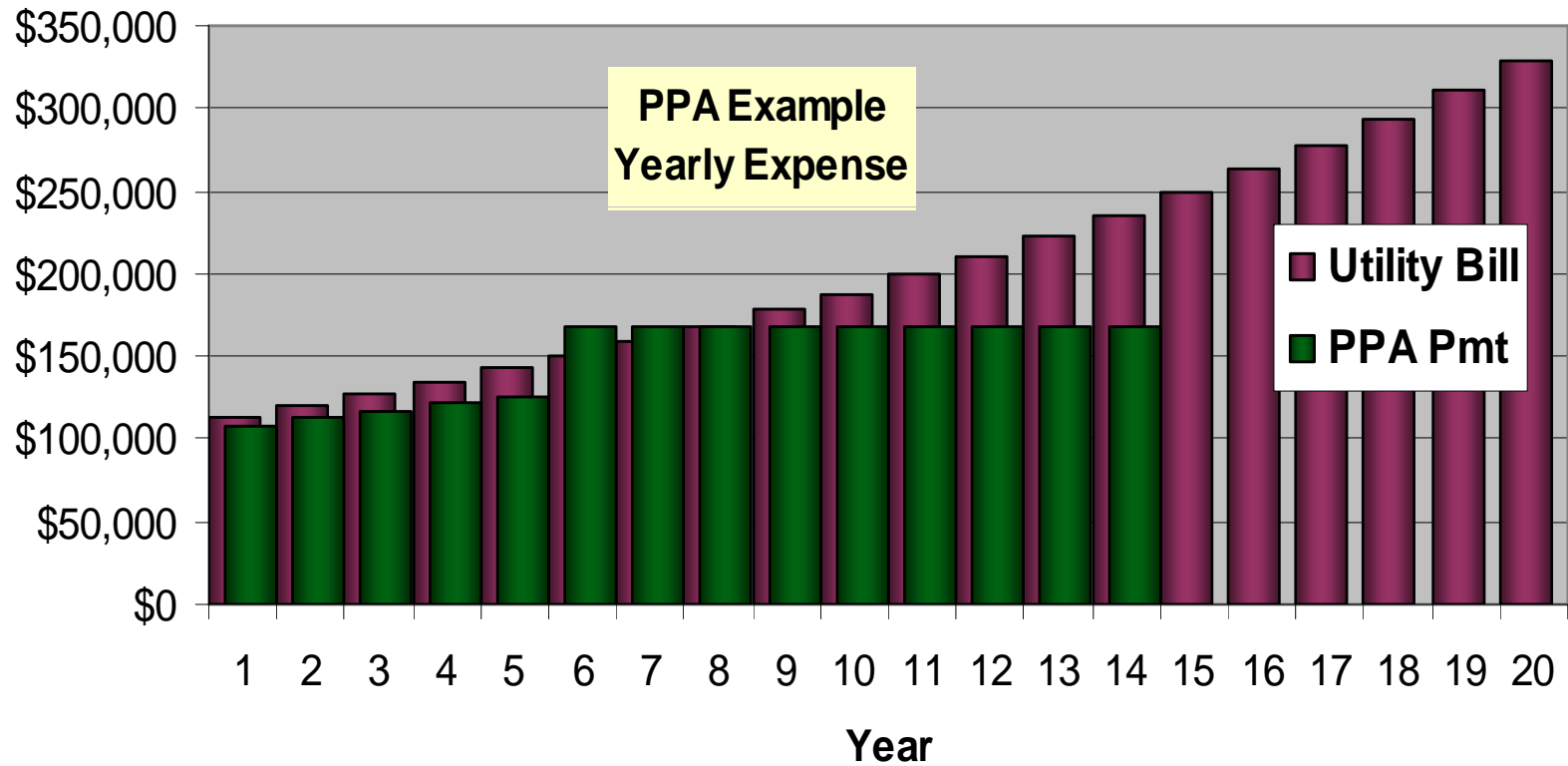
SYSTEM CAPITAL COST SUMMARY

65 KW PV System

\$ 530,308	Total System Cost
\$ 1,251	Estimated Permit Fees NOT in price
\$ 531,559	Cost After Fees
\$ (84,620)	PBI Incentive after Fed Tax (\$0.22/kWhr for 5 yrs)
\$ (159,468)	30% Federal Tax Credit
\$ (184,101)	MACRS Depreciation value (5 yrs)
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\$ 103,370	Net System Cost with Tax Benefits

Positive Cash Flow Financing

- **BUY**- System purchase financing (Finance Lease or Mortgage)
- **LEASE**- 10 yr payments below current electricity costs
- **PPA**, Power Purchase Agreement
 - **Buy solar energy**, not assets
 - No capital investment required
 - Host it on your roof, ground or parking facility
 - Buy the solar electricity produced at a fixed rate
 - 10 – 20 year terms with buyout option
 - No maintenance costs



PPA - Feasibility Assessment

1. Current monthly electrical **bill exceeds \$2500**
2. Copies of the last **12 months utility bills**
(kWh rates and volume)
3. **Structural drawings** (preferably CAD files) and digital photos of roof
4. Building **self-owned** or long-term lease
5. Good or **excellent credit rating**
6. Occupying the building for **15+ years**