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# **Electricity Rate Structures Can Be Used to Promote Customer-Sited PV: A Lesson From California**

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**Dr. Thomas Hoff**  
**Clean Power Research**  
**[clean-power.com](http://clean-power.com)**

**Christy Herig**  
**NREL**  
**[www.nrel.gov](http://www.nrel.gov)**

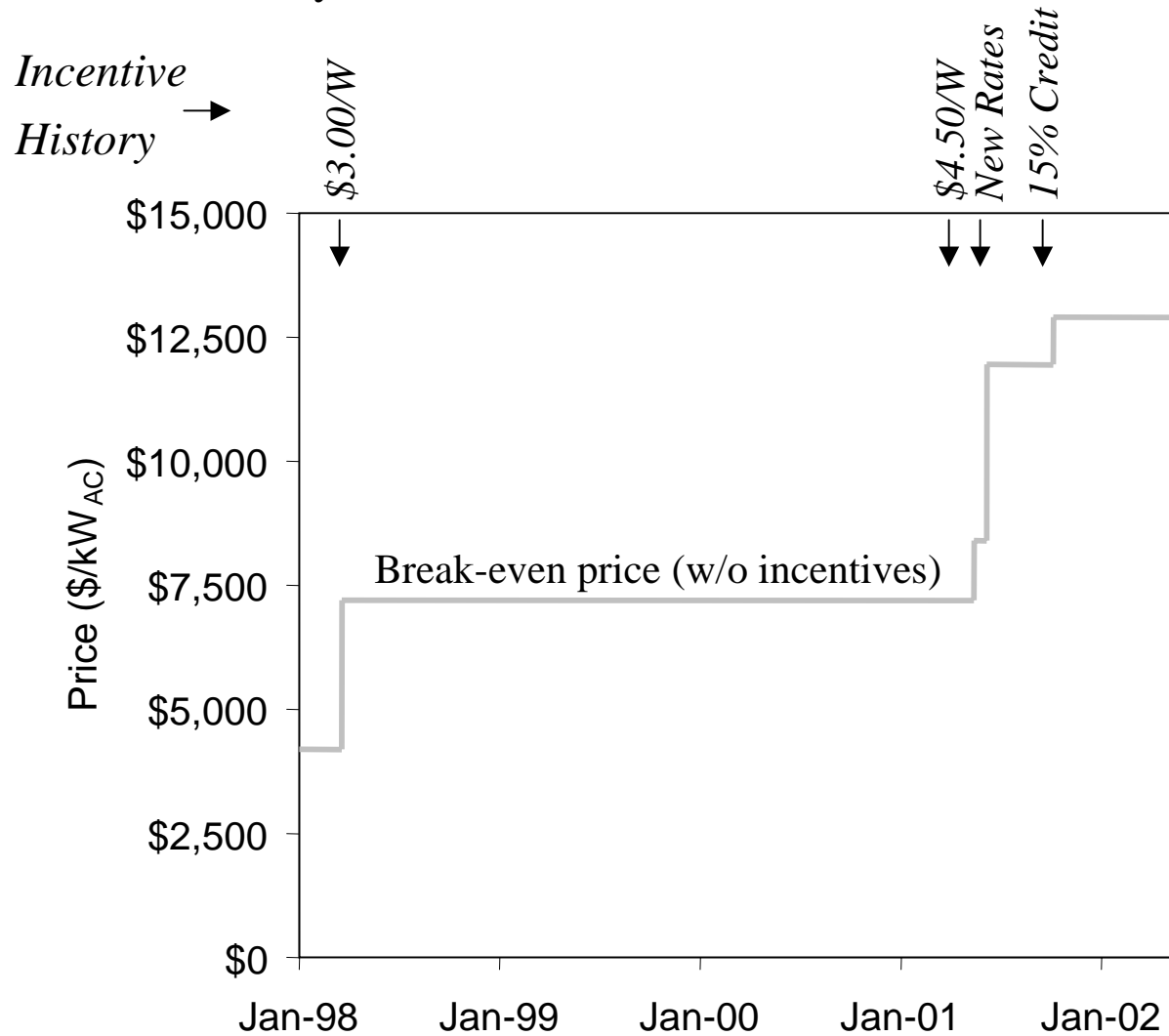
## Introduction

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- PV cost-effectiveness is driven by incentives, electricity rates, and solar resource
- Policy makers can influence incentives and electricity rates
- The combination of residential rate structures (implemented as a result of the California energy crisis) and incentives have been effective in promoting customer-sited PV systems

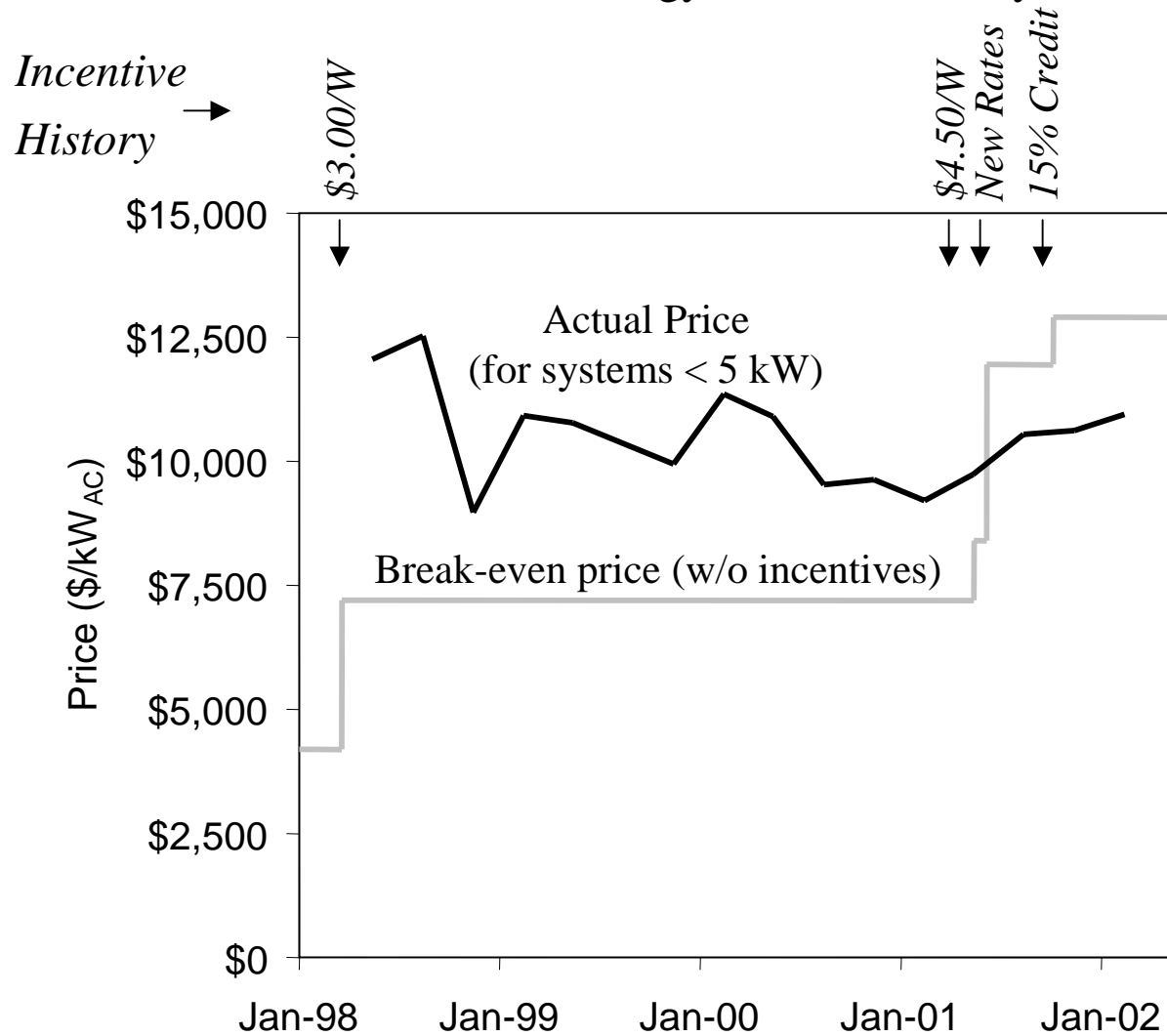
## History: Break-even Price in San Jose, California

Break-even price is the price that a customer can pay for a PV system and have a \$0 net cost in the first year



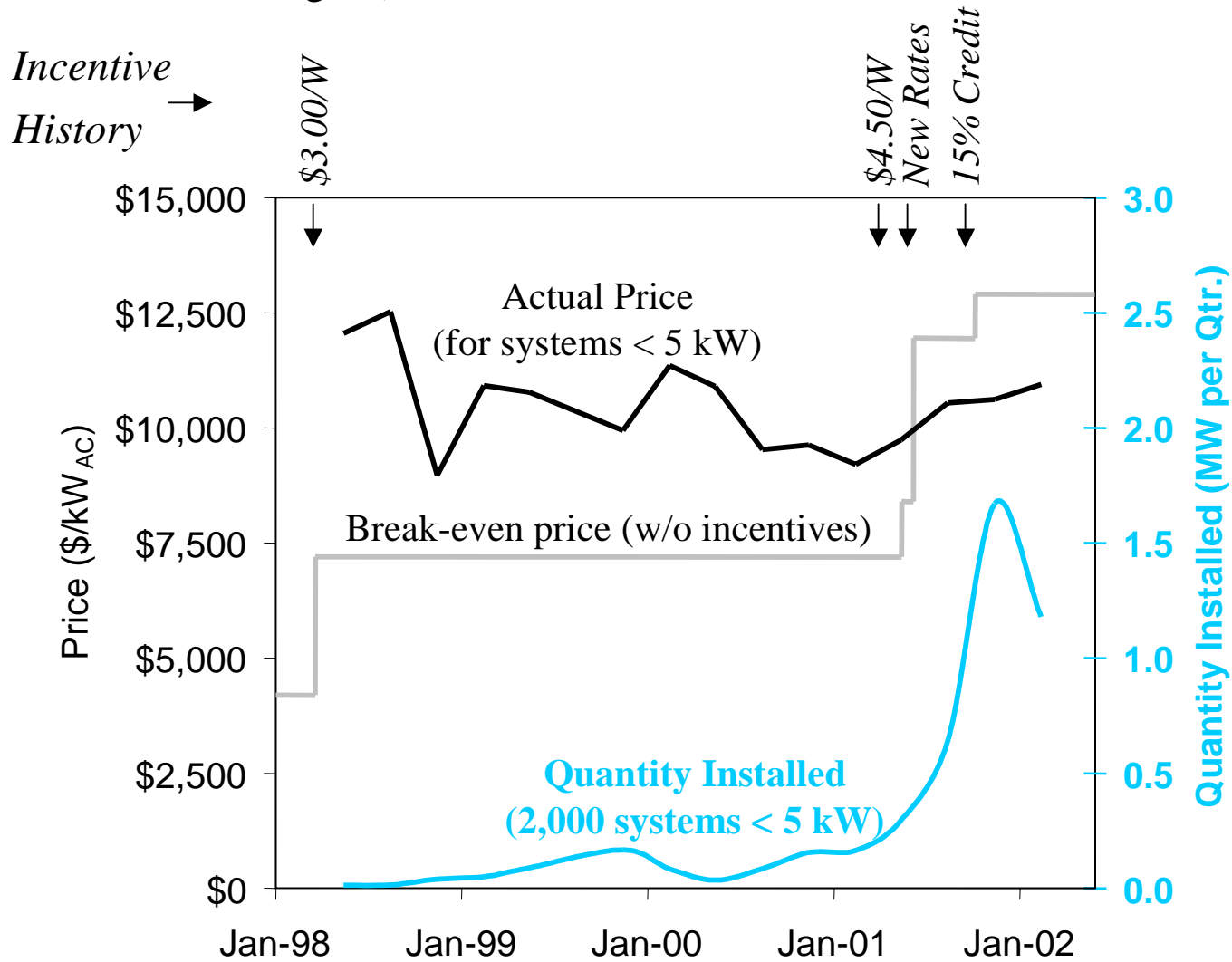
## History: Actual Price in California

Actual Price = cost of all systems < 5 kW divided by quantity installed during the quarter. Data source: California Energy Commission buy down data



## History: Installation of Systems Less Than 5 kW in California

Installations increased when actual price was less than break-even price (total of 4.7 MW are shown in figure)



## Definitions

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- ***Tiered rate structure*** is a rate structure where the marginal cost of electricity depends upon the amount of electricity consumed
- ***Break-even price*** is the price that a customer can pay for a PV system and have a \$0 net cost in the first year
- ***Net cash flow*** is customer's net cost/net savings in the first year after taking into account incentives, tax credits, loan payment, utility bill savings, and tax effects
- ***Clean Power Estimator*** is the tool used to perform analysis

## Assumptions

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- Customers
  - Residential customers in San Jose, CA or Los Angeles, CA
  - Rates are PG&E E-1 Area X (San Jose) and LADWP R-1 (L.A.)
  - Electricity consumption w/o PV equals 1,200 kWh per month
- System
  - 1 kW<sub>AC</sub> PV system (CEC rating)
  - Financed with 30-year, 7% loan w/ tax deductible interest
- Incentives
  - CEC buy down (San Jose)
  - LADWP's full incentive, including manufacturing credit (L.A.)
  - 15% state tax credit (San Jose & L.A.)
- Cost
  - Calculated for the break-even price calculations
  - \$9,000/kW<sub>AC</sub> for the net cash flow calculations

## Incentives

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The economic incentives “buy down” the initial cost of the PV system

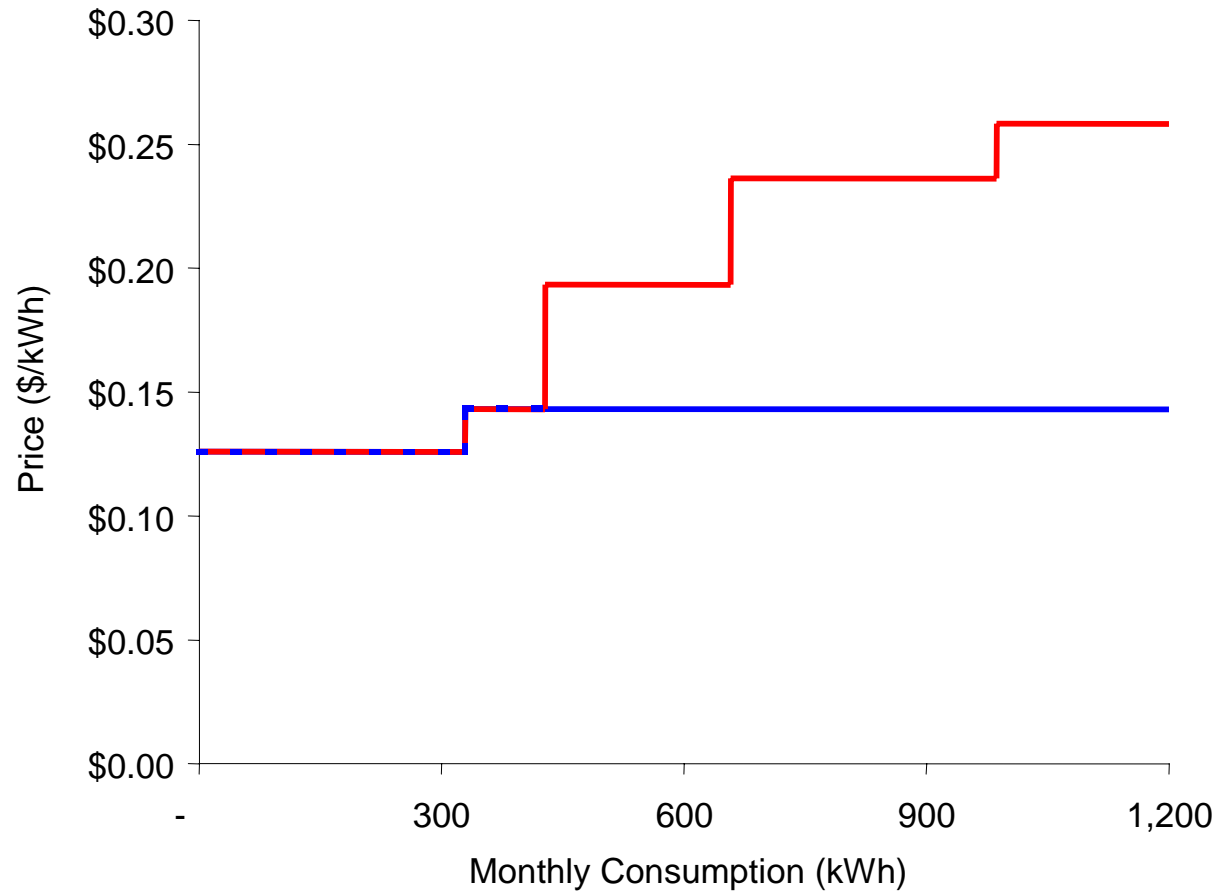
Incentive	Source	Date
\$3.00/Watt <sub>AC</sub>	California Energy Commission	March 20, 1998
Increased to \$4.50/Watt <sub>AC</sub>	California Energy Commission	May 16, 2001
15% Tax Credit	State of California	October 8, 2001

*Dates were supplied by Sandy Miller, California Energy Commission*



## PG&E Rate Structures

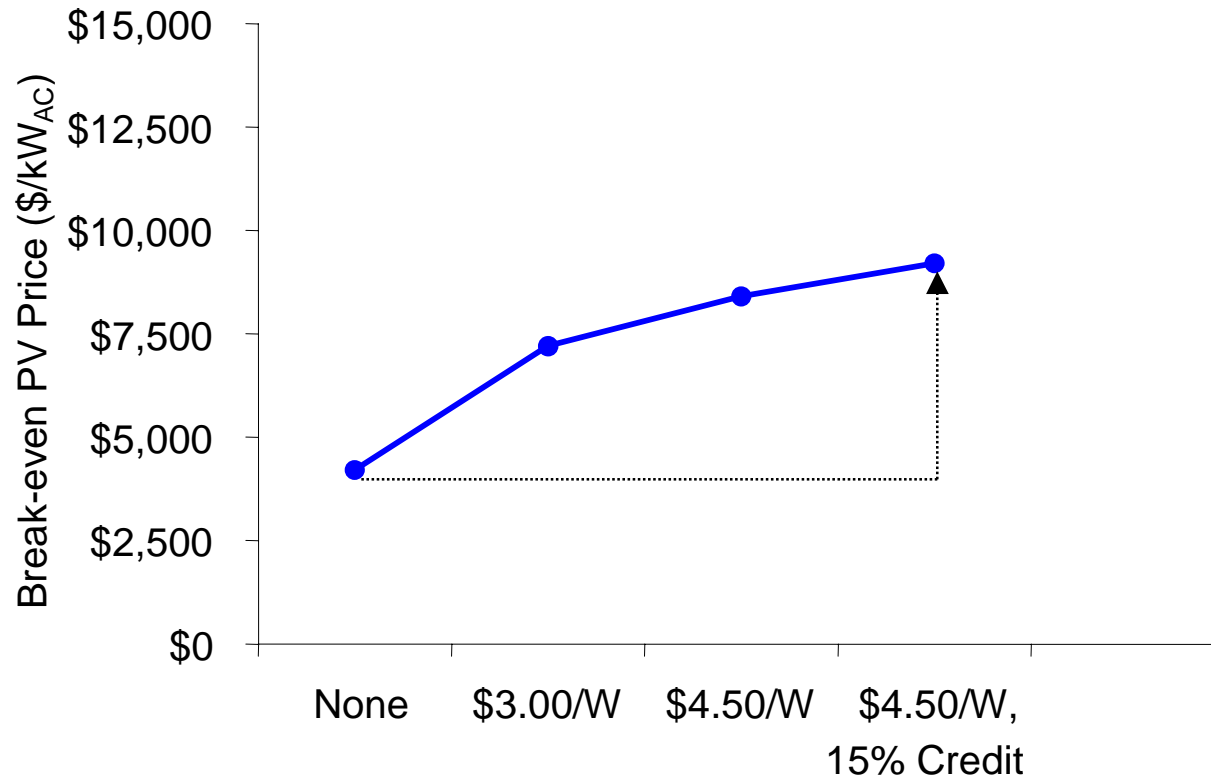
Three tiers were added to PG&E residential rate structures in June 2001



— PG&E Before 6/01 — PG&E After 6/01

## Break-Even Price: Effect of Incentives

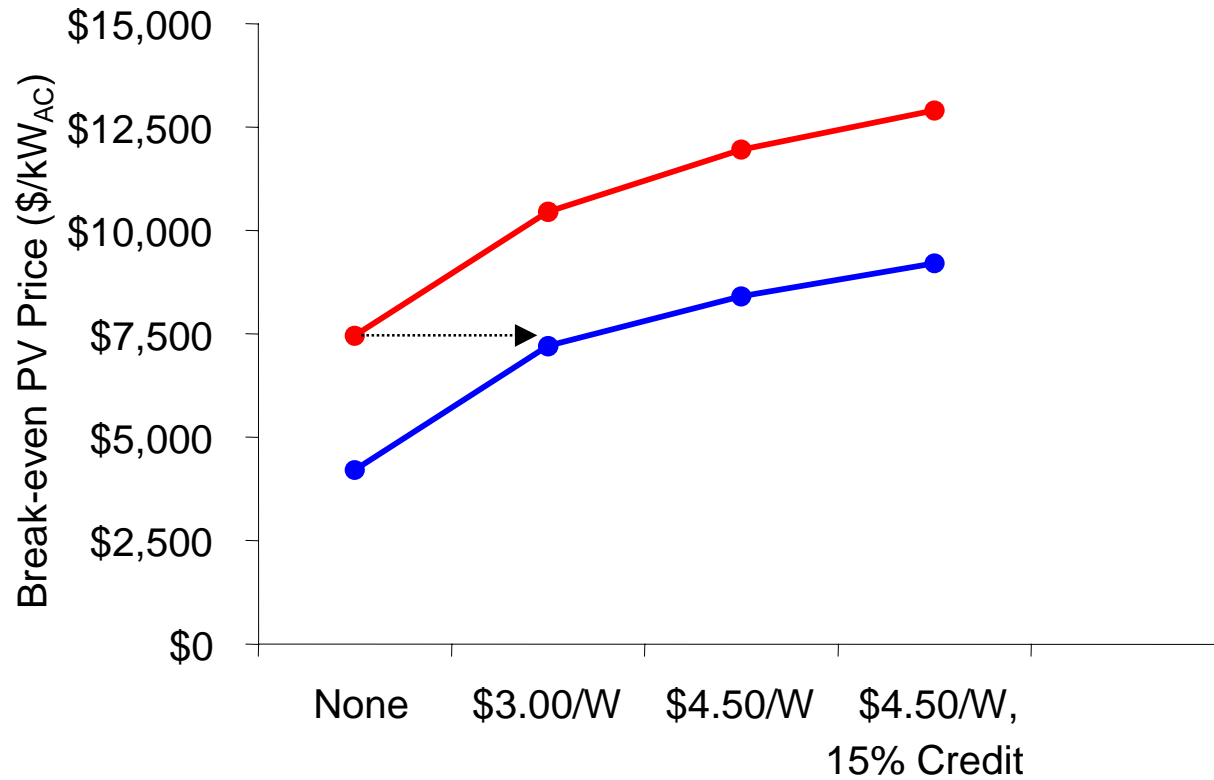
Incentives would have more than doubled the break-even cost of PV using PG&E rates prior to June 2001



— PG&E Before 6/01

## Break-Even Price: Effect of Rate Structures

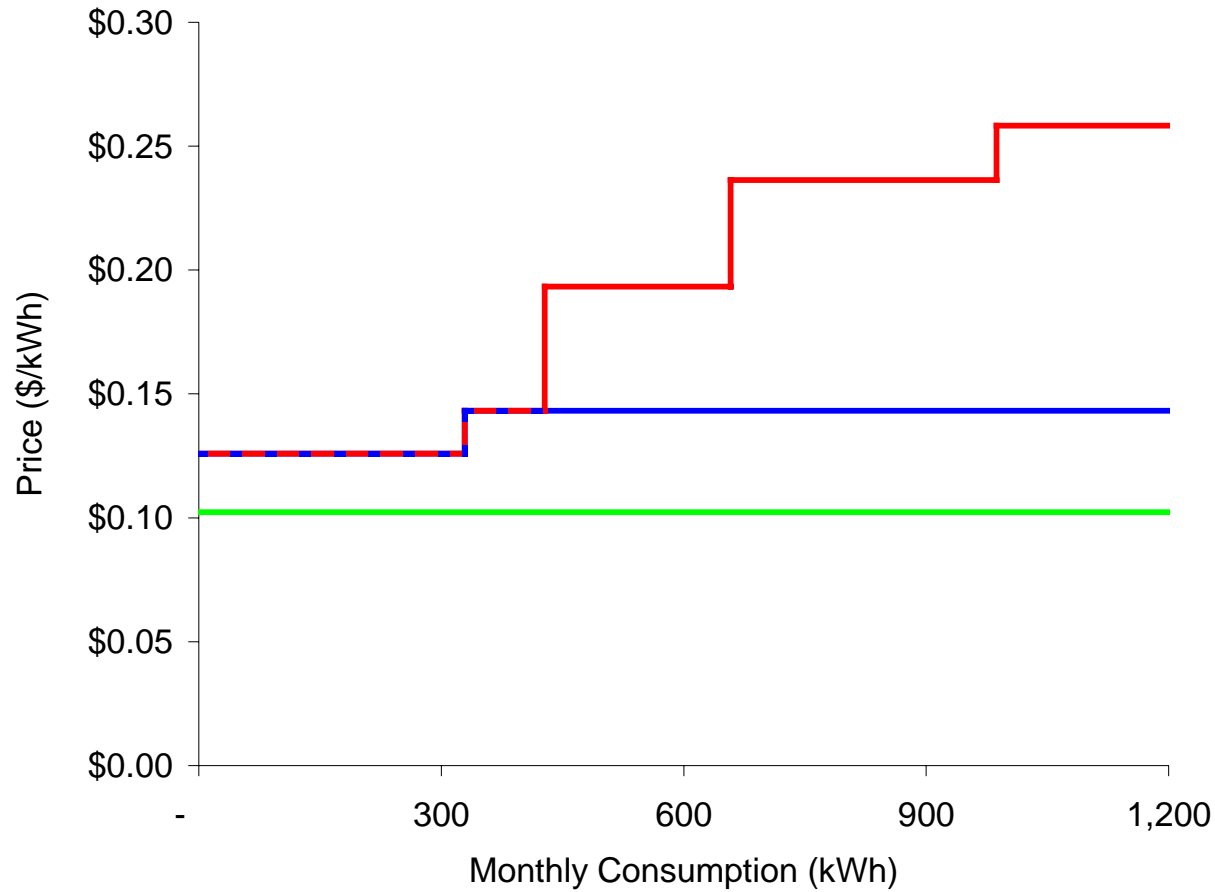
PG&E's rate structure change in June 2001 has a greater economic effect from a customer's perspective than offering a \$3,000/kW incentive with the old rates



— PG&E Before 6/01 — PG&E After 6/01

# PG&E Rate Structure Compared to LADWP Rate Structure

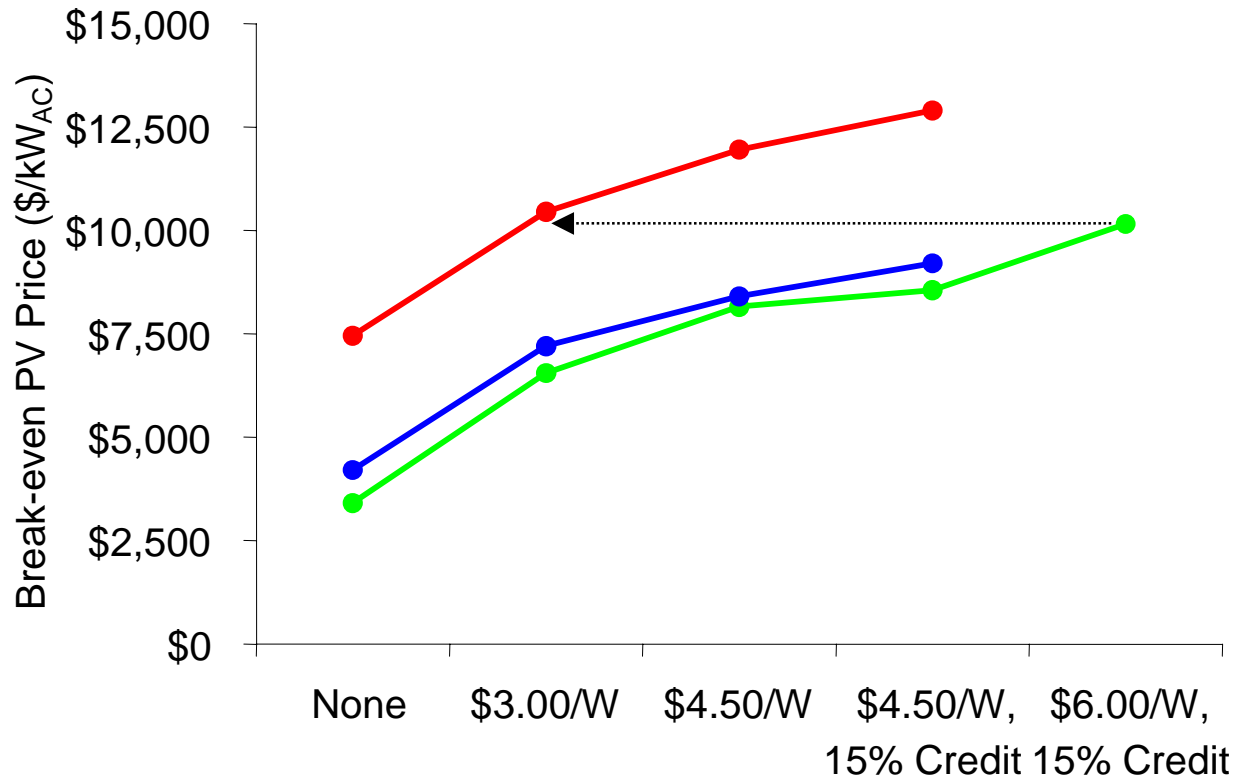
LADWP has a flat rate structure



— PG&E Before 6/01 — PG&E After 6/01 — LADWP

## Break-Even Price: Effect of Rate Structures (cont.)

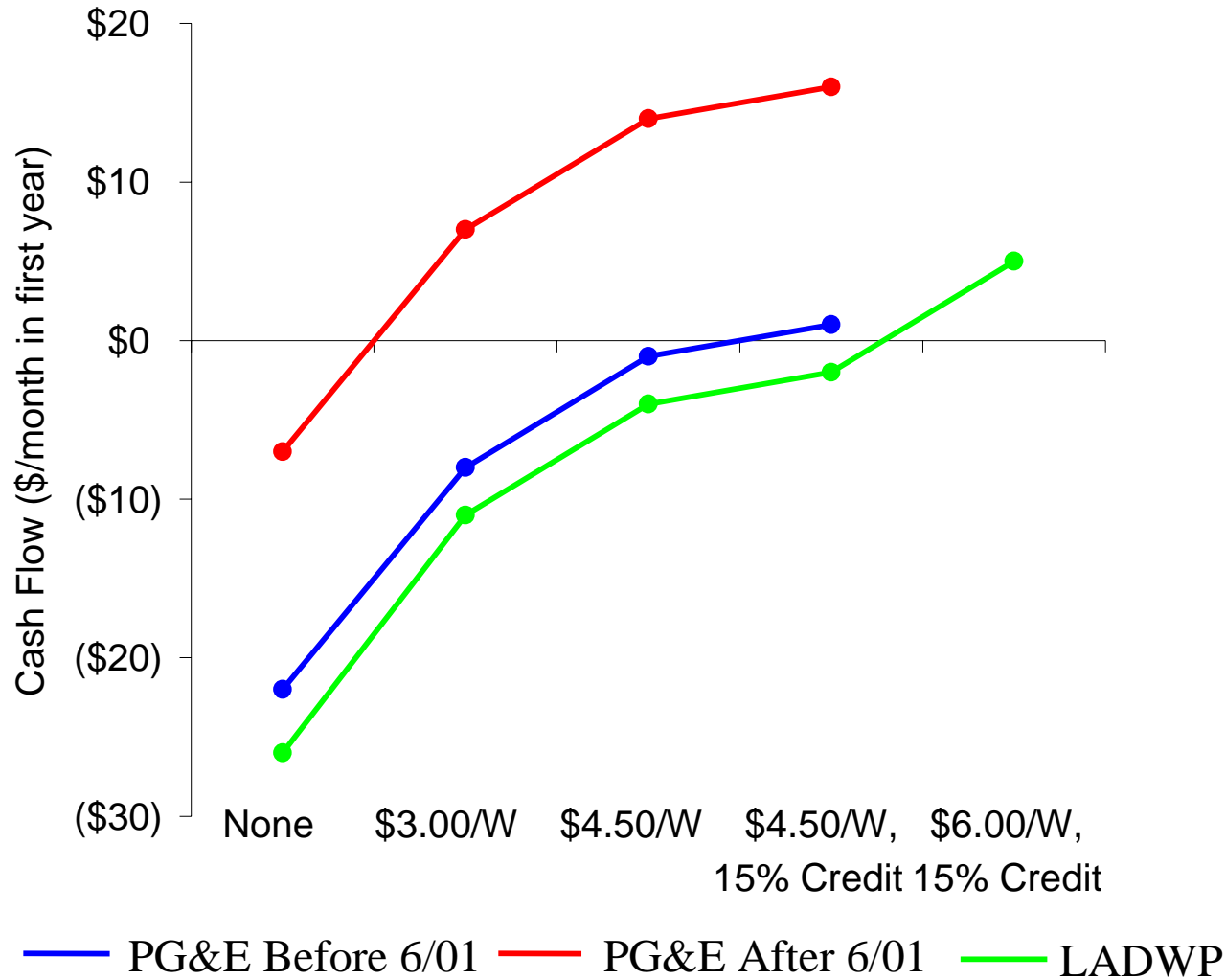
PV is more cost-effective for PG&E customers with a \$3,000/kW incentive than LADWP customers with a \$6,000/kW incentive



— PG&E Before 6/01 — PG&E After 6/01 — LADWP

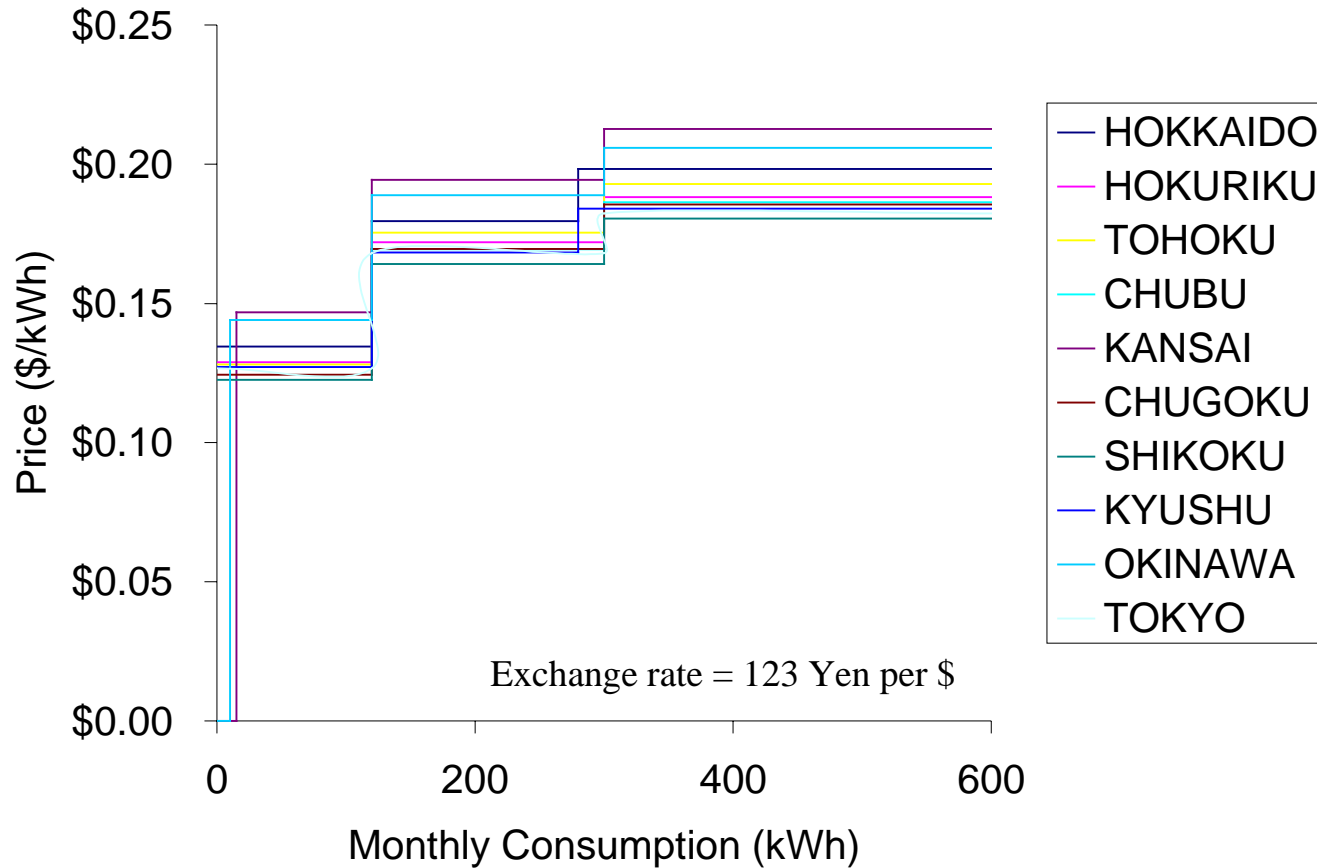
## Net Cash Flow

Effect is the same when evaluating PV from a net cash flow perspective (assumes \$9,000/kW<sub>AC</sub> system cost) rather than a break-even cost perspective



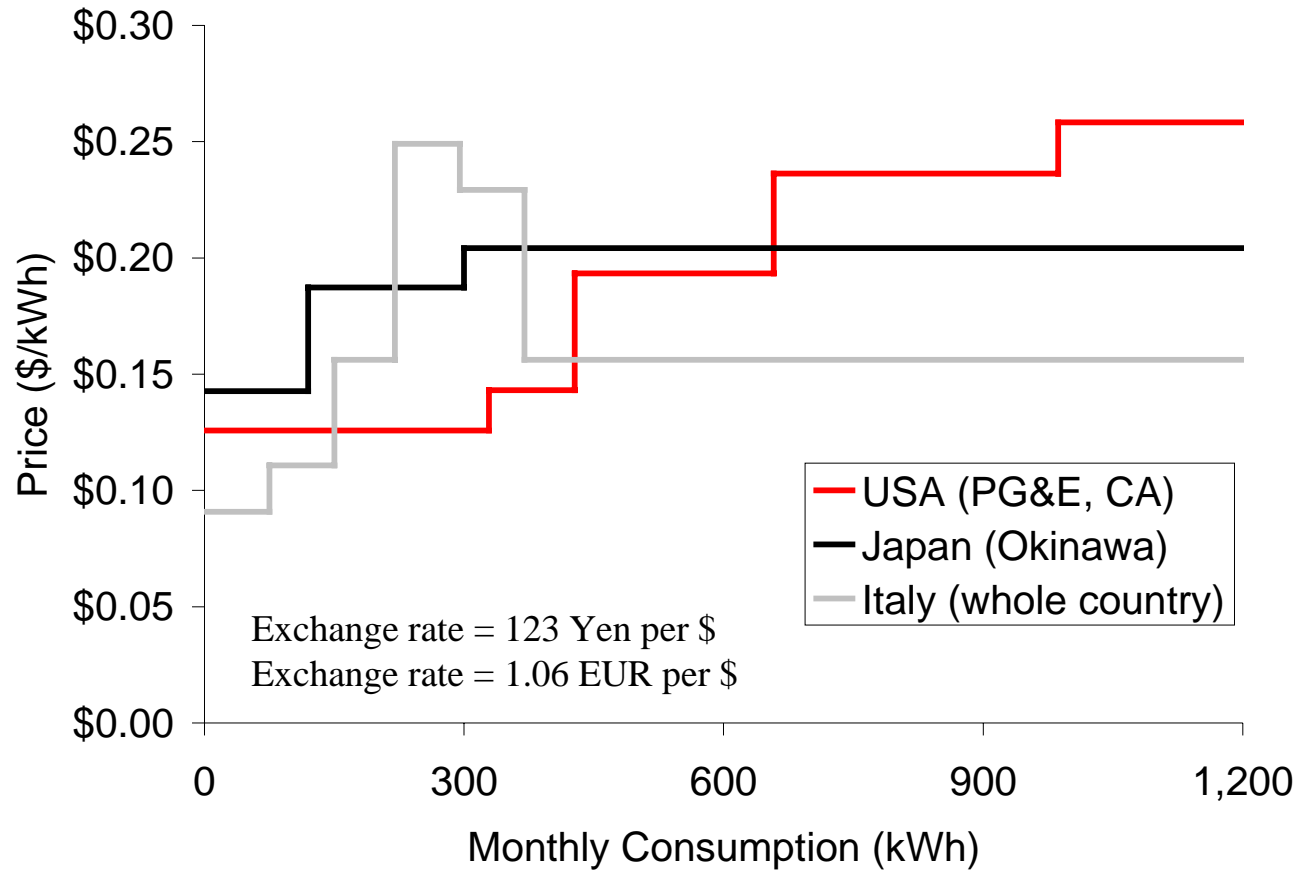
## Tiered rate structures are the status quo in some countries

Example: *Every utility* in Japan has tiered rate structures for residential customers



Data Source: BP Solar's Japanese Clean Power Estimator

## Several successful PV locations have tiered rate structures

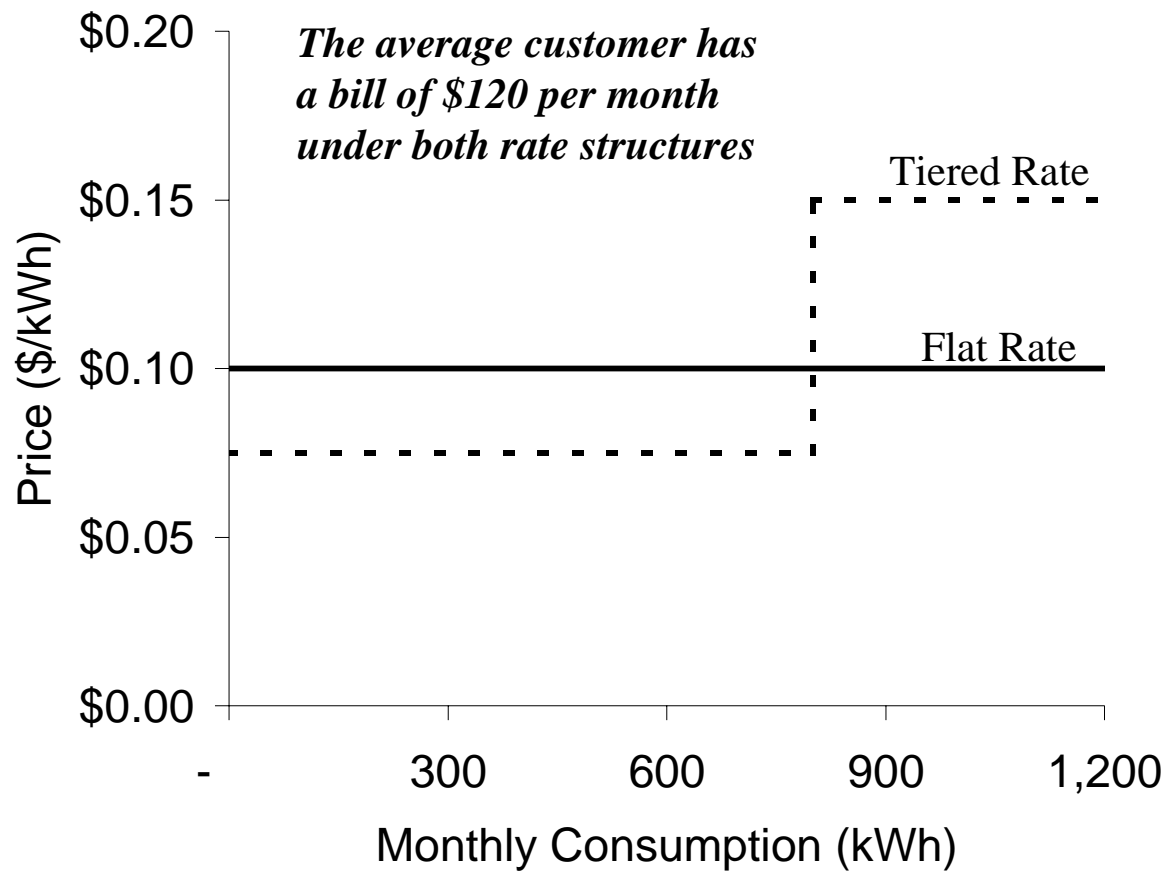


Data Source: BP Solar's Japanese and Italian Clean Power Estimators



## Policy Implications

PV (and other customer-sited technologies) can be promoted by converting flat rate structures to tiered rates in a revenue-neutral way



*Average customer uses 1,200 kWh/month*

## Conclusions

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- Tiered rate structures, combined with incentive programs, can be an effective policy tool in promoting PV (and other customer-sited technologies such as energy efficiency)
- Tiered rate structures could eliminate the need for a low income program
- Tiered rate structures are the status quo in some countries (e.g., Japan)
- Tiered rate structures can be designed to be revenue neutral