



# PG&E Solar Power Survey

Impacts of Customer Attitudes, Information and Opinions on Customer Decisions

**Susan Buller**

**Pacific Gas & Electric**

**Michael Sullivan**

**Freeman, Sullivan & Co.**

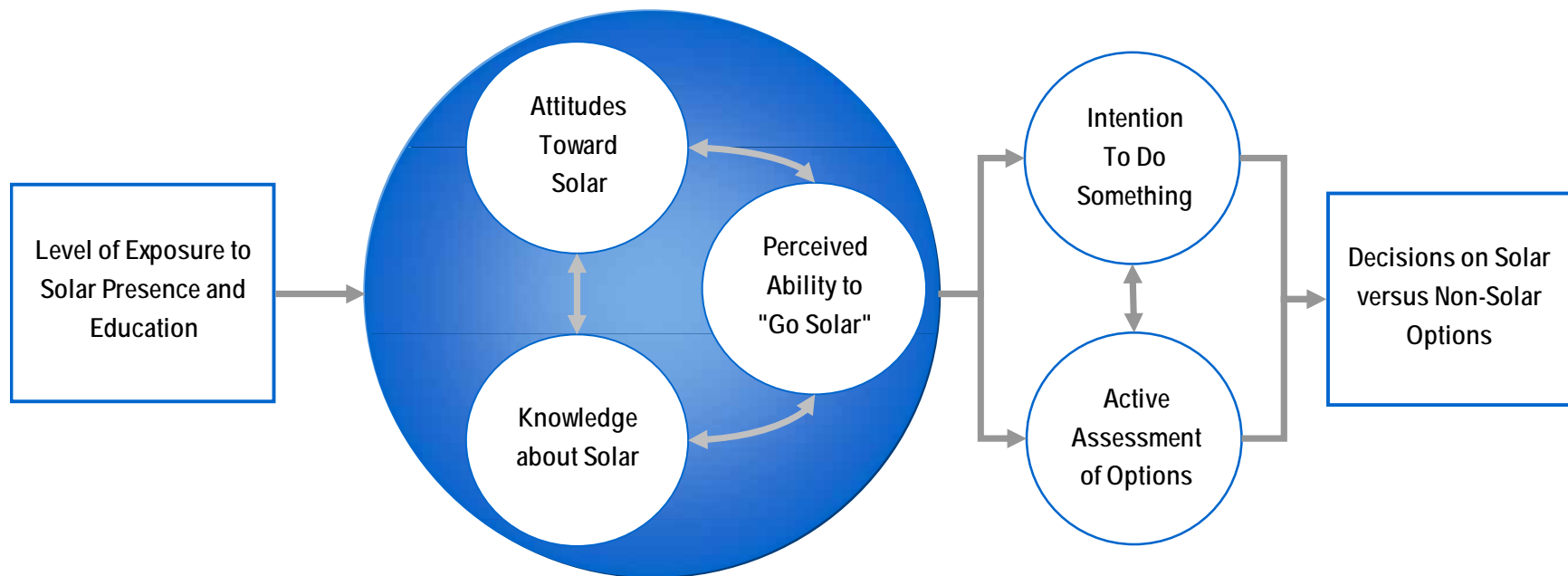
**January 2009**

---

# PG&E Solar Power Survey - Overview

- What are the impacts of information on attitudes and knowledge about solar power?
- What are the impacts of information on the demand or Willingness to Pay (WTP) for solar?
- What are the key drivers of demand for solar power systems and what are their impacts?

# A Framework for Thinking About the Influence of Increased Solar Presence and Education



# What We Did – an Overview

## Sample and Survey Design

- Random sample of Northern Californians, not just PG&E
- Questions about solar awareness and past solar related actions
- Randomly assigned three different sets of information and visual stimulus to respondents
- Solar attitudes and knowledge
- Decisions on home with and without solar
  - Solar homes with and without utility inspection and endorsement

## Data Collection

- 860 respondents
- 277 in control group
- 287 saw the “solar is everywhere” video
- 295 saw the “PG&E solar video”
- Data collected in a one week period (Aug 22<sup>nd</sup> to Aug 28<sup>th</sup>)
- Employed a survey panel
- Analyzed treatment / control group characteristics to ensure validity of experiment

## Impact on Attitudes & Knowledge

- Comparison of solar attitudes across the three groups
- Comparison of solar knowledge across the groups
- Tests of statistical significance
- Feedback about the customer confidence on solar info from PG&E in comparison to other sources

## Impact on Decisions

- Treatment impacts with regression methods
  - Used interval regression to estimate willingness to pay
- Ability to control for selection and for differences between groups
- Ability to identify key decision drivers and their impact
- Can increase signal to background noise ratio by explaining the noise

Impact on WTP and Likelihood of Purchasing a Solar Home

## The Randomly Assigned Videos

- Control Group - Video of a typical Northern California community
- Solar Video Group – Video of the same community which
  - Provided information about solar
  - Showed solar in communal areas
  - Included “if you look closely, you see the solar” thread
- PG&E Solar Video Group – Video of the same community which
  - Provided more detailed information about solar
  - Mentioned PG&E as the sponsor on multiple instances
  - Discussed the ability to sell power back to the grid
  - Did not include the “if you look closely, you see the solar” thread

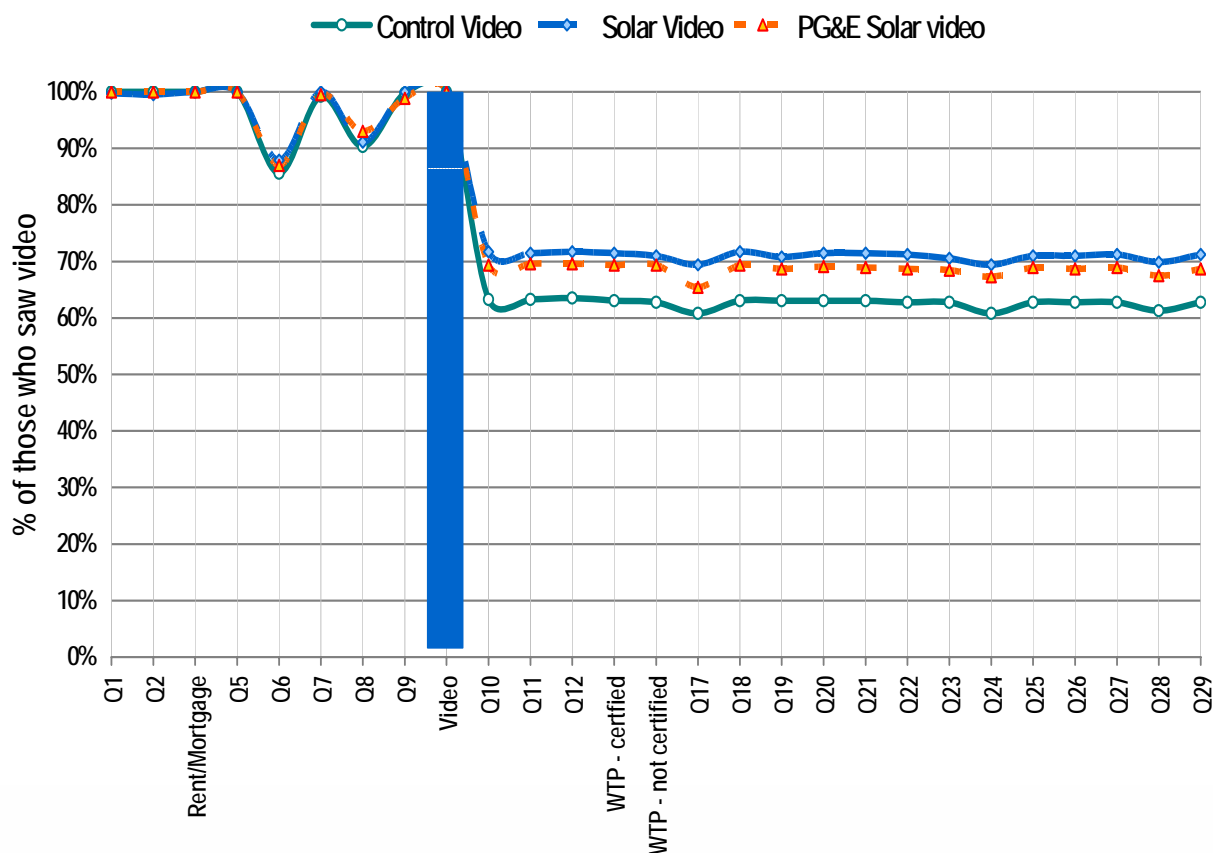
---

# Comparison of Treatment/Control Group Characteristics: Ensuring the Validity of the Experiment and Findings

# Comparison of Treatment/Control Group Characteristics

## The videos had an impact on who completed the survey

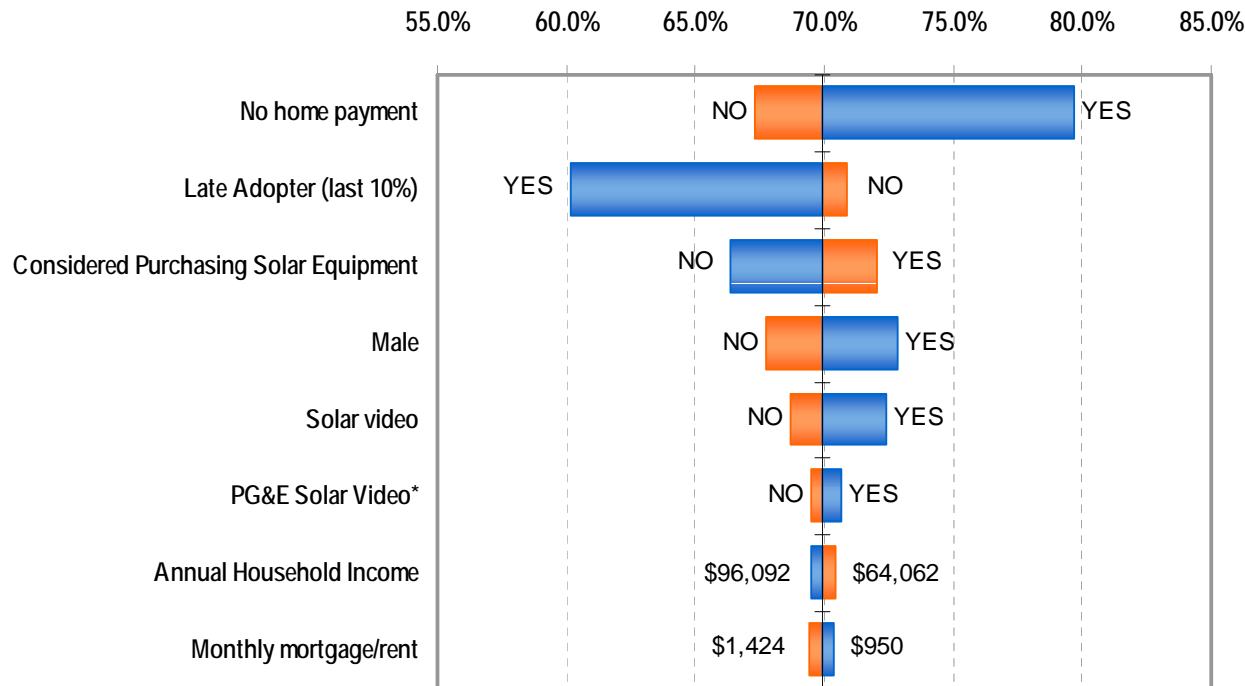
Survey Response by Question



- The video shown affected
  - The likelihood that someone would complete the survey
  - The characteristics of the respondents
- People who completed the survey are different than those who did not
- Differences due to censoring → selection bias, unless corrective measures are taken
- Simpler statistical tests (e.g. t-test) provide biased results

# Factors that affected the likelihood of completing the survey

Drivers of Likelihood of Completing the Survey  
(Base case - Averages for all values)



- **The following were more likely to complete the survey**

- Individuals who had no mortgage or rent to pay
- Male respondents
- Persons who watched the solar video
- Persons who watched the PG&E solar video

- **The following were less likely to complete the survey**

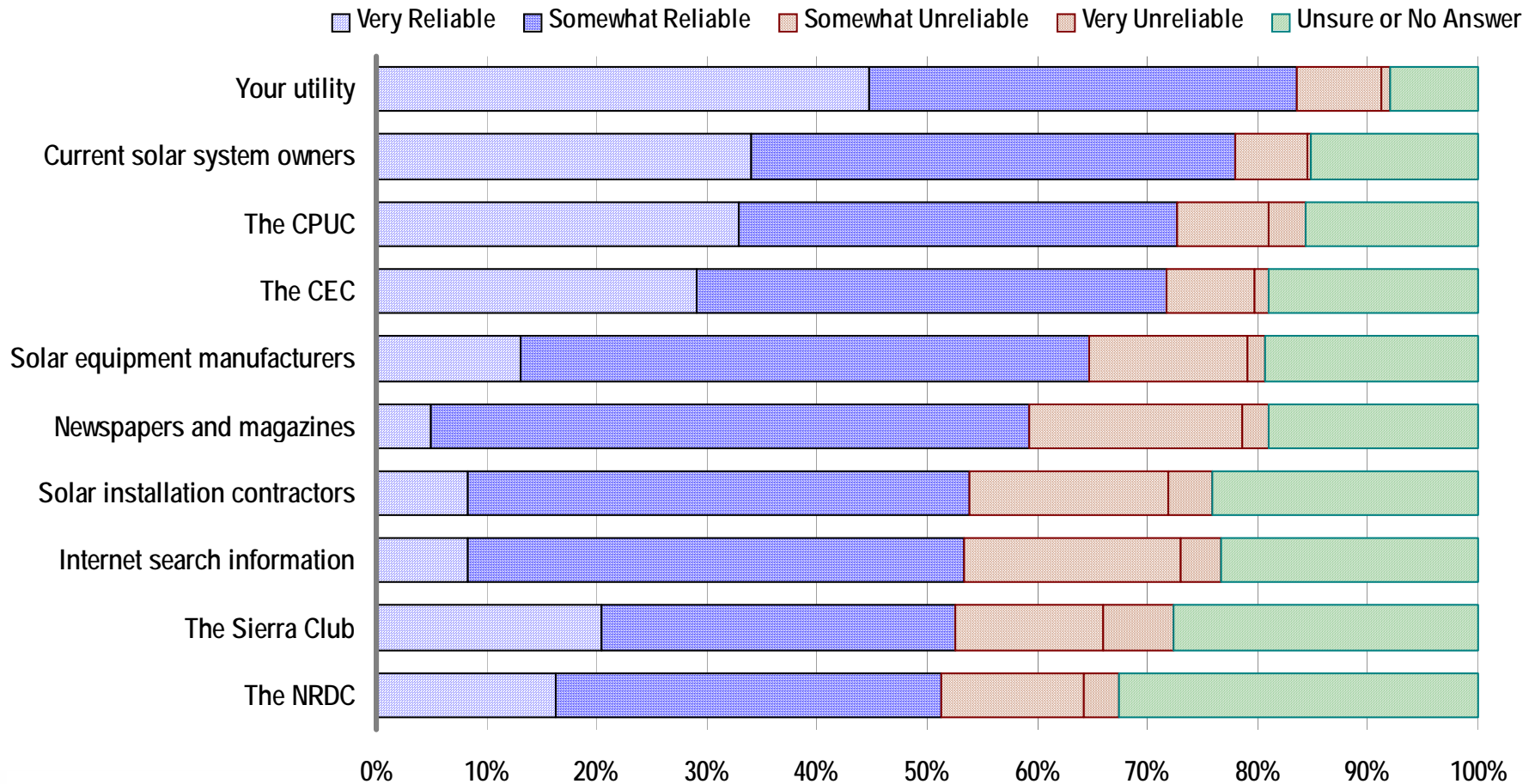
- Late adopters
- Persons who had considered purchasing solar equipment
- Persons with a high annual income



---

# When It Comes to Solar, How Does the Utility Compare to Other Sources of Information?

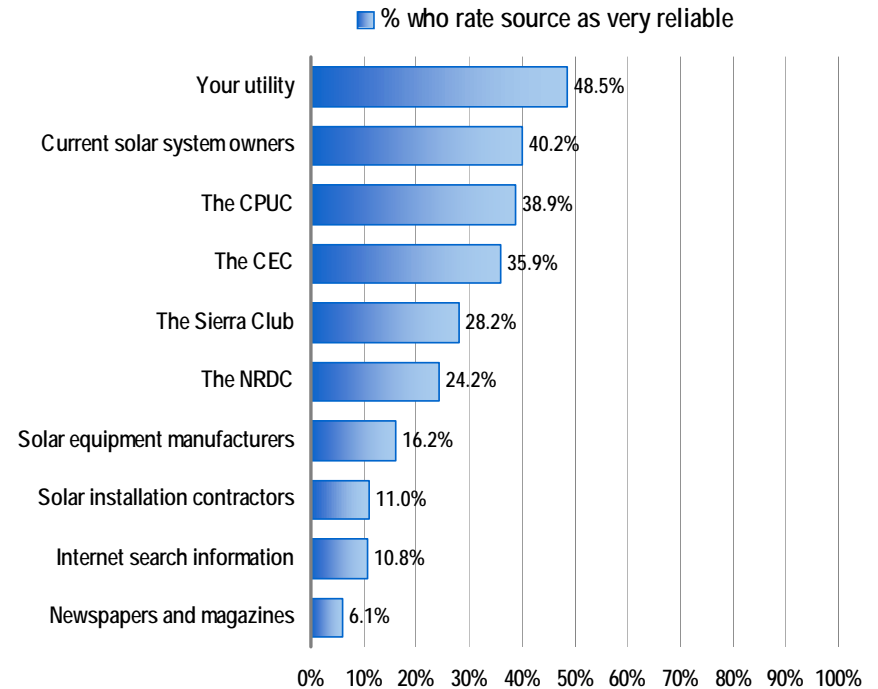
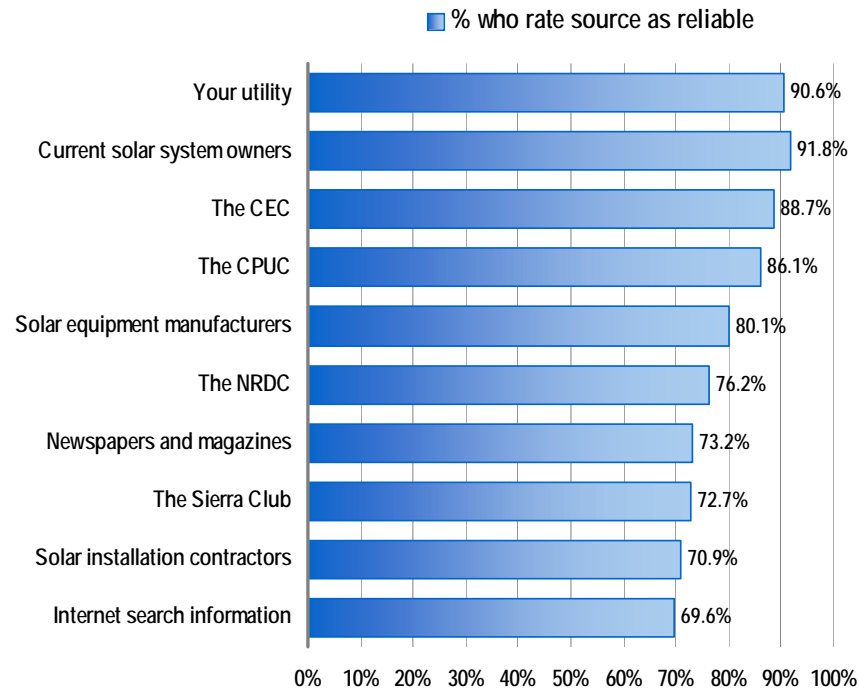
# Customers find their utility to be the most reliable source of information about solar



# When It Comes to Solar, How Does the Utility Compare to Other Sources of Information?

## Even after we exclude those with unformed opinions the utility is considered the most reliable source of information

- The utility had the highest share of customers who rate it as a very reliable source (statistically significant in all instances)
- The utility had one of the highest share of customers rating it as a reliable source – i.e., very reliable or somewhat reliable (except for current solar customers and the CEC, all differences are statistically significant)



---

# Impact of Information on Attitudes and Knowledge Towards Solar

# Impact on Attitudes and Knowledge Towards Solar

## Summary of impact on attitudes and knowledge

STATEMENT	Solar video			PG&E solar video		
	Direction of Impact	Change	Topic discussed?	Direction of impact	Change	Topic discussed?
Solar power is almost unlimited	→	4.6%	NO	→	5.2%	NO
Solar power is low cost energy	→	5.9%	NO	→	8.6%	NO
Solar power is very safe	→	7.9%	NO	→	9.9%	YES
Solar power panels require a lot of space	←	21.0%	--	←	13.9%	NO
Solar power panels are unsightly	←	19.2%	YES	←	7.8%	NO
Solar power panels are expensive	←	4.5%	YES	←	1.0%	YES
Solar power systems are expensive to install	←	4.1%	YES	←	2.0%	YES
Solar power systems are expensive to maintain	←	6.5%	YES	→	-8.8%	NO
Solar power technology is out of date	←	12.9%	NO	←	7.3%	NO
Solar power only works in sunny areas	←	18.5%	YES	←	0.8%	YES
Solar power systems require the owner to have a lot of special knowledge to operate	←	11.8%	YES	←	13.9%	YES
Solar power systems have a limited lifespan	←	18.0%	NO	←	19.8%	NO
Solar Power is good for the environment	→	4.1%	NO	→	2.8%	YES
Solar Power will make us more energy independent	→	4.5%	NO	→	-1.7%	NO

\*All significance tests via binary regression with a heckman model to control for selection bias

---

# What are the Key Predictors of Demand for Solar Power Systems and What is Their Impact?

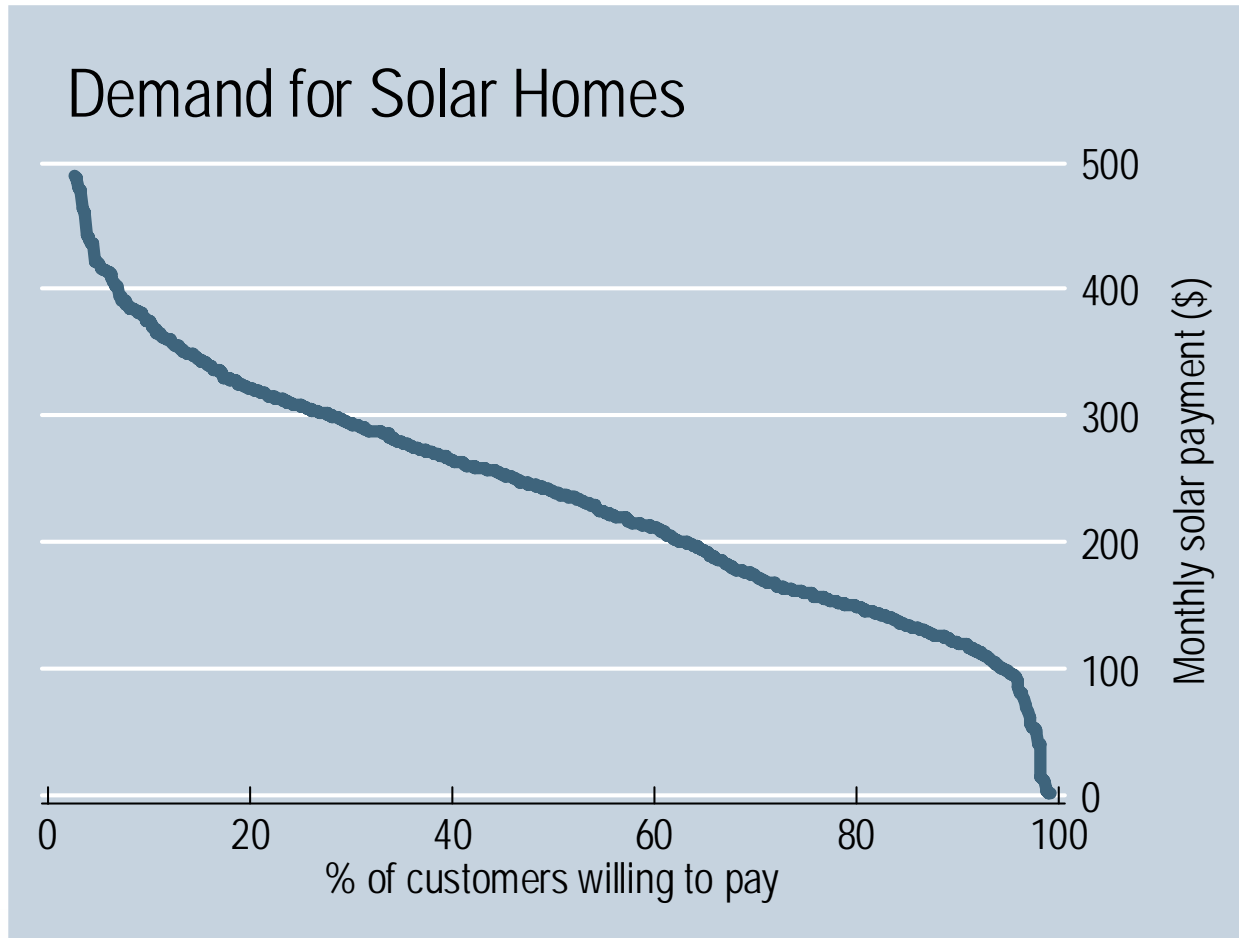
What are the Key Predictors of Demand for Solar Power Systems and  
What is Their Impact?

## How and why a demand model is useful

- Targeting customers who are most likely to be on the verge of action
  - Predict the propensity of specific customer segments to choose solar at different price levels
- Guide policy decisions, particularly about how to shape incentives
  - What is the upper bound on the impact that incentives of different sizes can have?
- Untangle the relationships between potential drivers/predictors and assign weights and certainty estimates to the factors affecting the decision
- Key factors in assessing and shaping the model...
  - Does it make sense?
  - Are the estimates unbiased?
  - Do the results change substantially if we add or exclude other potential drivers?
  - How accurate are the results?
  - How does it perform when compared with the actual decisions?

# What are the Key Predictors of Demand for Solar Power Systems and What is Their Impact?

## Demand for solar homes varies by monthly price



- Used solar share of rent /mortgage to define demand curve
- No transaction cost!
- Excluded respondents with base rent/mortgage below \$250 per month
- 25% willing to pay more than \$300 per month for a solar home
- 60% willing to pay more than \$200 per month for a solar home



# What are the Key Predictors of Demand for Solar Power Systems and What is Their Impact?

## The key drivers and predictors of demand for solar – I

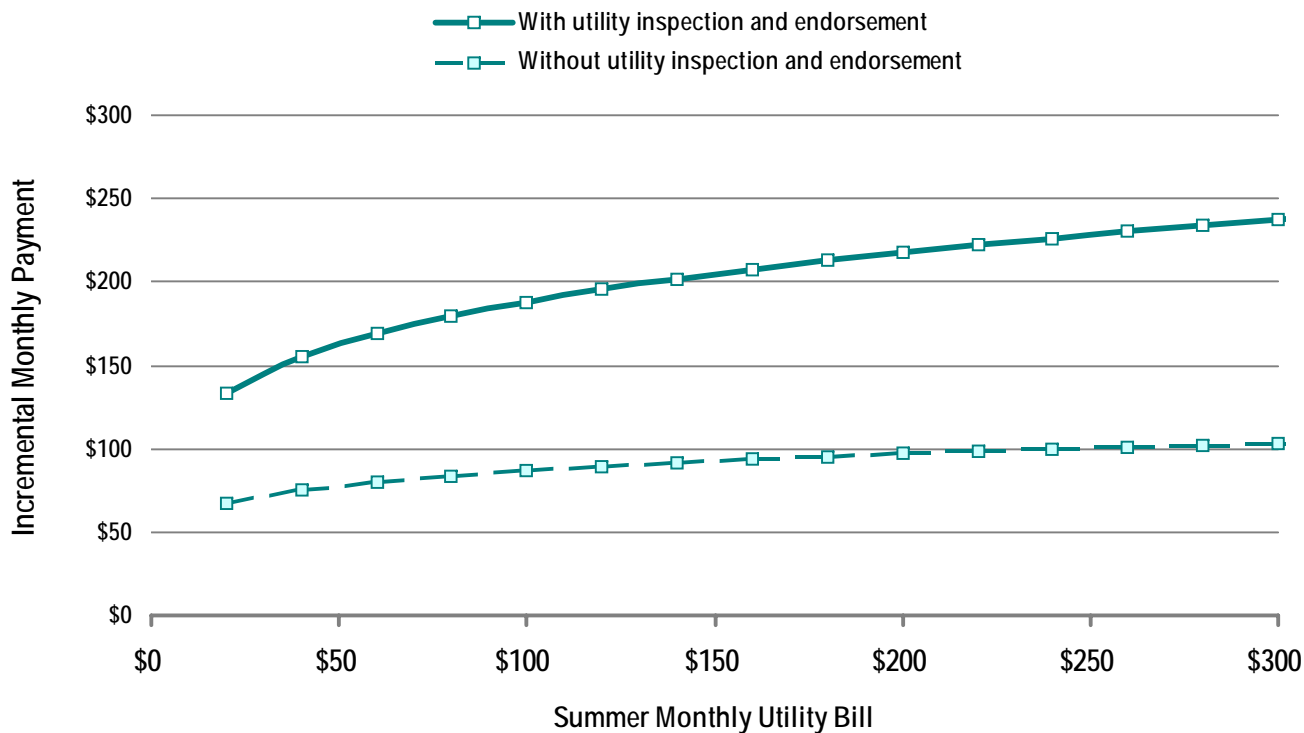
<b>Utility Inspection and Certification</b>
<b>Hybrid Vehicle Ownership</b>
<b>Annual household income</b>
<b>Monthly utility bill (summer)</b>
<b>Homeownership</b>
<b>Age of Respondent</b>

- **Caveat: utility inspection and endorsement of the solar power system was not a randomly assigned feature, potential for methodology to influence responses**
- **Persons who have purchased a hybrid vehicle, on average, are willing to pay 2.5 times more for solar power than those who have not**
- **It played a larger role when the solar power system had not been inspected and endorsed by the utility**
- **It played a larger role when the solar power systems had been inspected and certified by the utility**
- **Homeownership had a positive impact when the solar power systems that had been certified than renters. It had no impact without the inspection and endorsement.**
- **Older individuals had lower willingness to pay for solar. With the utility inspection and certification the impact was statistically significant. Without it, chance could not be ruled out as an explanatory factor.**

# What are the Key Predictors of Demand for Solar Power Systems and What is Their Impact?

## Utility inspection and certification

Willingness to Pay for a Solar Power System

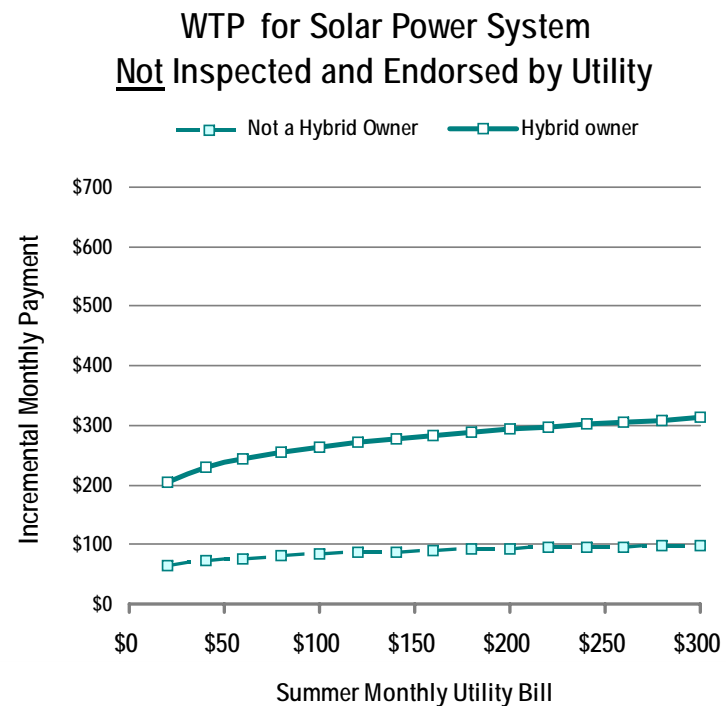
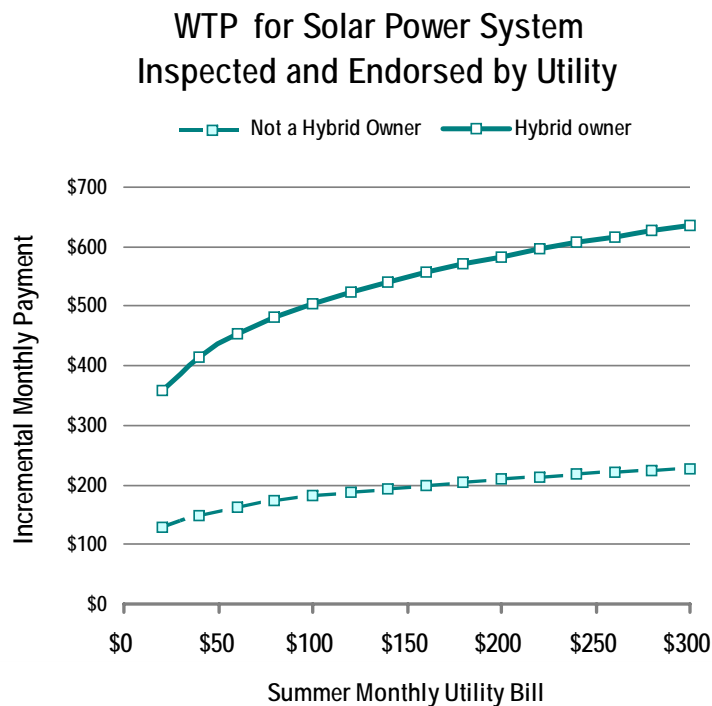


- Inspection and endorsement had more of an impact on homeowners than renters
- Caveat: utility inspection and endorsement of the solar power system was not a randomly assigned feature and was asked about in separate questions

# What are the Key Predictors of Demand for Solar Power Systems and What is Their Impact?

## Hybrid vehicle ownership

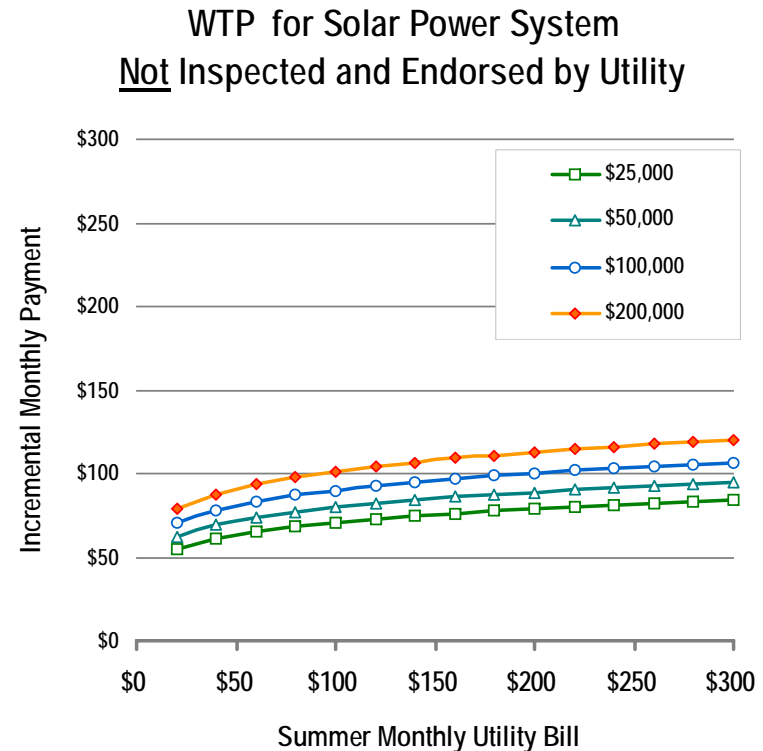
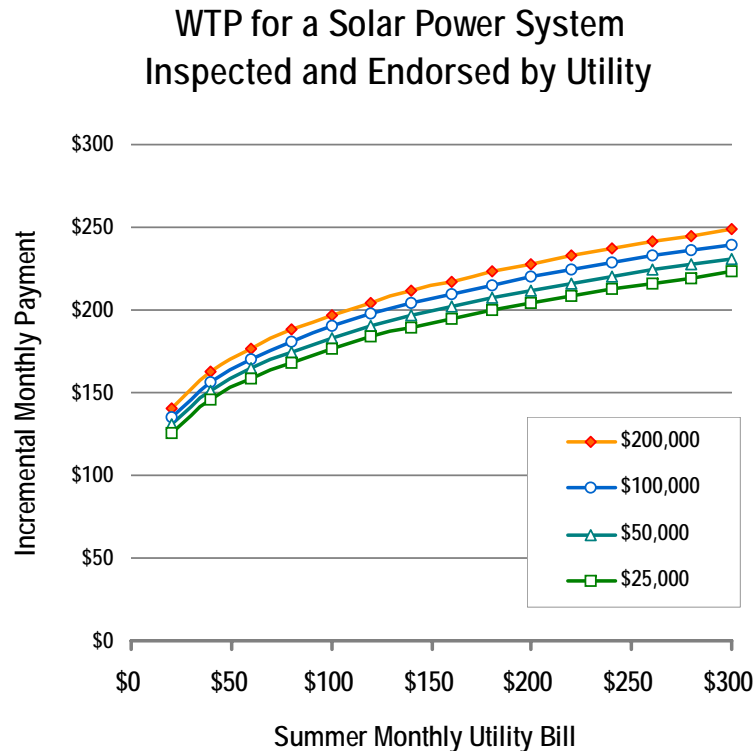
- Hybrid vehicle owners were willing to pay more than twice what individuals who did not own a hybrid were willing to pay. This was true with and without utility inspection and certification
- Hybrid vehicle ownership can be seen as a proxy a “green” early adopter



# What are the Key Predictors of Demand for Solar Power Systems and What is Their Impact?

## Annual household Income

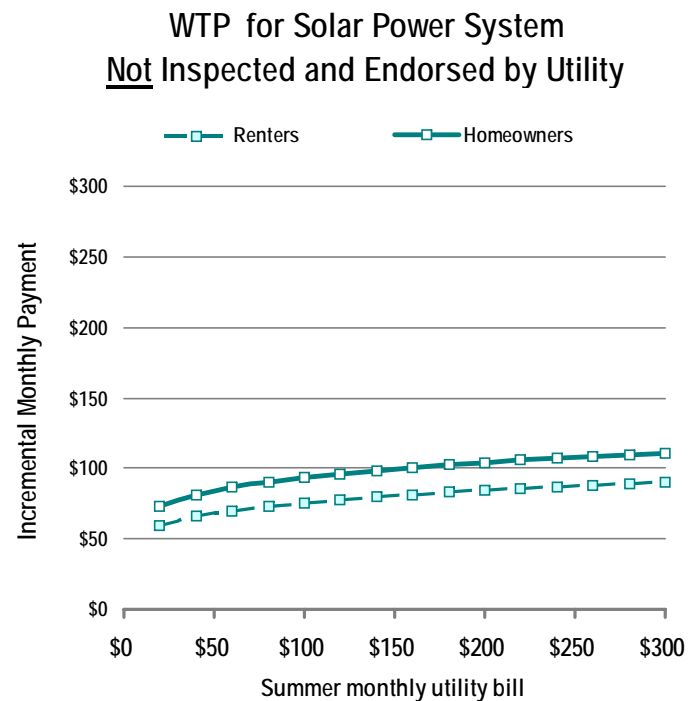
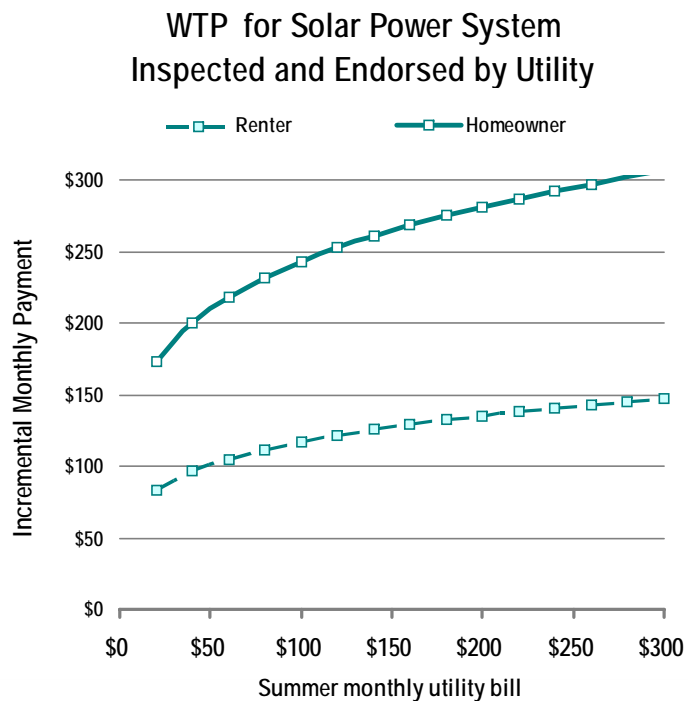
- A 10% increase in income is associated with a 0.52% increase in WTP when the solar power system is inspected and endorsed by the utility
- A 10% increase in income is associated with a 1.72% increase in WTP when the solar power system is not inspected and endorsed by the utility



# What are the Key Predictors of Demand for Solar Power Systems and What is Their Impact?

## Homeownership

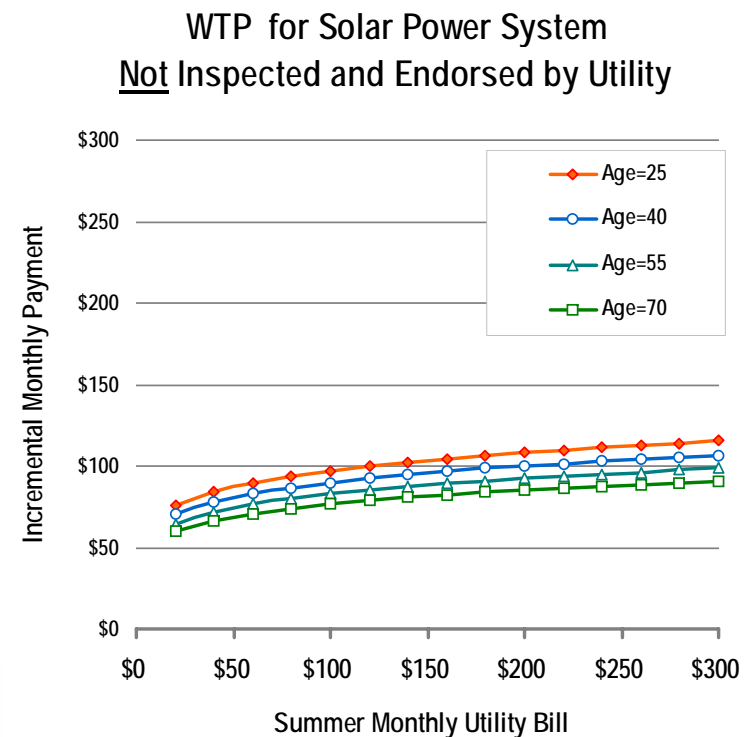
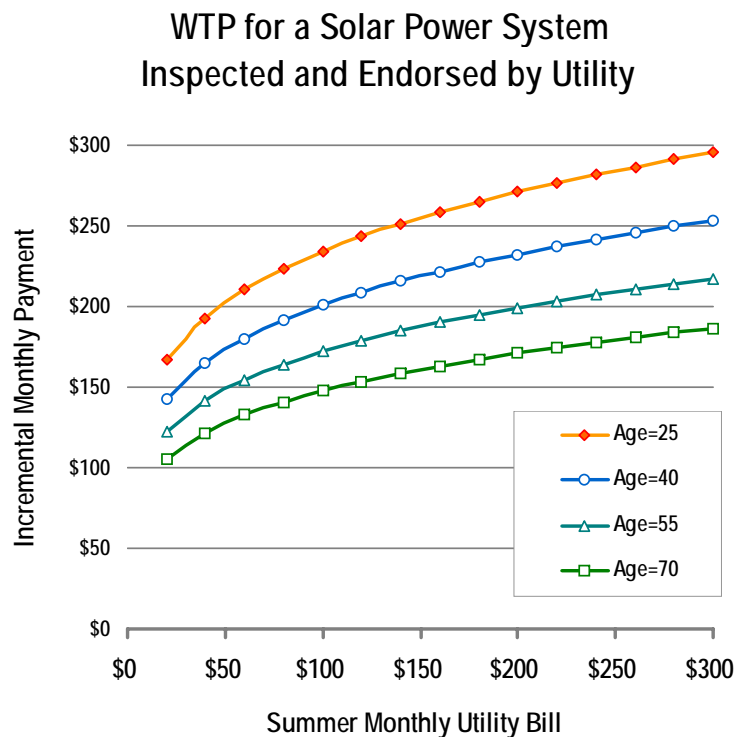
- Homeowners were willing to pay 90% more than renters when the property was inspected and endorsed by the utility (statistically significant)
- Homeownership was not a factor when the solar power system was not inspected and endorsed



# What are the Key Predictors of Demand for Solar Power Systems and What is Their Impact?

## Age of individual

- ◆ Age mattered only when the solar power system was inspected and endorsed by the utility. What do we make of it?
- ◆ One possible interpretation: utility certification was enough to influence younger individuals to take up the offer, but it had less of an effect on older folks



---

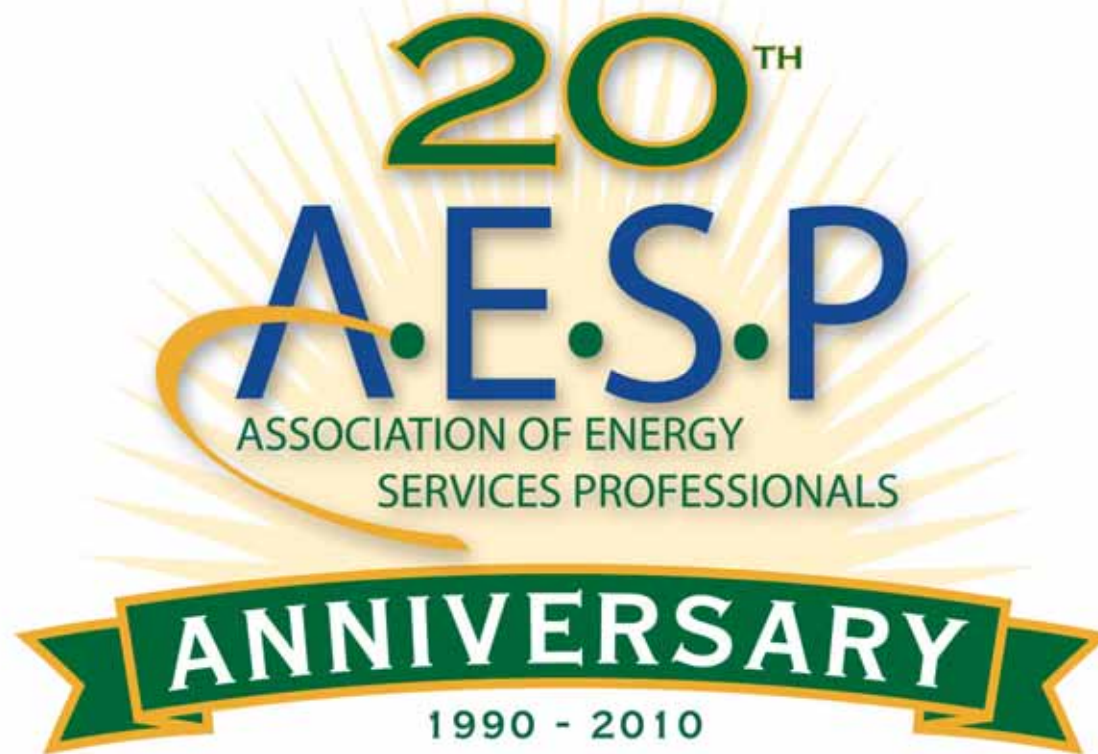
For any questions, feel free to contact

Susan Buller

or

Michael Sullivan Ph.D.

Freeman, Sullivan & Co.  
101 Montgomery Street 15<sup>th</sup> Floor, San Francisco, CA 94104  
michaelsullivan@fscgroup.com  
415.777.0707



CELEBRATE WITH US NEXT YEAR IN TUCSON!



19<sup>th</sup> National Energy Services Conference & Expo  
[www.aesp.org](http://www.aesp.org)

© 2009 Association of Energy Services Professionals, All rights reserved.