

SMUD ENERGY EFFICIENT REMODEL DEMONSTRATION PROGRAM

Presentation to CABEC Conference

May 6, 2010

San Luis Obispo, California

Mike Keese
Project Manager
Energy Efficiency Customer
Research & Development
SMUD



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



Outline

- SolarSmart Homes
- Home of the Future
- Deep Energy Retrofits
- Efficiency Packages
- Lessons Learned
- Recommendations



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



EFFICIENCY FIRST THEN SOLAR



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



What is a **SMUD Solar Smart** New Home?

**23-42% improvement to 2005 Title 24 plus solar
~ 60% Electricity Savings/ 30% Gas Savings**

Measure	Base	SolarSmart New Homes
Attic Insulation	R-38	R-38
Radiant Barrier	No	Yes
Wall Insulation R-13		R-13 + 1" R-4.2 Foam
Quality Installation*	No	Yes
Low Air Infiltration*	No	Yes
Windows	Energy Star	Energy Star
FURN AFUE	0.80	0.90+
A/C SEER	13 (3.7 ton)	14 SEER/12 EER (3.1 ton)
ACCA Design* No		Yes
Duct Testing*	No	Yes
Fluorescent Lighting	T-24	Yes
Solar PV	NA	2kW AC Solar System



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM

*HERS verified upgrades



SMUD & Other Incentives

- **SMUD (as of 04-30-10)**

– \$2.20/watt (2000 watt CEC AC rated)	\$4,400
– Efficiency rebate	<u>\$1,100</u>
– Customized Contract (per unit incentive)	\$5,500

- **Federal Tax Credits**

– Builder Tax Credit (if extended)	\$2,000
– Home-owner PV Tax credit	\$2,000

- **Other Incentives**

 - **IOU Advanced Home Program**

- **Total Incentives**

~\$7,750 - \$9750



SMUD **Solar Smart**

Market momentum - 46 Communities,
over 4,000 new homes over next 4
years

- Lennar
- Sunrise Lofts LLC
- Tim Lewis Communities
- Regis
- 49 Mile Development
- Standard Pacific Homes
- Woodside Homes



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.™



Home of the Future

- 80% Reduction Annual Source Energy
- Zero Net Summer Peak Electric Demand: 4 PM - 8 PM
- Demonstrate the features of the home to the public and builders



54-60% better than 2005 Title-24 LEED Platinum Home

- Attic R38 ceiling assembly (low density foam)
- Wall 2x6/R19-R21 cavity/R12 insulating sheathing -R30
- Envelope .0002 SLA (4 ACH50)
- Windows 0.29 U-value, 0.27 SHGC
- Ducts Tight ducts, inside conditioned space
- FURN Solar Assisted Hydronic space heating
- A/C Aqua Chill Water Cooled AC (Home)
- Ductless, HE, Mini-split Heat Pump (Casita)
- Water Solar with HE boiler hot water backup
- Lighting 100% CFL and LED Lighting
- Solar 3.8 kW AC Solar Electric PV
- Gas and/or Energy Star Appliances
- Home Automation
- Grid Tied Battery Back Up/Utility Dispatch



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



HOF Costs

- ~\$48,000 Incremental Costs:
- Big Hit: Solar
 - PV ~\$30,000
 - Solar Thermal ~\$8,000 (including heating)
- 2 Buildings (House & Apt)
- Didn't count the Green Stuff
- “Emerging” Technologies



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



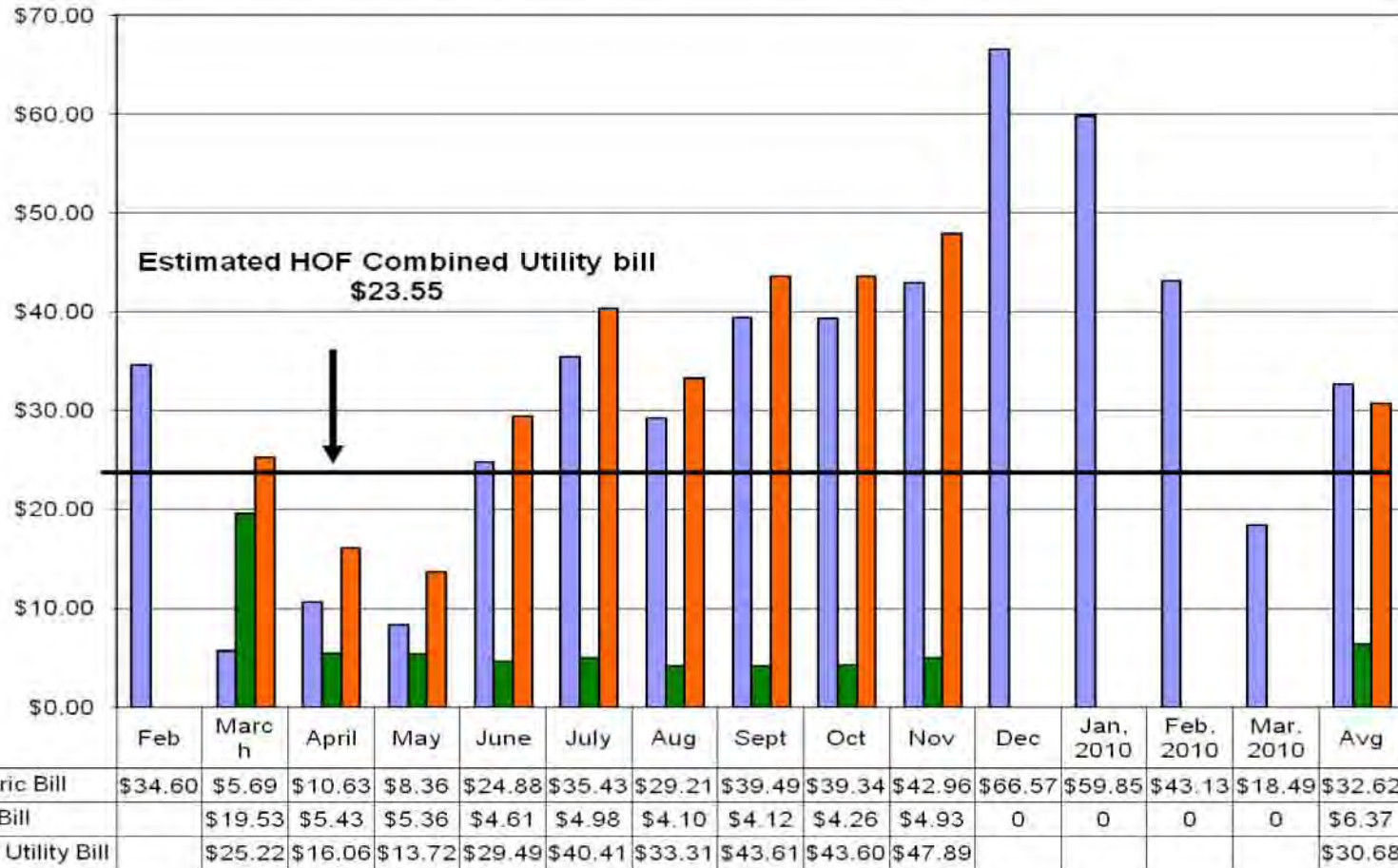
HOF Estimated Results

- Met Source Reduction Goal – 89%
- HERS 16
- Zero Electric Home But Not Zero Energy!
 - Net Annual Exporter of Electricity
 - ~ 2,000 kWh/year
 - 50% reduction in gas usage
- Impressive Bill Savings
 - \$24/month vs. \$140/month



Results to Date

HOF Utility Bill



SMUD

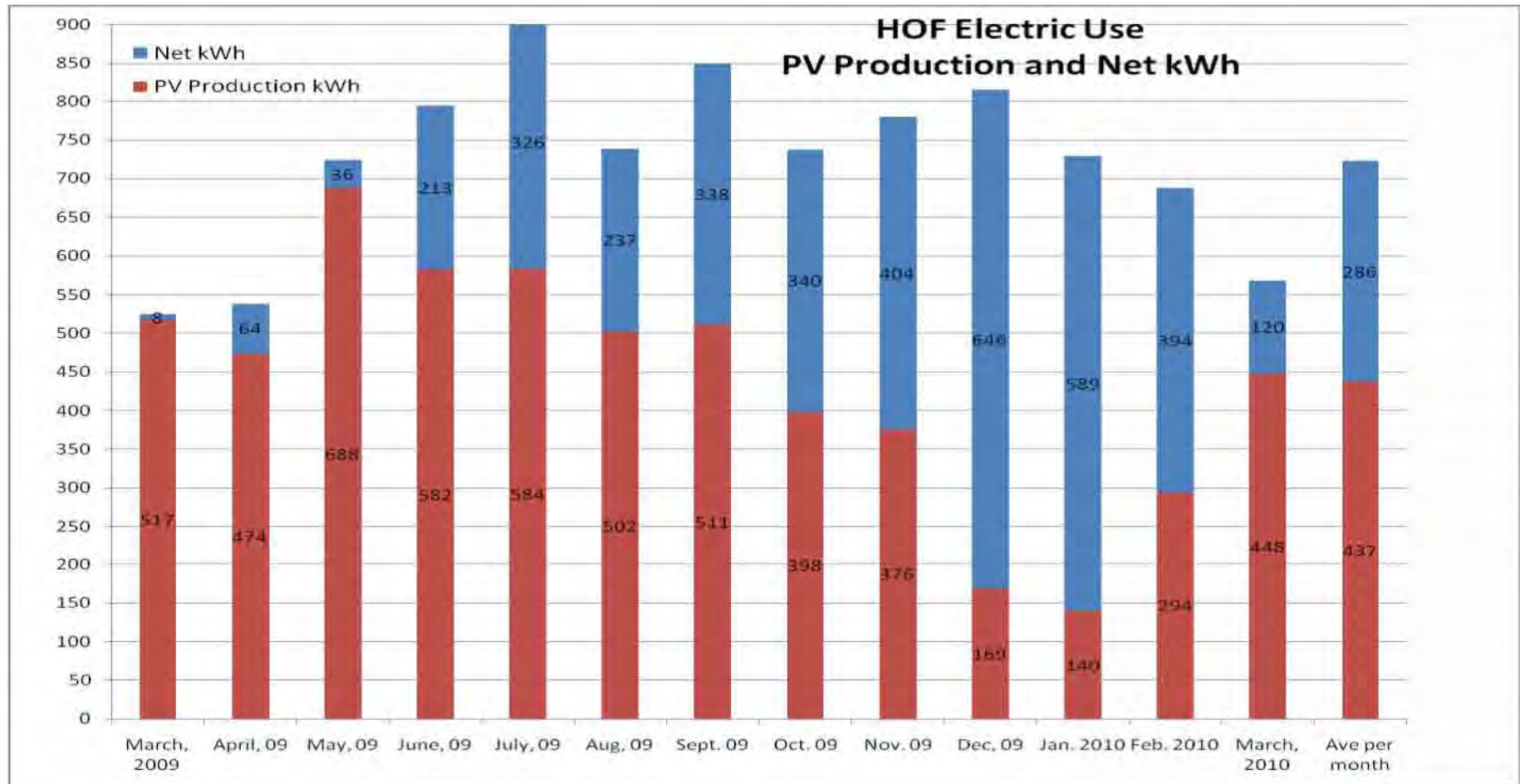
SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



PV Provides 60 % kWh

Results to Date



**Avg . Monthly Gas Use 8 therms vs estimated 30 therms
75% less than estimated**



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



Deep Energy Retrofit -What is it?

Retrofit/Upgrade home to
reduce total household
annual source
annual source
(electric/gas) energy use
50%



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.™



Typical Residential Energy Efficiency Measures

- R-40 Attic Insulation with Radiant Barrier
- R-19+ Walls
- Air Sealing, Tight Envelope, 3ACH50
- SEER 16+ AC
- AFUE 90% furnace w/ variable speed fan
- Tight, tested R-6 ducts
- Hi-Efficiency Water Heater
- Energy Star CFL fixtures and Appliances



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.™



R&D

- New Wall Insulation Methods
- Home Automation
- Advanced Solar PV & Thermal
- Heat Pump Water Heaters (all electric)
- Air Sealing Techniques



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



GreenBuilt Construction

8901 Quail Hill Way, Fair Oaks

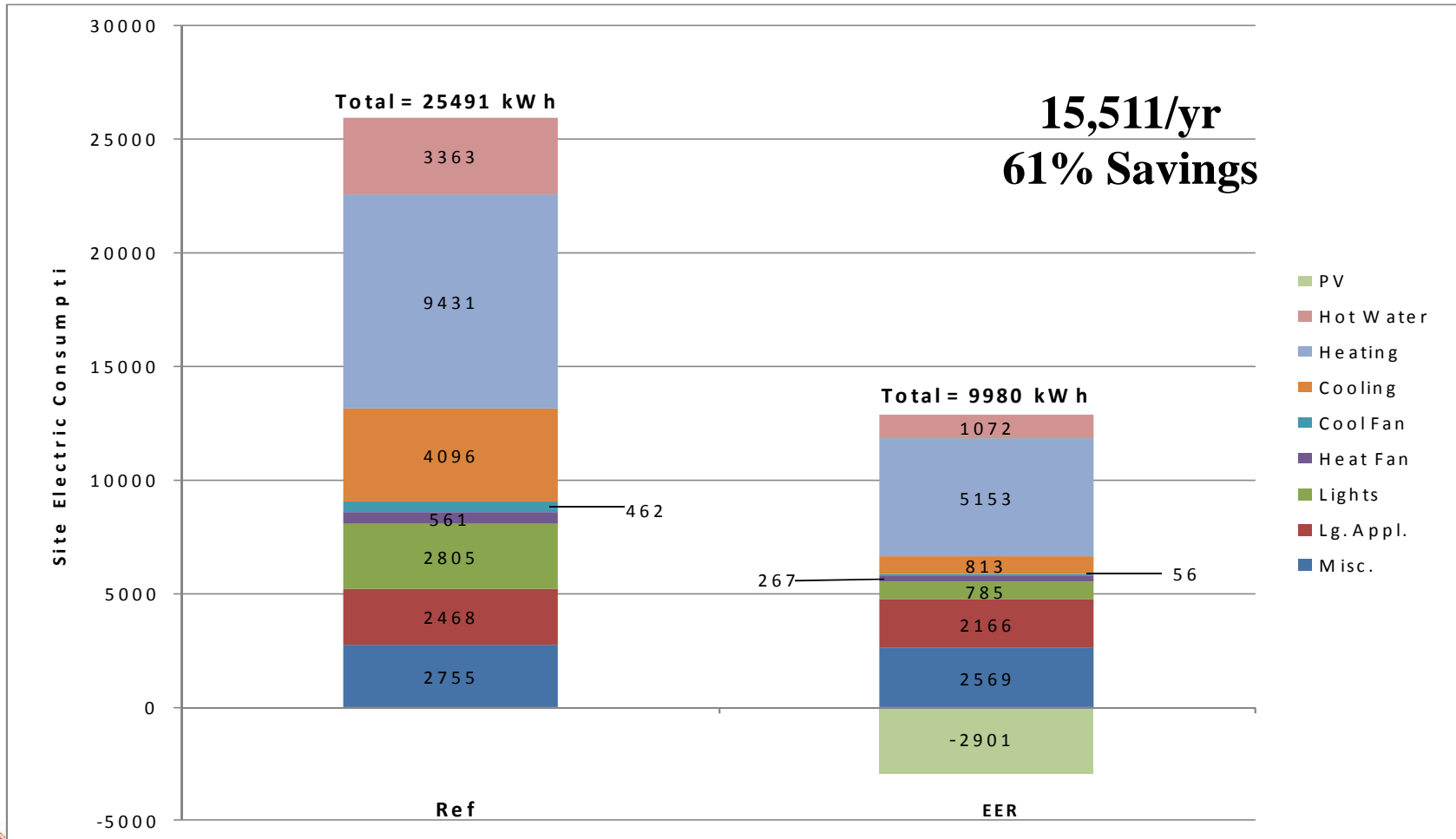


Market Rate Flip

- 62% Source Energy Savings
- \$42k
- 182 to 78 HERS score
- R-40 Attic Insulation with Radiant Barrier
- High Efficiency Windows
- Air Sealing, 4.1 ACH50
- SEER 16/ HSPF 9.0 Heat Pump w/ tight, tested R-6 ducts
- Heat Pump Water Heater w/ Solar Pre-Heat
- Energy Star CFL fixtures and Appliances
- Solar Electric PV



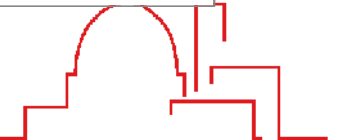
GreenBuilt Energy Savings



SMUD

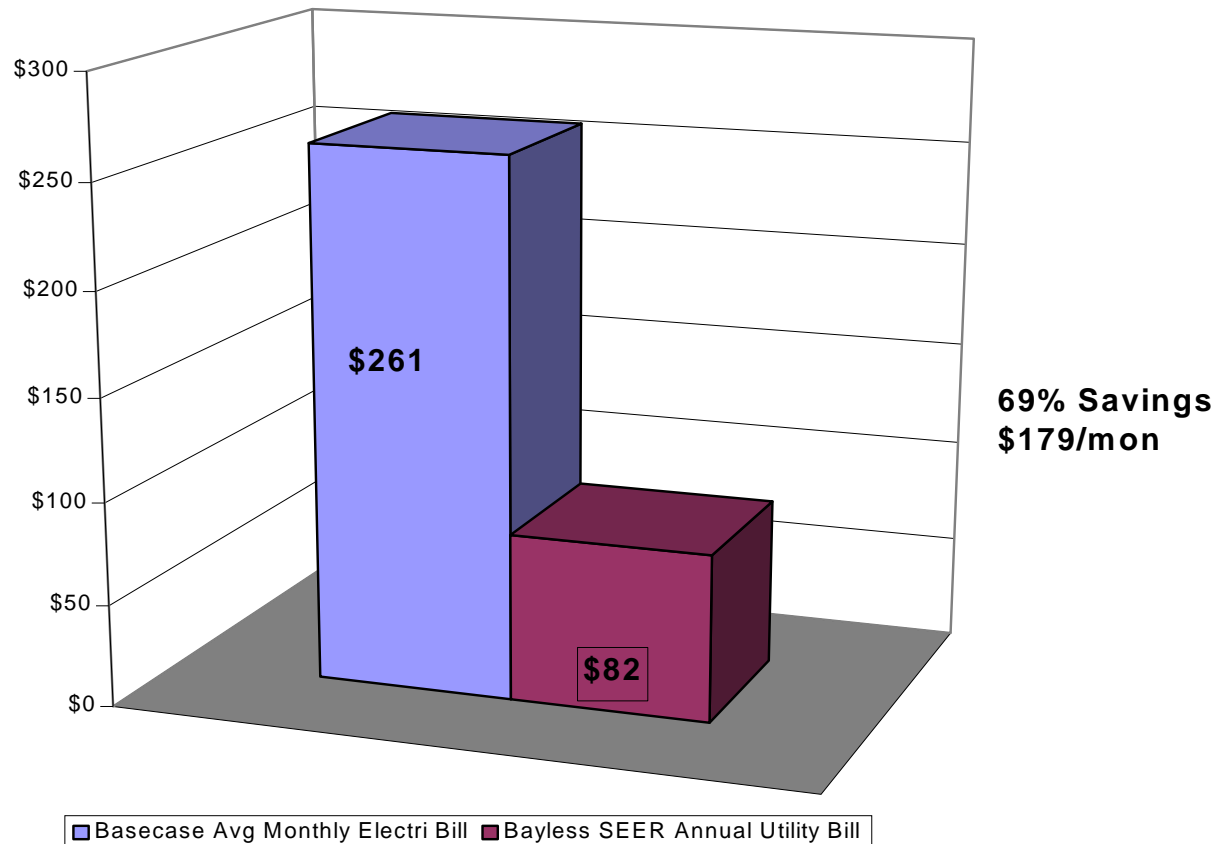
SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



GreenBuilt SEER

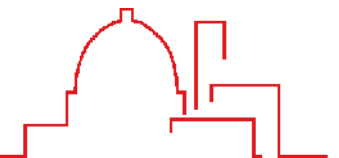
Avg. Monthly Energy Bill Savings



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



Housing Group Fund

5832 Mascot Ave., Sacramento



Rehabbed Abandoned
Home/ Affordable Housing

- 53% Source Energy Savings
- 241 to 86 HERS Score
- R-40 Attic Insulation with Radiant Barrier
- High Efficiency Windows
- Air Sealing, 6ACH50
- SEER 16/ 80% AFUE
- Tight, Tested R-6 ducts
- Condensing Tankless
- Energy Star CFL fixtures and Appliances



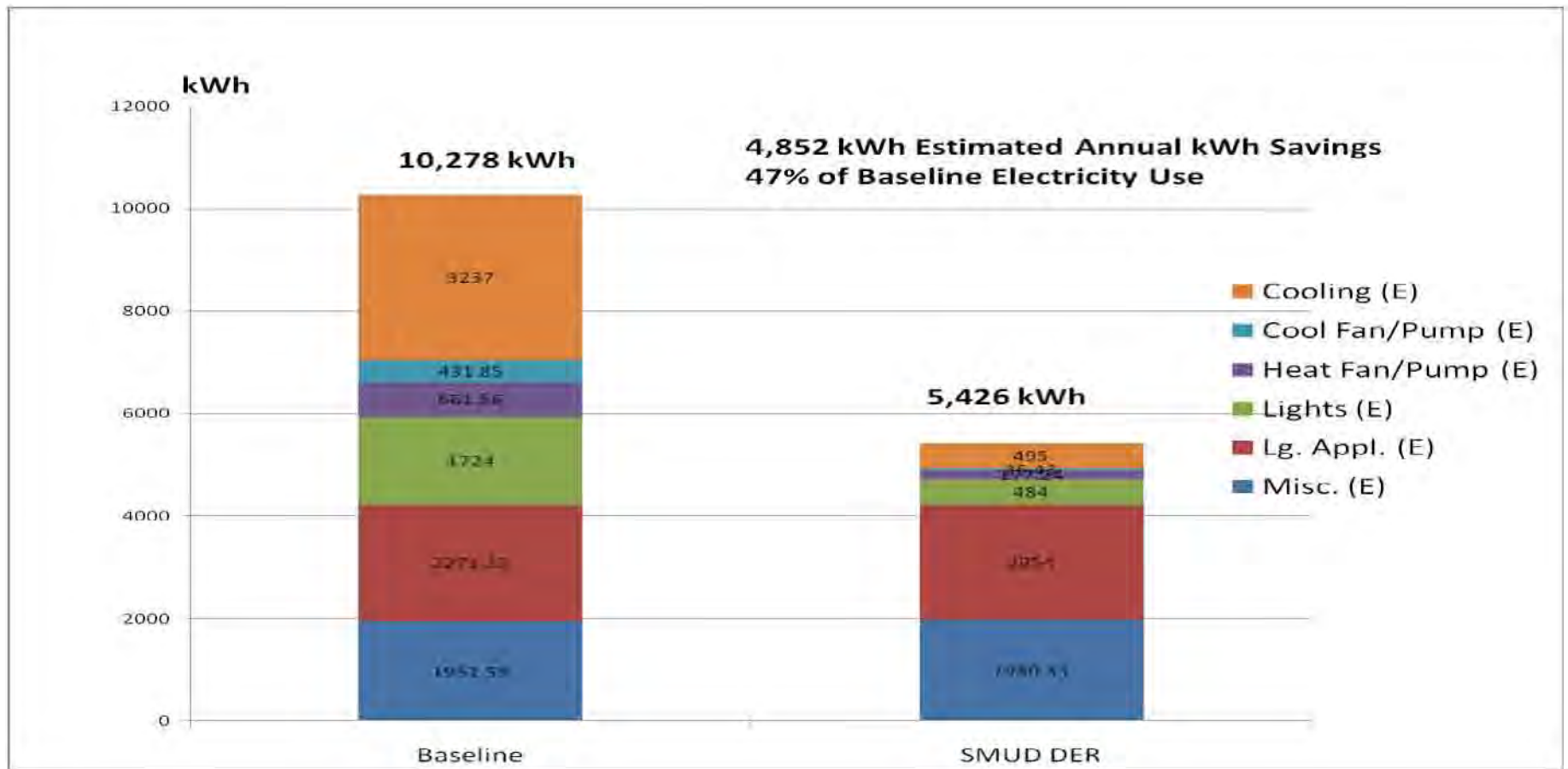
SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



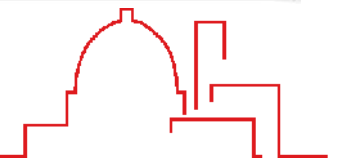
Mascot DER Estimated Annual Electricity Savings



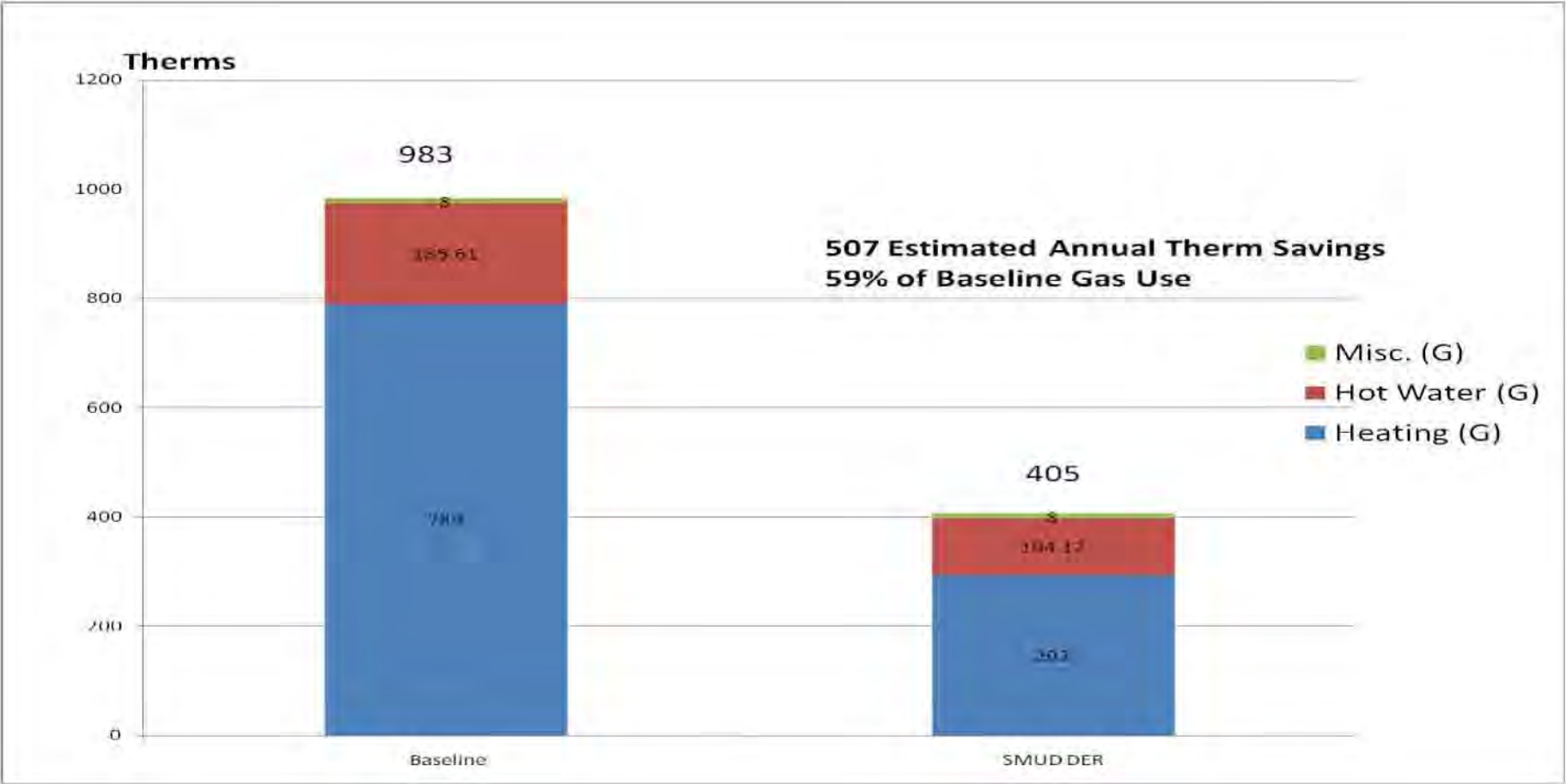
SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



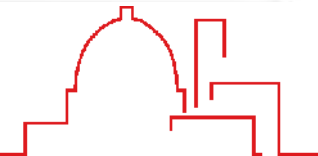
Mascot DER Estimated Annual Gas Savings



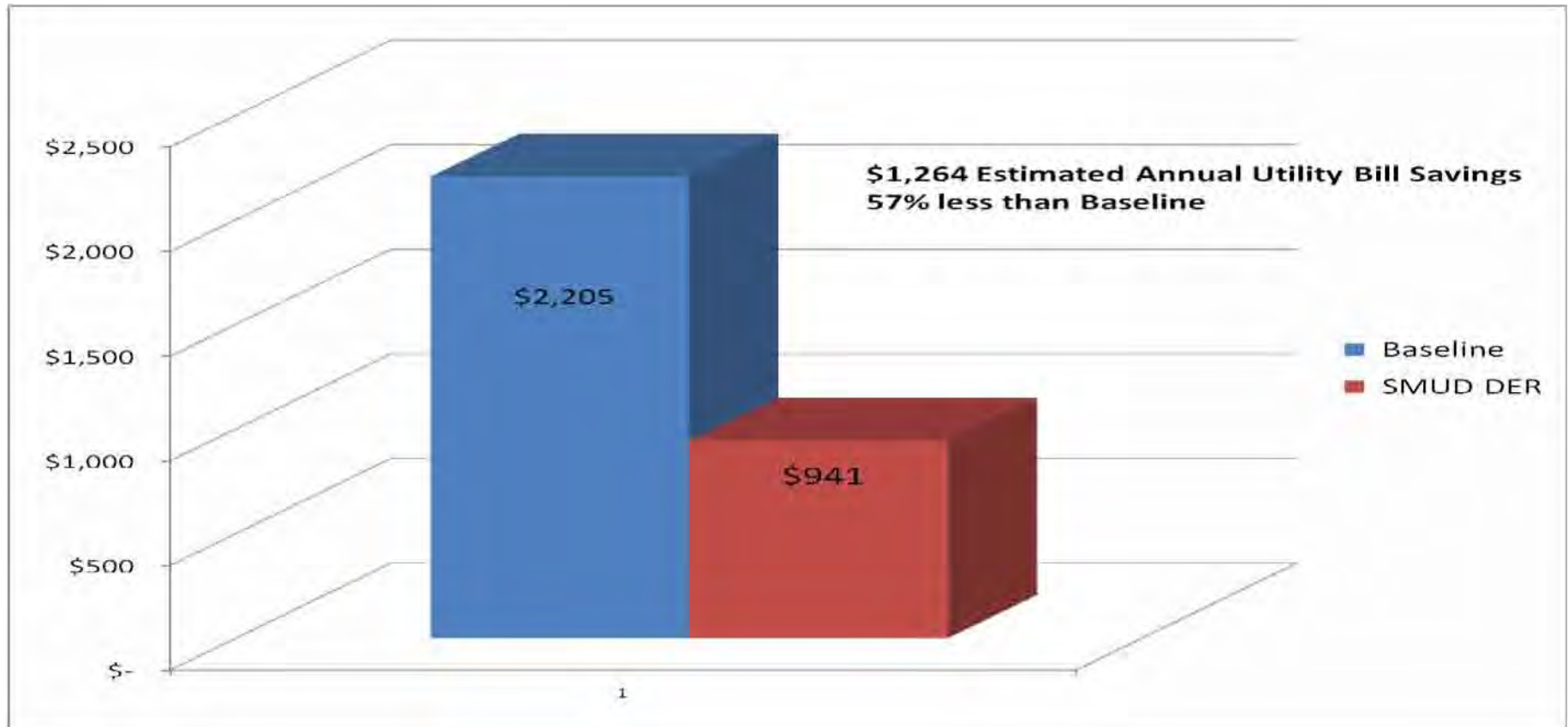
SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



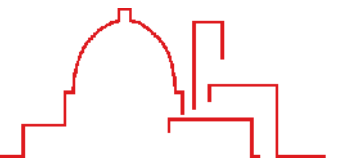
Mascot DER Estimated Annual Energy Bill Savings



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



Del Paso Solutions

1110 Jean Ave., Sacramento



Rehabbed Abandoned
Home/ Affordable Housing
All Electric

- 57% Source Energy Savings
- R-40 Attic Insulation
- High Efficiency Windows
- Air Sealing, Tight Envelope, 3ACH50
- SEER 15/8.8 HSPF Mini-Split Heat Pump
- Heat Pump Water Heater
- Energy Star CFL fixtures and Appliances



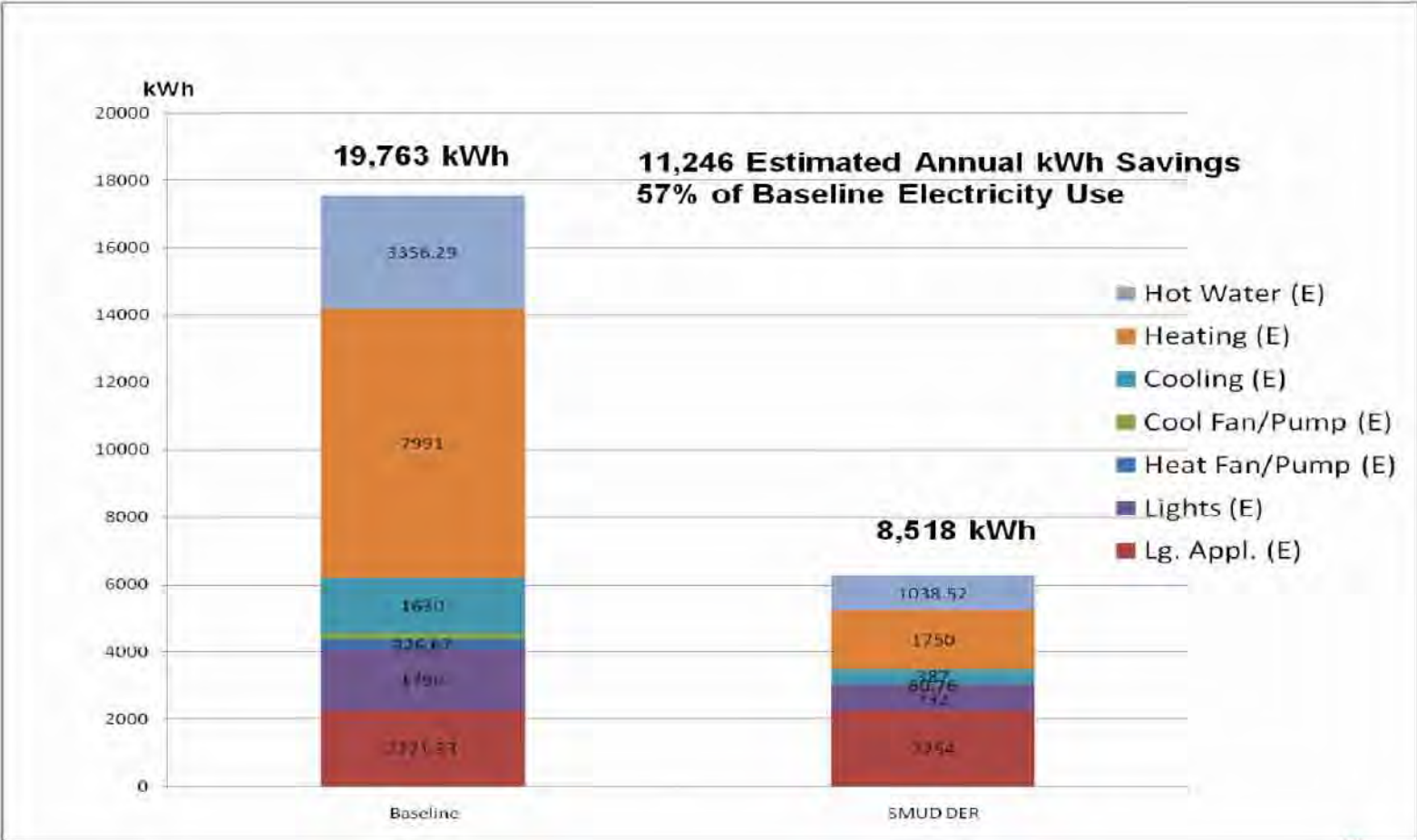
SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



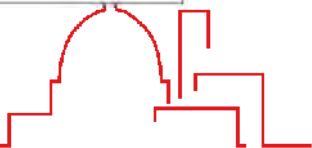
Jean DER Estimated Energy Savings



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



Jean DER Estimated Annual Energy Bill Savings



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



Home Performance Approaches

- Performance – *available now*
 - Comprehensive ‘whole-house,’ assessment,
 - Test-in and test-out
 - Shell measures + system upgrades
 - TBD ~ \$3,500 customer incentive
- Prescriptive – *under development*
 - Shell measures
 - TBD ~ \$1,000 customer incentive
- Both approaches are in coordination with IOU, PACE, and potentially Home Star programs



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



The Basics – 30% Savings

- **Perform Home Energy Rating (HER)**
- **Air seal the house to 8 ACH 50**
- **Insulate the attic to R-38**
- **Seal and tighten heating and air conditioning ducts to 6% leakage**
- Insulate the water heater
- Reduce hot water demand – install water-saving faucets and showerheads
- Install an ENERGY STAR® programmable, set-back thermostat



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.™



The Basics – 30% Savings

- Control the sun – Install interior blinds, exterior shade screens or awnings, or low emissivity (low-e) films on east and west facing windows. Install retractable awnings on south-facing windows
- Replace incandescent lighting with ENERGY STAR® CFL lighting
- Plug electronic and entertainment equipment into power strips



Re-Roof- 30%+ Savings

- Basics +
- Radiant Barrier or Cool Roof

Bathroom – 30-40% Savings

- Basics +
- .62 EF Water Heater or 2.0 COP Heat Pump Water Heater
- Energy Star Windows
- Energy Star Exhaust Fan
- CFL/LED Hard Wire Fixtures



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



Kitchen– 30-40% Savings

- Basics +
- Energy Star Windows
- Energy Star Appliances
- Energy Star Range Hood
- CFL/LED Hard Wire Fixtures



HVAC Replacement – 30-40% Savings

- Basics +
- ACCA Manual's J, S, and D mechanical system design
- SEER 14.5 / EER 12 AC
- .92 AFUE Furnace or 8.0 HSPF Heat Pump
- Sealed R-6 ducts sealed tested to be less than 6% leakage or better.



Gut Rehab/Additions 50-60% Savings

- Basics +
- Energy Star Windows
- HVAC Replacement
- Water Heater Replacement
- CFL Hard Wire Fixtures



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



Pre 80s – 50- 60% Savings Package

- HERS Testing/Inspections
- Air Seal to ~8 ACH50 (0.35 ACH n)
- R-38 Attic Insulation (Radian Barrier w/ Reroof)
- SEER 14.5 AC/92 AFUE Furnace w/ Tight Ducts (< 6% leakage)
- Energy Star + Windows
- .62 EF Gas Water Heater or HPWH
- Energy Star Hard Wired CFL Fixtures



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



Lessons Learned – Home Buyers

- Significant utility bill savings – **It's Affordable**
- Solar/Efficiency has little appeal as an option but immense appeal as a standard feature
- Energy savings need to be sold on cash flow not payback
- New home buyers are unfamiliar with the benefits of owning their own PV system
- Solar and efficiency have not hit “critical mass,” with buyers, but momentum is building – **SolarSmart 30% of Market**



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM



Lessons Learned - Builders

- Clear builder preference for building-integrated PV systems over roof mounted PV systems
- Builders want to use their own subcontractors and/or have turn key solutions
- Partner with and reward Market Leaders
- Train Them



Lessons Learned - Others

- UTILITIES
 - Significant peak demand reduction.
 - Potential Distribution System savings (yet to be proven)
- Engage and train Local Government
- Energy simulation ain't real



What does Cost Mean?

- Home sold close to asking price in worst market ever in 3 months.
- One offs are expensive.
- What are you selling?
Quality vs. Quantity
- SF Costs
 - 2400 SF vs 2300? What's the difference?
 - Quality



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.™



Challenges to Achieving Residential Zero Energy

- Offsetting Gas Usage
 - 28,962,234 Btus = 8,476 kWh or ~ 5 kW +
- Peak Demand Issues
 - Cooking
 - Water Heating
 - Clothes Drier
- Dumb Grid/Dumb Appliances/Dumb House



Challenges to Achieving Res Zero Energy/Peak

- No Price Signals
- Bad Market
- Growing Plug Loads
- Uninformed buyers/users
- Need for Collaboration and
Coordination Among Utilities



Achieving Residential Zero Energy

An All Electric House!?!

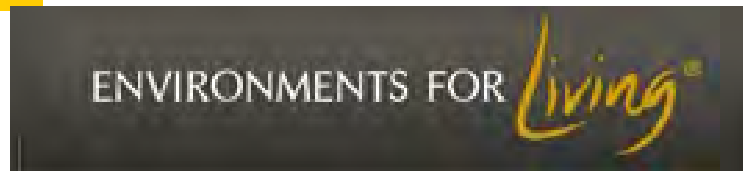
- Solar w/ Heat Pump Water Heaters
- Electric Clothes Drier (w/ controls)
- Japanese Homes
- Review/Revise T-24 Assumptions





What's Green?

80% Energy
20% Everything Else



Recommendations

- Partner w/ the Building America Program
- Work w/ local utilities
- Get Trained
- Green Building Programs must emphasize energy savings!
- Efficiency First, Then Solar



Summary

- New – 80% in reach
- Retrofits - 50% + Energy Savings
- DER Packages
- Partner w/ local Utility(ies)
- Watch out for Plug Loads



More Information

Mike Keesee

Project Manager

(916) 732-5244

Mkeesee@smud.org



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.SM

