

SETTING A NEW STANDARD - THE PREMIER GARDENS ZERO ENERGY HOME

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SMUD



SMUD'S ZEH Experience

- What is ZEH?
- Premier Gardens ZEH Project
- PV Performance
- Potential Impacts
- Lessons Learned



DOE's ZEH Program Goals

- Communities built in 2003 – 2004
 - 60% reduction in energy bill
 - Annual net-zero electricity use
 - \$600 total annual energy bill
- Communities built by 2010
 - Annual net-zero energy use



PUBLIC/PRIVATE PARTNERSHIP

- Energy Star



Energy Star (15% better than Title 24)

- ComfortWise



ComfortWise

Third party inspections and tests

- SMUD Tier III Advantage Home

50% reduction in Title 24 cooling energy budget



Premier Gardens



Premier Gardens



- 95 home in-fill, entry-level community
- 1,300 to 2,400 square foot homes (1,875 ave.)
- Diverse community demographics
- Standard Feature
- 190 kW Solar
- Occupied < one year



Premier ZEH Features vs. Neighbor

32% to 38% > 01 Title-24 Standards

<u>Measure</u>	<u>Base</u>	<u>ZEH</u>
Attic Insulation	R-30	R-38
Wall Insulation	R-13	R-13 + R-4.2 Foam
Low Air Infiltration	No	Yes
Windows	Vinyl, low SHGC	Vinyl, Low SHGC
Furnace	0.80 AFUE	0.92 AFUE
A/C SEER	10	14 w/TXV
ACCA Design	YES	YES -- Short Runs
Duct Leakage	TIGHT	TIGHT
Water Heater	Storage EF .62	Tankless EF .87
Distribution	Standard	Pipe insulation
Fluorescent Lighting	--	All Permanent Fixtures
PV	--	2 kW
Home Energy Rating	--	Required



Roof Integrated Solar Electric System

- 48 GE Energy GT 55 BIPV Modules
 - 2,208 kW AC
- One Source Circuit
- High-Voltage
- SMA 2500 Inverter
- PV System Sizing
 - Building America Features
 - ConSol Engineering Analysis

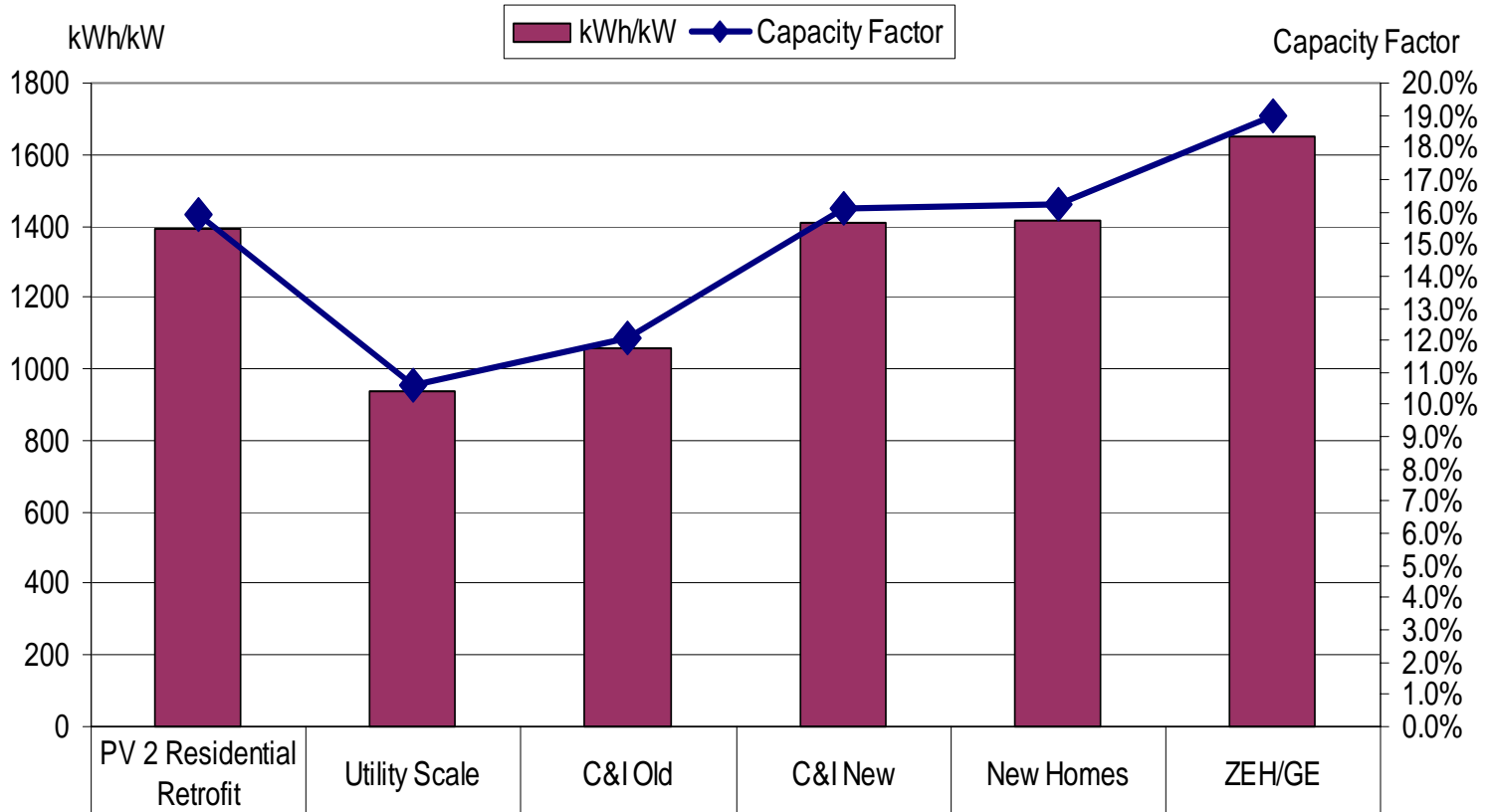


SMUD's Participation

- \$500 hook-up fee discount
- \$200 lighting and Energy Star Home (3rd party inspection) incentives
- \$20,000 marketing support
- Buydown of the PV system
 - Costs \approx \$7.76 /watt AC Installed
 - Builder pays \$4.26 (PV equipment + install)
 - SMUD pays \$3.50/watt AC Average PV Buydown



SMUD PV Fleet Performance



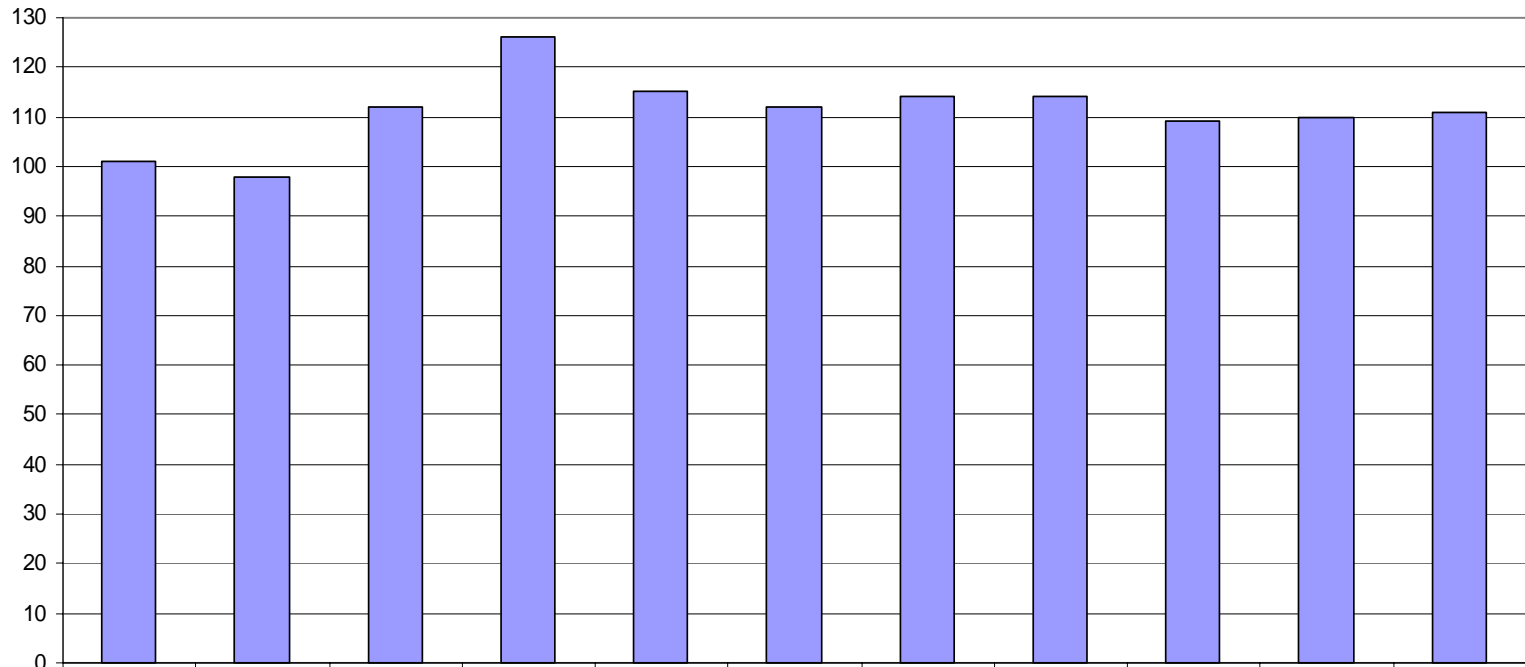
kWh/kW	1394	940	1061	1411	1413	1650
Capacity Factor	15.9%	10.6%	12.1%	16.1%	16.2%	19.0%



Performance of ZEH PV Systems

GE GT55/ SMA 2500 PV System Performance

Percentage of Expected kWh
Production



	9/15-10/15/04	10/15-11/15/04	11/15-12/15/04	12/15/04-1/15/05	1/15-2/15/05	2/15-3/15/05	3/15-4/15/05	4/15-5/15/05	5/15-6/15/05	6/15-7/15/05	Average to Date
GE GT55 SMA	101	98	112	126	115	112	114	114	109	110	111

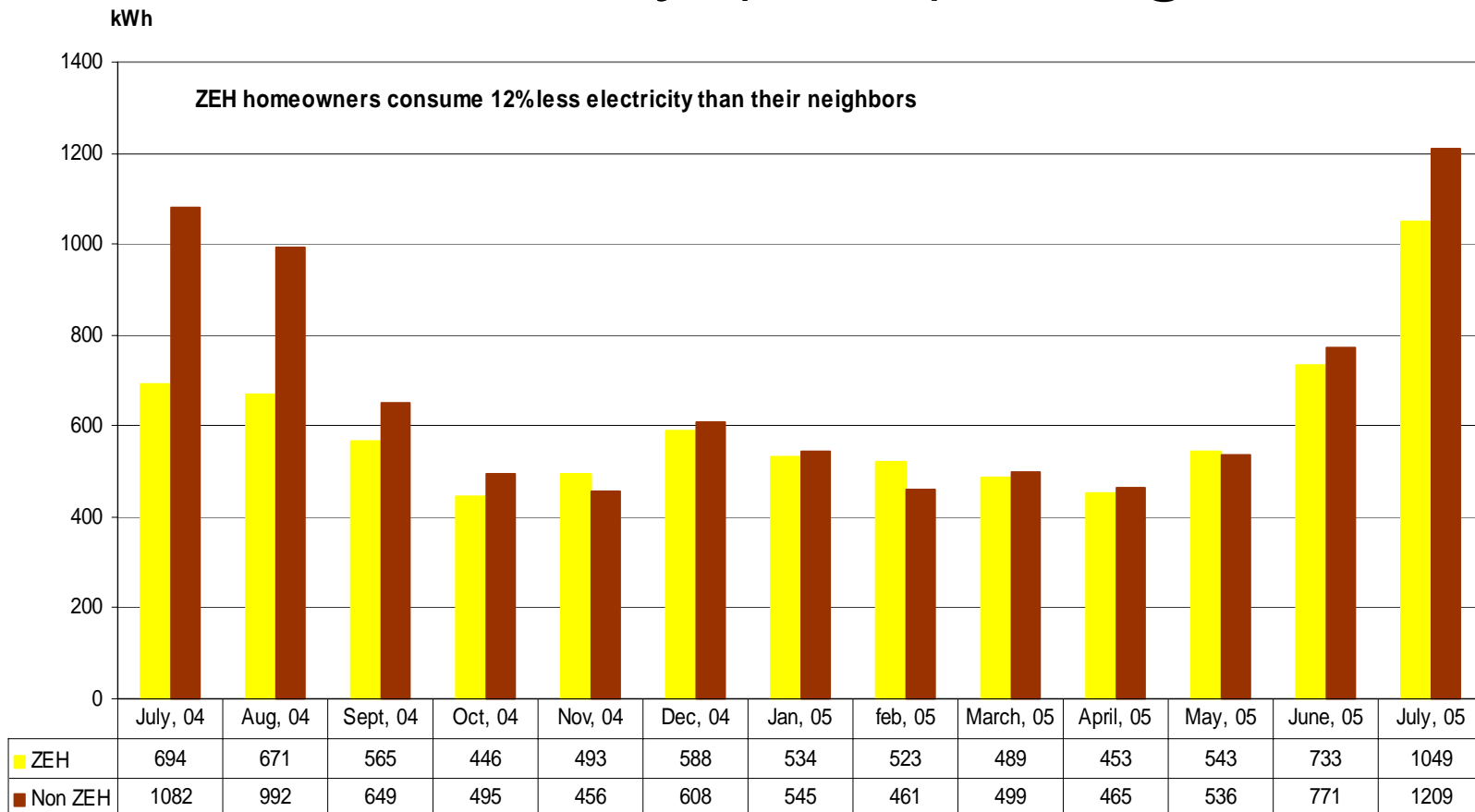


ZEH Potential Impacts

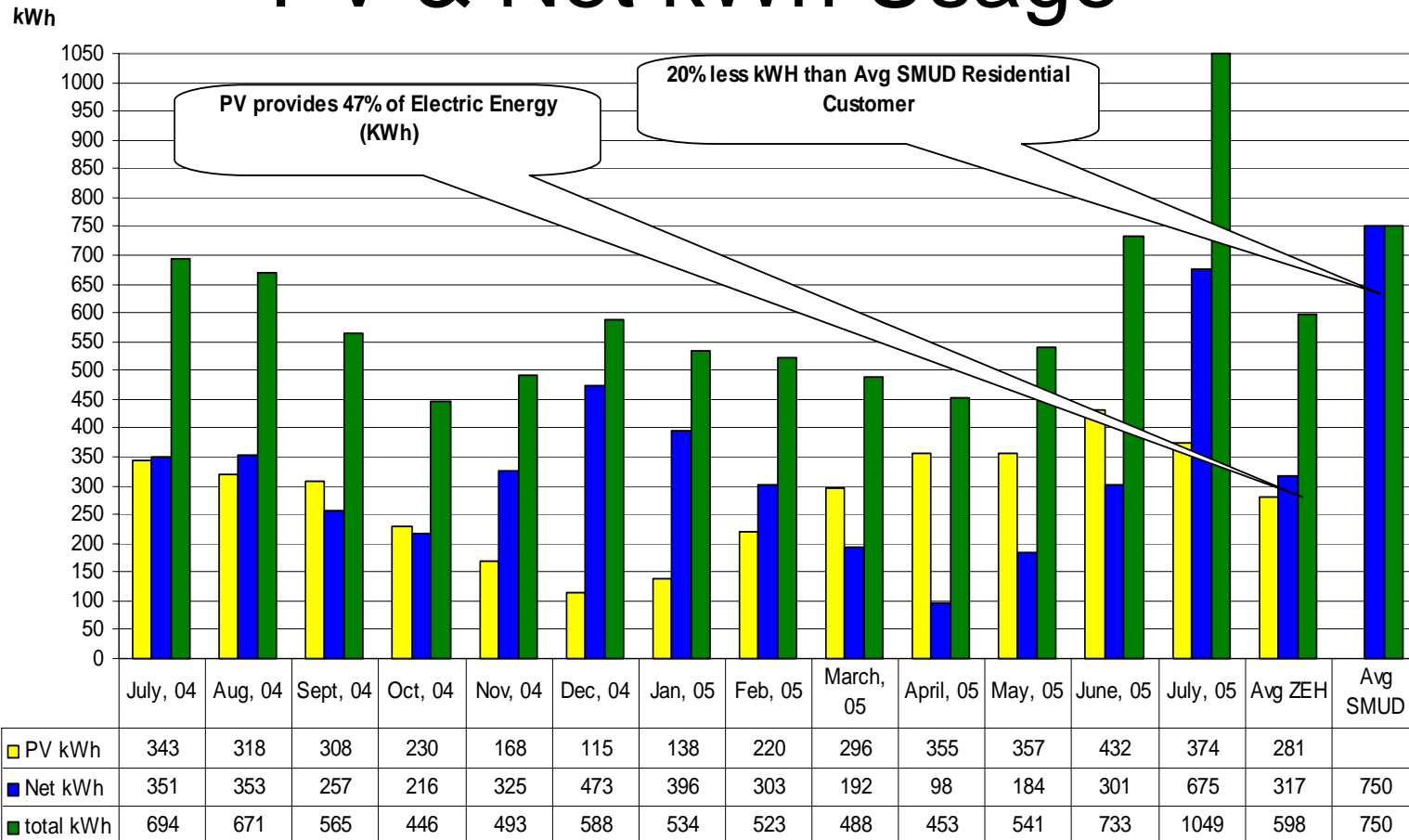
- Demonstrates total annual energy bill reduction without losing off-peak electricity sales
- Potential peak demand savings – up to 20+ MW/year



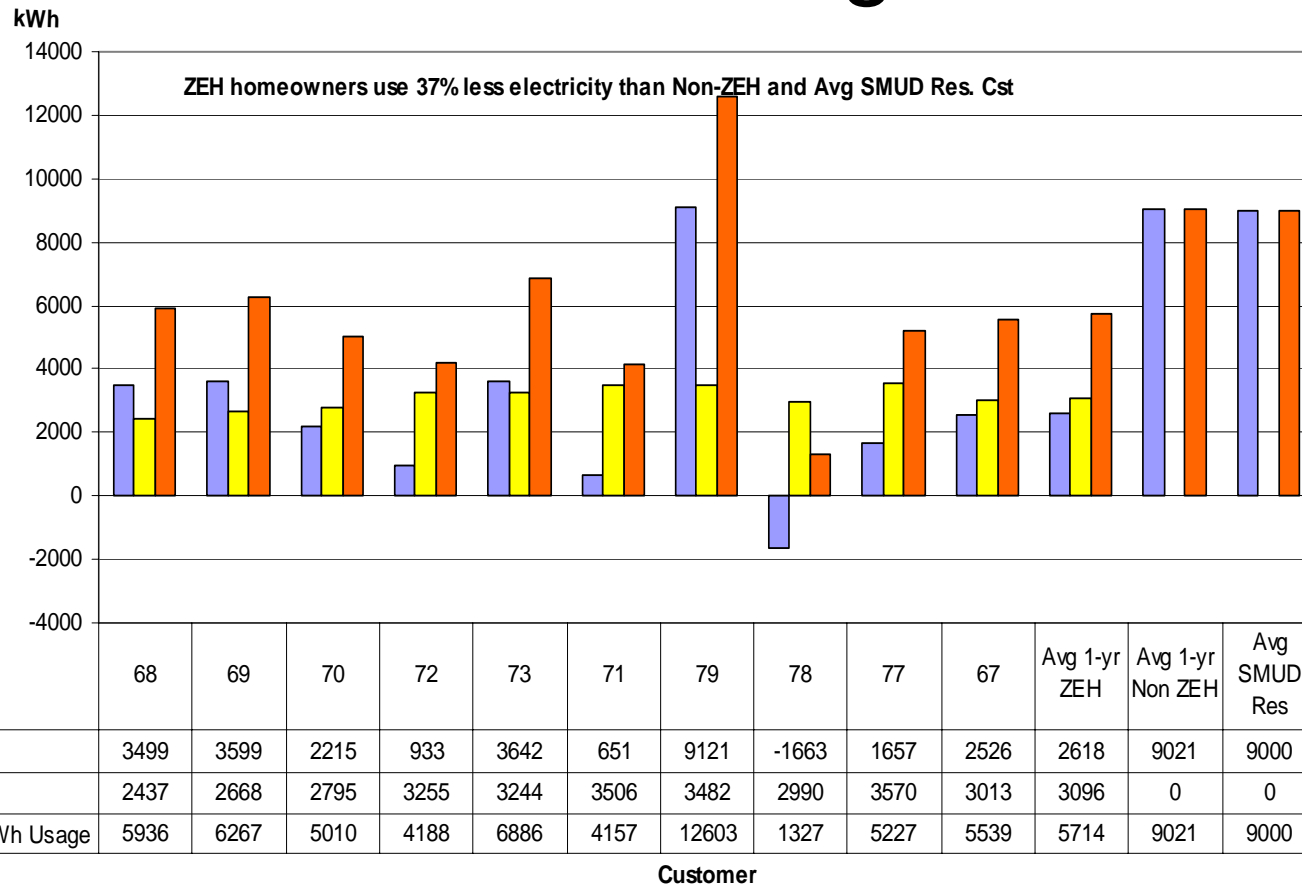
ZEH vs. Non ZEH Monthly Electricity (kWh) Usage



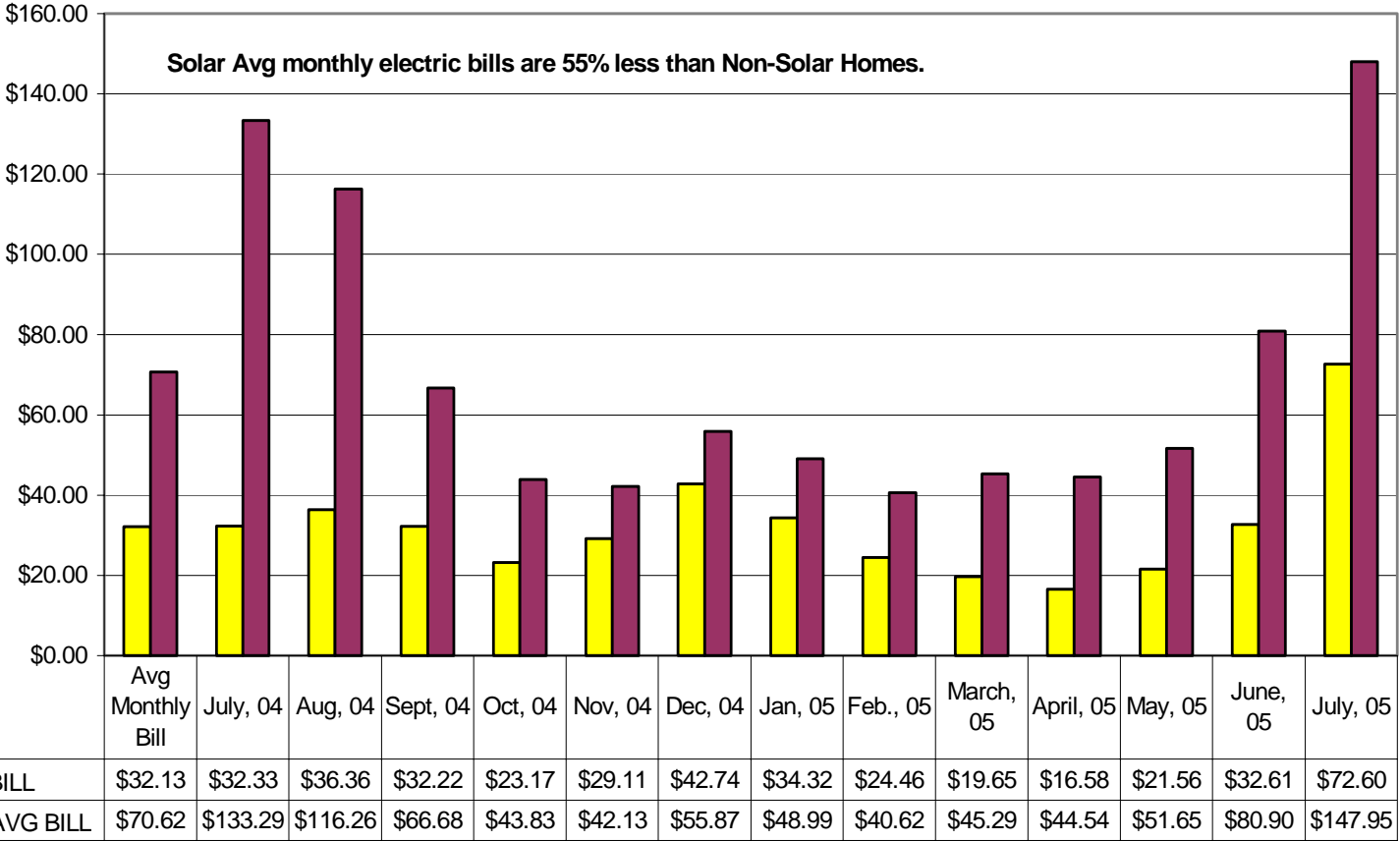
ZEH Monthly Average PV & Net kWh Usage



ZEH 2004-05 Monthly PV & Net kWh Usage



ZEH vs Non ZEH 2004-05 Monthly Electric Bills



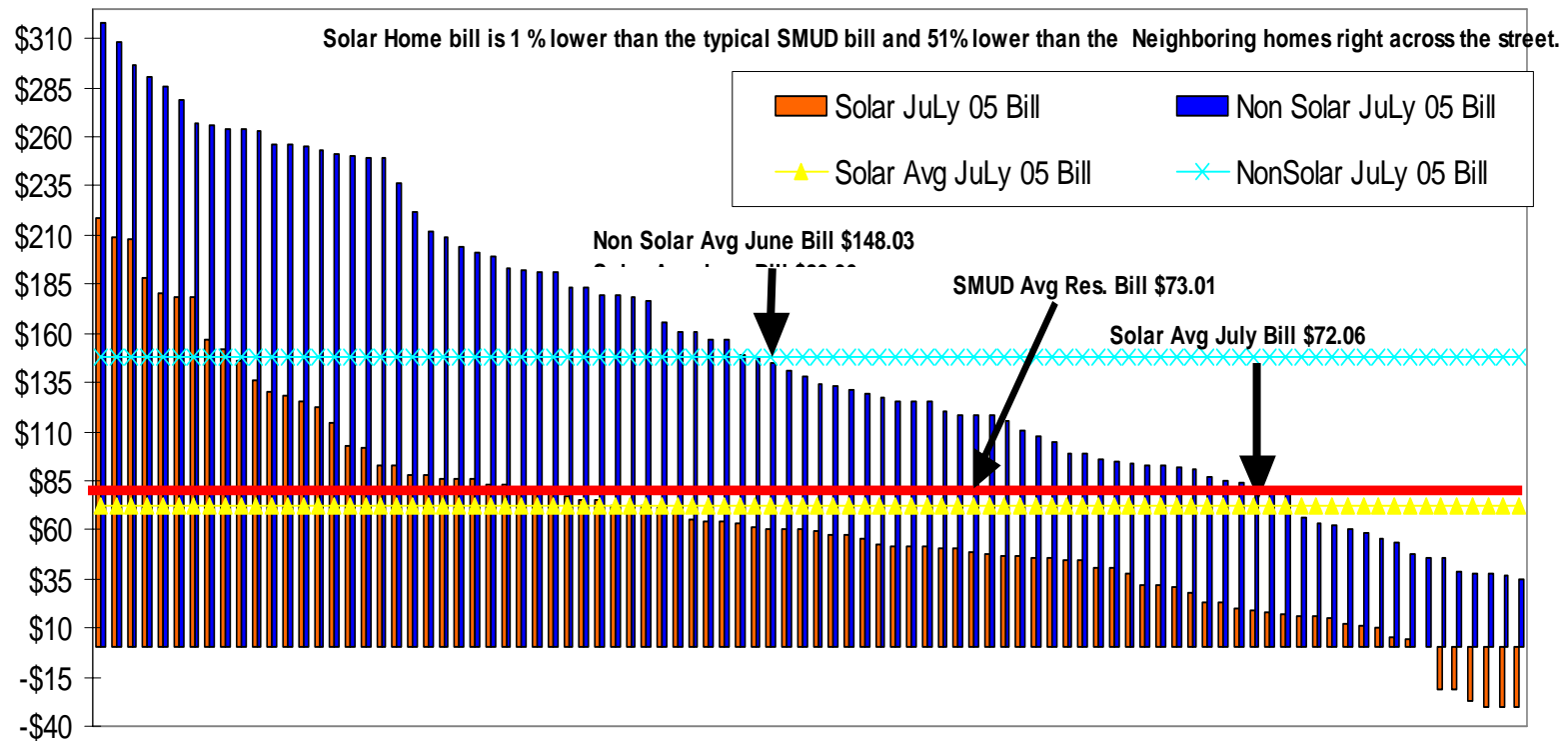
SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.™



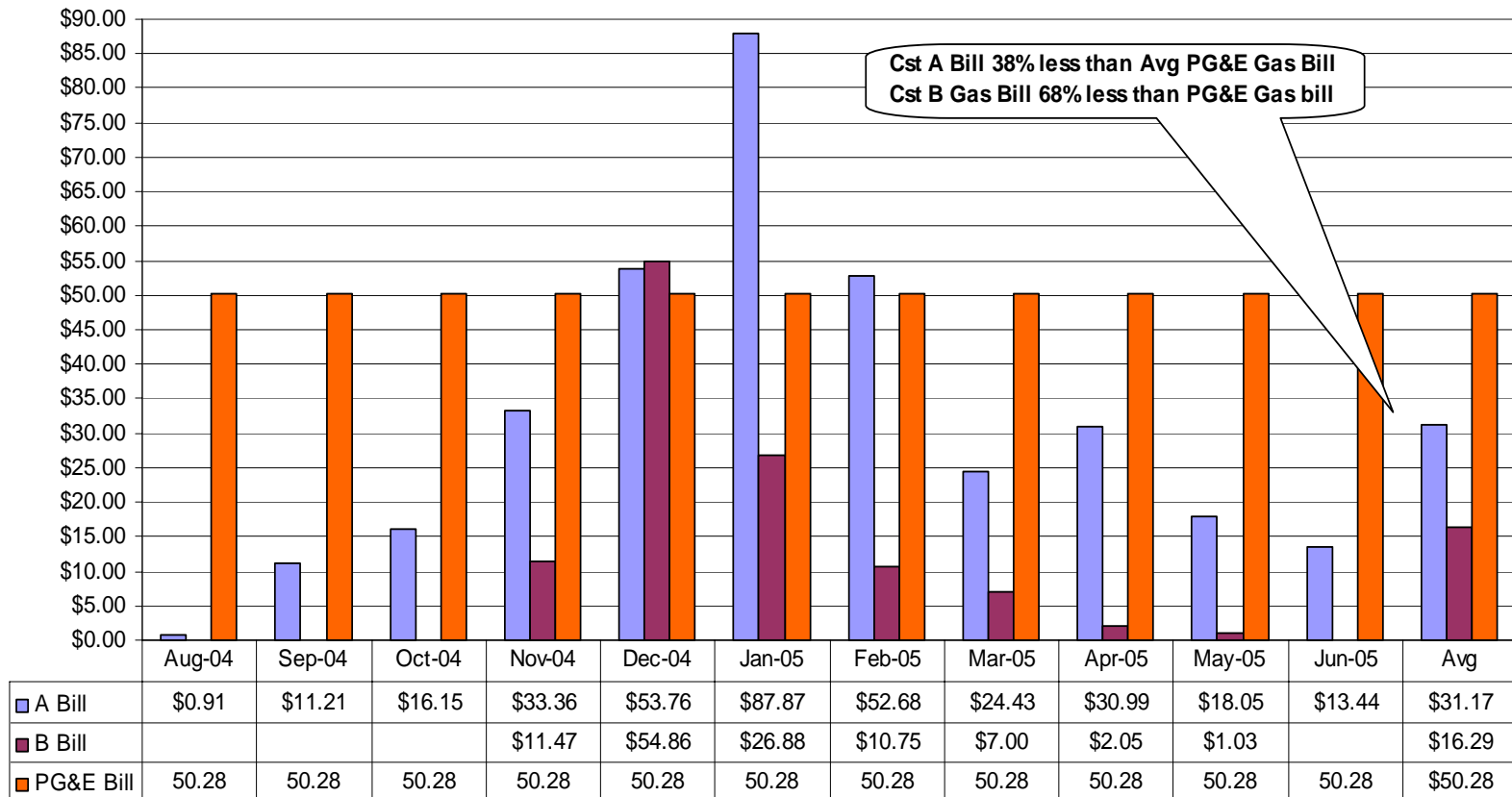
ZEH vs Non ZEH July '05 Electricity Bills



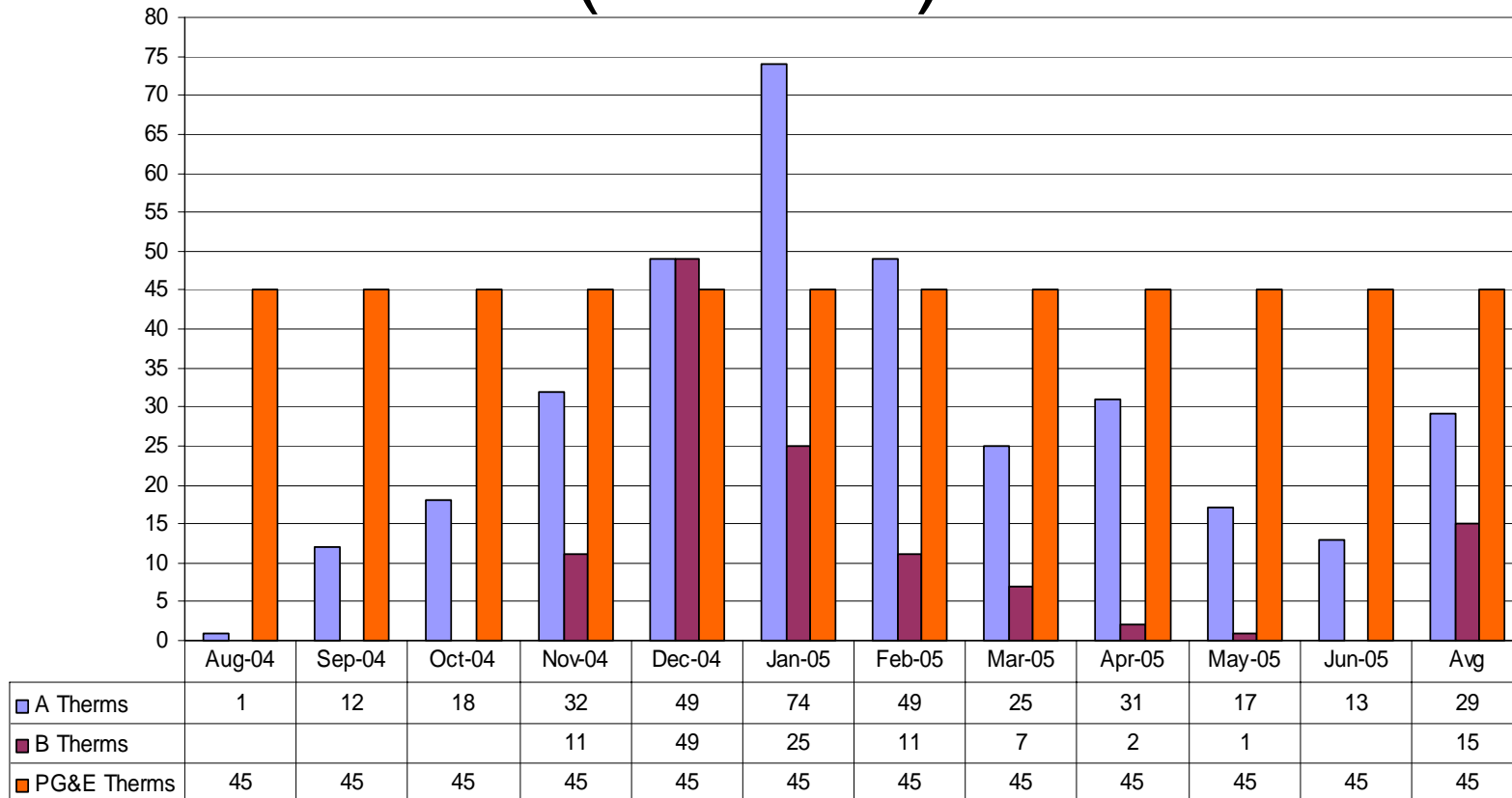
Electric Bills



ZEH vs PG&E Cust 2004-05 Avg Monthly Gas Bills

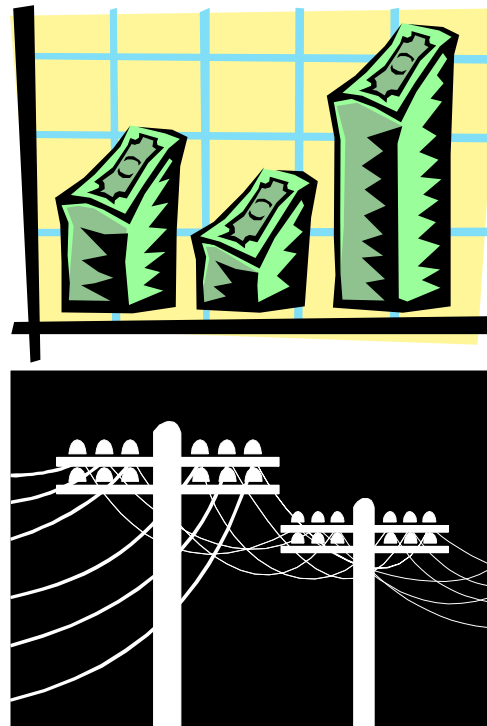


ZEH vs PG&E Cust 2004-05 Avg Monthly Gas Usage (Therms)

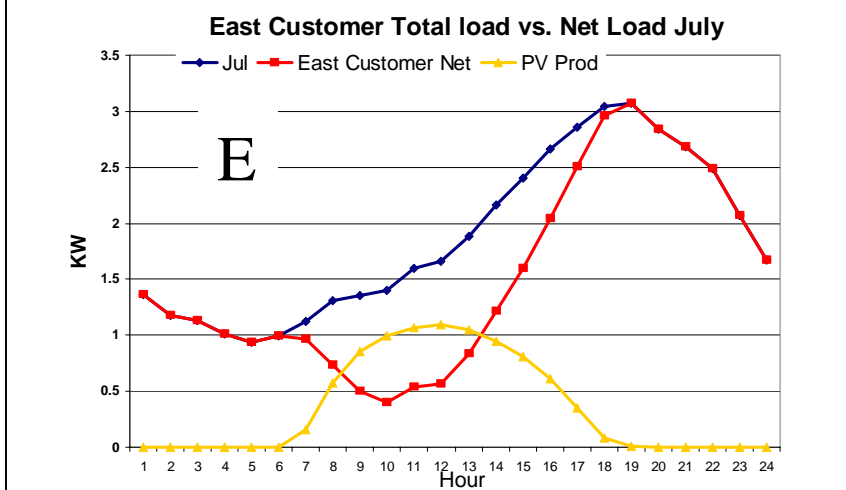
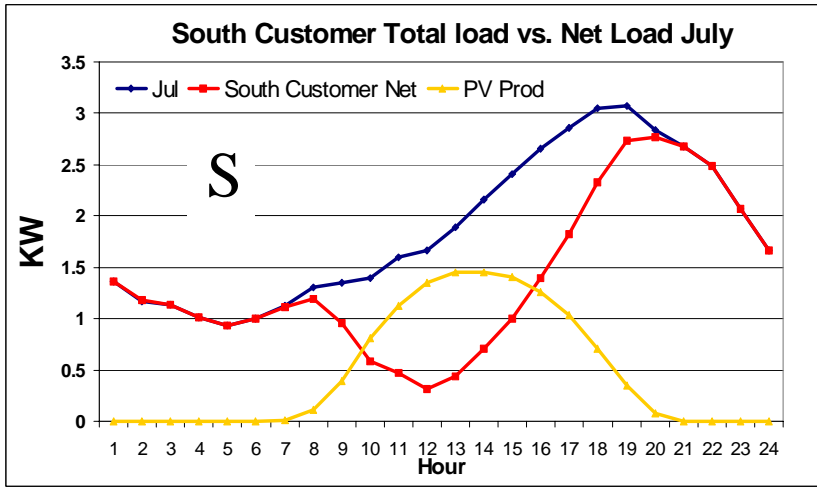
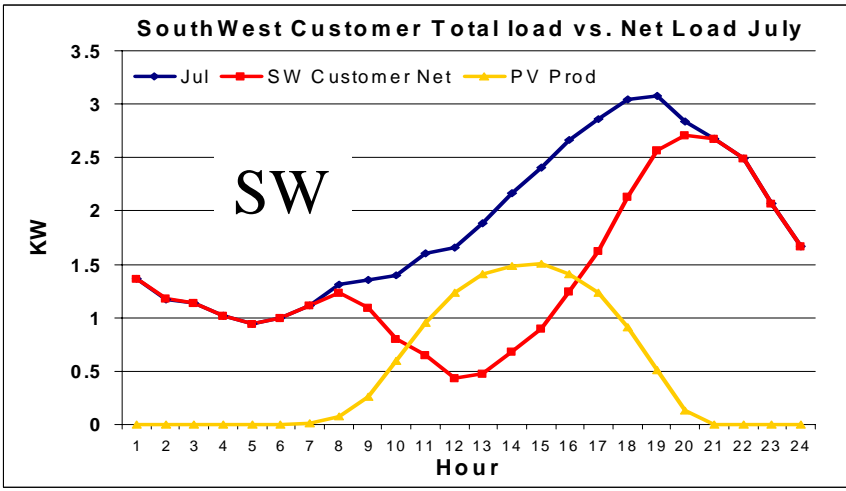
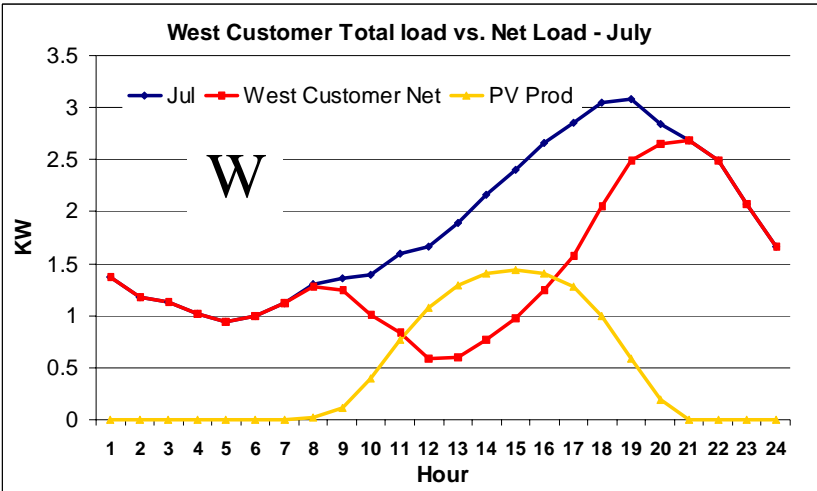


Why Peak Shaving?

- Reduce Peak Liabilities
 - Economical
 - Reliability
 - o Limit Voltage Dips
 - o Reduce Need for New Capacity



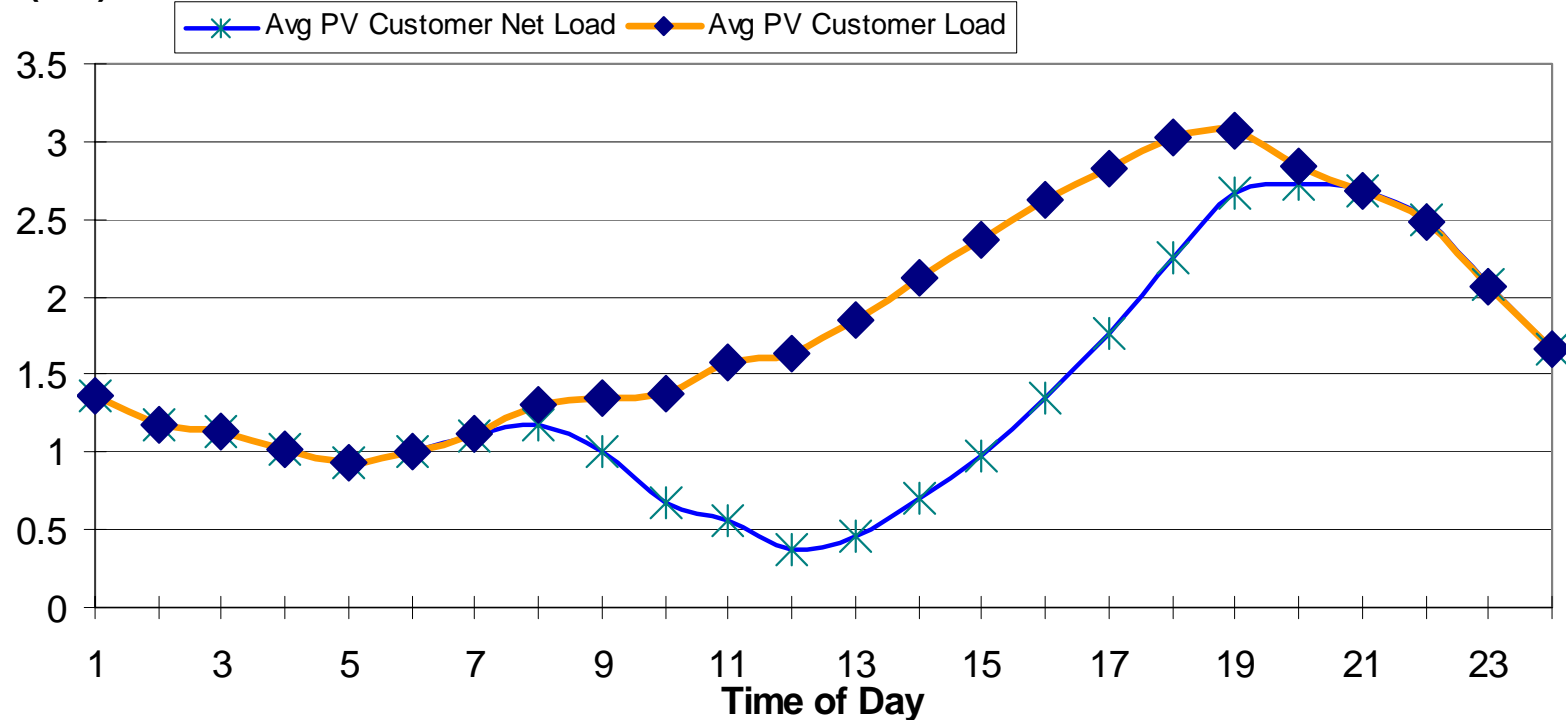
Hourly Curves - July



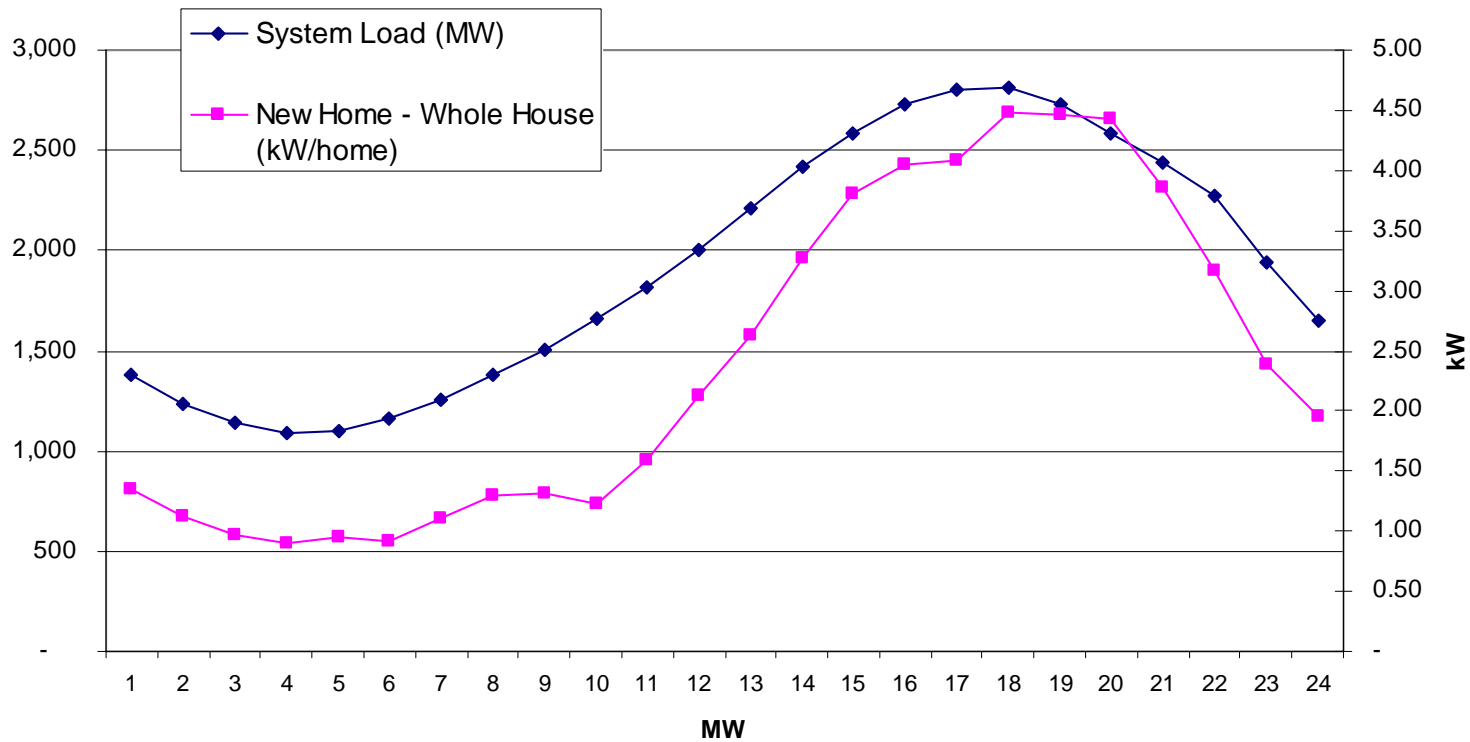
Average SMUD PV Customer Load vs. Net Load

PV systems can reduce a customer's peak demand by as much as 13 percent (0.4 kW).

Load (kW)

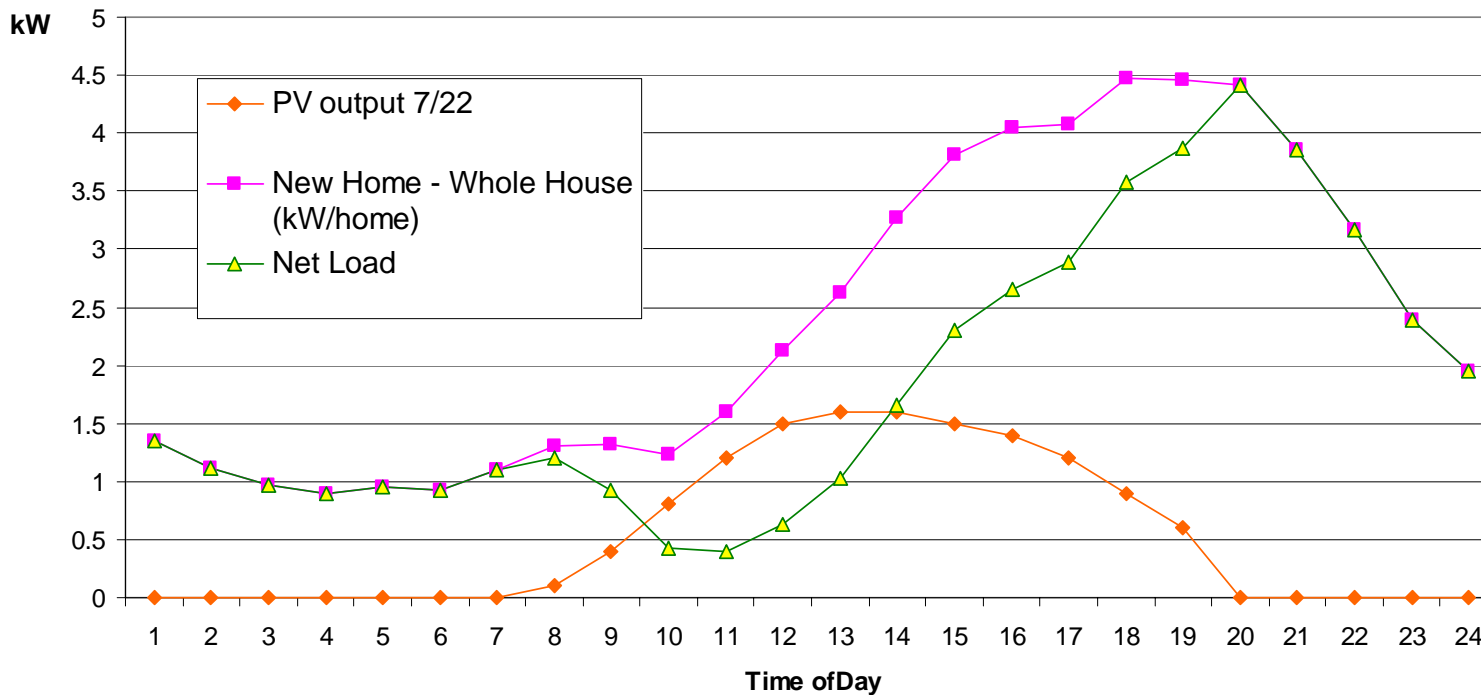


System Load July, 2003 vs. New Home Load



New Home Load with PV Production

Average New Home's peak demand measured at 6 pm is reduced 20 percent (0.9 kW)

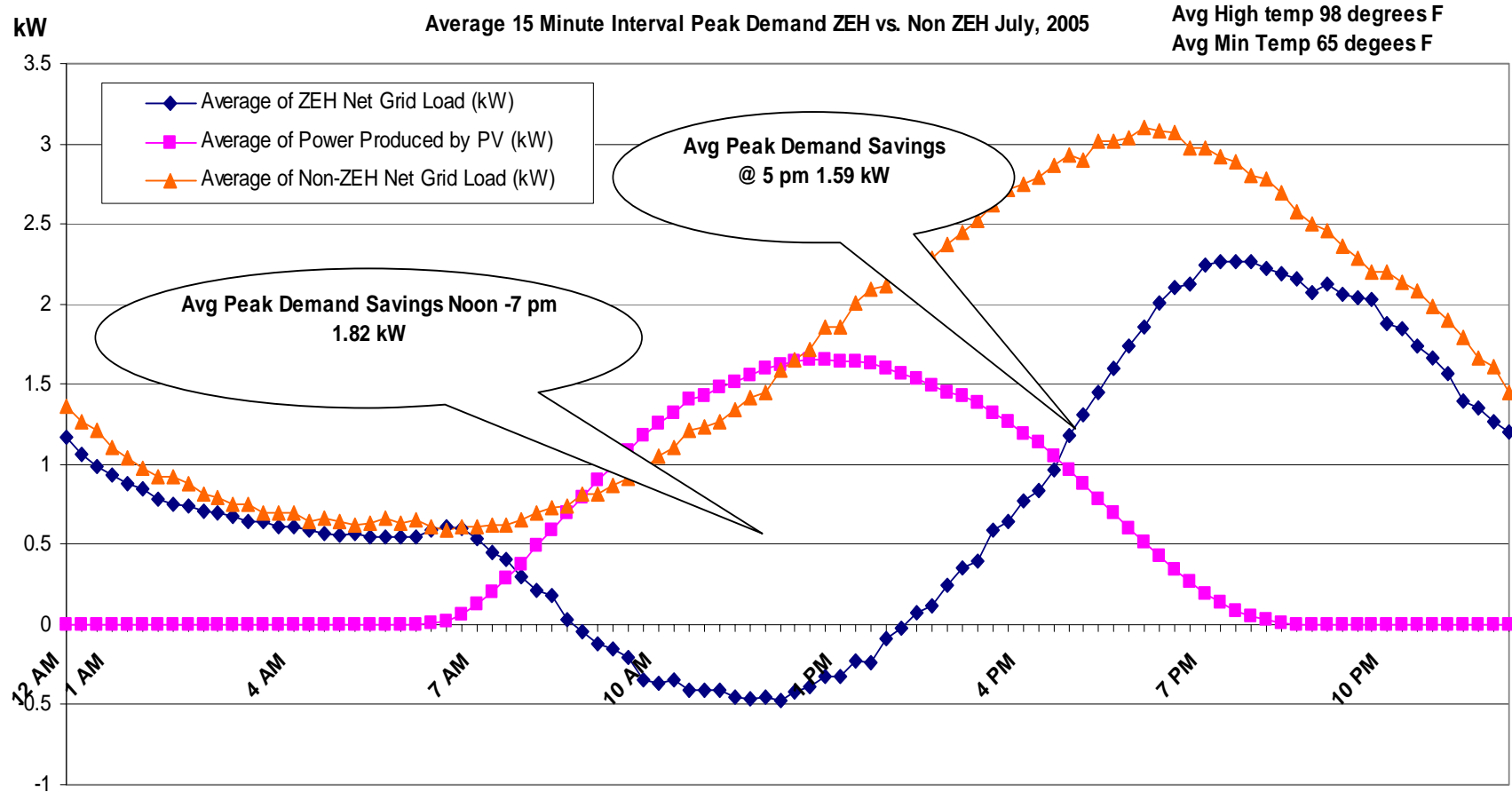


ZEH Peak Demand Potential

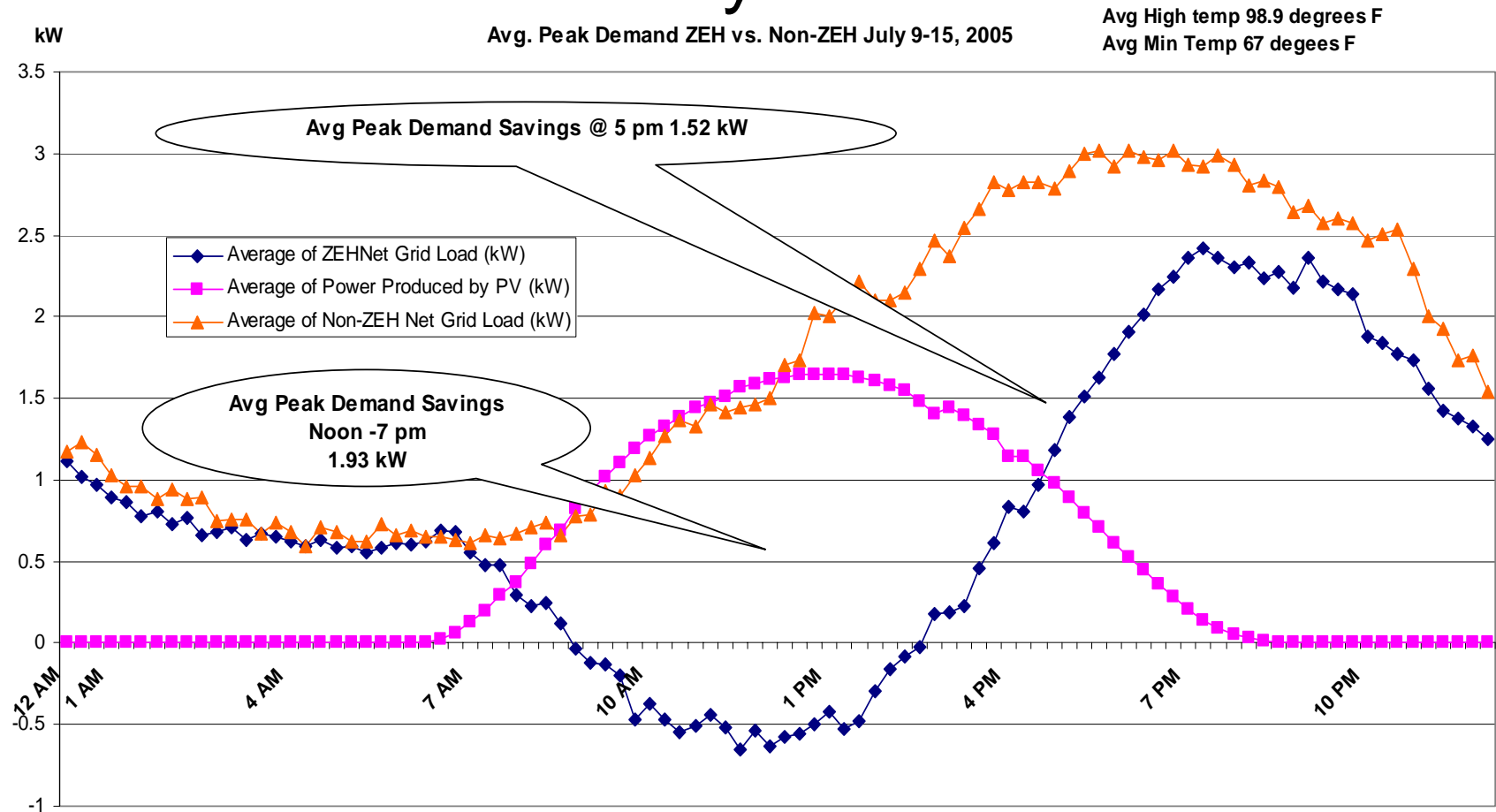
- Side-by-Side Evaluation of ZEH vs Non-ZEH Communities
 - Monitoring 18 homes in each community
 - Power production
 - Monitor energy savings/production (kWh)
 - Monitor peak demand savings (kW)
 - Monitor exports to grid
 - Distribution system impacts
 - Voltage flicker and harmonic distortion



ZEH Peak Demand Potential Preliminary Results



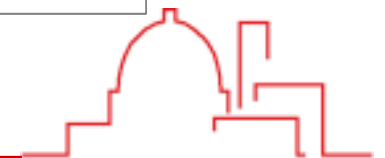
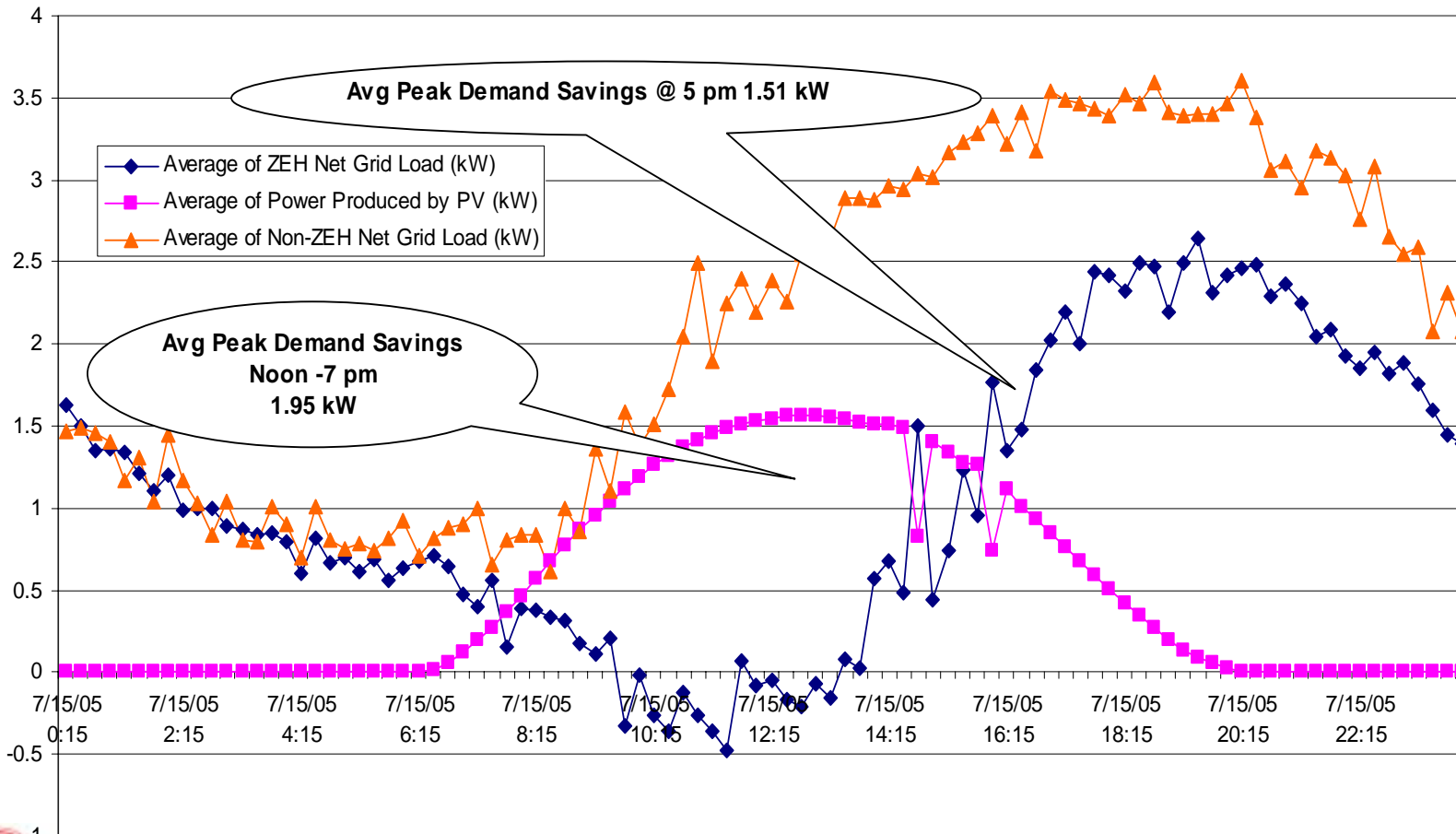
ZEH Peak Demand Potential Preliminary Results



ZEH Peak Demand Potential Preliminary Results

Avg Peak Demand ZEH vs Non-ZEH July 15, 2005

High Temp 107 degrees F
Min Temp 71 degrees F



Next Steps

- 100+ ZEHs in 2005
- Demonstrate new roof-integrated PV product
- Tailor for SMUD's residential new construction program



Treasure Homes ZEH

32 home in-fill, entry level, 1st move up community

BP Solar Integra

- 175 watt module
- 83 square feet/kw
- Low profile
- Installed over comp shingle roof
- Xantrex GT 3.0



Lessons Learned

- Production builders will build ZEHs with proper products, incentives and support
- Buyers like PV/ZEH
- PV system costs fall with volume
- ZEH production homes offer substantial electricity (and gas) bill savings
- ZEH home owners use less electricity
- ZEH production homes offer potential for significant peak load reduction and distribution system benefits



Lessons Learned

BUT

- Builders want branded, turnkey PV systems backed by long-term warranties and service.
- Need to build awareness among home buyers.
- kWh/kW, distribution system savings need to be documented.



More Information

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