



U.S. Department of Energy
**Energy Efficiency
and Renewable Energy**
Bringing you a prosperous future where energy
is clean, abundant, reliable, and affordable
Building Technologies Program



**Building
AMERICA** SM
U.S. Department of Energy
Research Leading to Zero Energy Homes

Solar and Efficiency Powers Homes



Steve Vang
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Building AMERICA
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Premier Gardens



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

The Power To Do More.®

BIRA
 Building Industry Research Alliance



Side-By-Side Developments near-ZEH Control

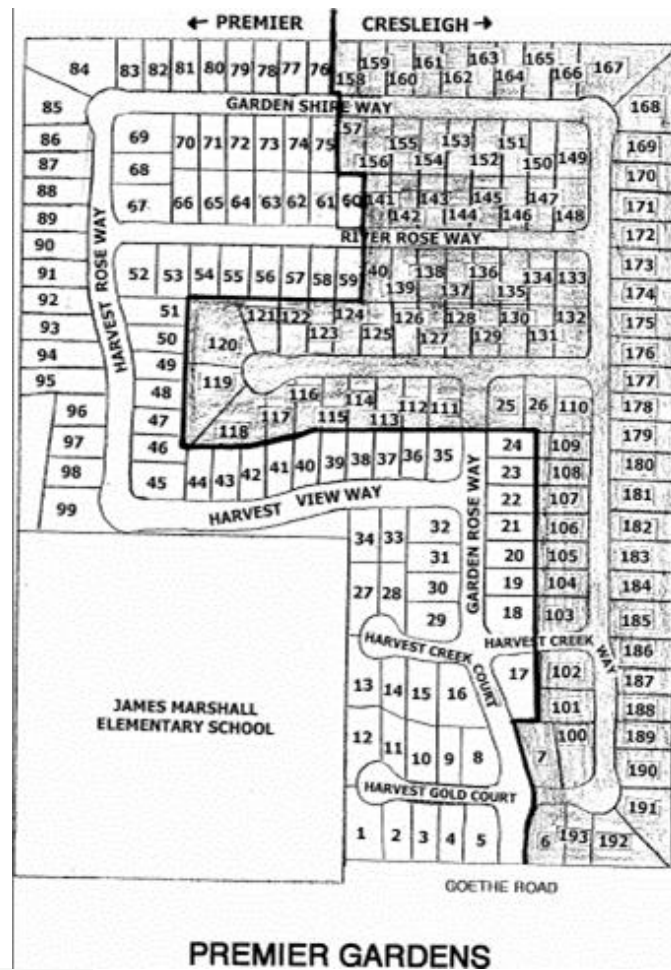




**Near-ZEH
 (60% Whole-House
 Energy
 Savings)**

vs.

**SMUD Advantage
 (30% Cooling
 reduction)**





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Energy Efficiency Features

	<u>Non-ZEH</u>	<u>Premier</u>
Walls	<i>R-13 + 1" Foam with Stucco</i>	
Ceiling Ins.	R-30	R-38
Windows	<i>Vinyl-Framed Low-E2</i>	
AFUE	80	92
SEER	10	14 w/TXV
Air Flows	Normal	ACCA - Tested
Ducts (attic)	R-4.2	Buried in ceiling Ins
Duct Sealing	Normal	Sealed
Air Infiltration	Normal	<3 SLA, tested
Water Heater	40gal 0.60EF	Tankless 0.82EF
Lights	Incandescent	Fluorescent
Solar	None	2.4kW BIPV



Demographics

- Similar price and size
- Contemporaneous sales
- Near-ZEH
 - More-experience buyers
 - More educated
 - Did more research prior to buying
- Control
 - Larger families (larger bedrooms)
 - More wage-earners (2-3/household), more income



SMUD

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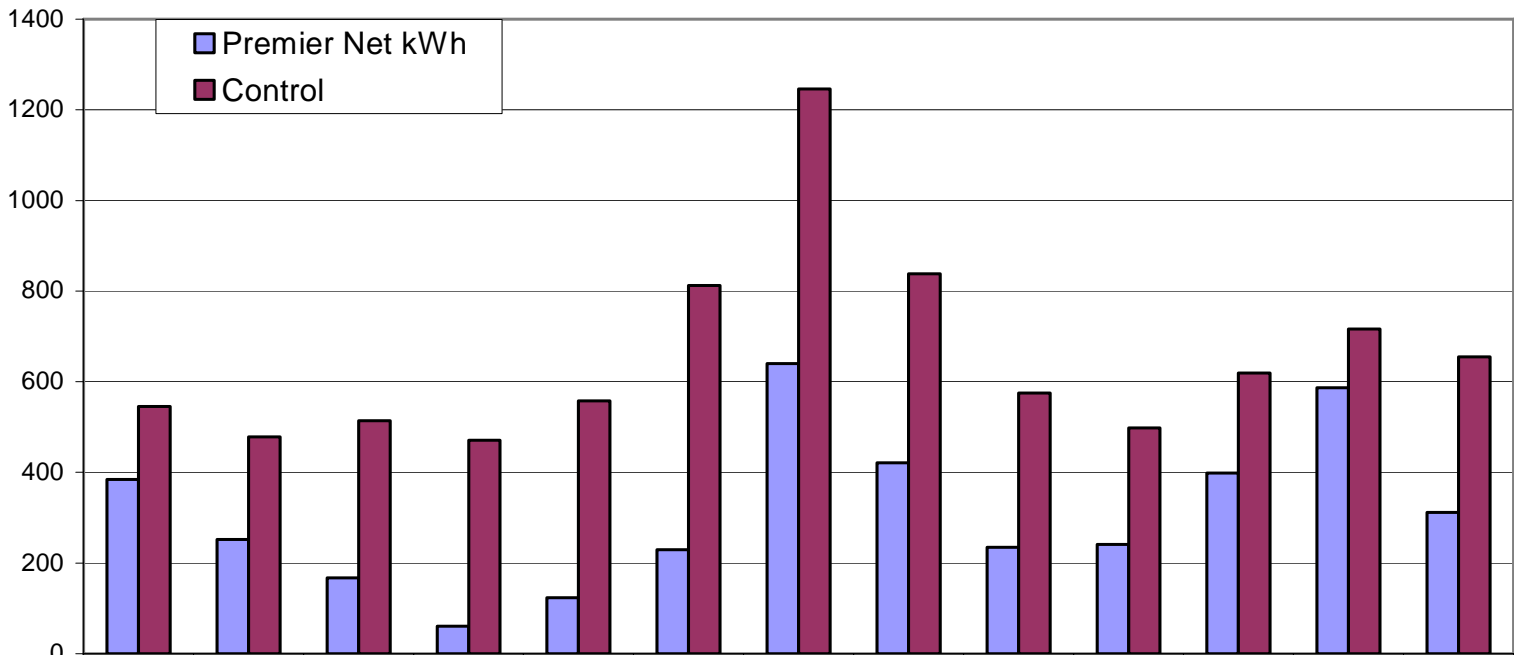
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Impact of ZEH on Mo. kWh

Average Monthly Net kWh Use

kWh

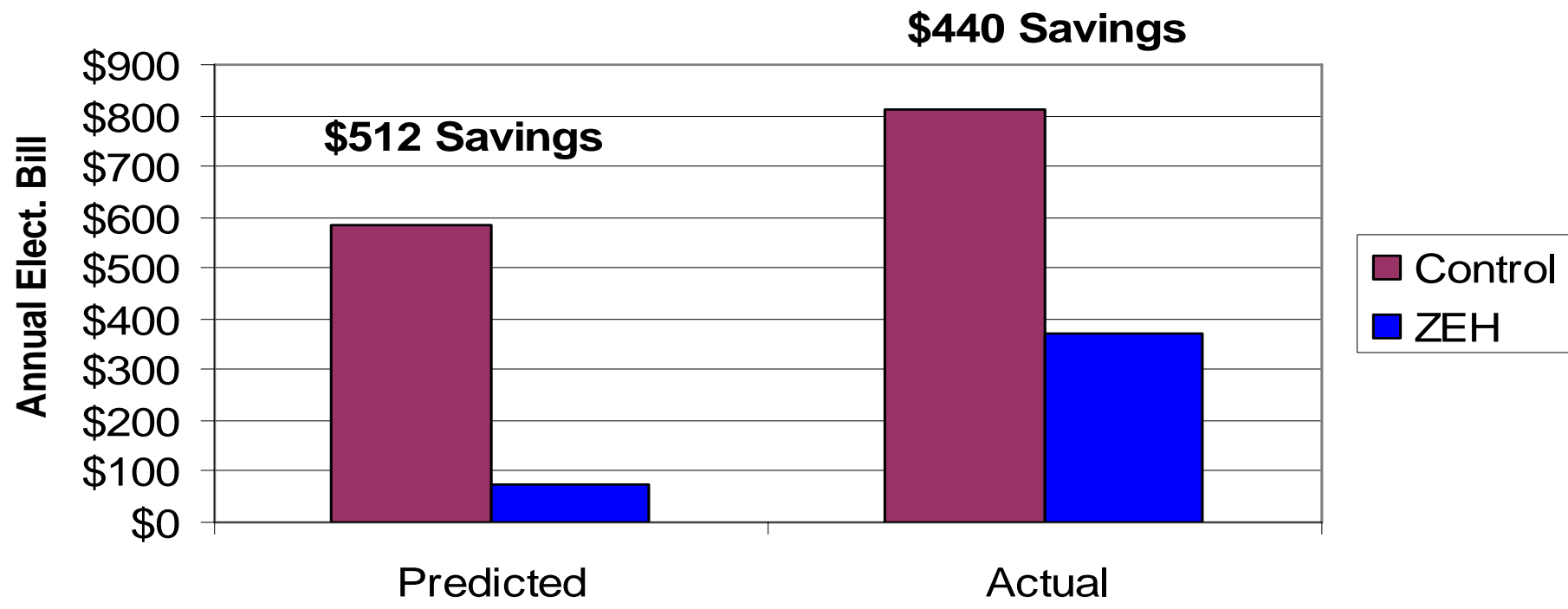


	Jan, 05	Feb, 05	March, 05	April, 05	May, 05	June, 05	July, 05	Aug, 05	Sept, 05	Oct, 05	Nov, 05	Dec, 05	Monthly Avg
■ Premier Net kWh	385	252	168	61	123	229	640	421	234	241	399	587	312
■ Control	545	478	514	471	558	812	1246	838	575	498	619	716	655



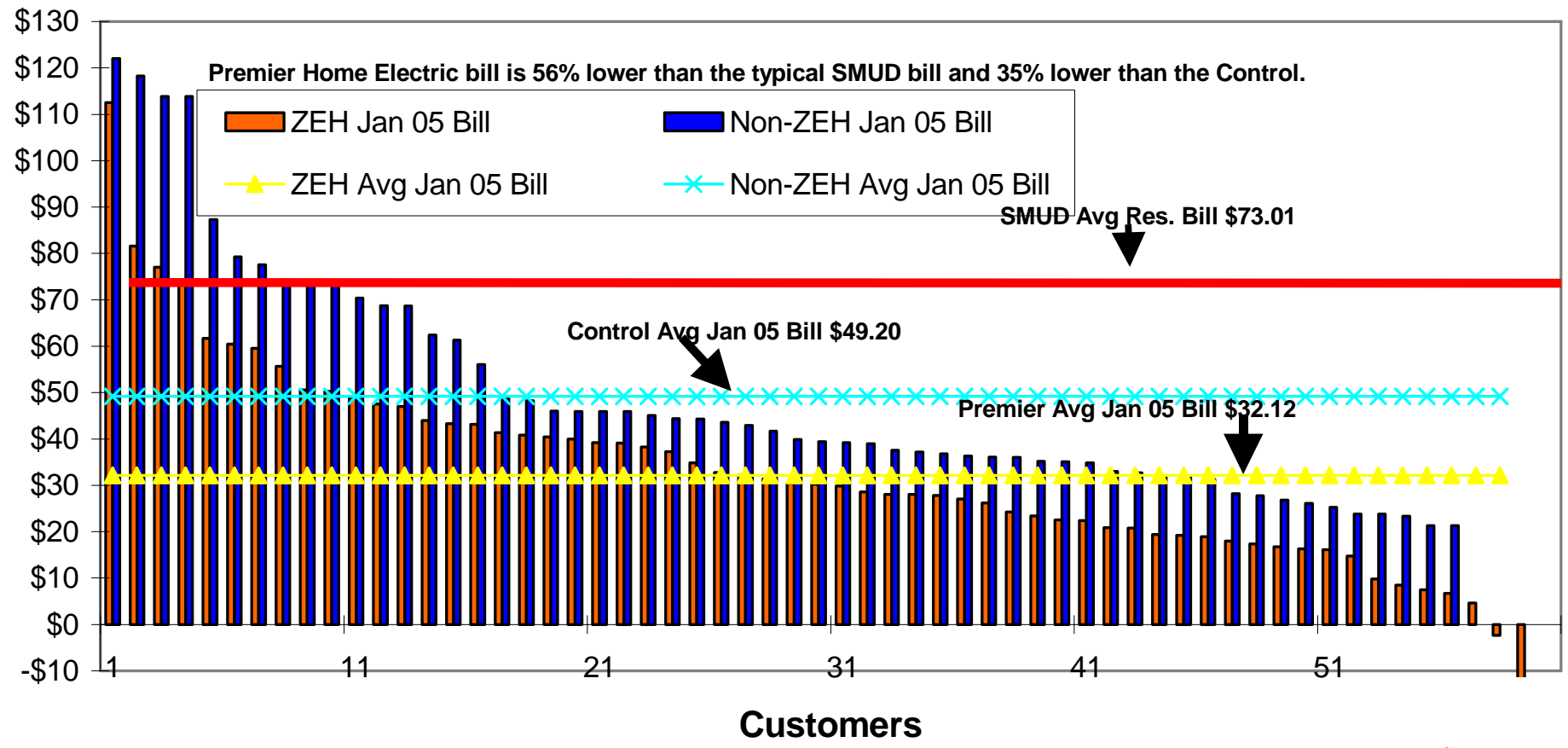
ZEH vs “Control” SMUD Advantage Home -- Predicted vs Actual

Average Annual Electricity Bill Savings



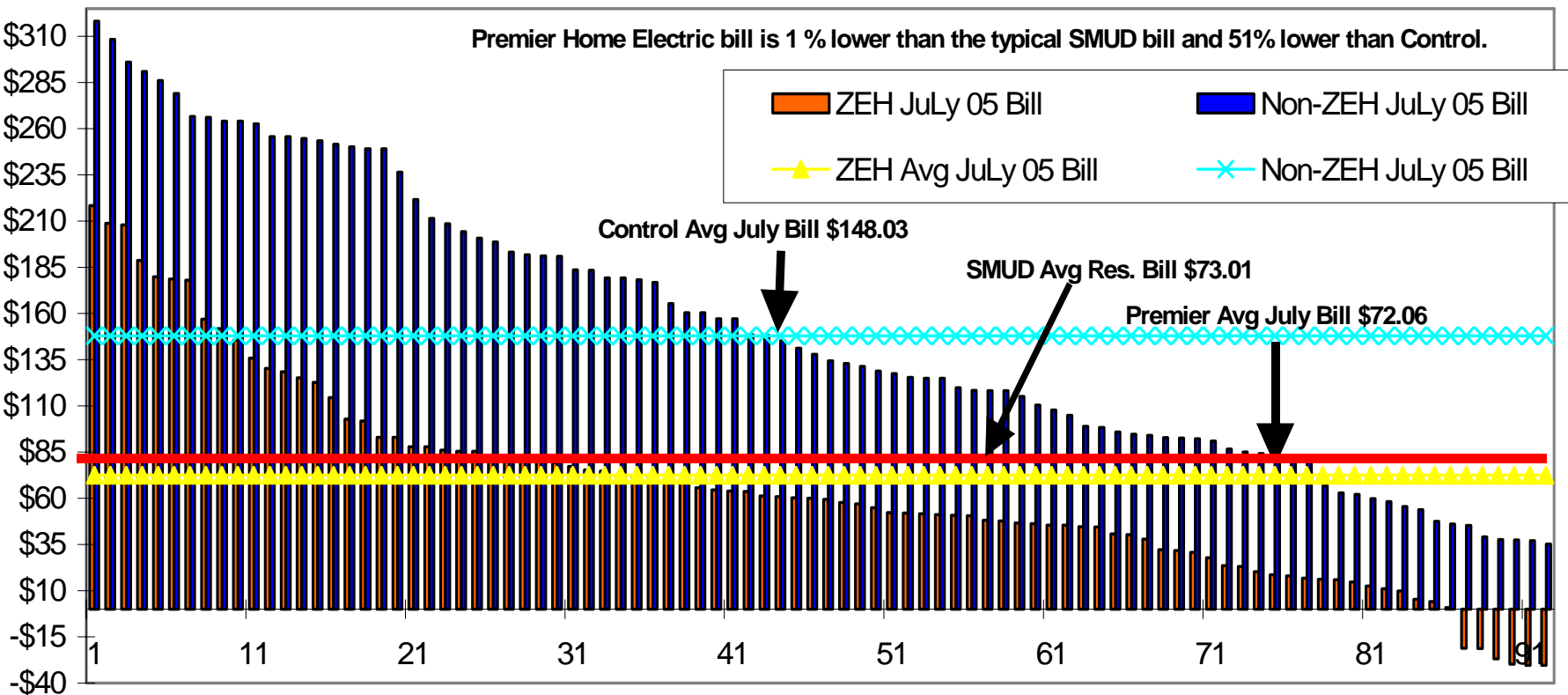


ZEH vs Control January Bills





ZEH vs Control July Bills



Electric Bills





Near 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



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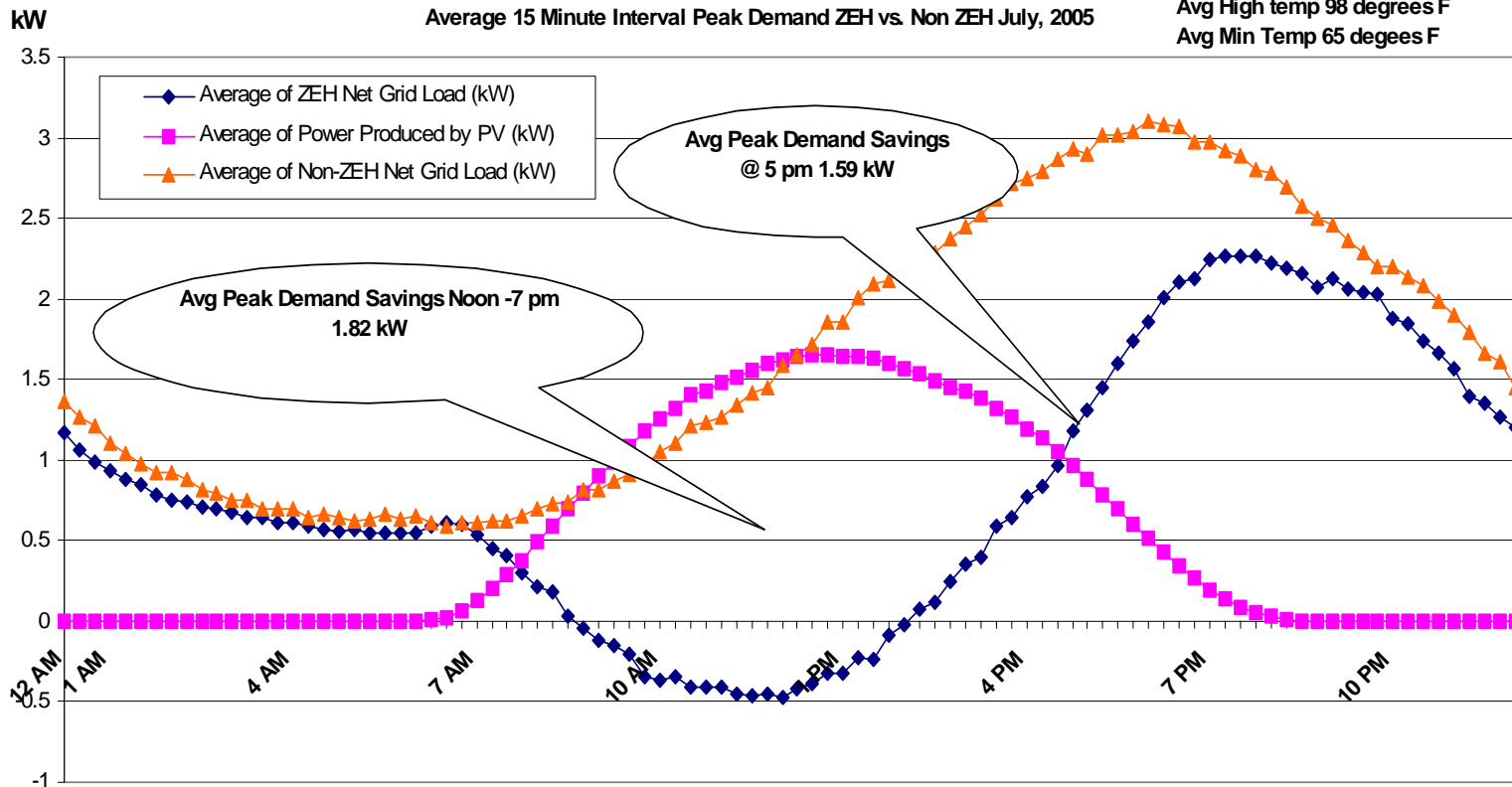


Over 1/4 ZEH Not Contributing to Peak Reduction

Orientation of PV Systems at Premier Gardens				
	Actual of all 95		SMUD's Sample of 18	
	#	%	#	%
SW	1	1%		
S	54	57%	11	61%
E	23	24%	5	28%
W	17	18%	2	11%
Total	95		18	

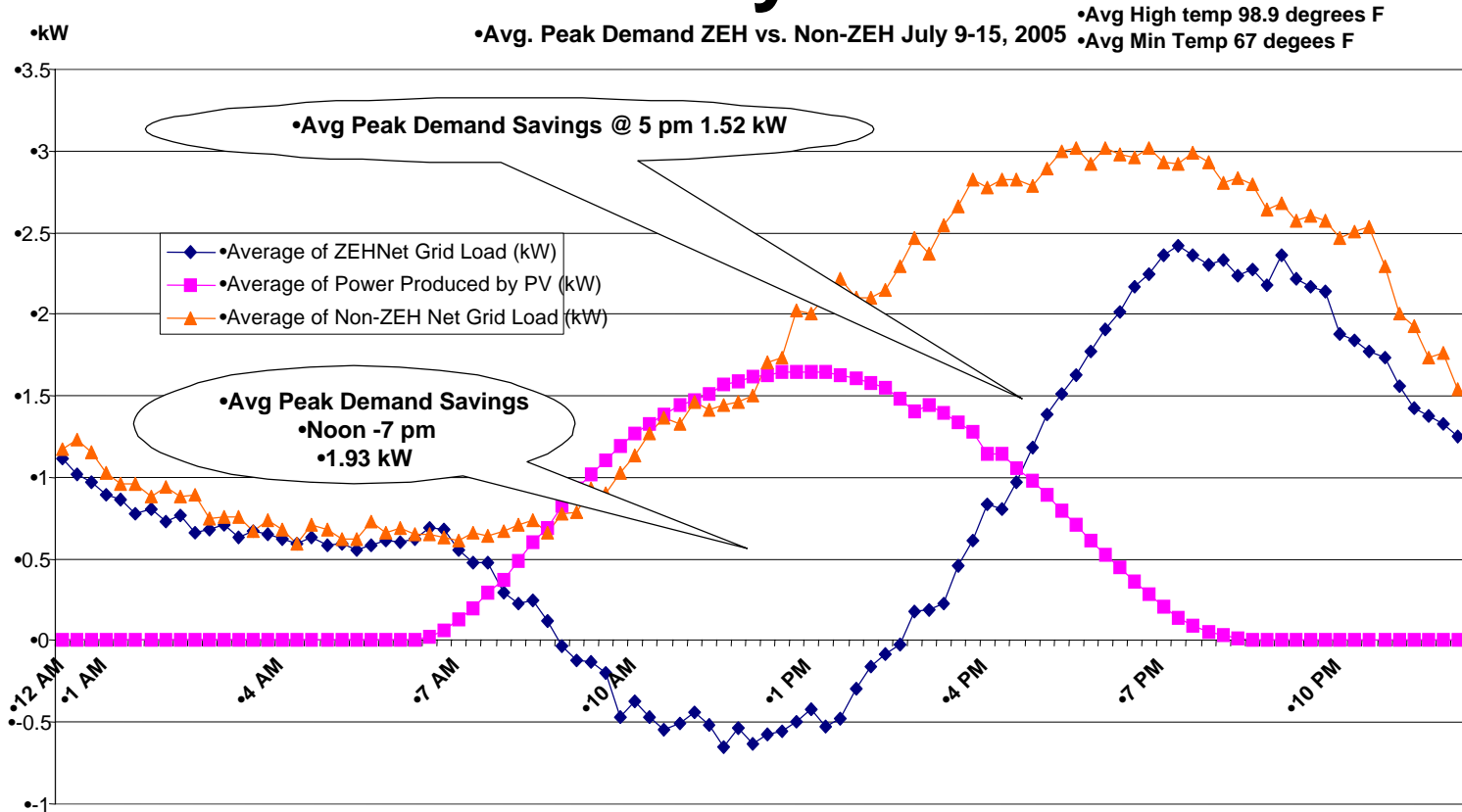


Near ZEH Peak Demand Potential Preliminary Results





Near ZEH Peak Demand Potential Preliminary Results

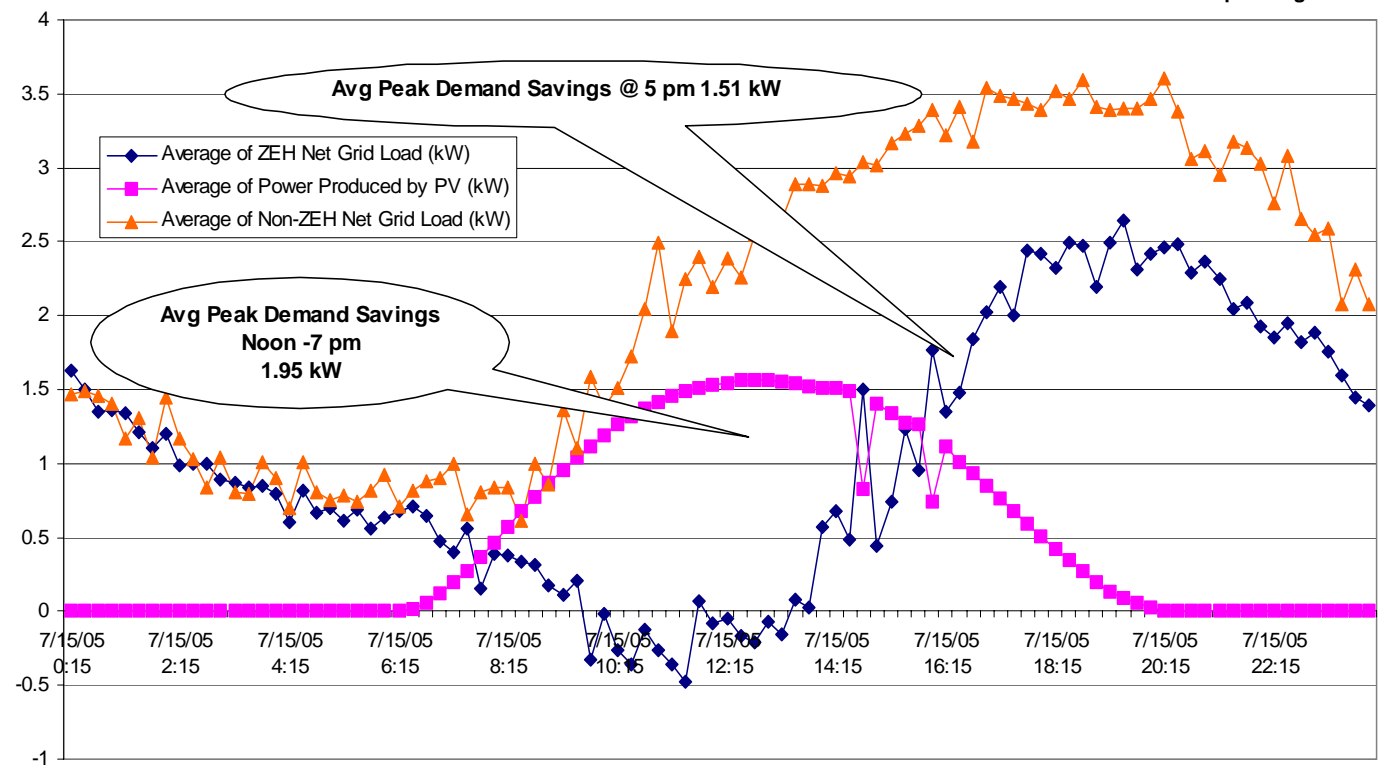




Near ZEH Peak Demand Potential Preliminary Results

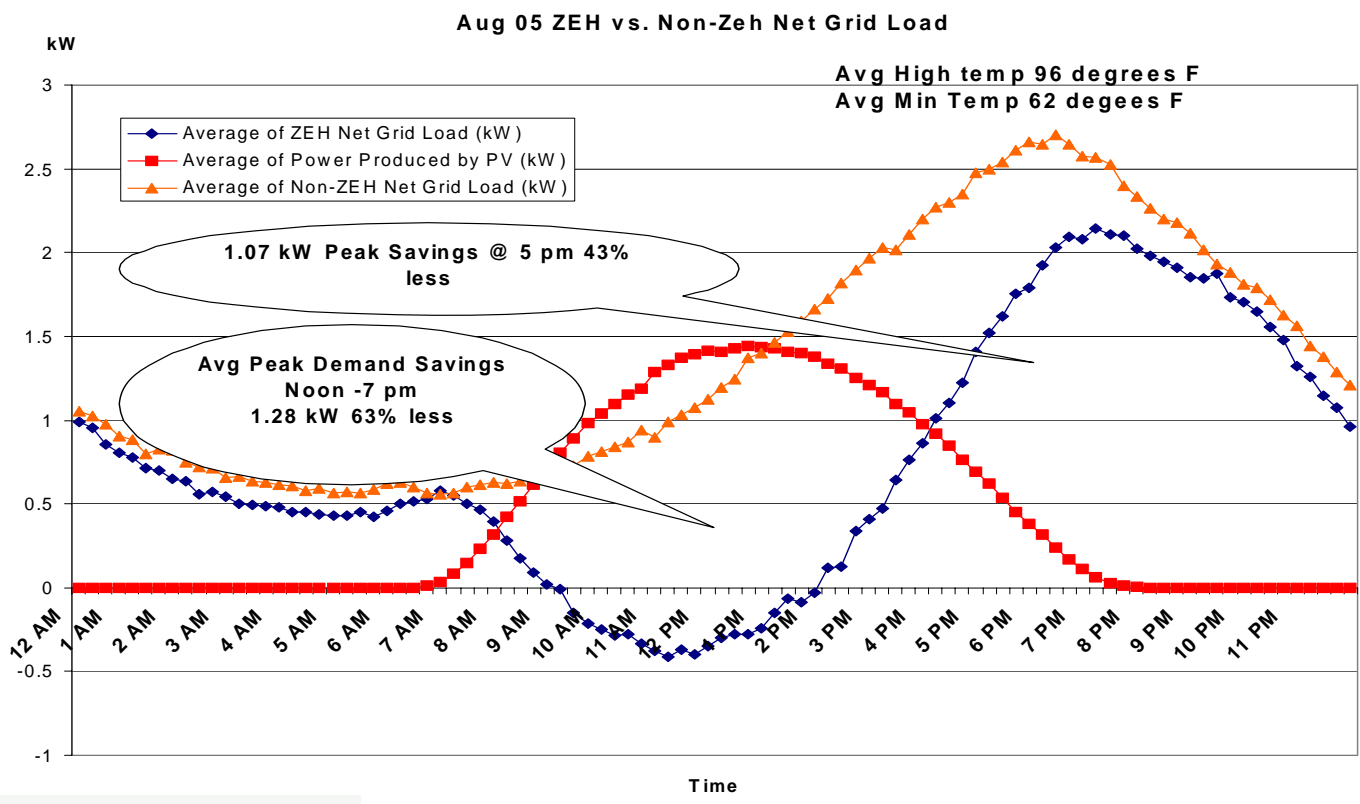
Avg Peak Demand ZEH vs Non-ZEH July 15, 2005

High Temp 107 degrees F
 Min Temp 71 degees F



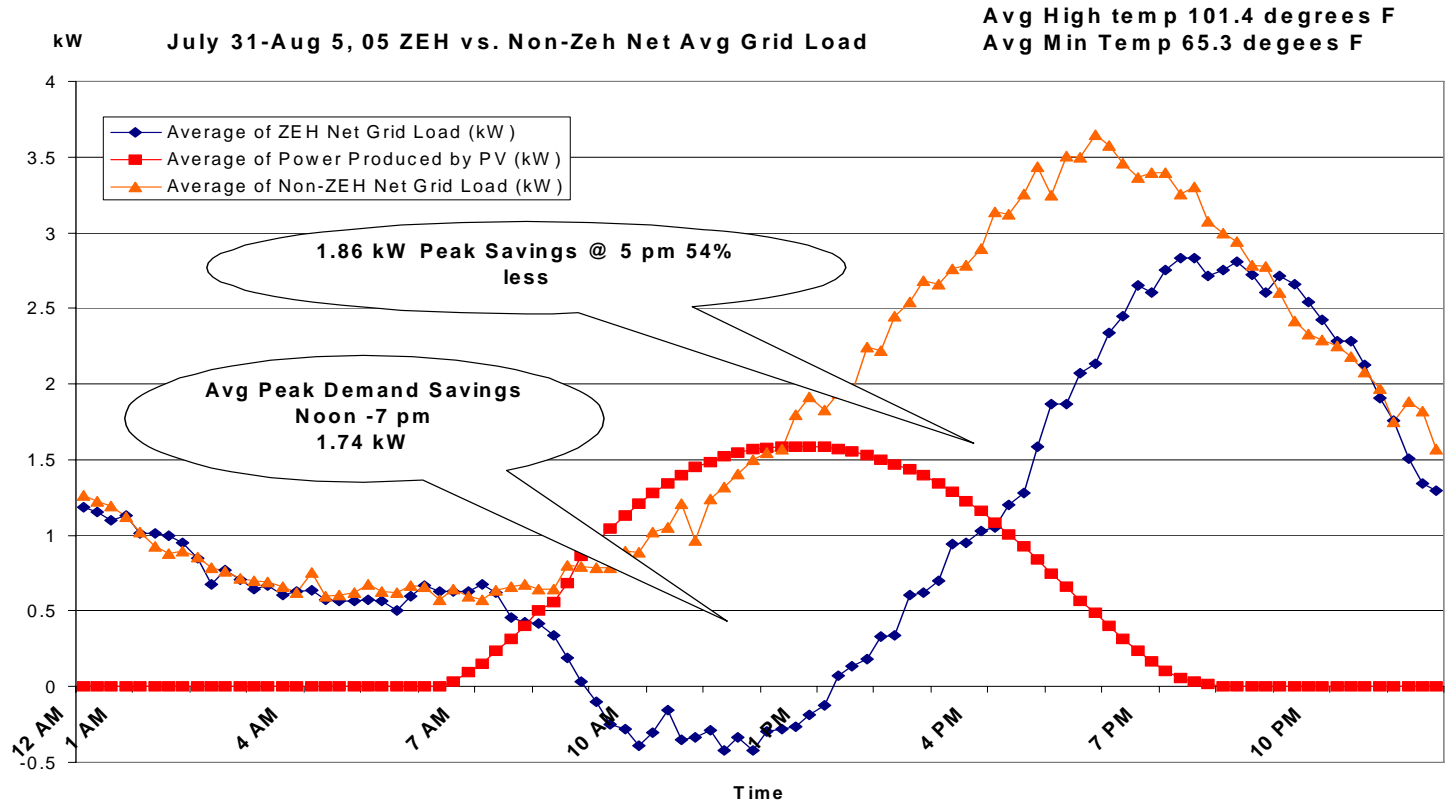


Near ZEH Peak Demand Potential Preliminary Results





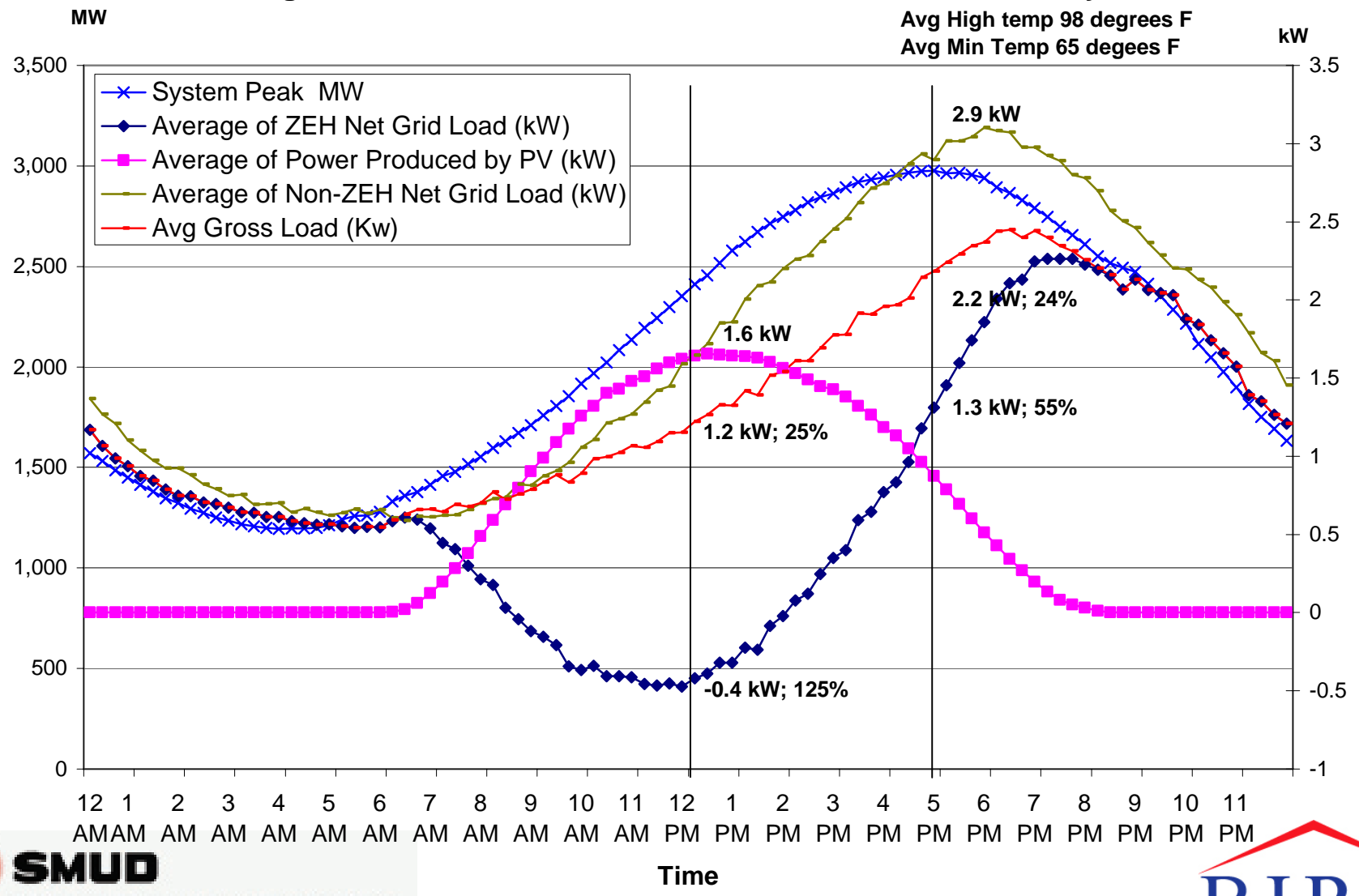
Near ZEH Peak Demand Potential Preliminary Results





Average 15 Minute Interval Peak Demand ZEH vs. Non ZEH July, 2005

Avg High temp 98 degrees F
 Avg Min Temp 65 degees F



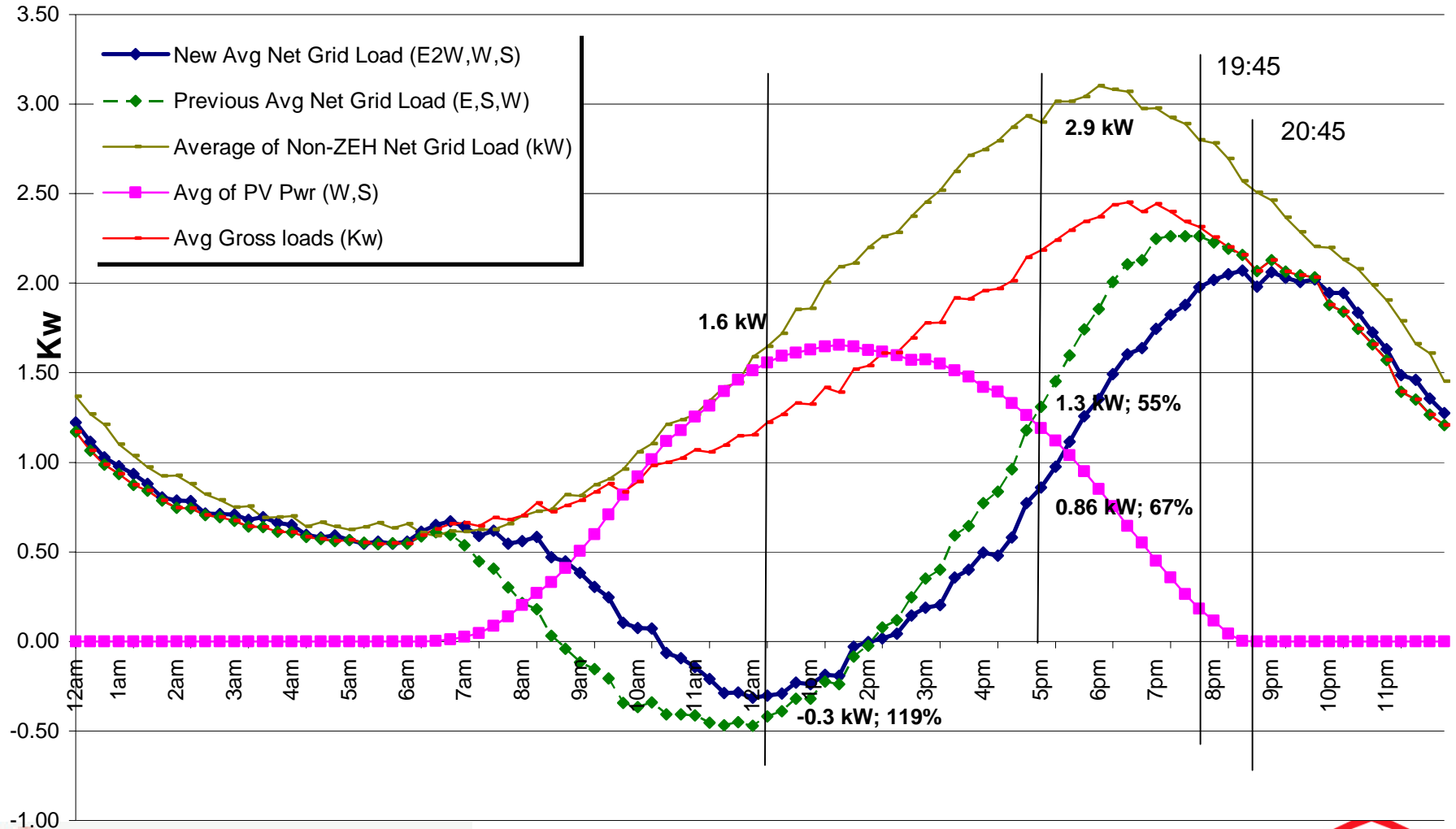


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No East , Eleven South , And Seven West



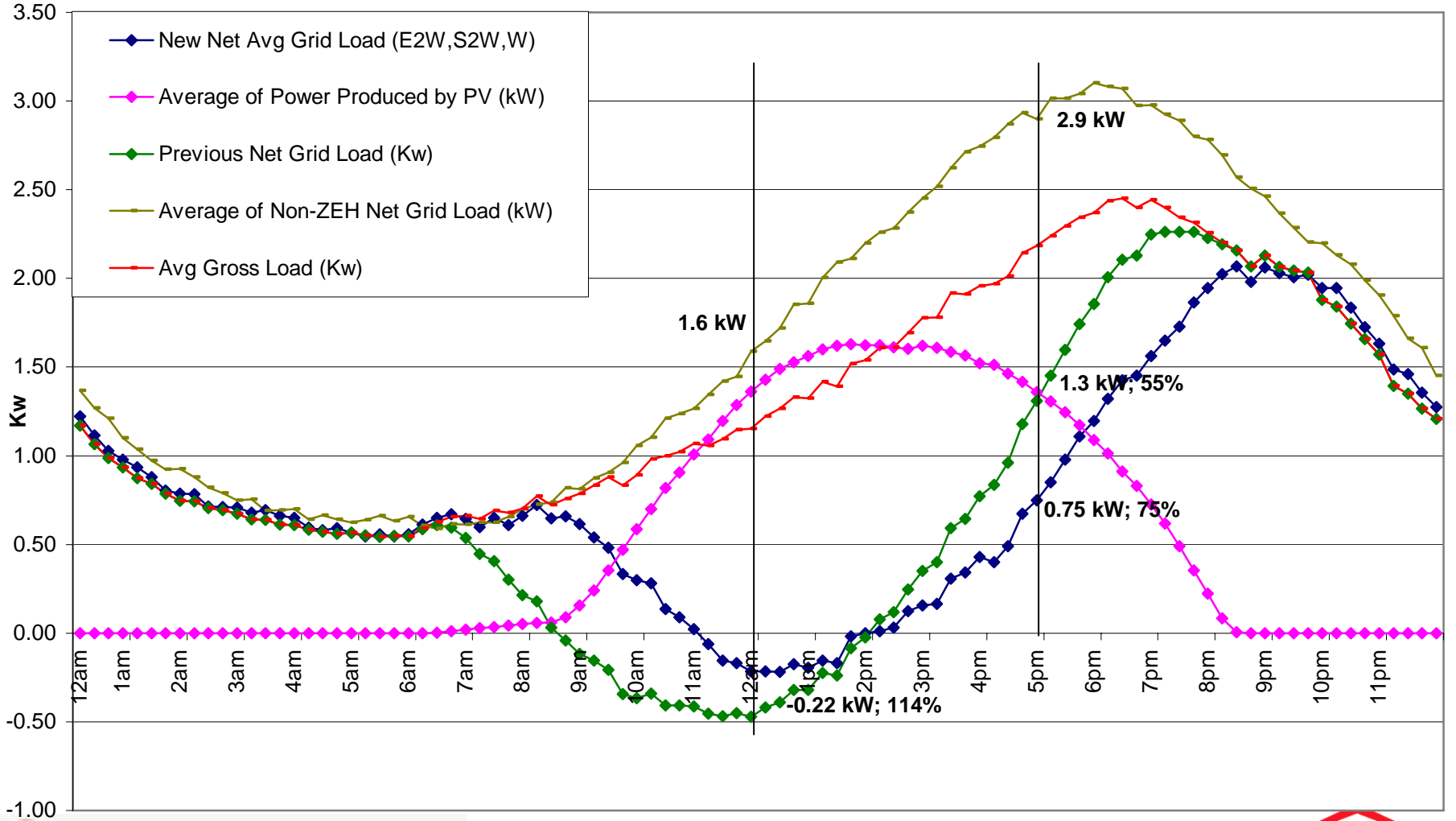


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If All West





Can The Concept Be a Reality?

- Feasibility of eliminating east-facing solar panels
- Study of two community site-plans
 - Premier Gardens , Premier Homes
 - Vista Palo Verde , Clarum Homes



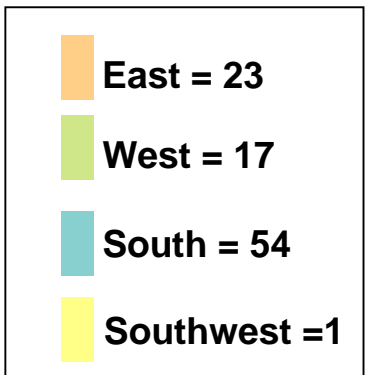
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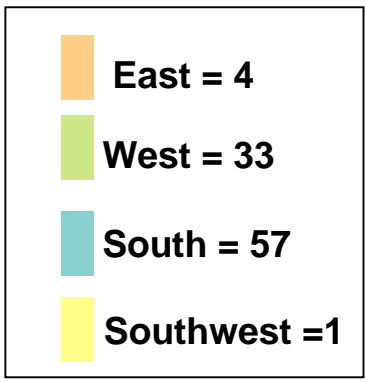
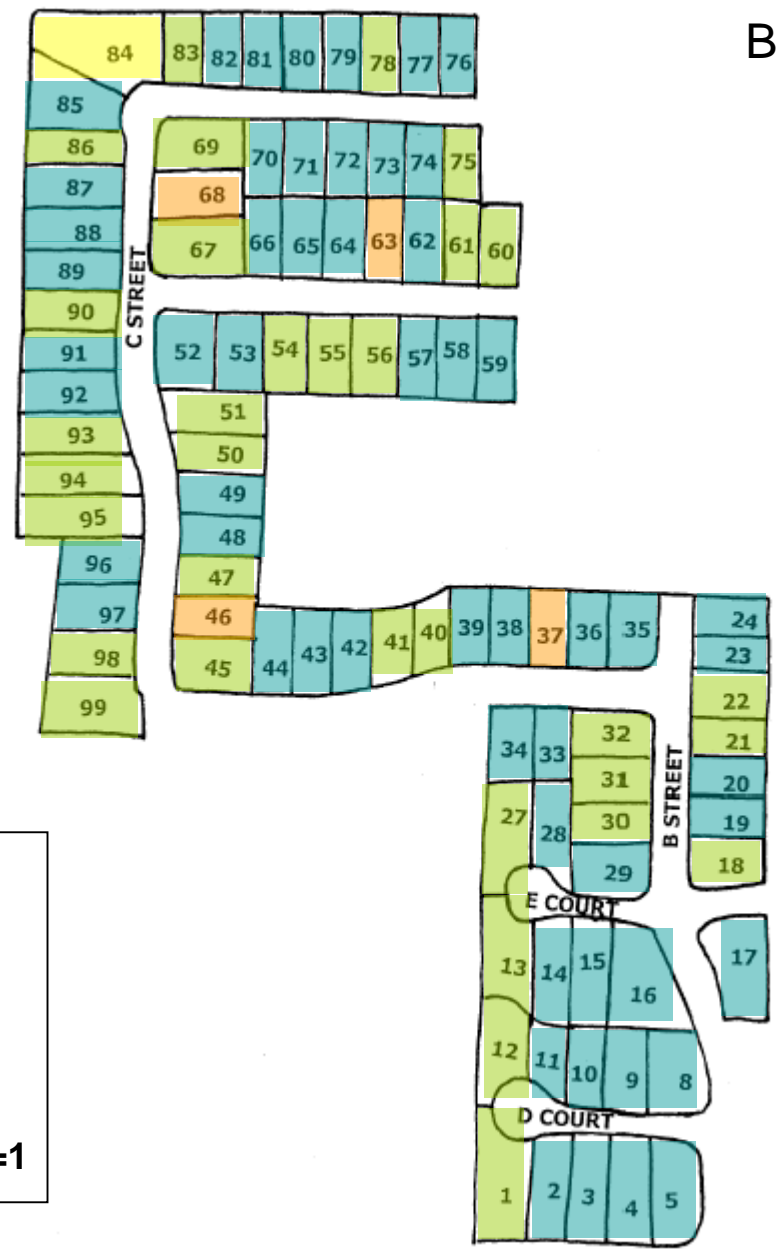
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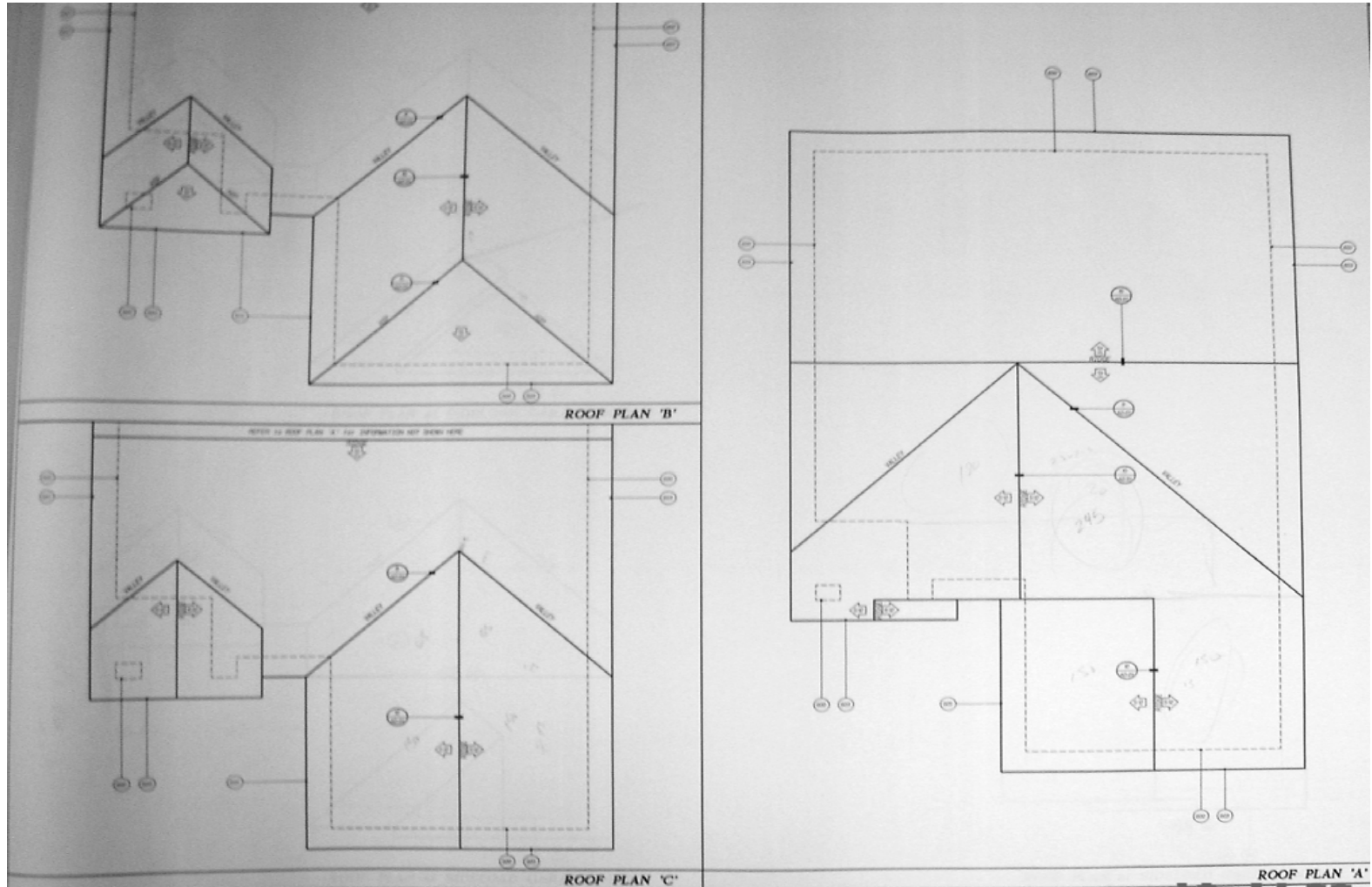
Development As Built



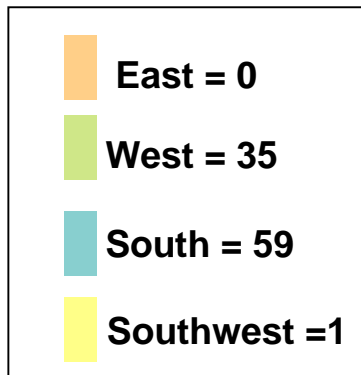
Best Opportunity As Built



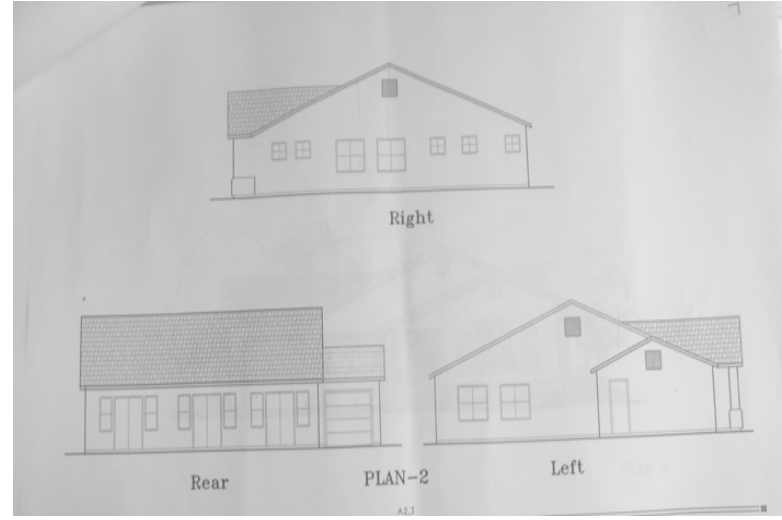
Roof Design



With Roof Optimized For PV



•Clarum Homes Future Community: Vista Palo Verde 86 Homes in Blythe, California







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Thank You!

Questions?

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