DAVIS ENERGY GROUP INCORPORATED

Pacific Gas and Electric Company ® PG&E

Building AMERICA SM U.S. Department of Energy Research Toward Zero Energy Homes

Observed Data

Scatter in observed raw data.

BA Prototype Electric Use by Month

Reference Homes Electric Use by Month
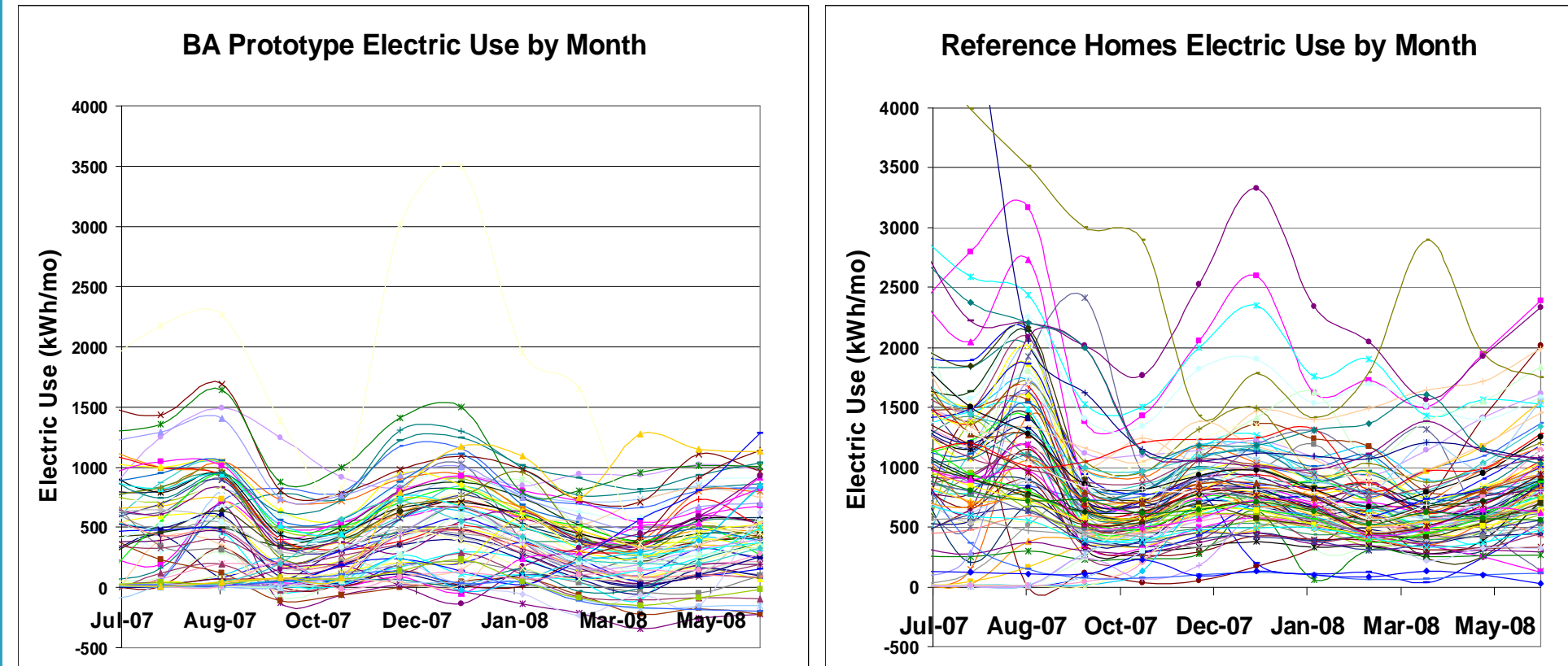
Electrical use histogram of filtered data.
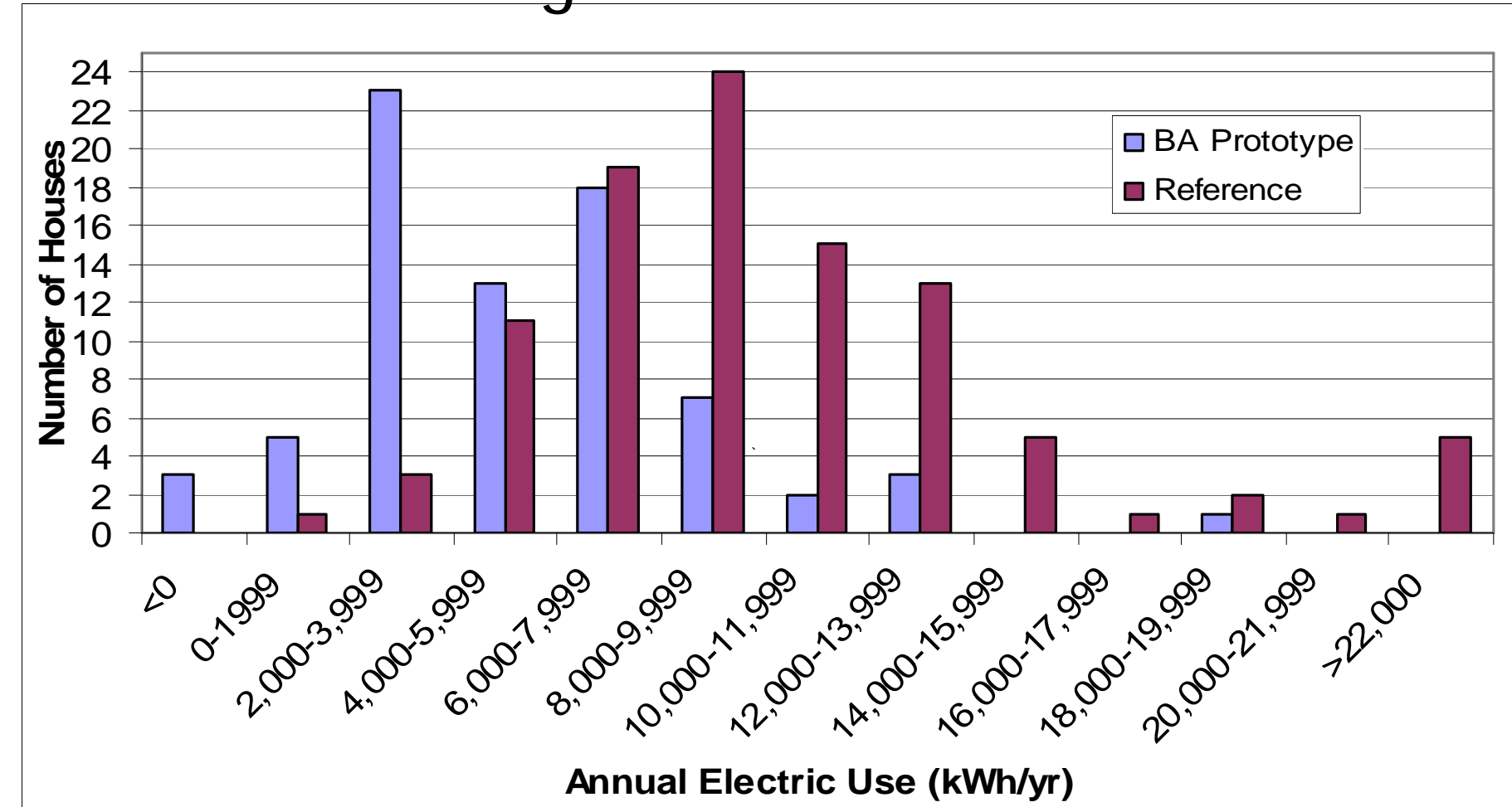
Statistics based on 75 BA & 100 reference homes.

	Average Electric Use (kWh/yr)	Average Natural Gas Use (Therms/yr)	Average Source Energy (MBTU/yr)	Average Utility Cost ($/yr)
BA Prototype (w/PV)	5,048	371	92	1,009
Reference Community	10,281	474	159	2,523
Savings 95% Confidence Interval	3,896 to 6,009	63 to 144	51 to 77	1,227 to 1,800
% Savings Interval	38% to 58%	13% to 30%	32% to 49%	49% to 71%

Modeling Reality?

Presented by: David Springer & Christine Backman

With the support of the U.S. DOE Building America Program, DEG modeled new high performance production homes in the Carsten Crossings development as well as "builder standard" homes adjacent Rocklin, California communities. PG&E provided billing data that was used to reconcile the modeled energy use and savings projections to actual energy consumption. Our analysis showed that up to 80% of annual electric use can be comprised of lighting, appliance, and miscellaneous loads that are unregulated by Title 24. It is important to address these loads if the CPUC's 2020 Zero Net Energy goal is to be realized.

Lessons Learned:

Large variations in miscellaneous electric use and homeowner behavior can obscure energy savings resulting from efficient design.

Differences found between simulated and measured energy use point out the need to improve calibrations of models that are used to make design decisions.

Statistically significant evaluation of bill data requires a large sample of homes with similar design features. Improved access to billing data is needed to advance building science.

Evaluation of billing data is complicated by mid-month billing cycles and the lack of separation of PV generation from house loads. There is a role for smart meters to reduce these errors.

Lighting and miscellaneous energy use was found to vary seasonally and to a greater extent than predicted by models. Standards should begin to address these loads.
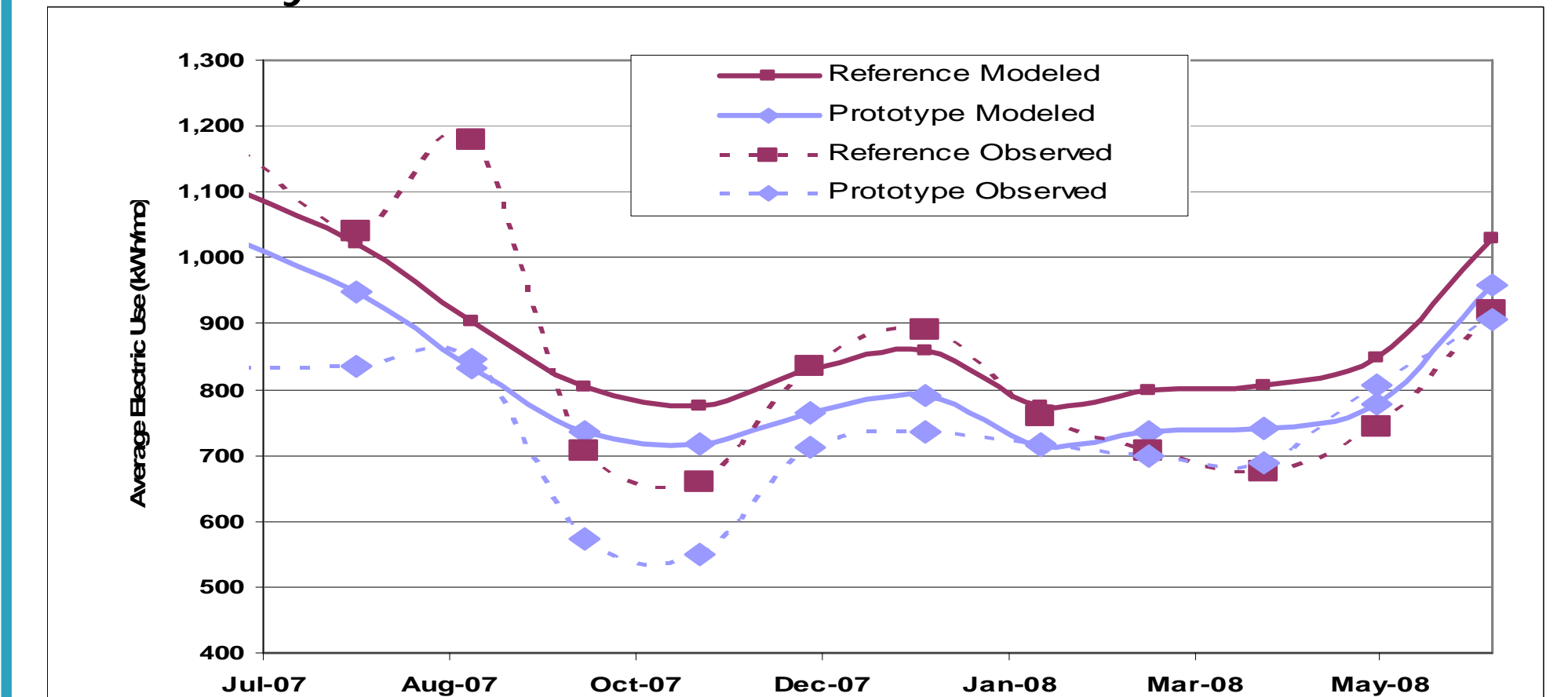
Modeling Results

(DOE BEopt Software)
Natural Gas: Model consistently over predicts by 35%
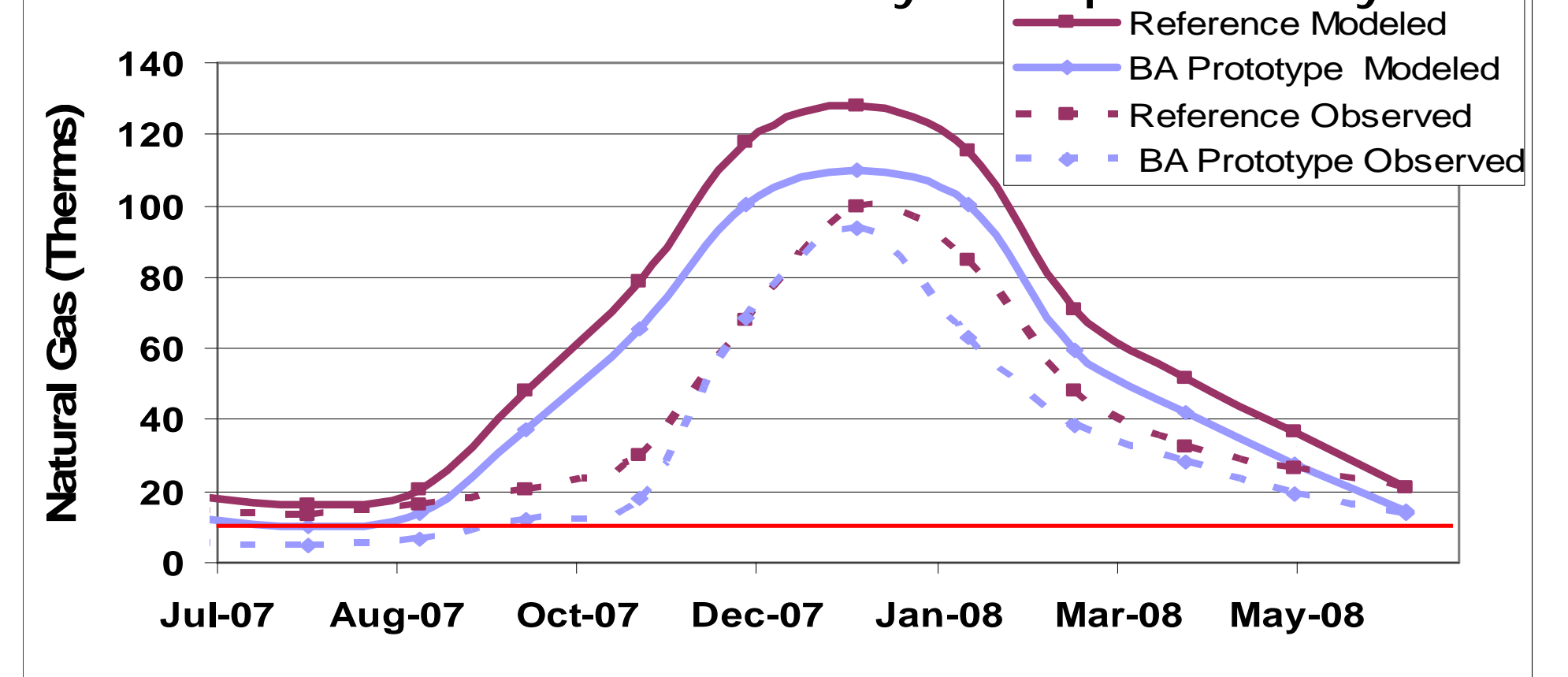
	Reference			BA Prototype		
	Observed	Modeled	% Better	Observed	Modeled	% Better
Gas Heating (Therm/yr)	278	485	43%	279	440	37%
Base Load Gas Use (Therm/yr)	196	228	14%	93	160	42%
Gas Total (Therm/yr)	474	724	35%	372	594	37%

Electricity: Model inconsistent with observed data

	Reference			BA Prototype		
	Observed	Modeled	% Better	Observed	Modeled	% Better
Base Load (kWh/yr)	8,244	8,537	3.4%	7,537	7,969	5.4%
Cooling + Fan (kWh/yr)	1,611	1,439	-12%	1,086	1,195	9.1%
Total Electric (kWh/yr)	10,281	10,552	2.6%	8,906	9,743	8.6%

Base load is comprised of Lighting, Appliances, and Miscellaneous. Base load is 80% of total electrical use.

Title-24

A closer Look w/Micropas8 Software based on Carsten Crossings Plan 3

	Observed	Predicted 2008 T-24	% Over Actual
Cooling (kWh/yr)	963	2,332	142.0%
Heating (Therm/yr)	258	290	12.4%
DHW (Therm/yr)	122	192	57.0%