

Projecting Total Energy Use...

How Good Are We?



Ben Adams

VP Program Development
MaGrann Associates

Sarah Poe

Evaluation Team Leader
Columbia Gas of Ohio



Data
Observations
Questions
Conclusions?



Indicator of relative performance

Other homes

Code

Marketing

Programs & incentives

Asset rating (model)

Verified construction

Standardized reference

Standardized occupant assumptions





Name:
Account Number:
Phone Number:
Service Address:

01/31/2013

\$184.53
\$114.54
\$299.07
\$299.07

Billing Summary

Bill Date
Thank you for your payment of \$220.59

Current Period Charges

Gas
Electric

Total New Charges

Total Amount Due on 02/22/2013

Message Center

New charges contain estimated total state taxes of \$6.02, including \$7.01 for State Gross Receipts Tax.
Your estimated electric price to compare is \$0.0869 per kWh.
The amount of this bill will be automatically deducted from your bank account on Feb 22, 2013.

General Information

Next scheduled meter reading: **February 28, 2013**
PECO, 2301 Market St, Philadelphia, PA 19103-1380. If you have any questions or concerns, please call **1-800-494-4000** before the due date.
Si tiene alguna pregunta, favor de llamar al numero **1-800-494-4000** antes de la fecha de vencimiento.

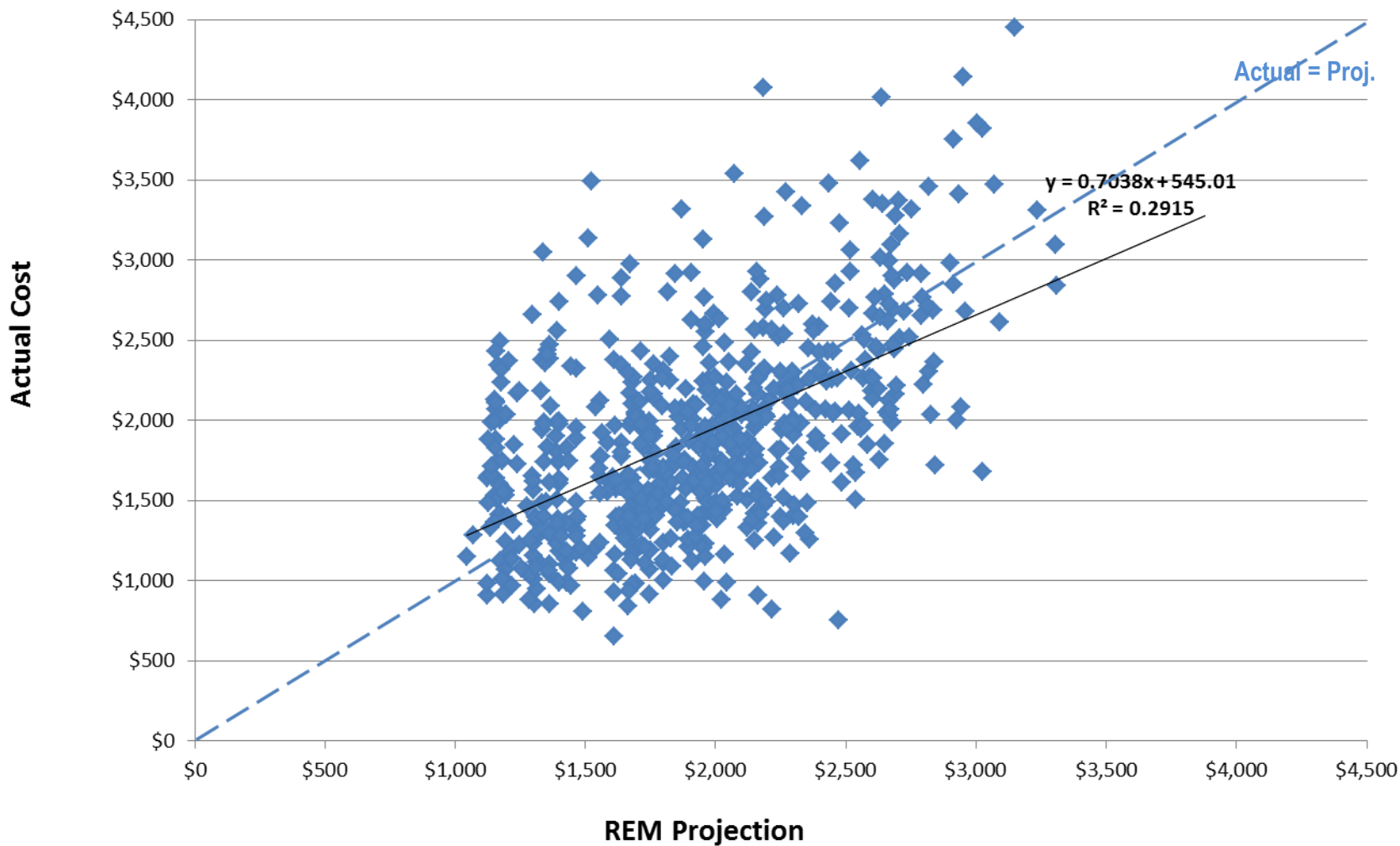
Customer Self Service - Manage Your Account 24/7

How Good Are We At Projecting Total Energy Use?

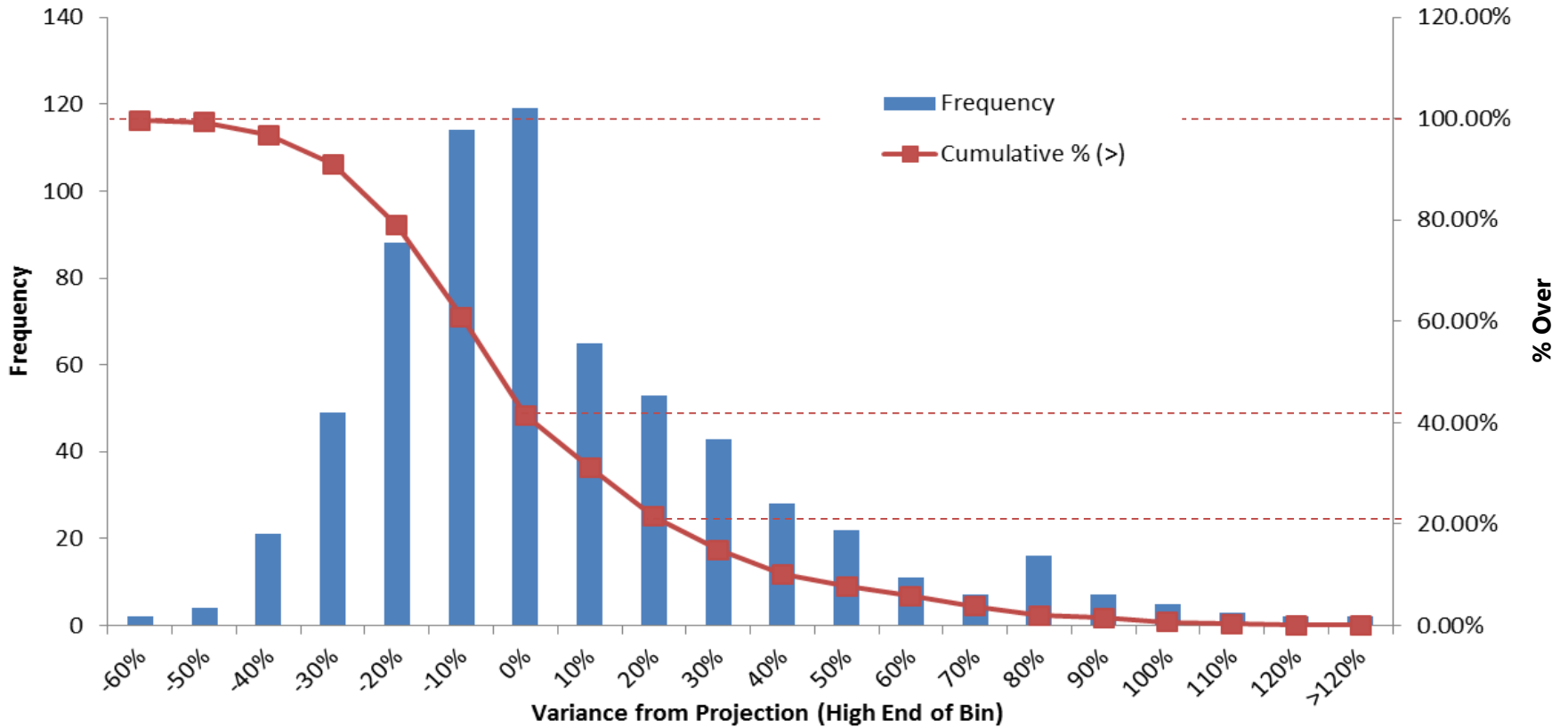


Act./Proj. 97% ±1% in weather adjusted program evaluation

Actual vs REM Total Cost



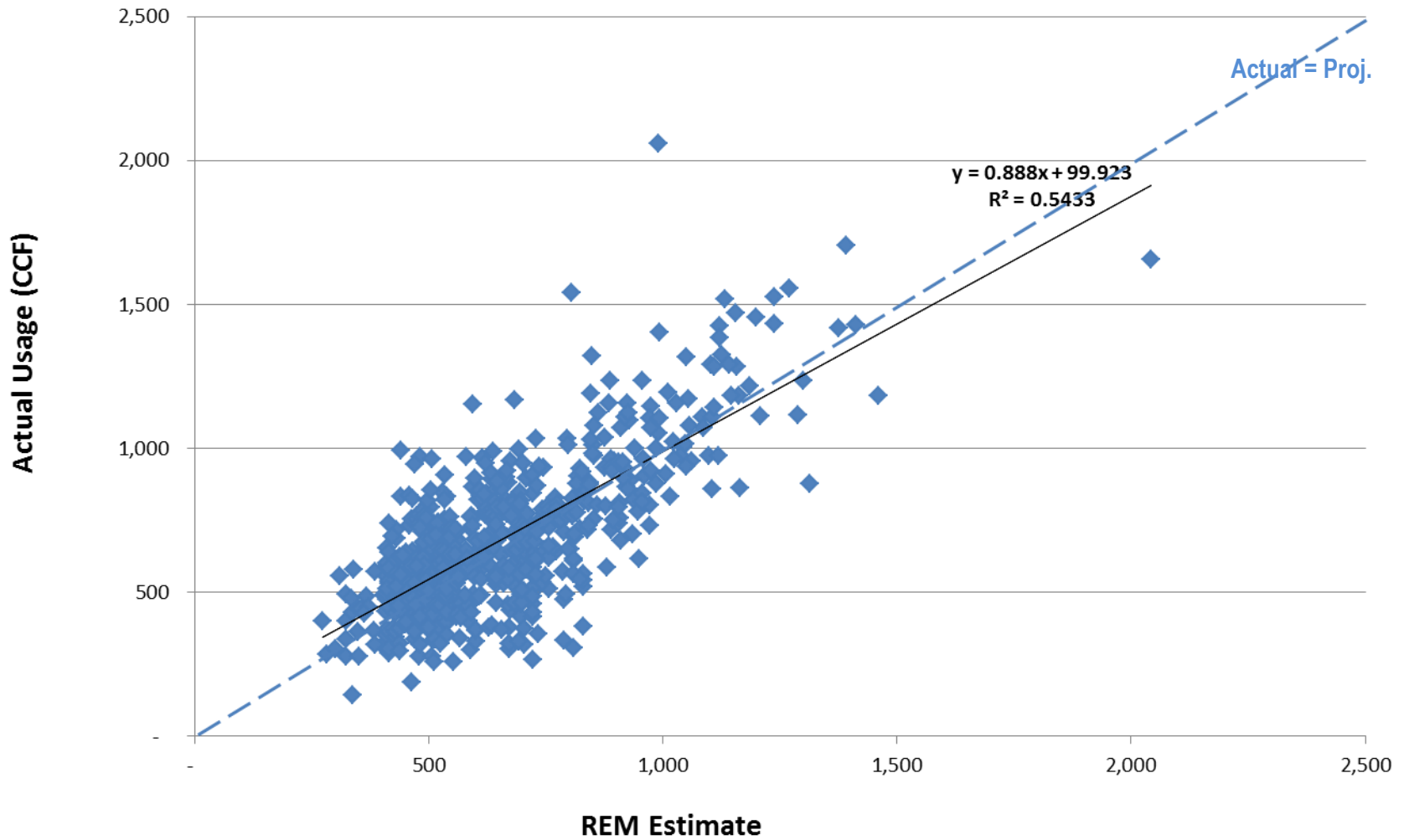
Variability of Actual vs. REM Projected Total Cost



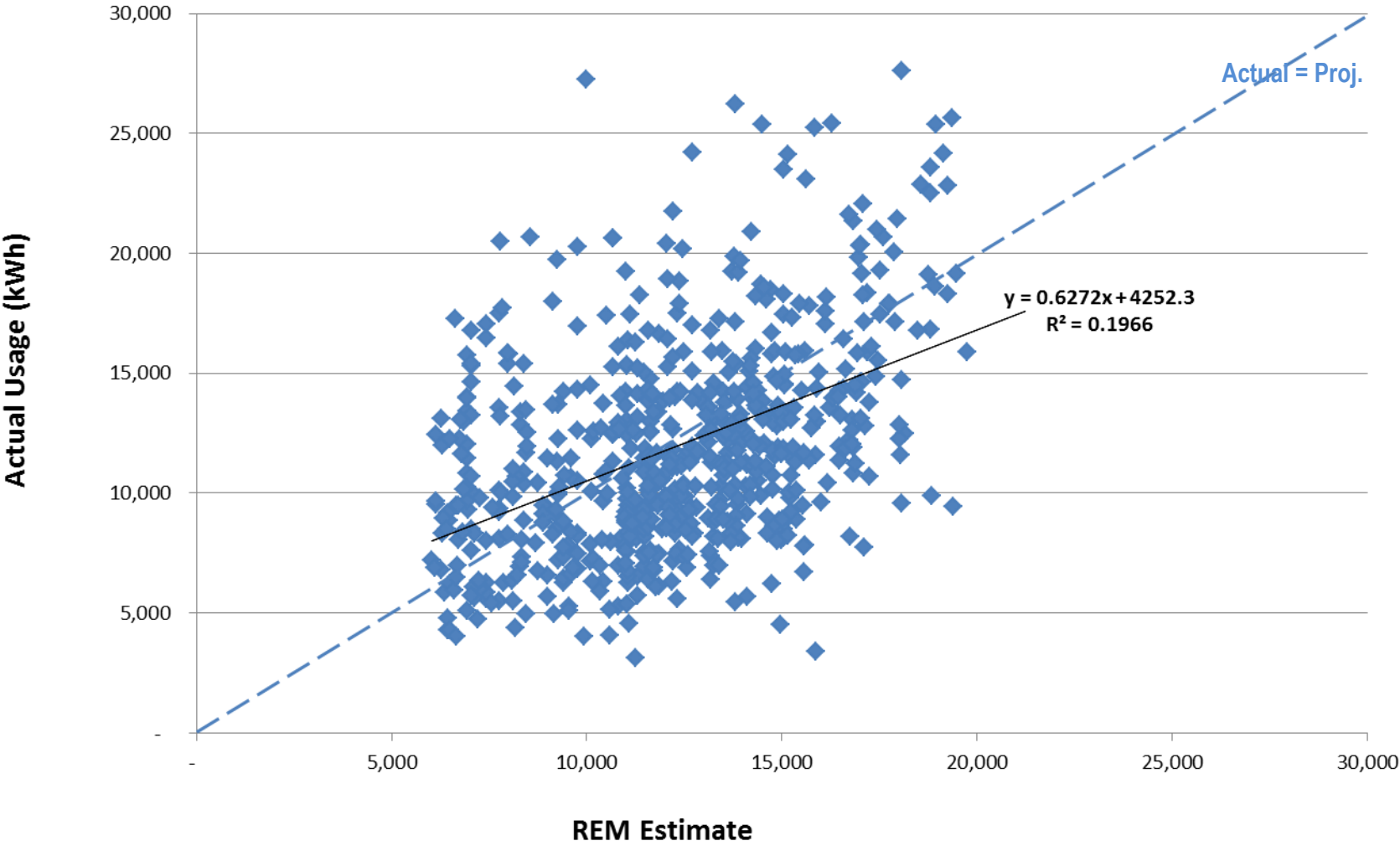
Monthly Bill Impact

\$ Over / Month	% Homes Lower
\$0	59%
\$17	70%
\$33	79%
\$50	86%
\$67	91%
\$83	94%

Actual vs REM Annual Gas Usage



Actual vs REM Annual Electricity Usage







What else?

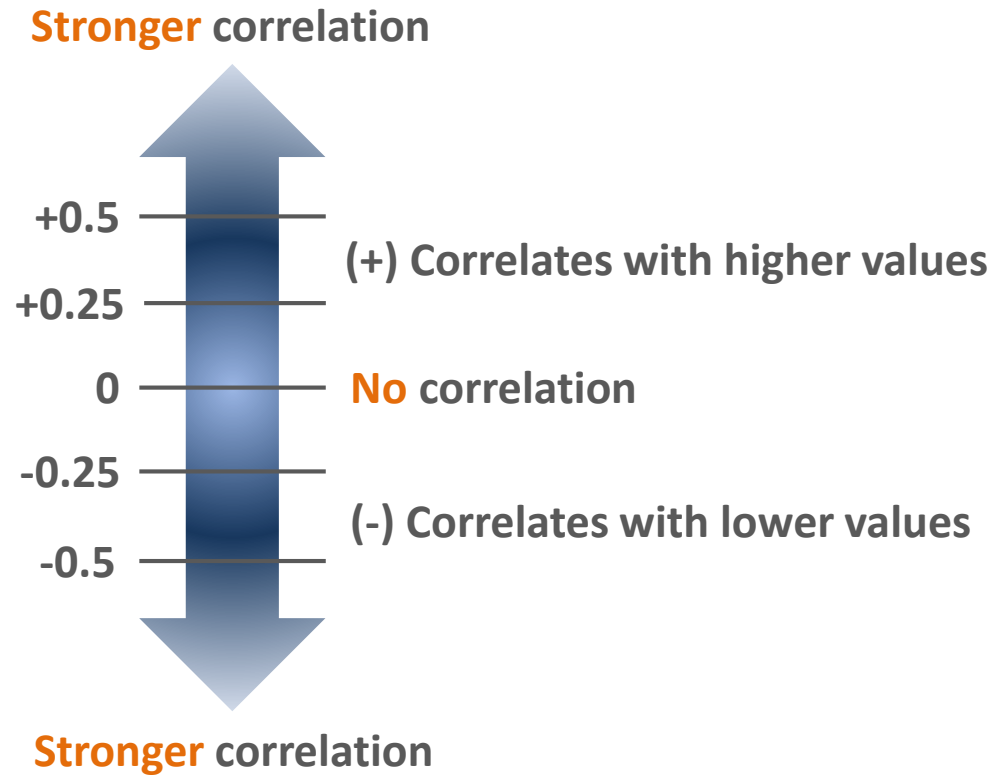
Something about the
building characteristics
or the **rating**?

Potential correlations with error

(Error = % difference from prediction)

ENERGY STAR version	-0.07	No correlation
HERS score	-0.05	No correlation
House size (CFA)	-0.21	Some correlation
A/C efficiency	0.06	No correlation
Number of A/Cs	0.02	No correlation
Furnace efficiency	-0.06	No correlation
Number of furnaces	0.01	No correlation
Water heater efficiency	-0.21	Some correlation
Number of DHWs	-0.07	No correlation

A word about Pearson's Co-efficient

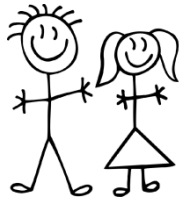


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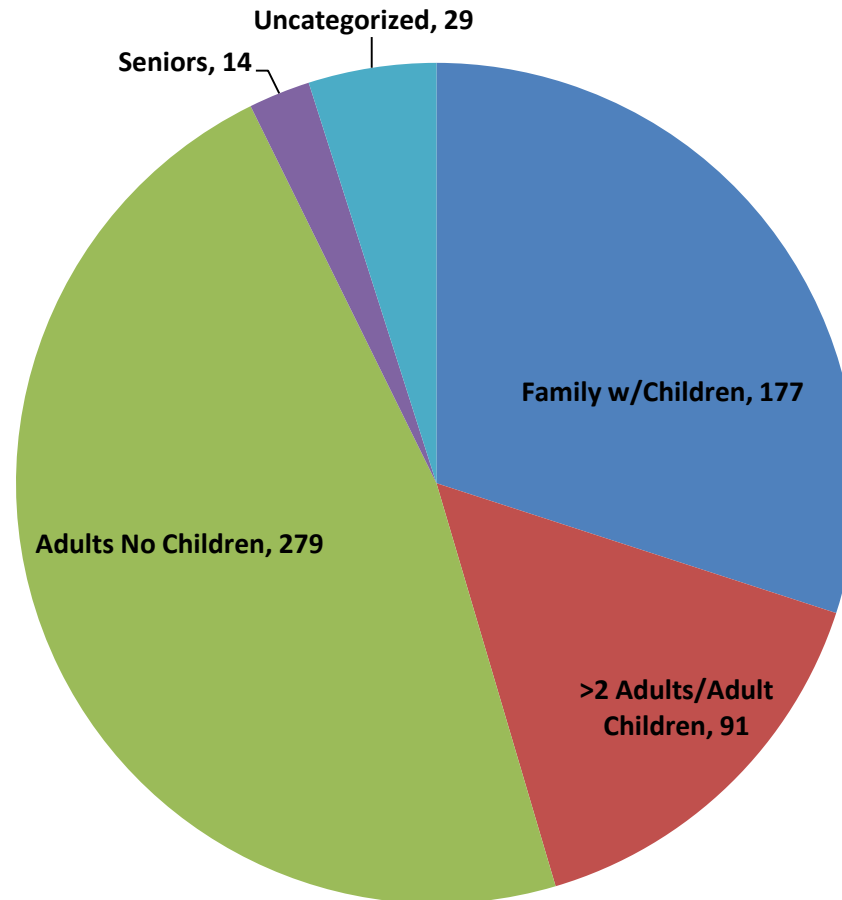
But what about behavior and demographics?



“Occupant intensity”

- Families, seniors, adults/children, age, etc.
- Size of home?
- Validity of “bedrooms +1”?

In our sample of 590*



*Homes with demographic overlay available

	Error	Actual Cost	Projected Cost
Family	+0.13	+0.24	+0.16
Adults only ¹	-0.14	-0.19	-0.01
Seniors ²	-0.02	-0.03	-0.02
Number of Children	+0.15	+0.26	+0.17
Number of Adults ³	+0.04	+0.13	+0.13

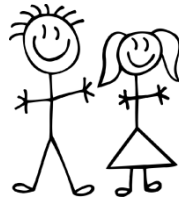
¹Adults only: ≤2

²Seniors: Note small “n” (14)

³Number of Adults: Includes children ≥18

Is it all about the kids?

Other ways to look at **behavior** and **demographics**

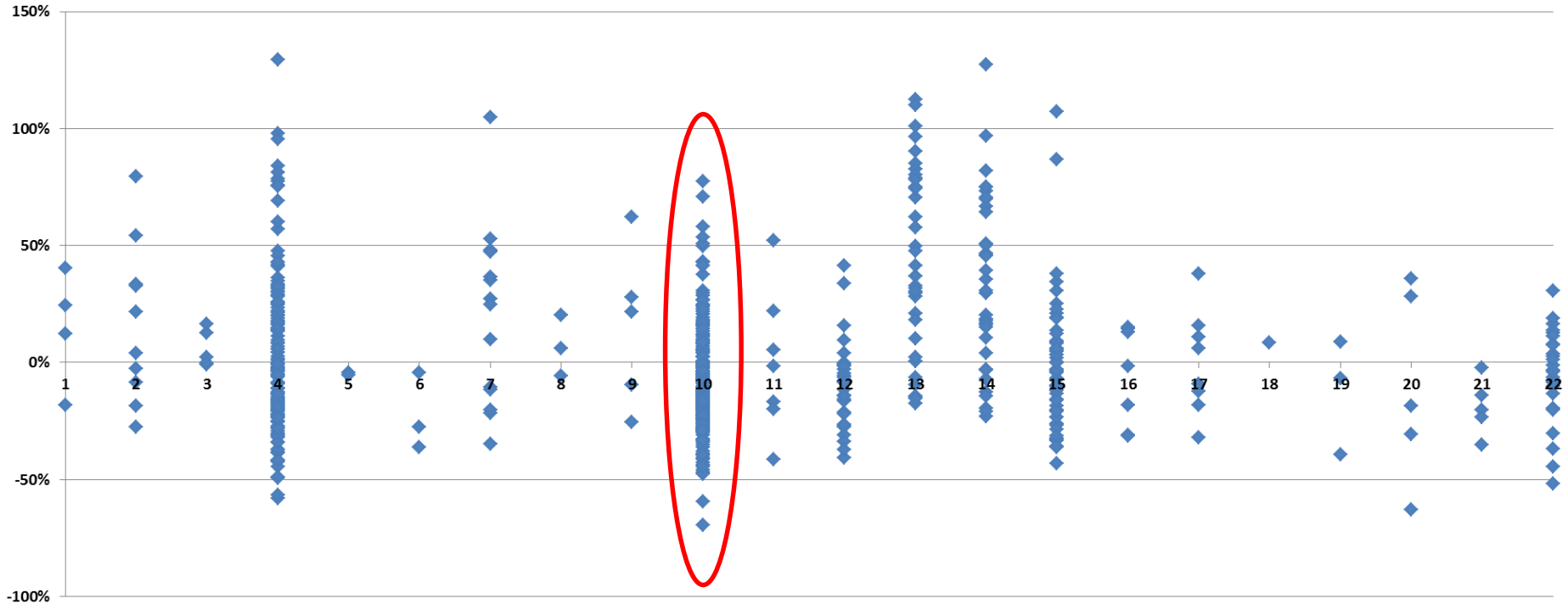


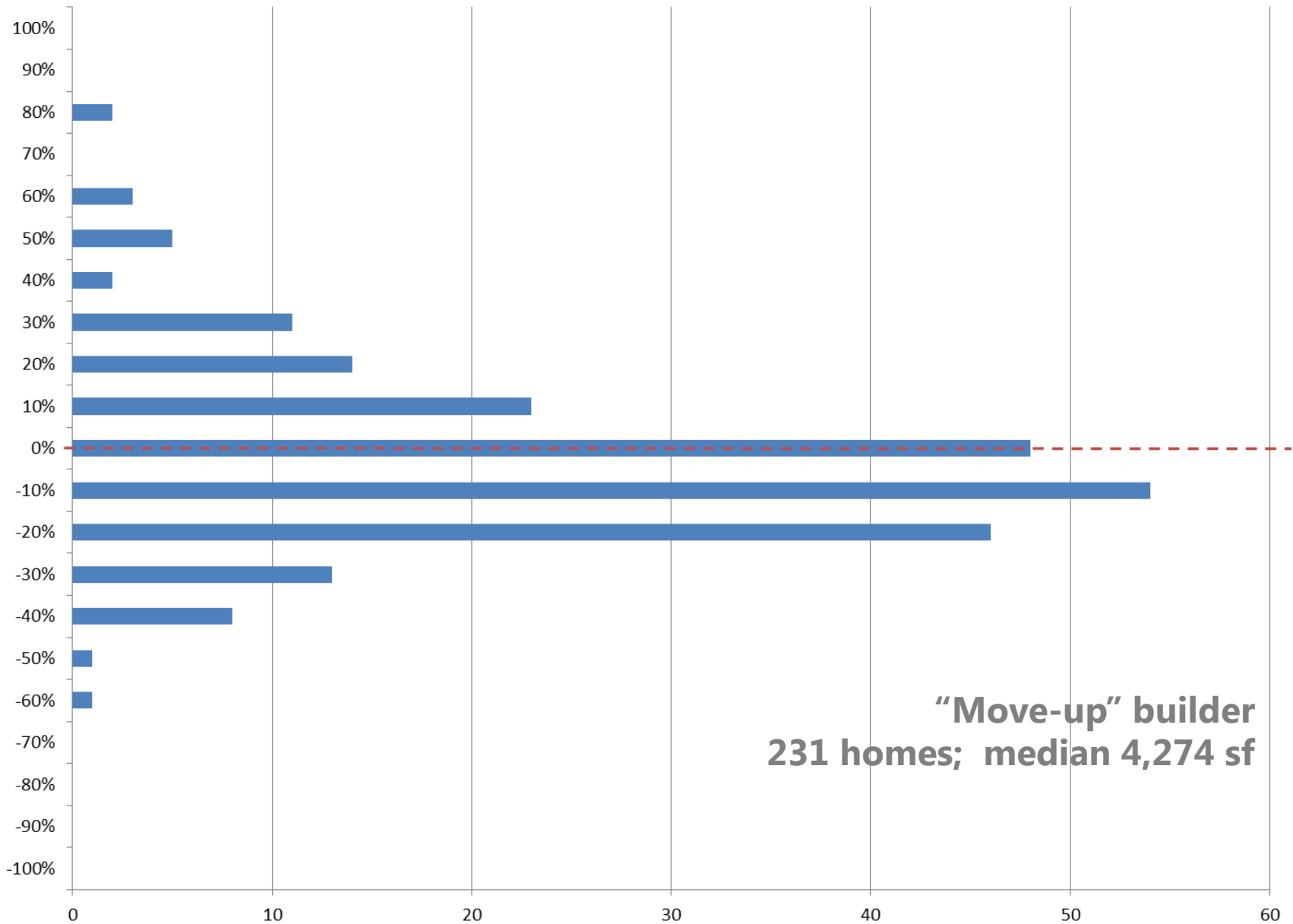
Builders target specific market segments

- **What can we learn by looking at variation by builder?**

Variability by Builder

(% difference from prediction)

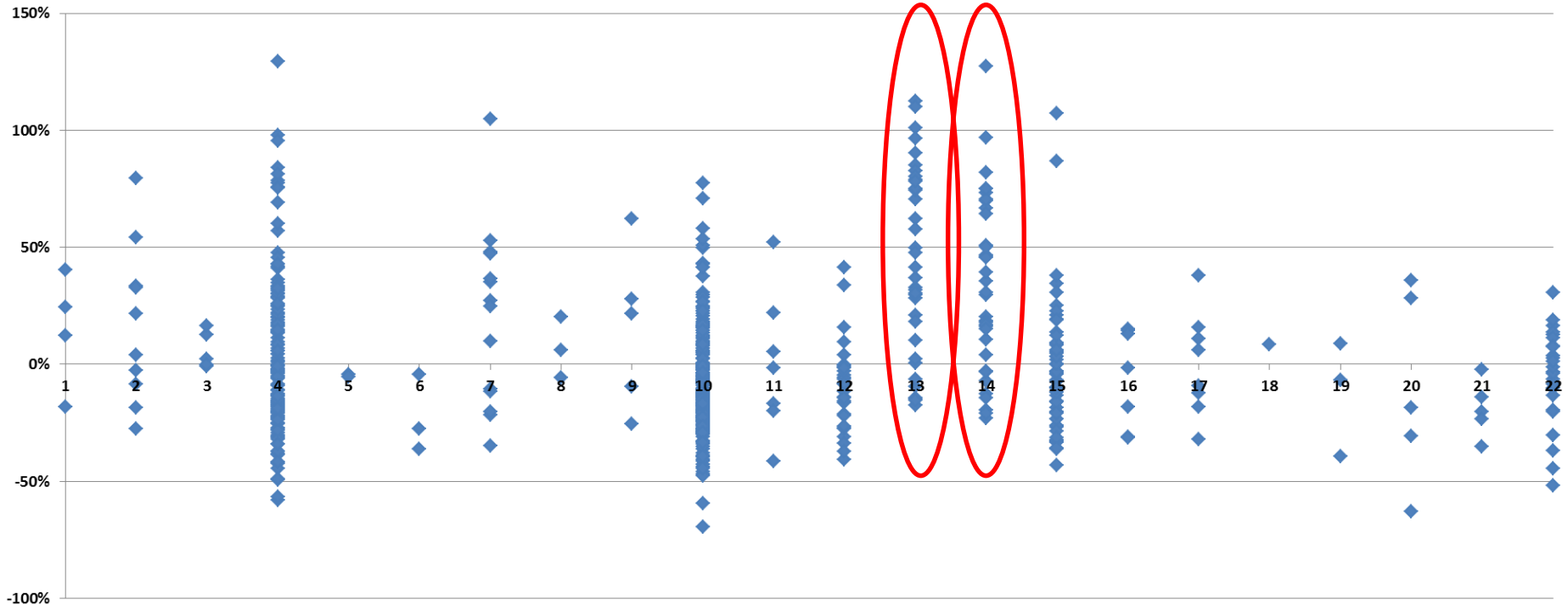


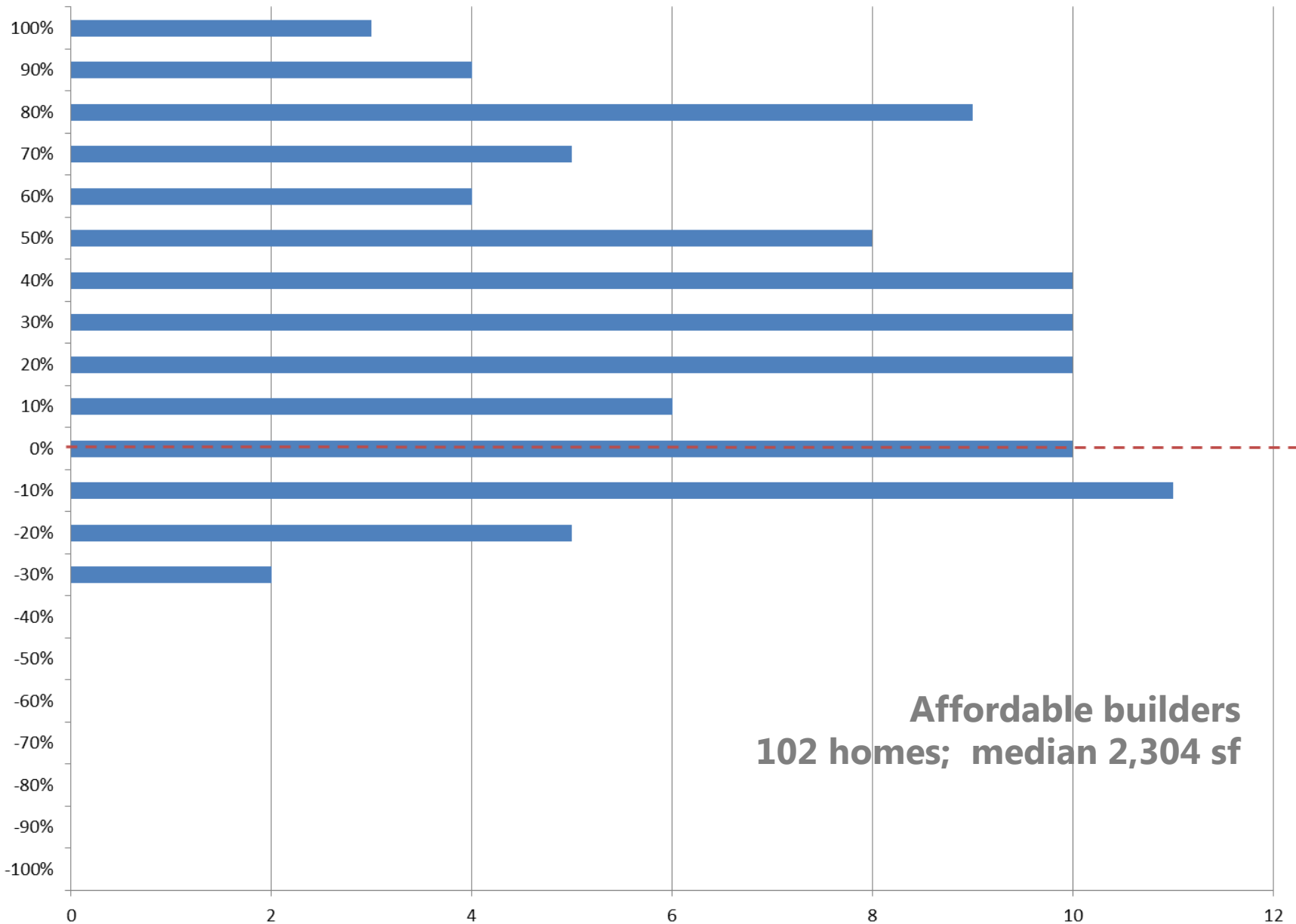


**“Move-up” builder
231 homes; median 4,274 sf**

Variability by Builder

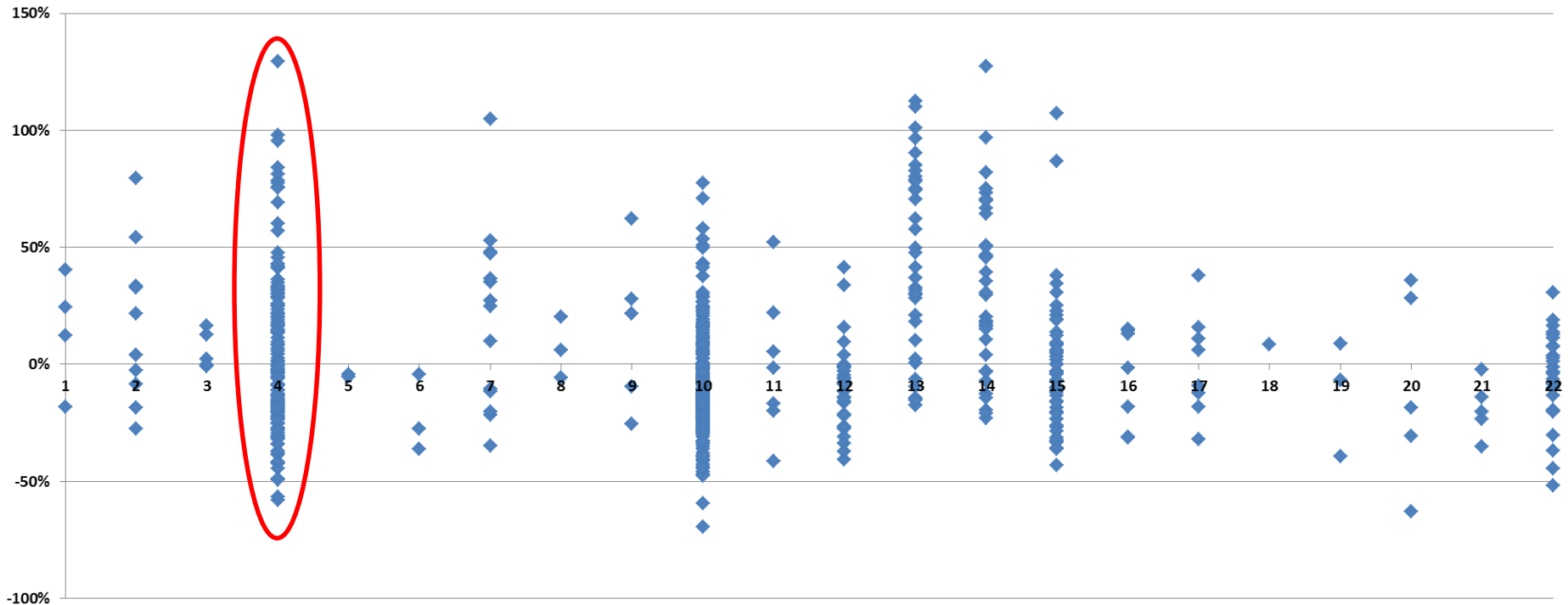
(% difference from prediction)

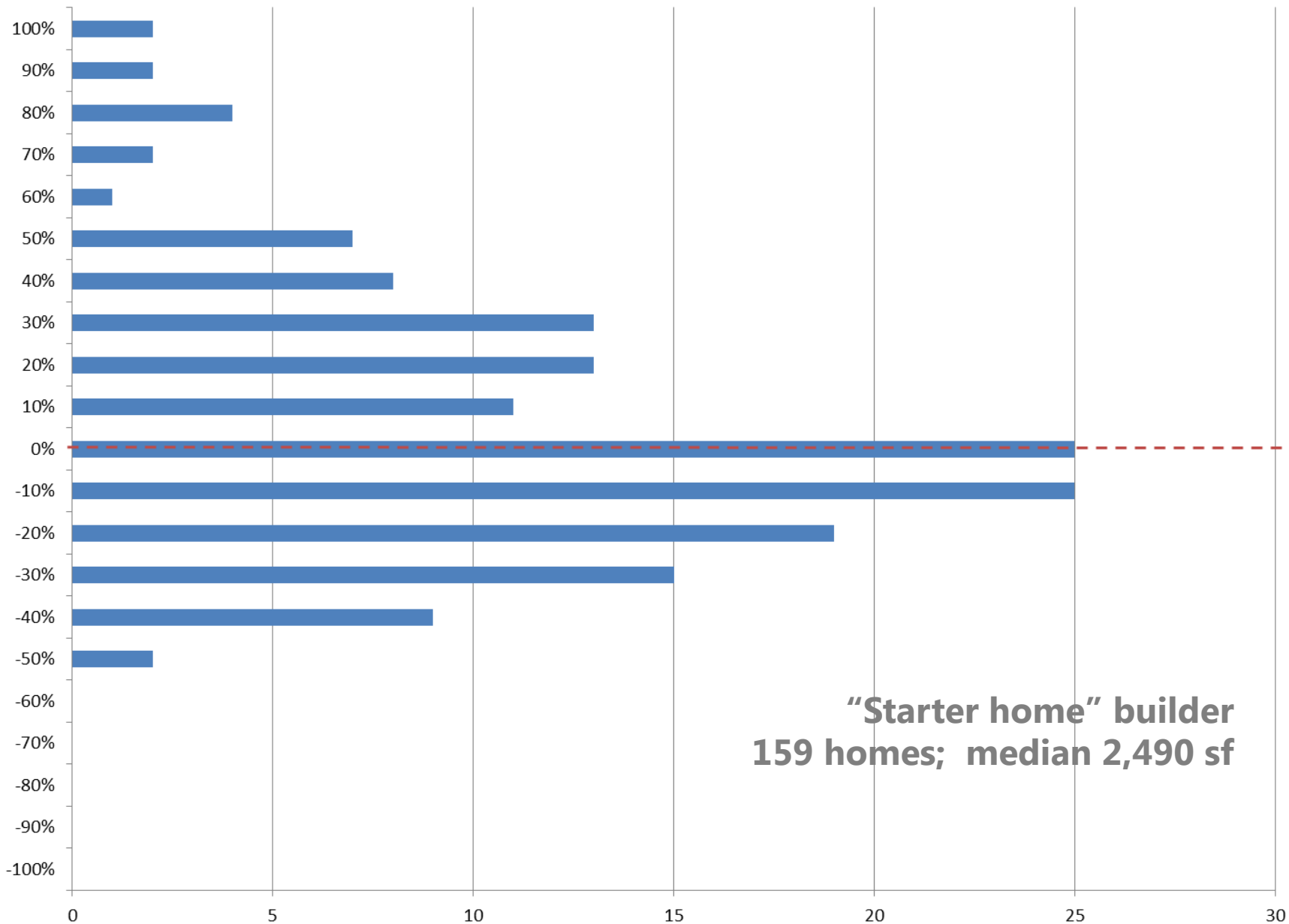




Variability by Builder

(% difference from prediction)





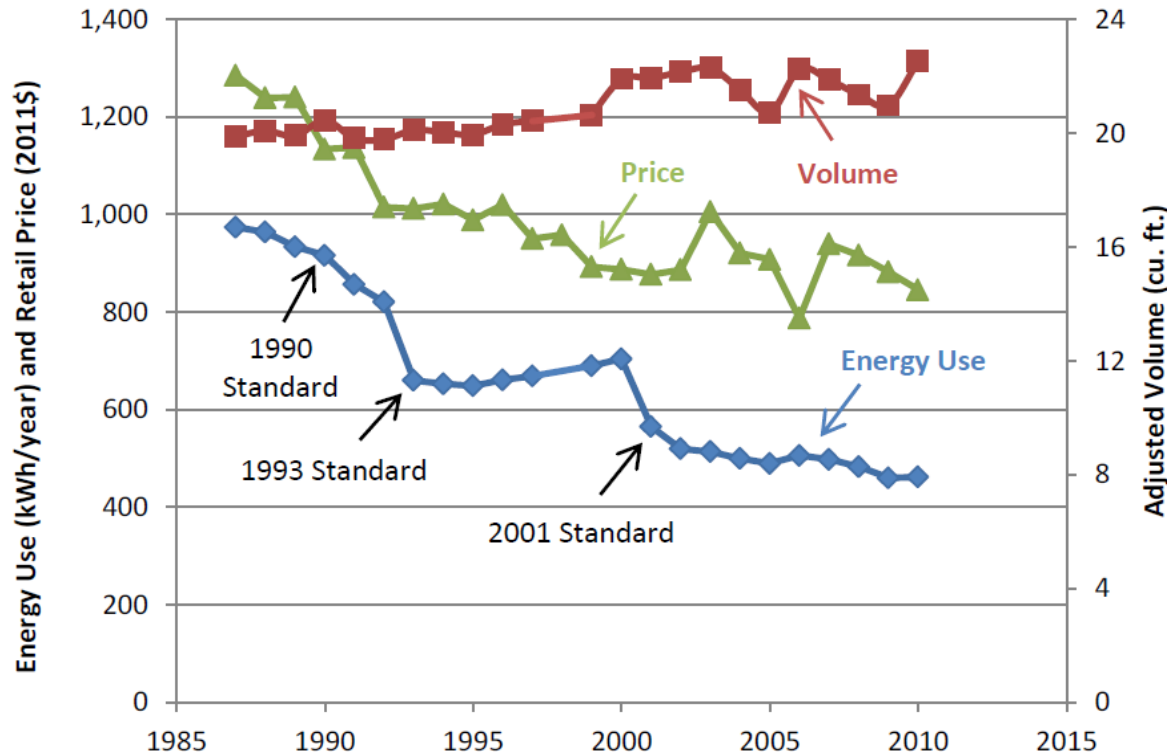
Hmm, what's different?

- **Appliances**

- Efficiency if not builder supplied?
- But raters are using appropriate defaults



New refrigerator efficiency over time



Sources: AHAM (2011) for energy use and volume; authors' analysis of U.S. Census Bureau Current Industrial Reports data for price; DOE (2011d) for markup.

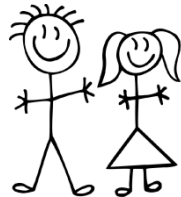
Better Appliances: An Analysis of Performance, Features, and Price as Efficiency Has Improved
 Joanna Mauer, Andrew deLaski, Steven Nadel, Anthony Fryer, and Rachel Young
 May 2013
 Report Number A132

Median total usage by category

Median Data	Sq.Ft.	kWh Proj.	kWh Act.	CCF Proj.	CCF Act.
Move-Up	4,274	14,460	11,866	694	736
Affordables	2,304	7,043	9,930	534	676
Starter	2,490	10,991	9,759	513	484

So...

back to **behavior** and **demographics**?

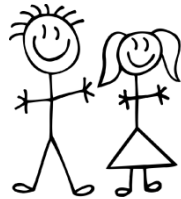


“Occupant intensity”

- Families, seniors, adults/children, age, etc.
- Size of home?
- Validity of “bedrooms +1”?

So...

back to behavior and demographics?



“Occupant intensity”

- Families, seniors, adults/children, age, etc.
- Size of home?
- **Validity of “bedrooms +1”?**
- **Time at home**
 - Heating/cooling & lighting
 - Plug loads

TV Power Consumption (W)

Screen Size	LED	LCD	CRT	Plasma
15 inches	15	18	65	---
17 inches	18	20	75	---
19 inches	20	22	80	---
20 inches	24	26	90	---
21 inches	26	30	100	---
22 inches	30	40	110	---
24 inches	40	50	120	---
30 inches	50	60	---	150
32 inches	55	70	---	160
37 inches	60	80	---	180
42 inches	80	120	---	220
50 inches	100	150	---	300

http://energyusecalculator.com/electricity_lcdleddisplay.htm

Conclusions

HERS appears to be predicting total usage (cost) accurately over large numbers of homes

But with lots of individual variation, and there will always be outliers

In fact, most households are performing close to or better than projected
But some demographic characteristics appear to skew results

When it comes to total usage, “occupant intensity” may warrant more study

- Assumptions associated with family size (specifically kids)
- Assumptions related to plug loads and behavior

But the conclusions are not really about the asset rating or savings
They’re about additional opportunities in post occupancy engagement!

Thank you



Ben Adams
benadams@magrann.com

Sarah Poe
spoe@nisource.com

