

Energy / Greenhouse Gas Savings of Energy Star for Homes Program



Challenge:
**How We Can Accurately and Inexpensively
Gauge the Real-World Savings
of Energy Star Qualified Homes
across the nation**

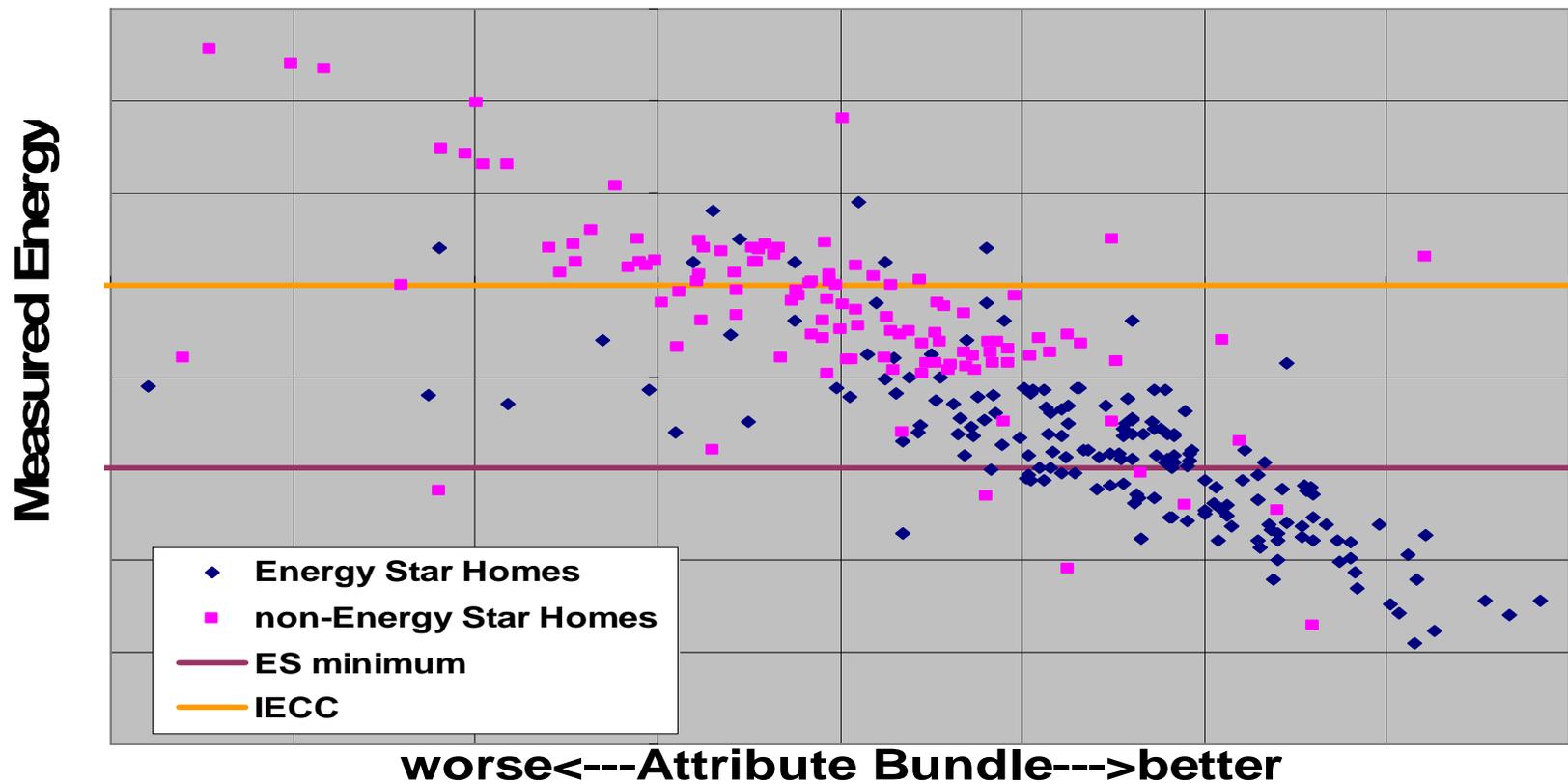
**Residential Branch
Climate Protection Partnerships Division
U.S. EPA**

2009

Typical example of what previous studies have shown



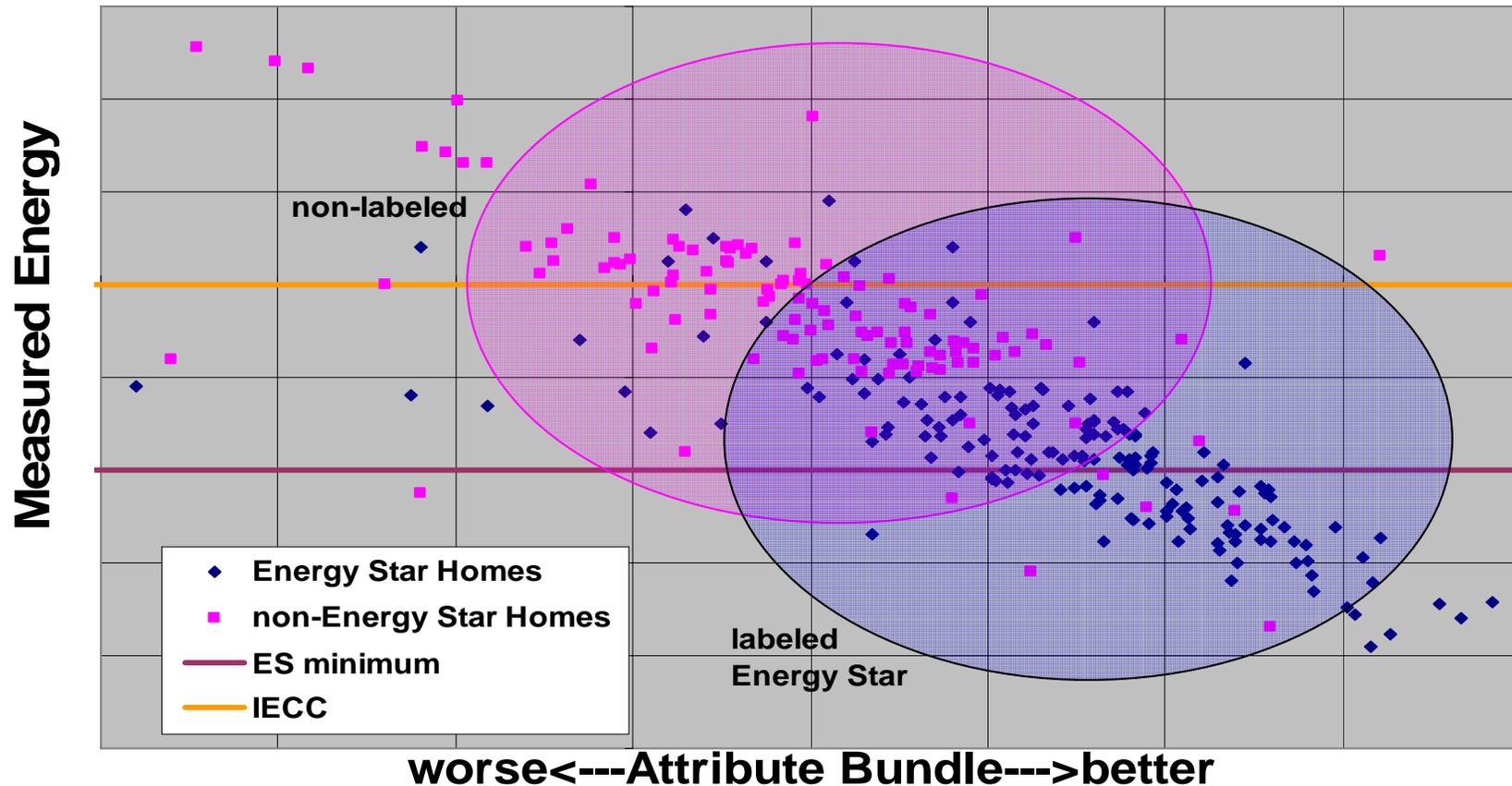
Normalized Energy Consumption [kBtu/sf-yr]



-What's going on?...



Normalized Energy Consumption [kBtu/sf-yr]



Problems with knowledge of attributes in these studies



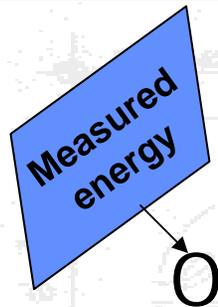
Attribute	Energy Star labeled	Non-labeled “control”
Energy consumpt.	---usually avg. total or H/C kWh or therms---	
Fuel	---sometimes matched, sometimes not known or disaggregated---	
Vintage	---not always matched---	
Construction characteristics	Usually unknown or unretrievable	Pretty much unknowable
House Size	sometimes known as a group average	
HERS Scoring Parameters	Usually unknown or unretrievable	never known
Locale	---not always matched---	
weather year	---not always the same---	

Major Item missing: no correlation of software predictions & measured energy consumption

Comparison of what we know about the data points



Old Paradigm



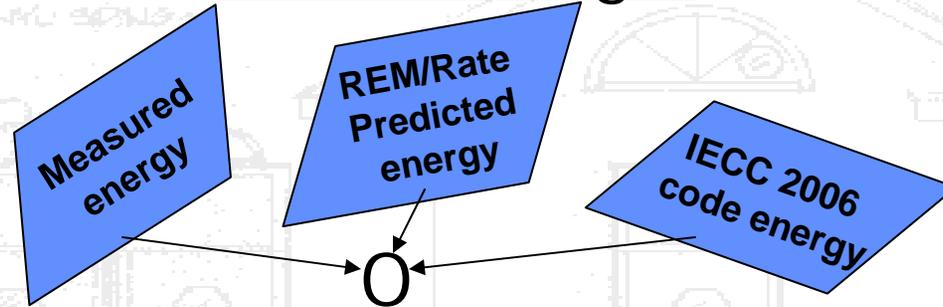
Attributes largely unknown
Little or no statistical control

DATA

- Experimental: "labeled"
- Control: "unlabeled"
- "Experimental" & "control" are separate populations and not well-matched

Large unwieldy population

New Paradigm



Attributes well-known
Good statistical control

DATA

- Experimental: REM/Rate predicted energy
- Control: measured energy
- Perfectly matched "experimental" & "control" data (same house!)
- Additional ref.point: IECC code house
- Actual corresponding weather data

Carefully selected, smaller, manageable population

Approach

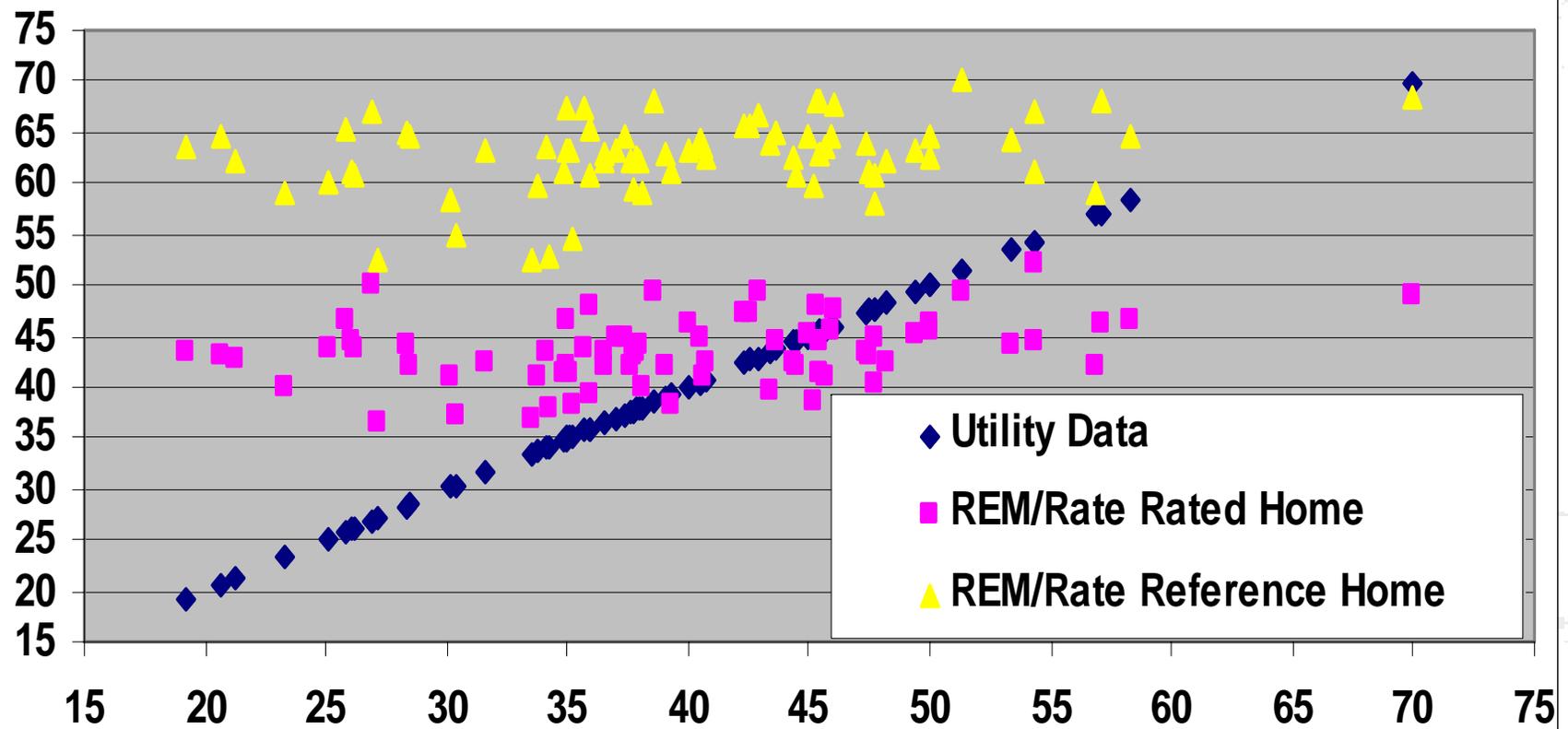


- Choose population of recent Energy Star labeled homes in a particular weather location
- Collect REM/Rate blg. files & blower door test results
- Collect 12 mo. of utility billing data (kWh, therms, \$)
- Corroborative analysis
 - correction to weather year corresponding to utility data
 - examine outliers (and eliminate if justified)
 - calibrate with respect to various construction & efficiency parameters
- Determine relationship between REM/Rate predictions and real-world consumption
- Extend to additional populations in other climate zones
- Weight results of REM/Rate simulations wrt climate, house size, construction characteristics, etc. to project energy/GHG programmatic savings

Original Raw Data for site energy



Site EUI [kBtu/sf-yr] Original Raw Data

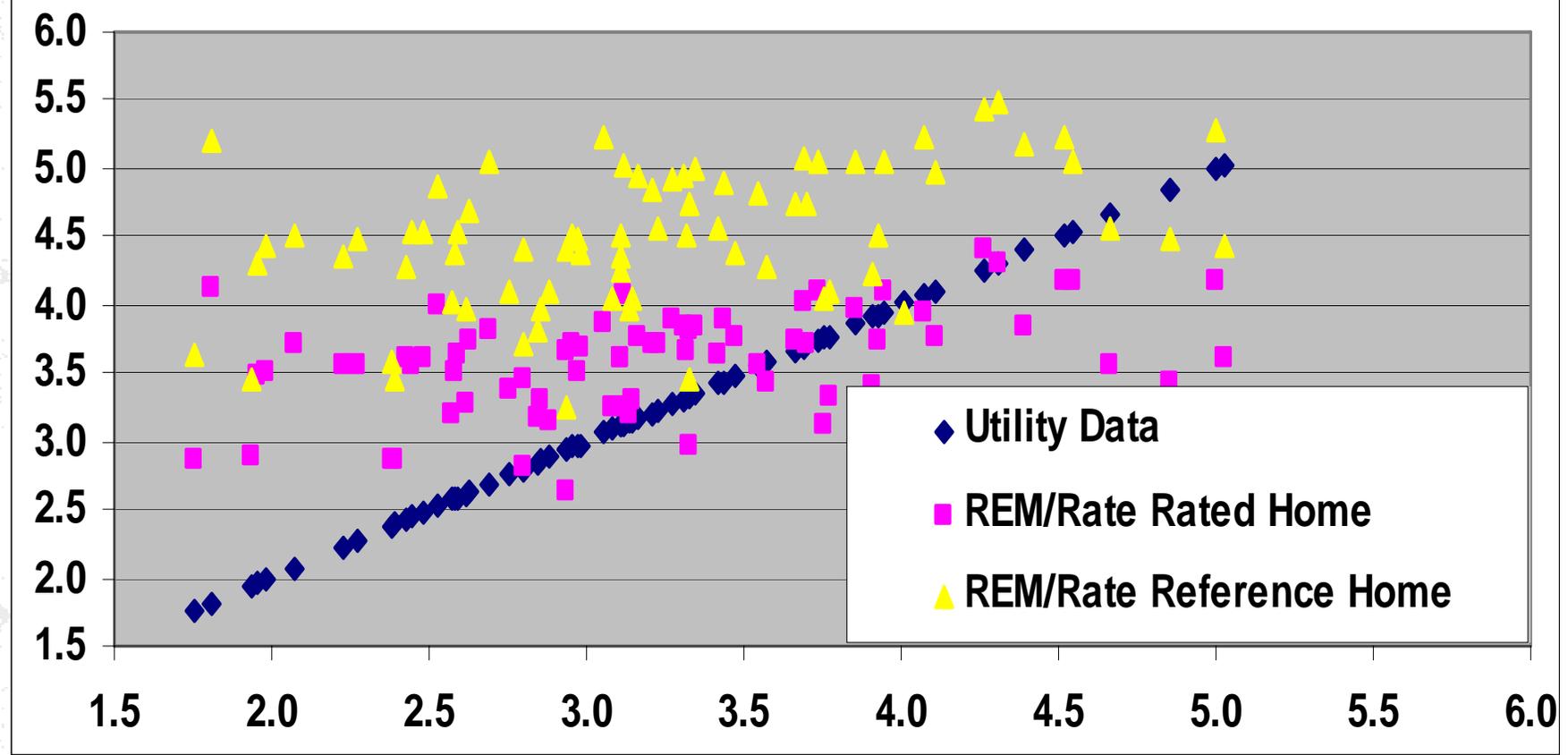


Let's examine Carbon emissions

-original raw data



Carbon [MTCe/yr] - Original Raw Data

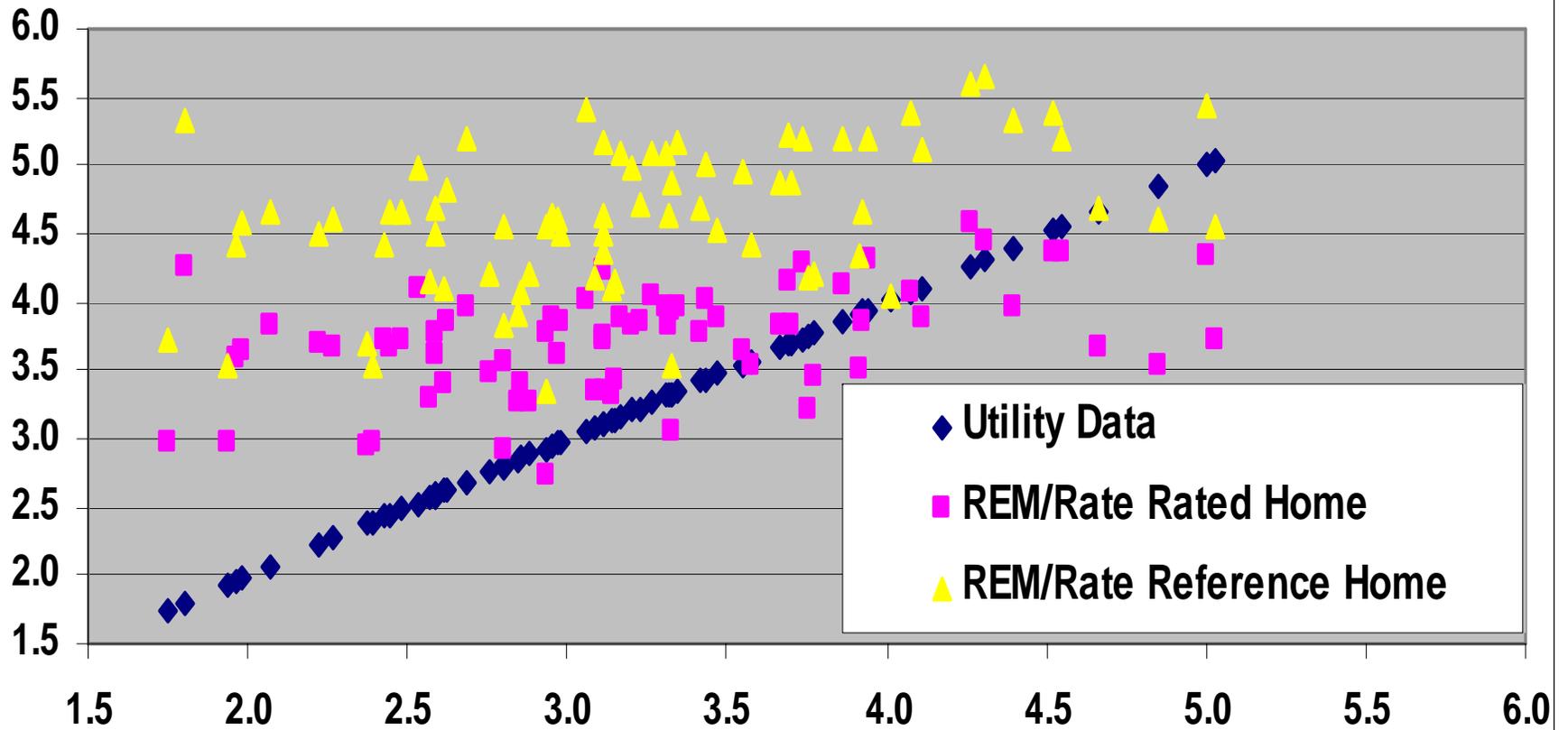


Carbon emissions

-weather-corrected



Carbon [MTCe/yr] - Weather Adjusted to CY2008

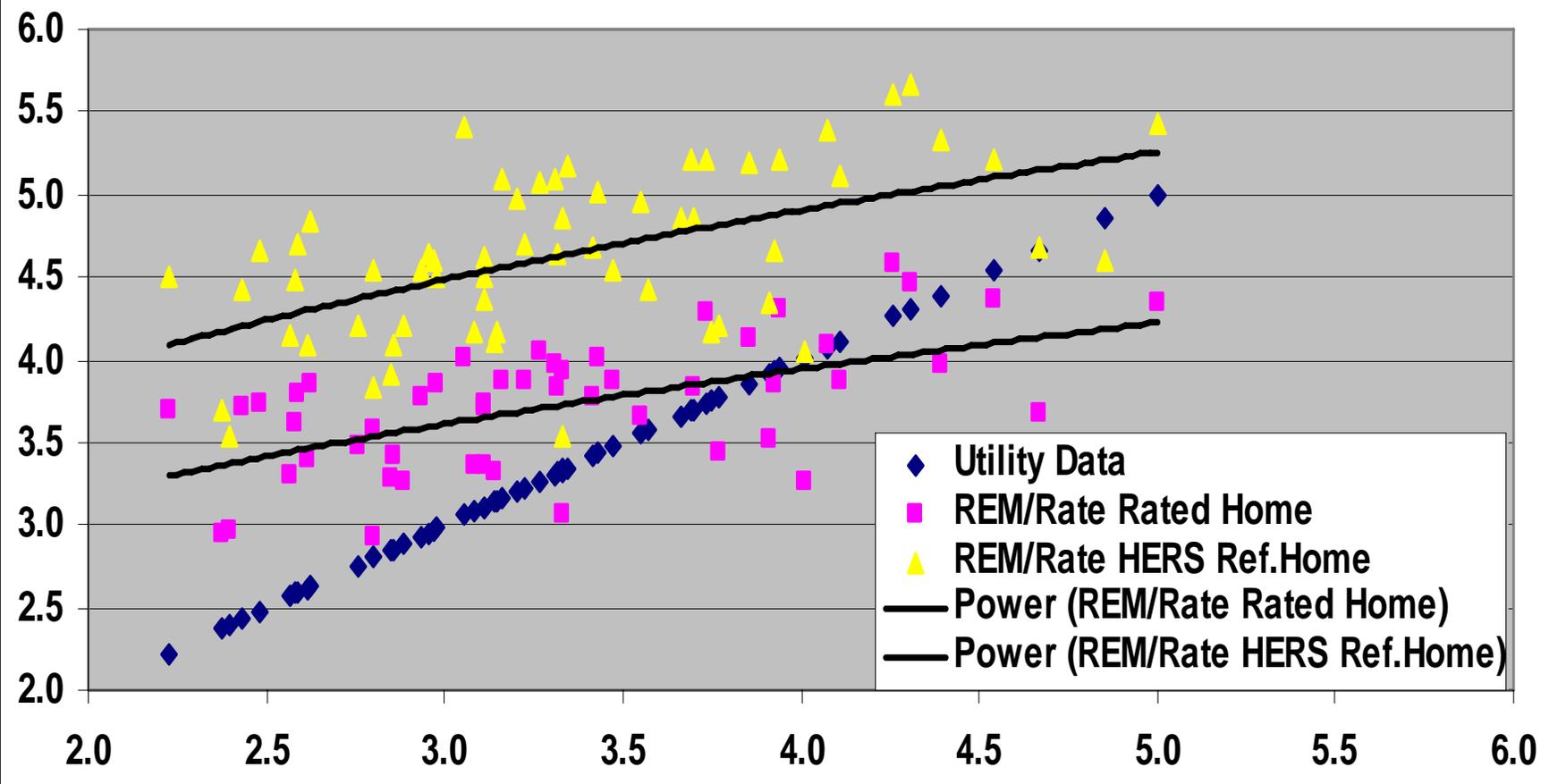


Carbon emissions

- weather corrected
- outliers removed (e.g., missing util. bill data)



Carbon [MTCe/house-yr] - wthr.adjusted/outlier-free

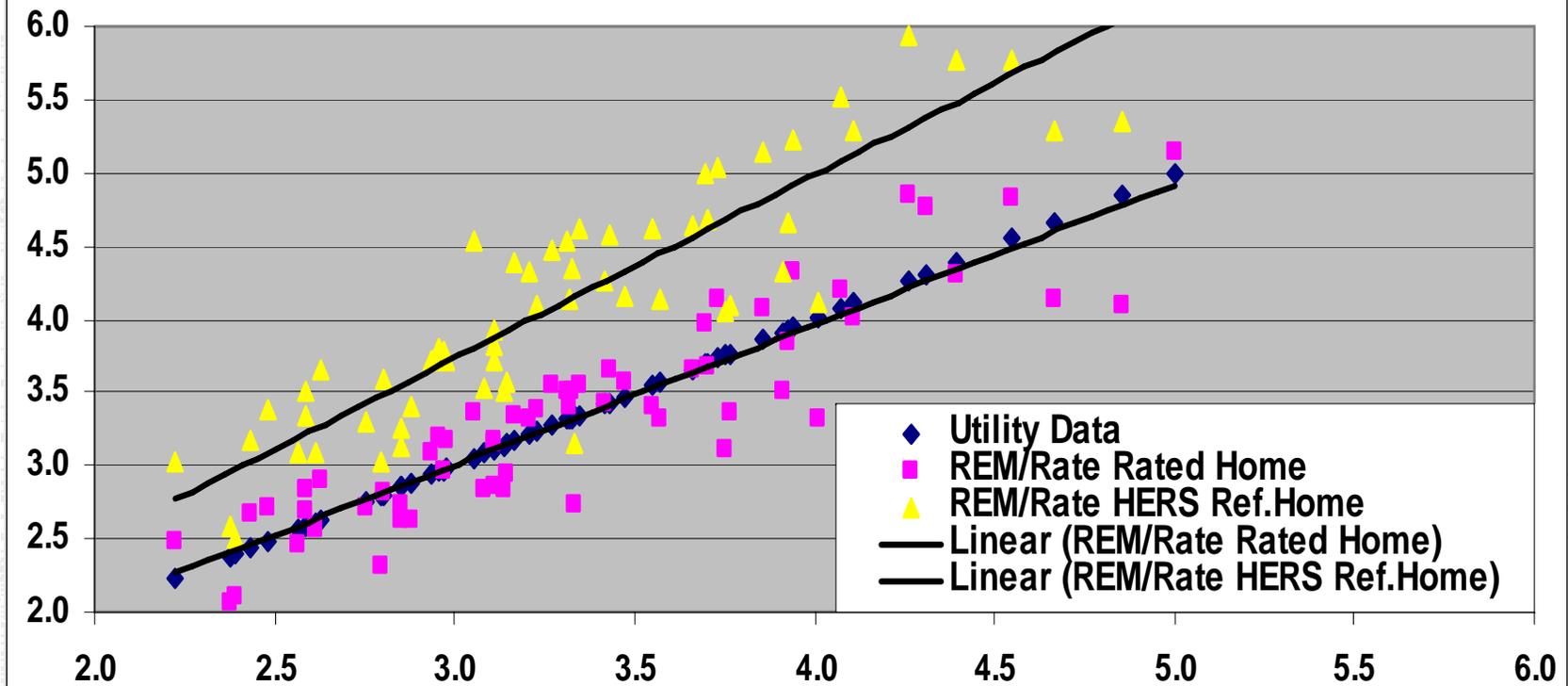


Carbon emissions

- weather corrected
- outliers removed (e.g., missing util. bill data)
- calibrated with respect to house size



Carbon [MTCe/house-yr] - weathr adjusted/outlier-free/calibrated



Preliminary Indications/Results



- For the first time a targeted/focused, statistically-significant, inexpensive (in time and \$\$) methodology is being executed that may allow an accurate determination of the real-world energy and GHG savings of the Energy Star for Homes Program across the nation, compared to HERS rating predictions
- The flagship study is based on 75 Minneapolis gas-heated, HERS-rated/blower-door-tested Energy Star Homes with conditioned basements and (mostly) ducts-inside-the-conditioned-space
- The analysis is being extended to other climate regions/different fuel mixes/a range of house sizes & construction characteristics
- It may additionally provide information to RESNET which may be useful in adjusting HERS rating assumptions/algorithms (e.g., plug load assumptions)