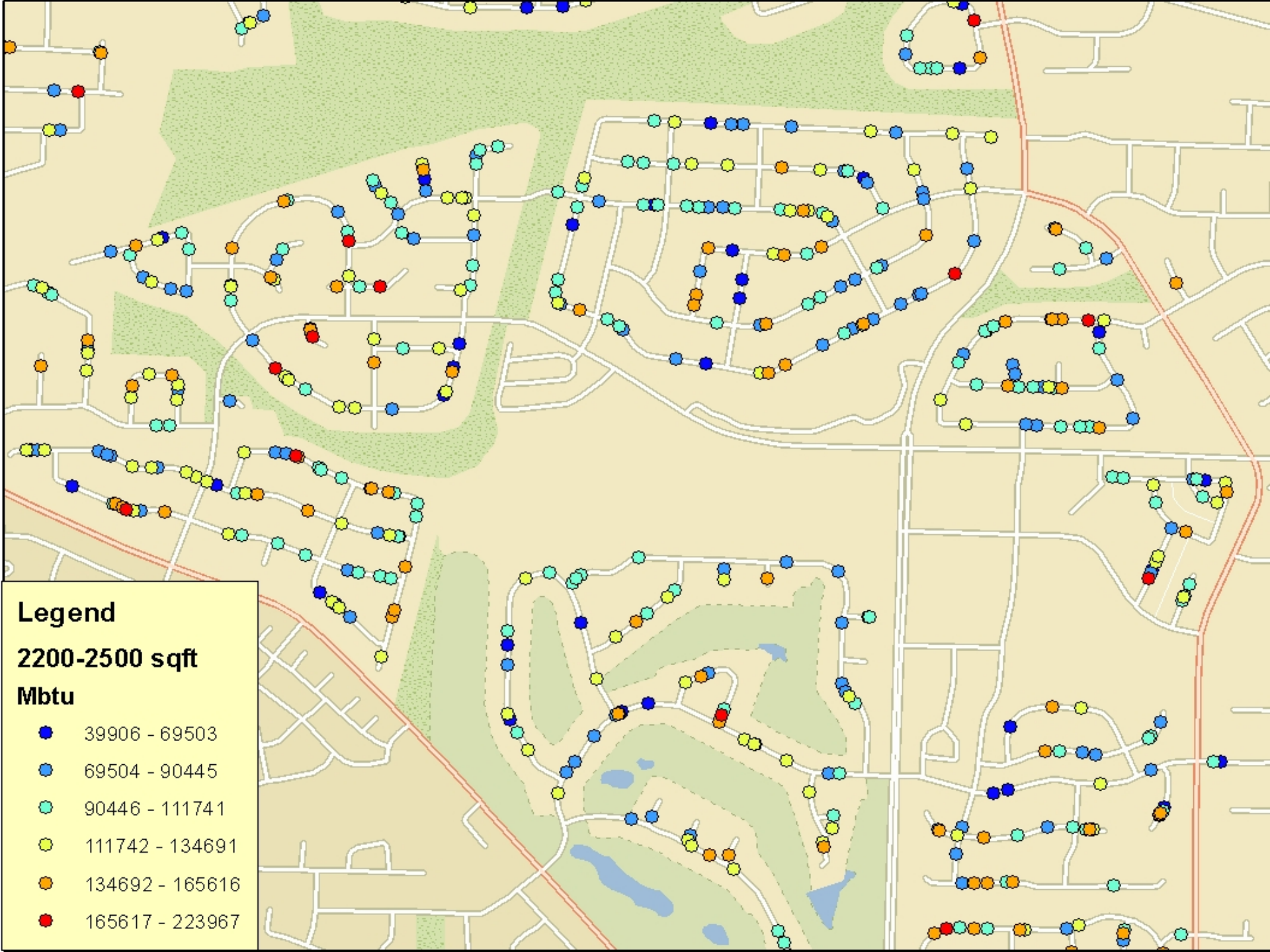


ONE OF THESE HOMES IS NOT LIKE THE OTHER

Residential Consumption Variability
November 18th 2013



Legend

2200-2500 sqft

Mbtu

●	39906 - 69503
●	69504 - 90445
●	90446 - 111741
●	111742 - 134691
●	134692 - 165616
●	165617 - 223967

OUTLINE

- » Quantify variance of energy consumption within homogeneous segments of homes
- » Analyze and compare distributions across segments
- » Identify causes of variability across segments
- » What this means for energy efficiency

THE DATA

- » Weather normalized **billing data**
- » **Tax assessor data** with square footage and year built
- » **Census data** (2000) to estimate socioeconomic indicators

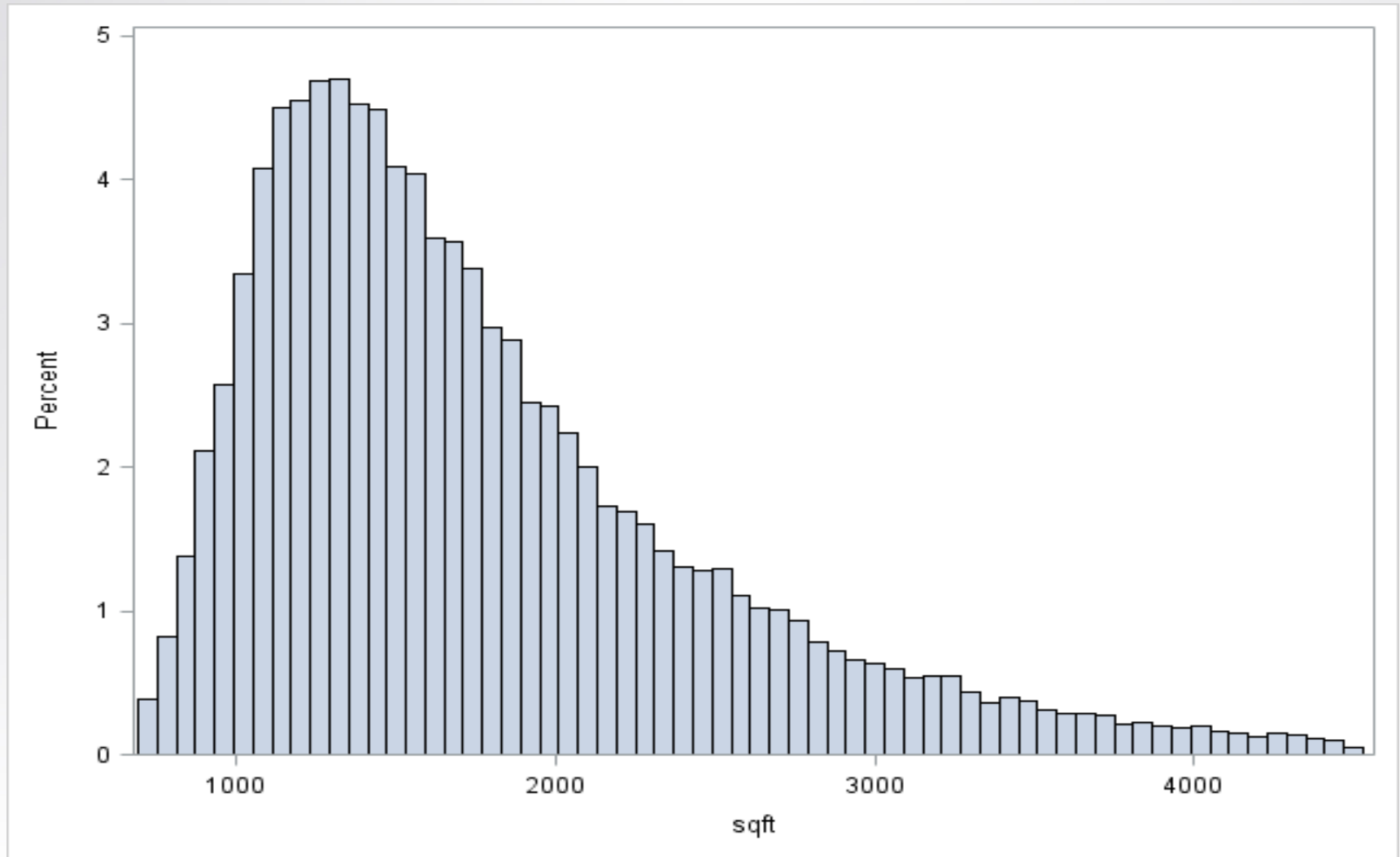
THE SAMPLE

- » 150,000 homes in a mostly urban area in a western state
- » 70,000 homes in a mostly urban area in an eastern state
- » **Gas heated homes** whose gas and electric consumption are matched to other data sources

HOMOGENEOUS SEGMENTS

- » Creating homogeneous groups of homes is most important part of analysis
- » Homes manually segmented on home size and vintage, two important elements that drive energy consumption
- » Homes segmented by home size in 300 sqft intervals
- » Homes are segmented by 20 year intervals

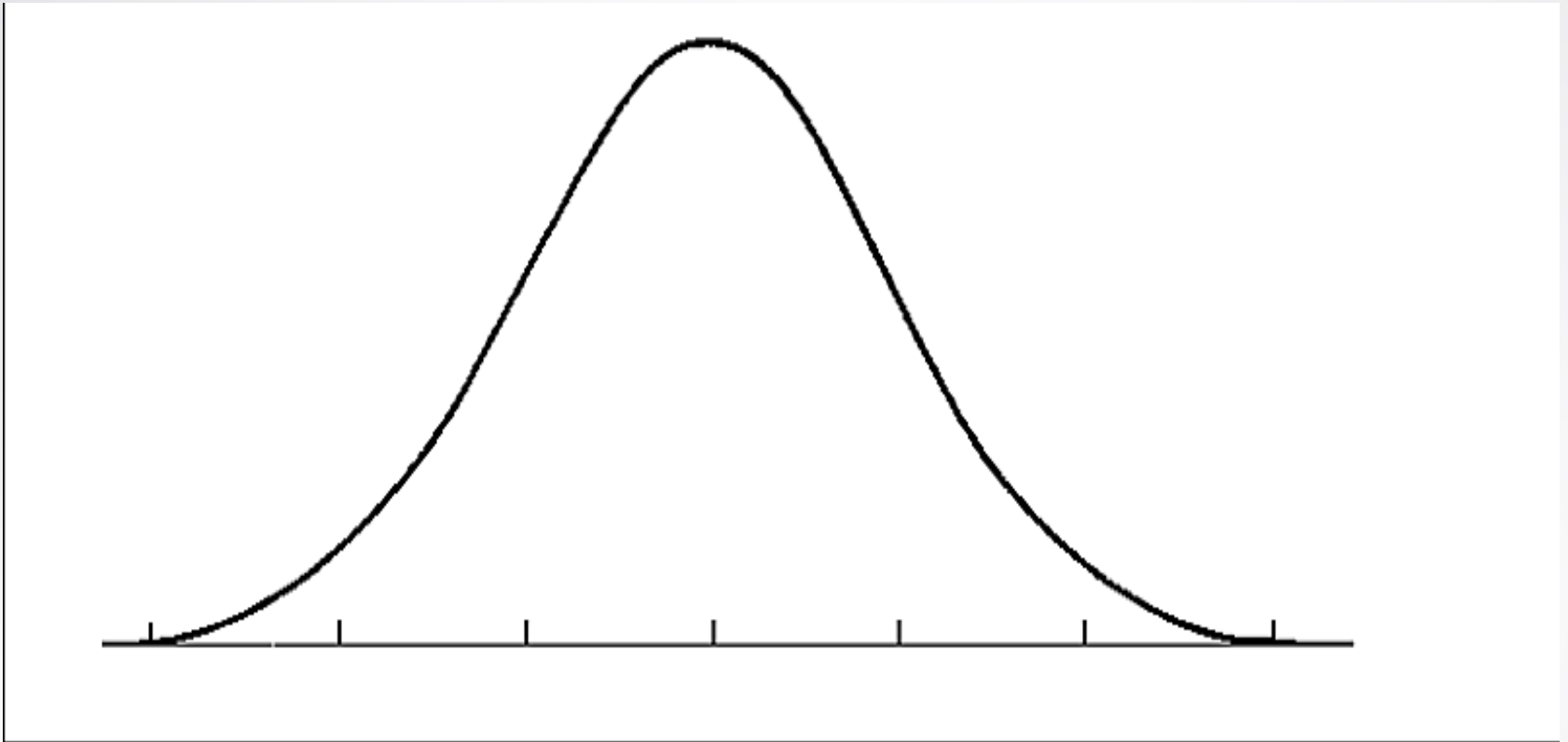
WESTERN SAMPLE HOME SIZE



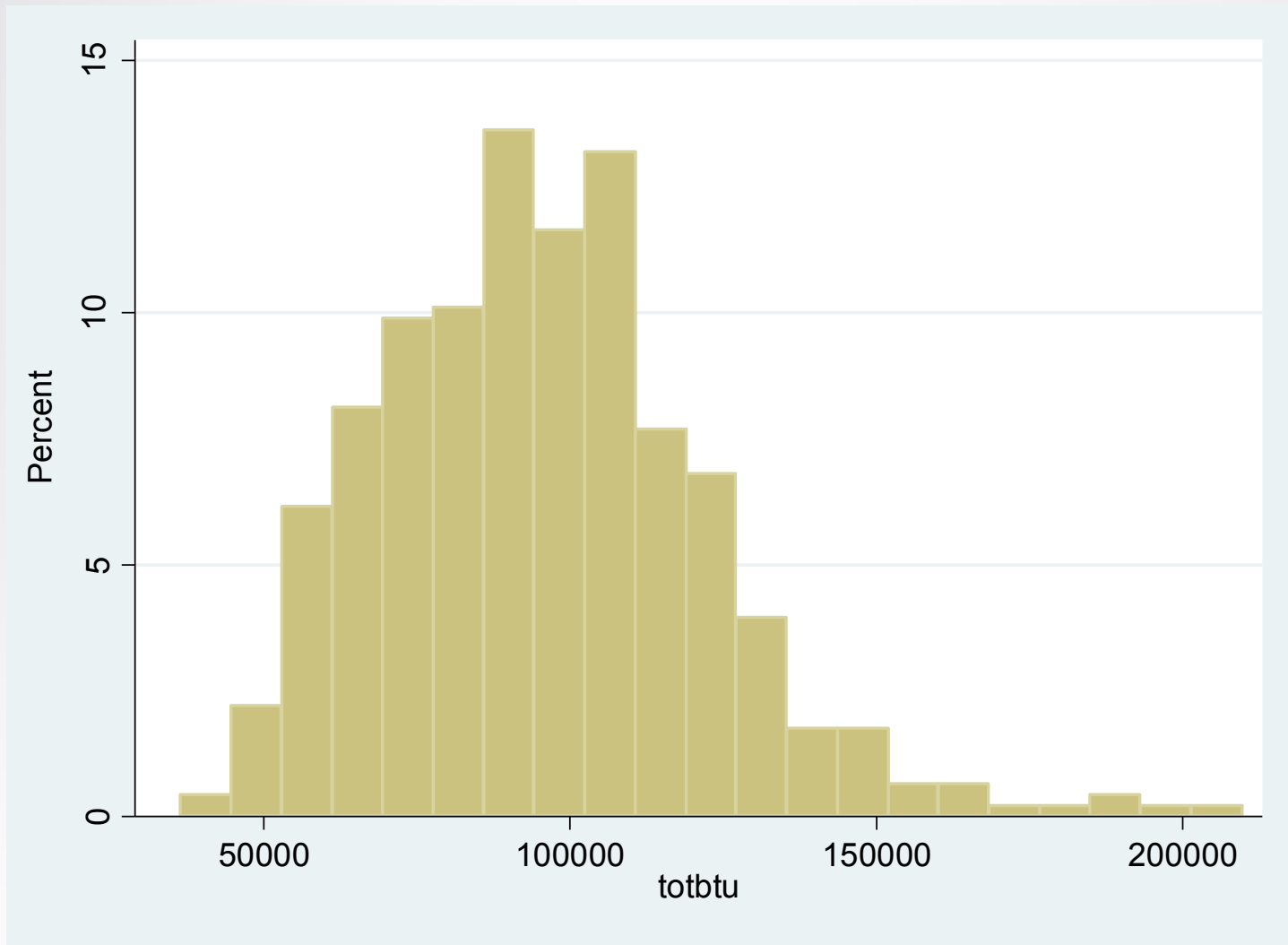
HOMOGENEOUS SEGMENTS

- » Sub segments created using a statistical k-medians cluster analysis using socioeconomic indicators from census
- » 362 segments in Western sample with an average of 400 homes per segment
- » 307 segments in Eastern sample with an average of 240 homes per segment
- » Segment sizes vary from 51 to 2,495

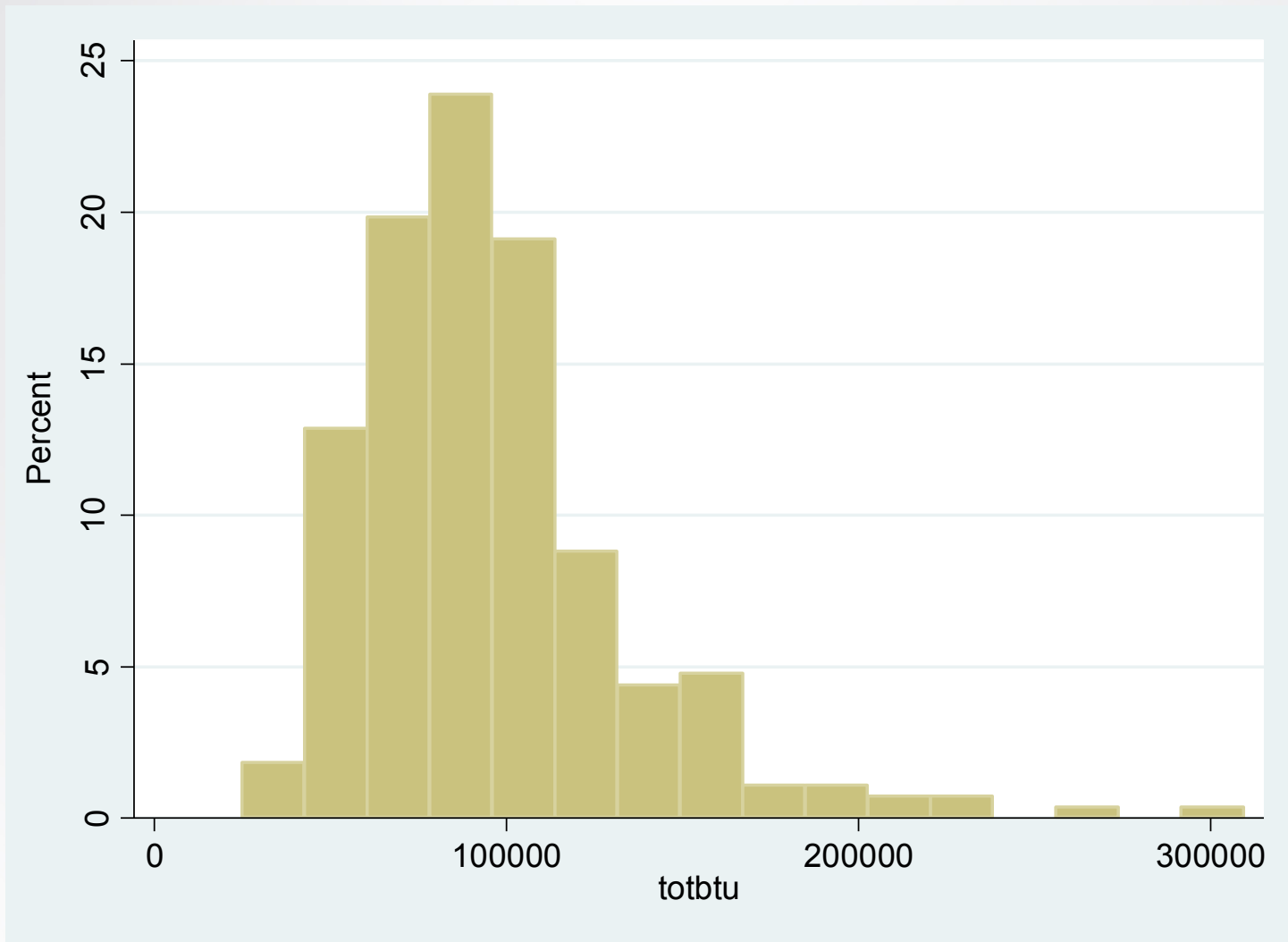
STATISTICS 101



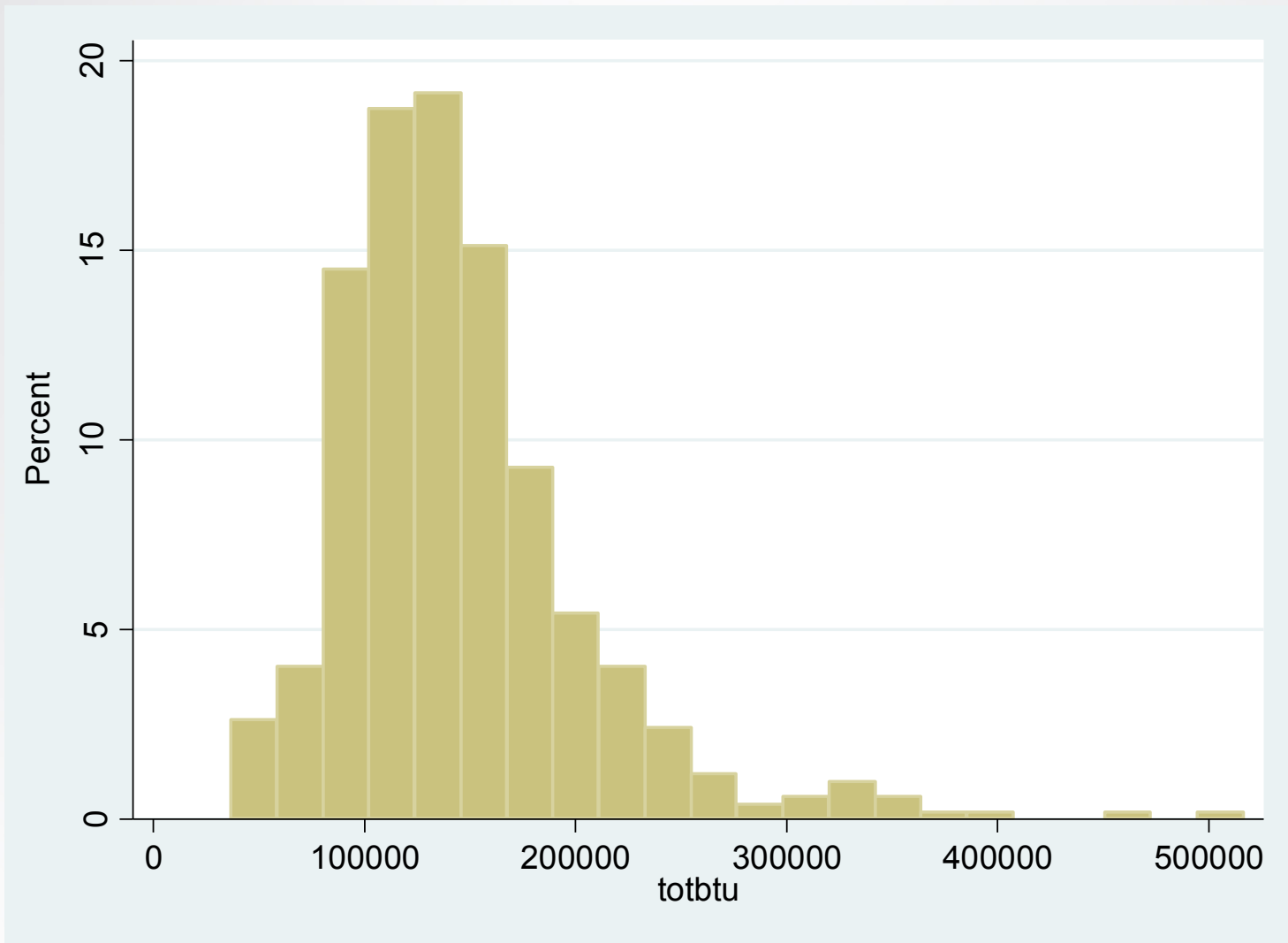
LOW VARIANCE



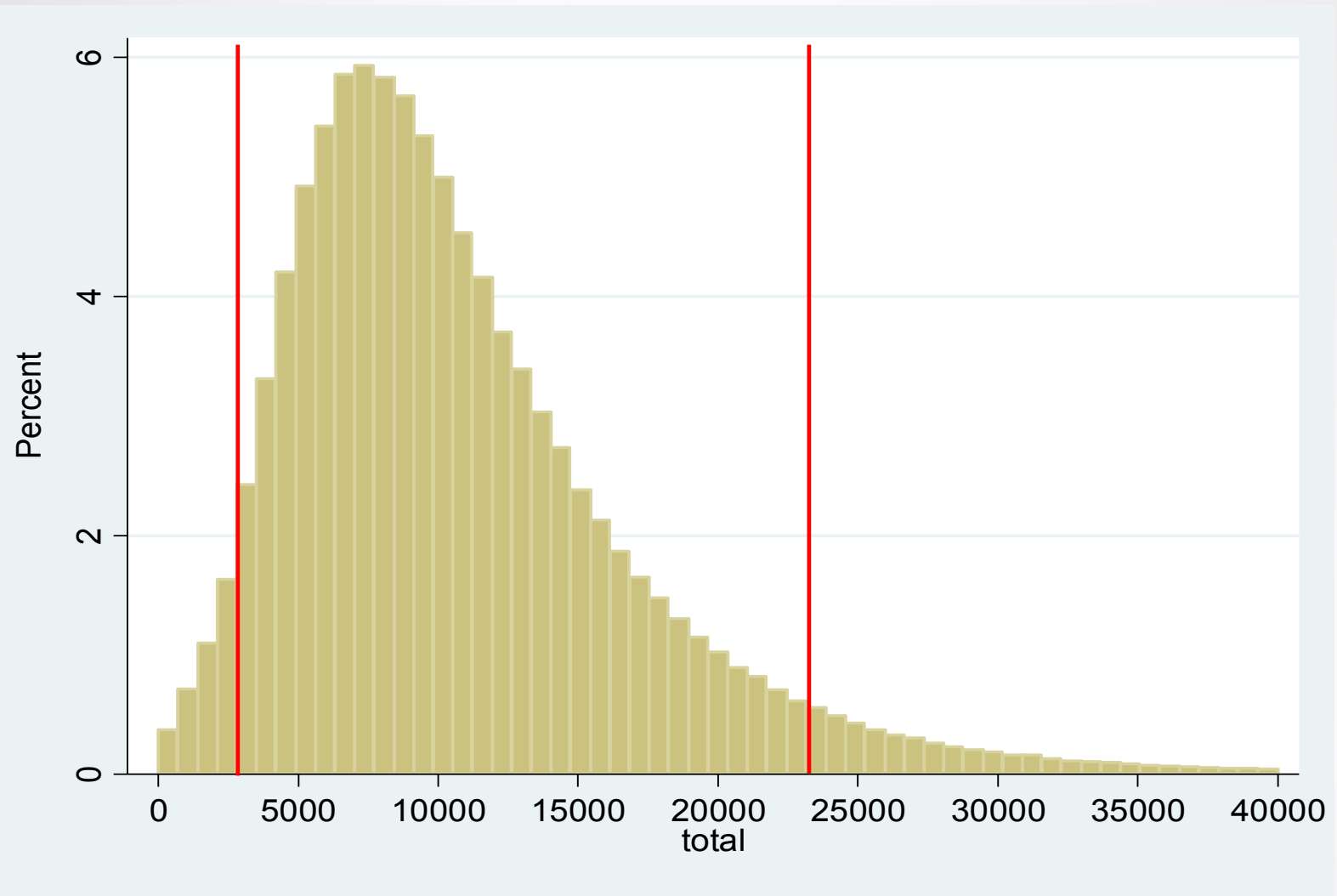
AVERAGE VARIANCE



LARGE VARIANCE



CUTTING OFF THE TAILS



WESTERN SAMPLE SPREAD

GAS CONSUMPTION



ELECTRIC CONSUMPTION



TOTAL ENERGY
CONSUMPTION



EASTERN SAMPLE SPREAD

GAS CONSUMPTION



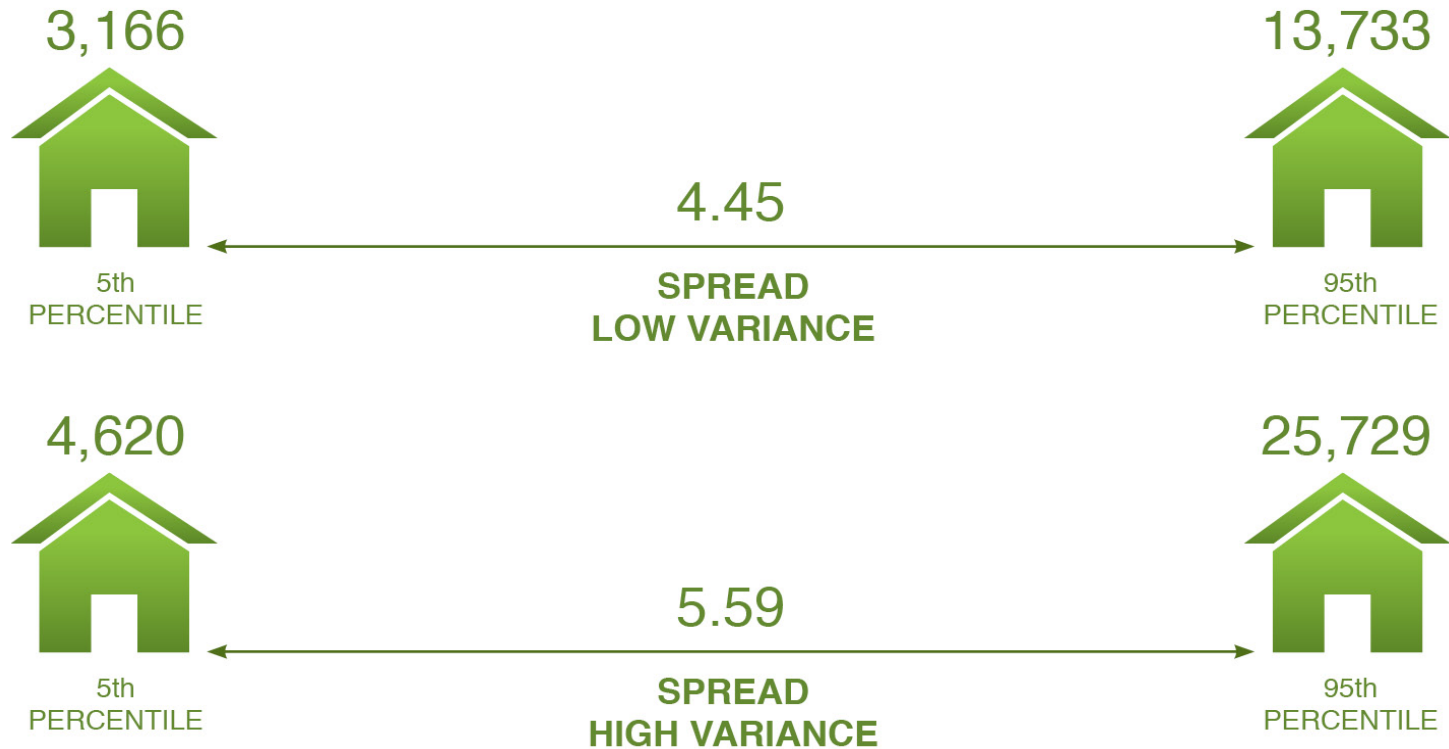
ELECTRIC CONSUMPTION



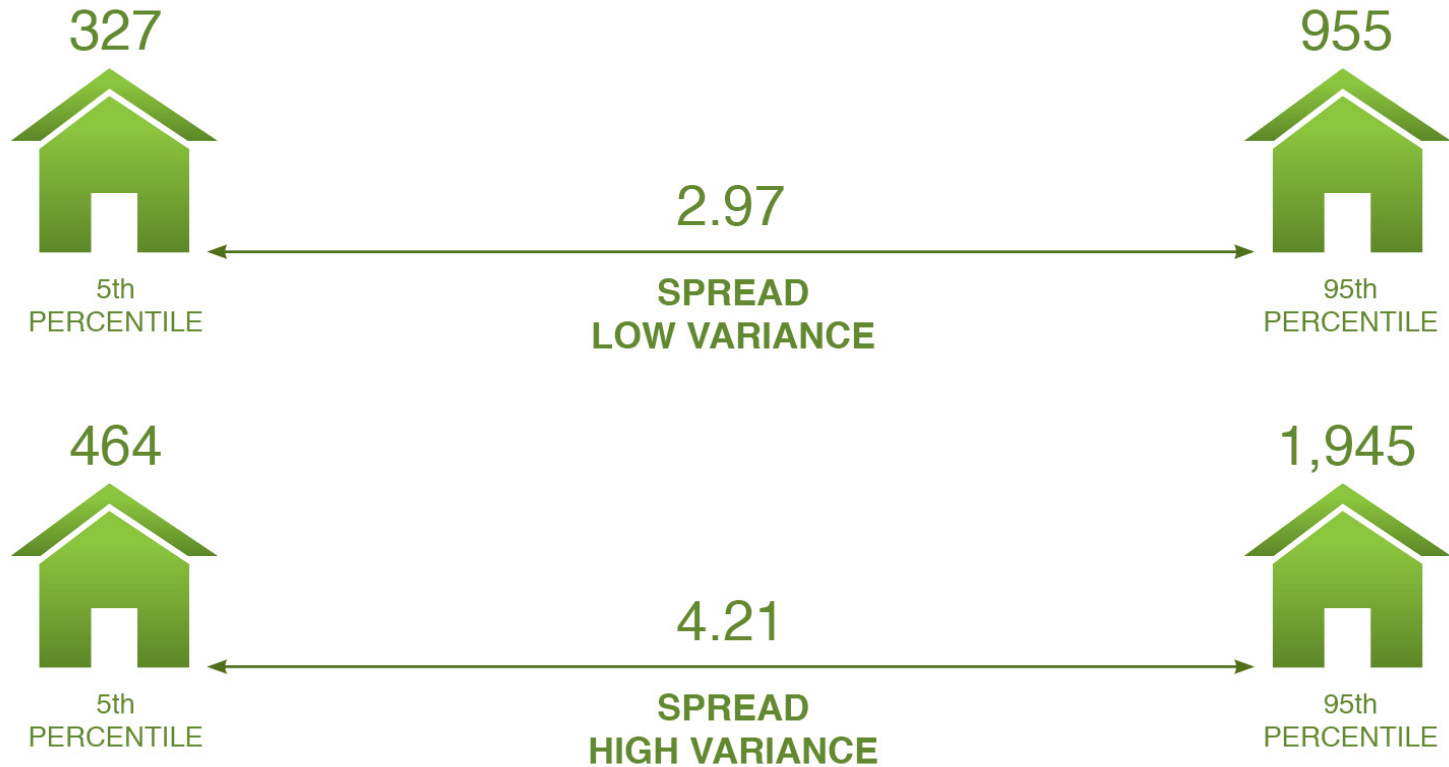
TOTAL ENERGY
CONSUMPTION



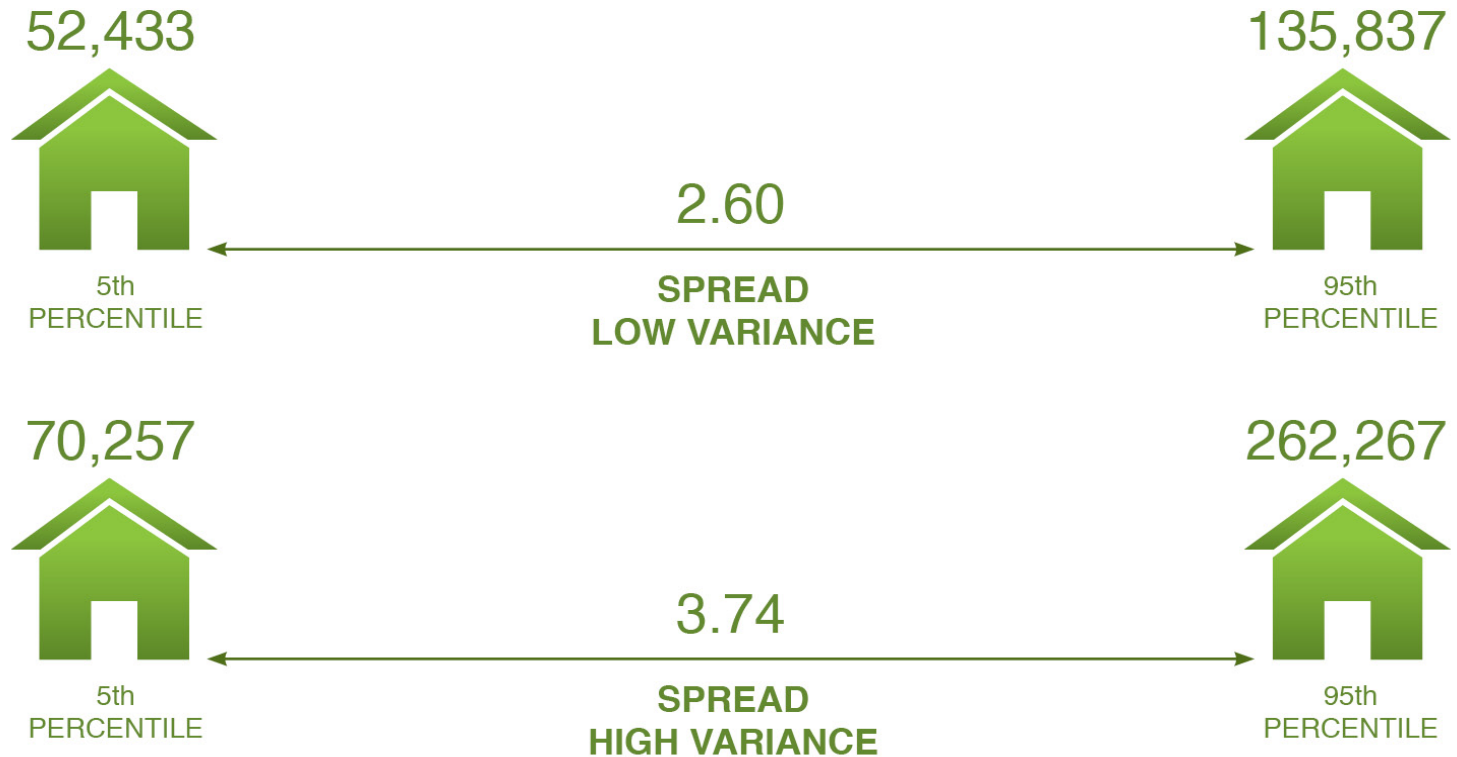
WESTERN SAMPLE ELECTRICITY



WESTERN SAMPLE GAS

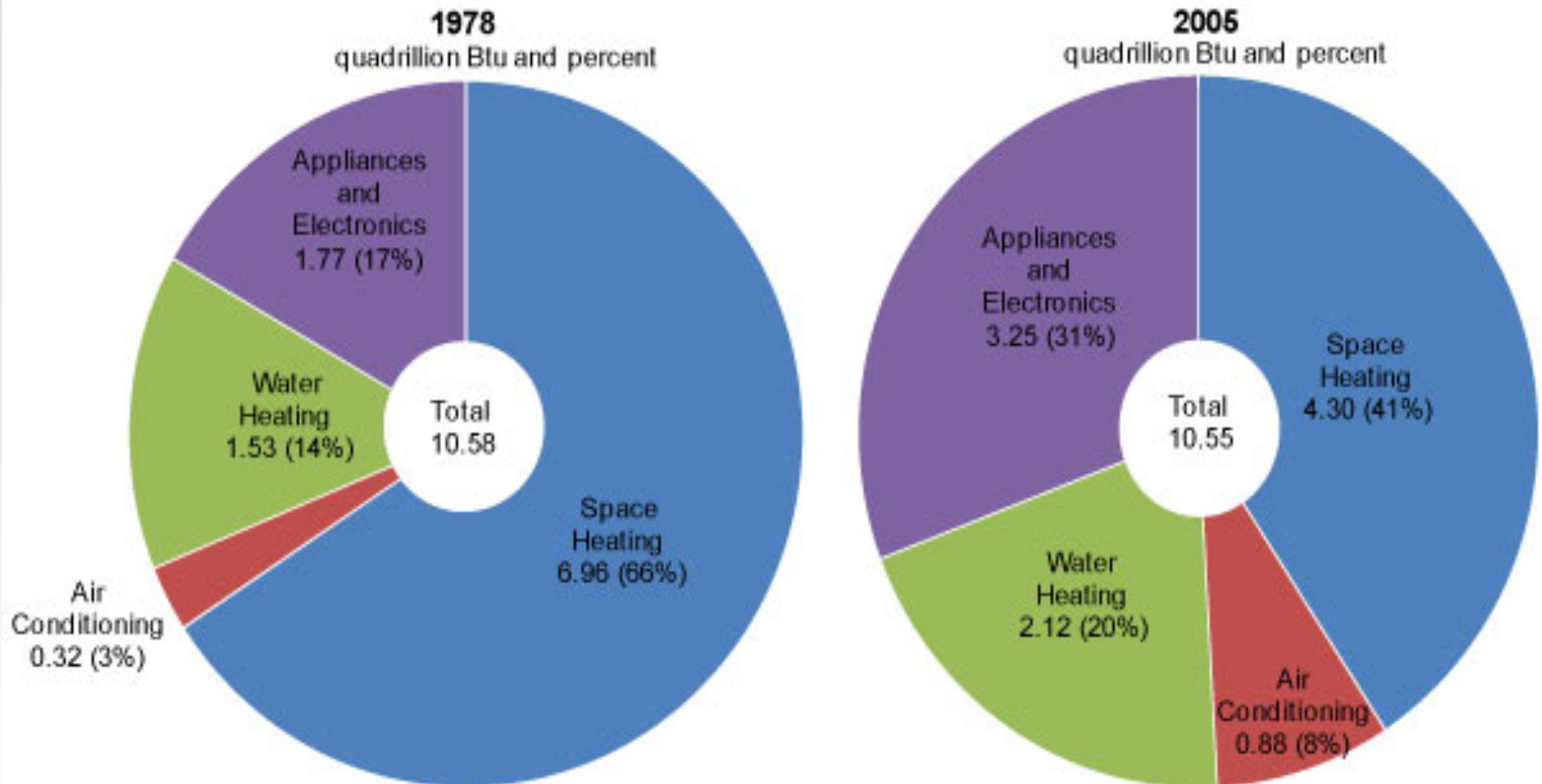


WESTERN SAMPLE TOTAL ENERGY



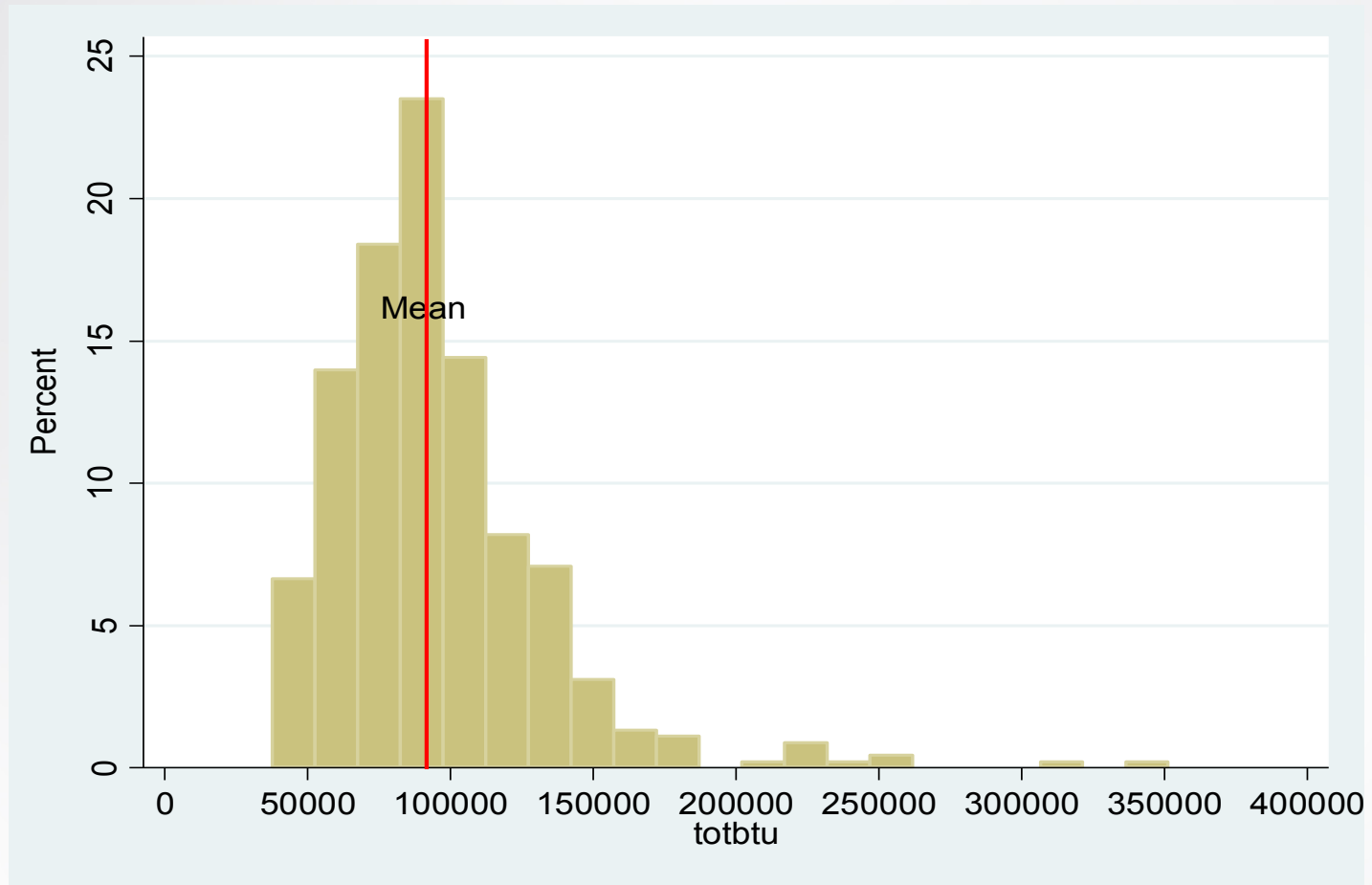
CONSUMER ELECTRONICS ON THE RISE

Total energy use in homes

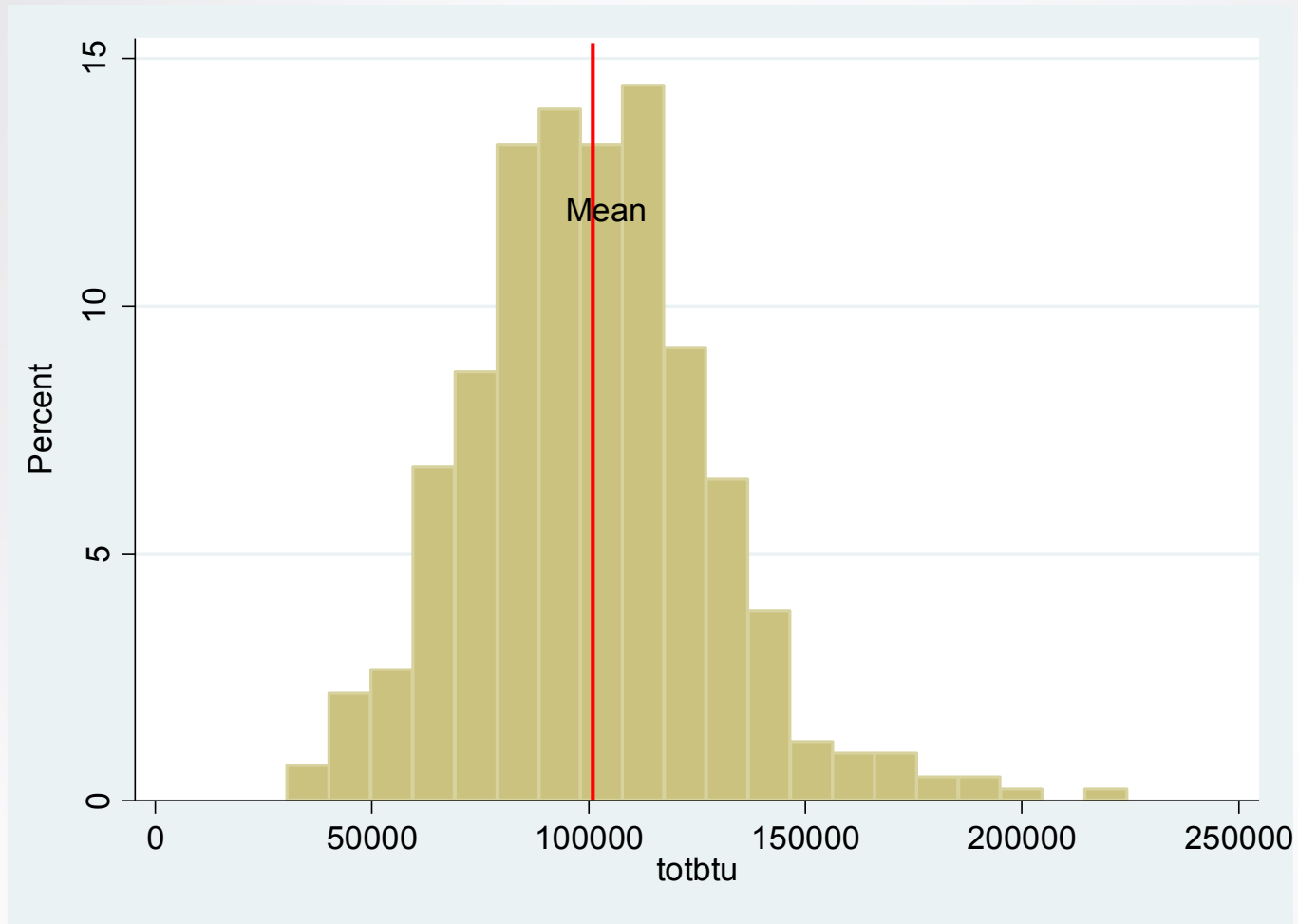


Source: U.S. Energy Information Administration, 1978 and 2005 Residential Energy Consumption Survey

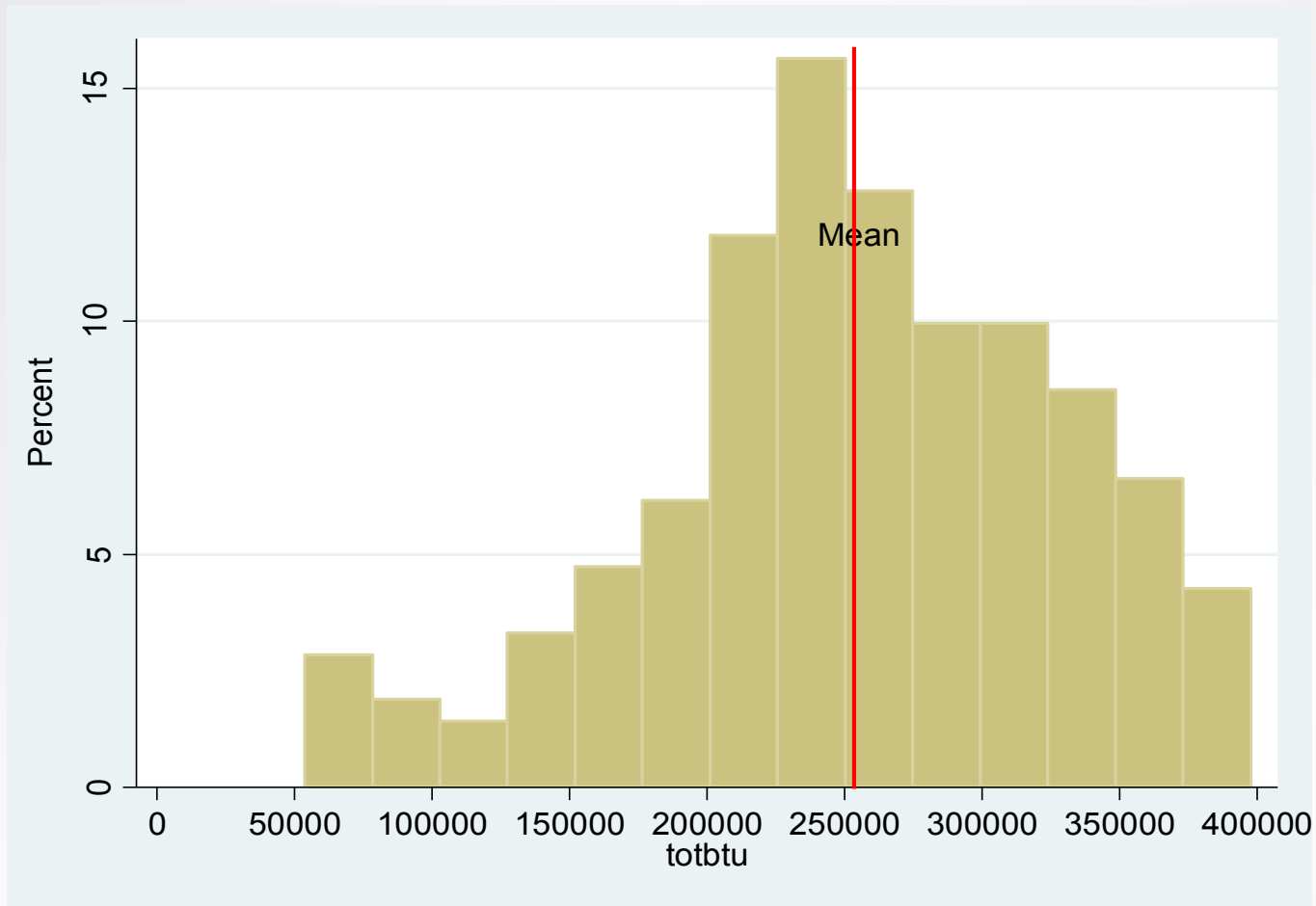
POSITIVE SKEWNESS



LESS POSITIVE SKEWNESS



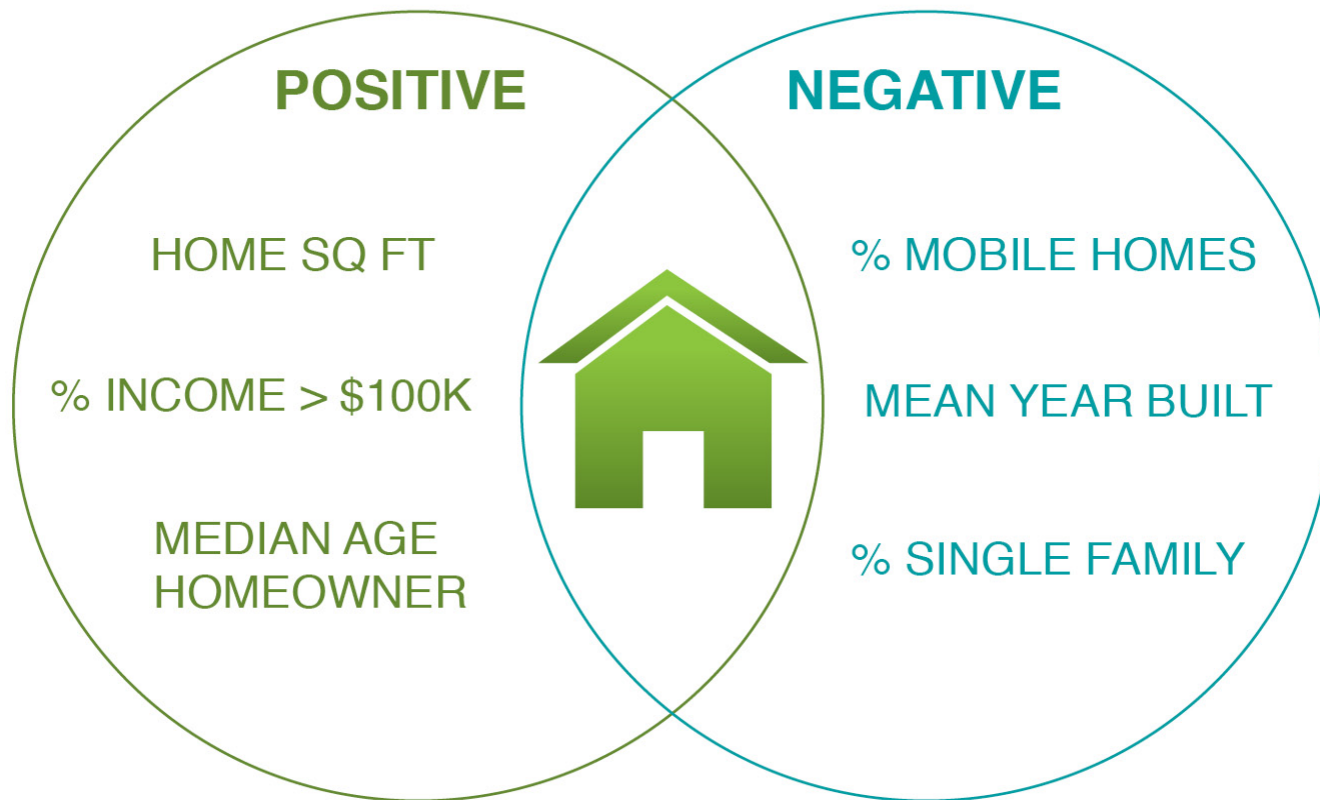
NEGATIVE SKEWNESS



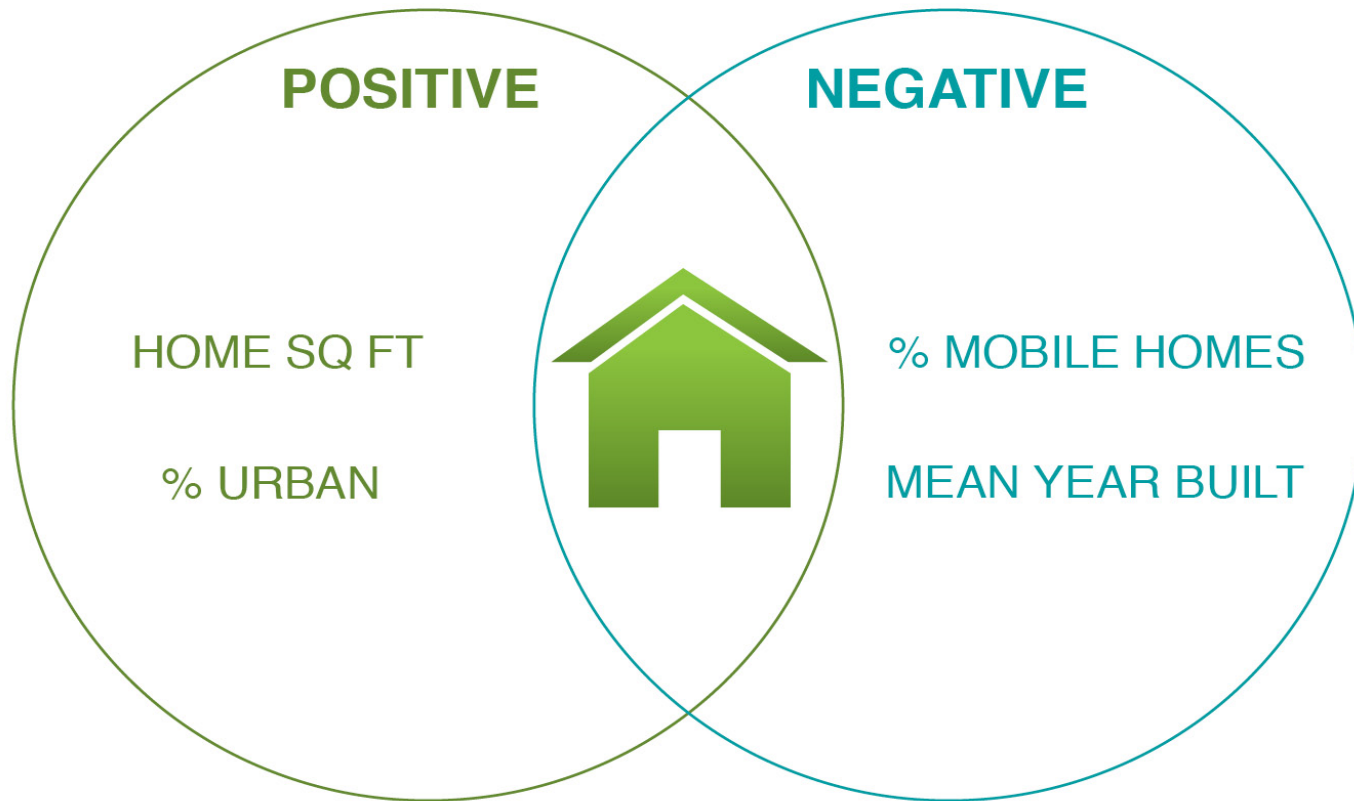
SKEWNESS

	N	Average	St. Dev.	Min	Max
West	362	1.04	0.32	0.37	2.54
East	305	0.39	0.41	-0.84	2.08

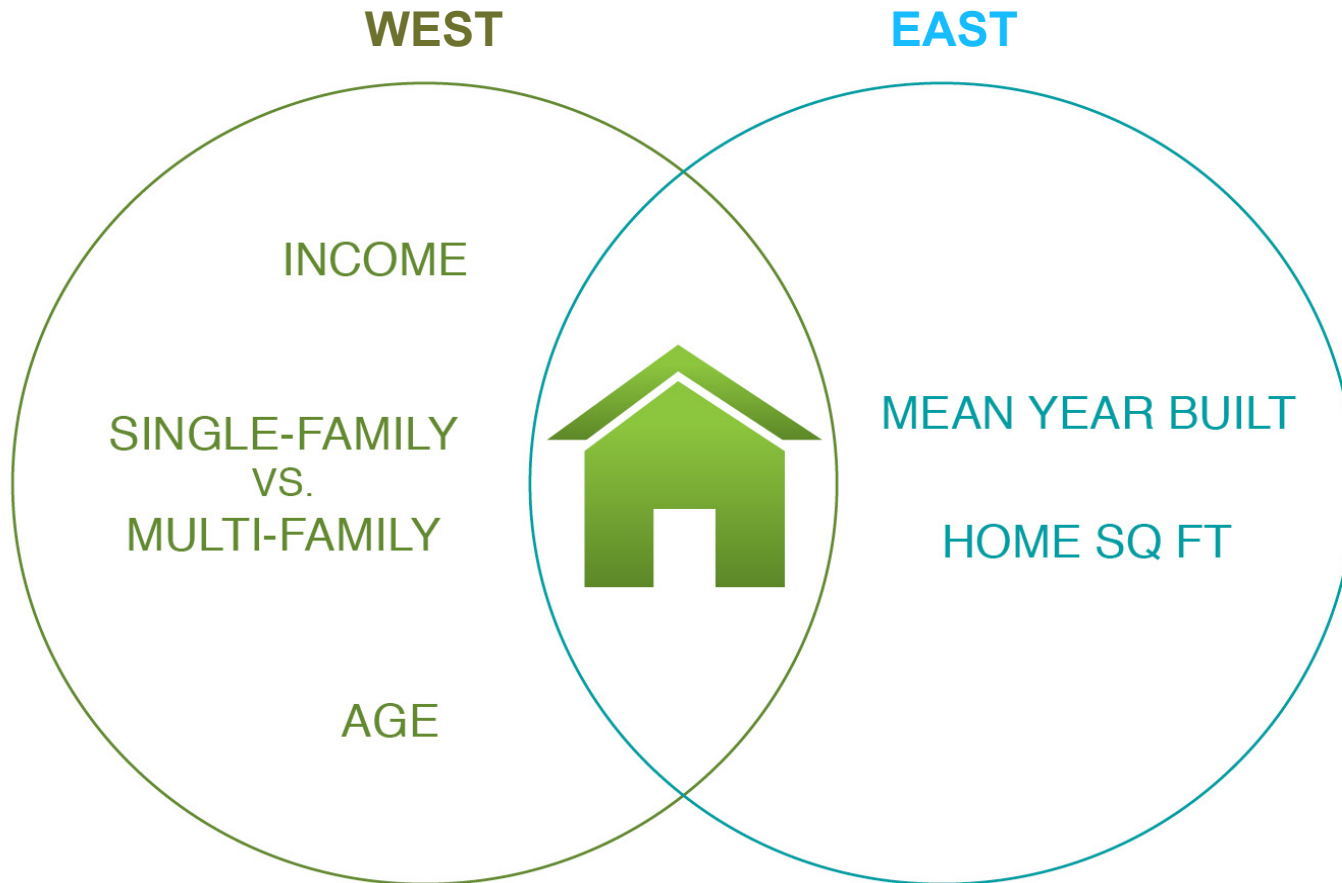
WESTERN SAMPLE VARIABILITY MODEL



EASTERN SAMPLE VARIABILITY MODEL



VARIABILITY MODEL



PROGRAM PARTICIPATION

- » EE program participation increases with variance
- » Participants come from the whole distribution
- » Participants are diverse

SEGMENTED APPROACH

- » Segmented marketing and program design will produce more effective behavioral programs
- » Study small, average, and large users of energy
- » Will require site visits, surveys, and interviews

WHAT CAN WE LEARN FROM OTHER INDUSTRIES?

- » Political Campaigns
- » Retail Sales
- » Insurance
- » Healthcare
- » Facebook

THANK YOU



PHILLIP KELSVEN – ENERGY CONSULTANT

phillip.kelsven@itron.com

503.358.3920

www.itron.com