

Housing and Plug Load Trends: Updates from the Residential Energy Consumption Survey



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U.S. Energy Information Administration

Large Public Power Council Rate Committee Meeting

Madison, Wisconsin

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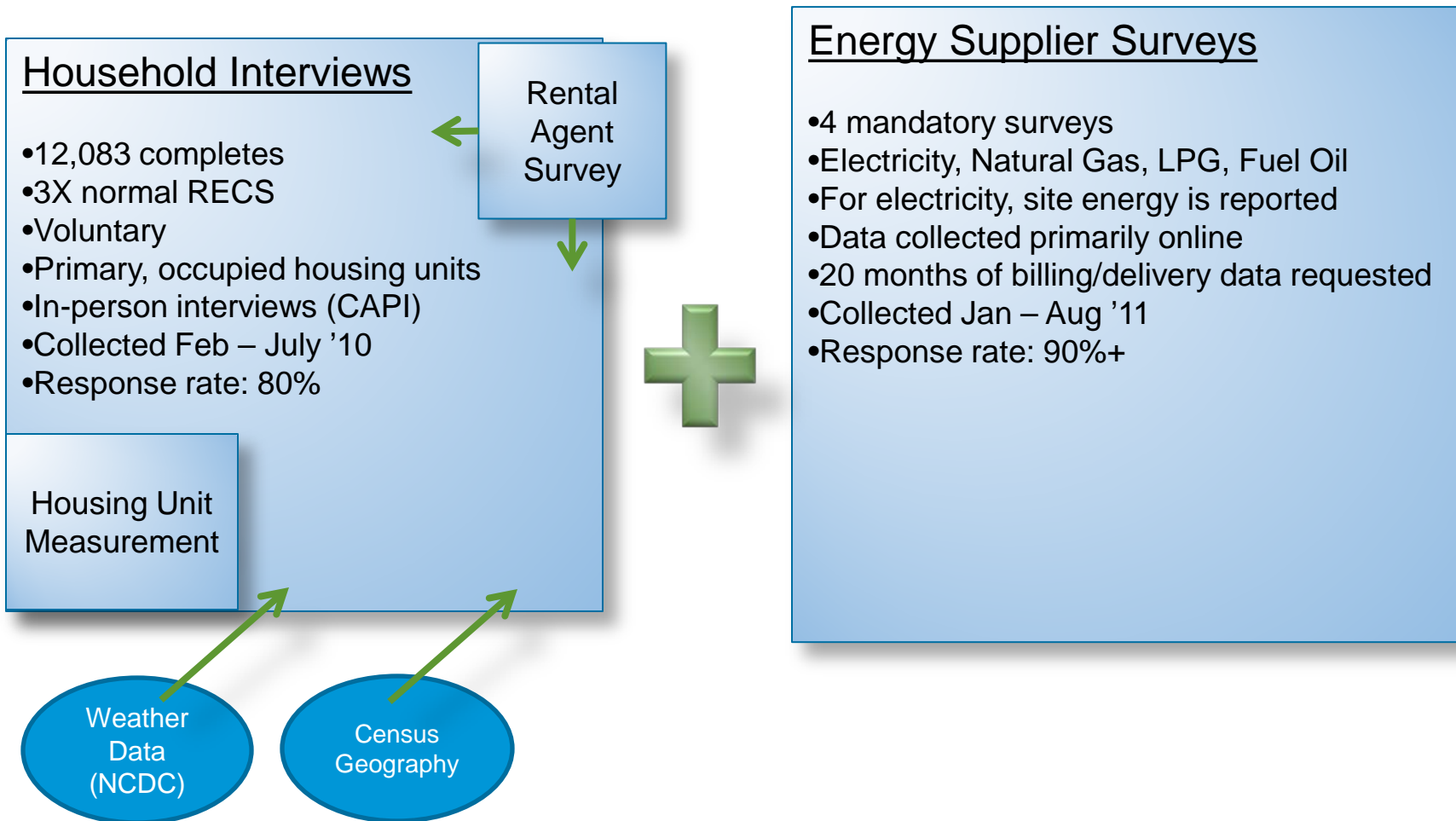
Agenda

- I. RECS Overview
- II. 2009 RECS Data and Trends: Tables and Highlights
- III. RECS Data Availability and Micro Data
- IV. Feedback to EIA

RECS History

- The only comprehensive source of national-level data on energy related characteristics and consumption for occupied U.S. homes.
 - Produces estimates for U.S., Census Regions and Divisions, States, and groups of States.
- The only survey in EIA that collects household data.
- First conducted in 1978. Periodic and is now conducted every 4 years.

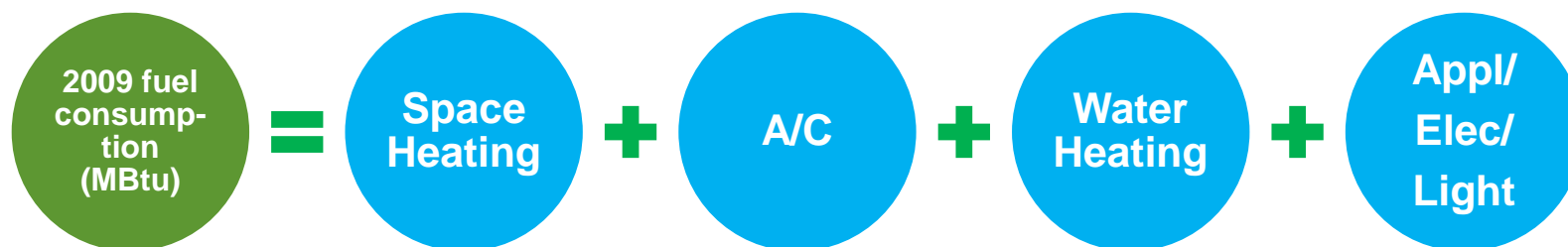
2009 RECS Data Collection



2009 RECS Timeline

	2009						2010												2011												2012																			
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12								
Household Survey																																																		
Sample Design and Listing	X	X	X	X	X	X	X																																											
Data Collection							X	X	X	X	X	X	X	X																																				
Editing								X	X	X	X	X	X	X	X	X																																		
Imputation and Weighting									X	X	X	X	X	X	X	X	X																																	
Characteristics Dissemination																X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
Energy Supplier Surveys (ESS)																																																		
Pre-Survey Activities															X	X	X	X	X	X																														
Data Collection																X	X	X	X	X	X	X	X	X	X	X	X																							
Editing																					X	X	X	X	X	X	X	X	X																					
Consumption and Expenditures (C&E) Estimates																																																		
Annualization/Imputation																					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
End-Use Modeling																												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
C&E Dissemination																																																		

Characteristics and supplier data feed into end-use consumption and expenditure models

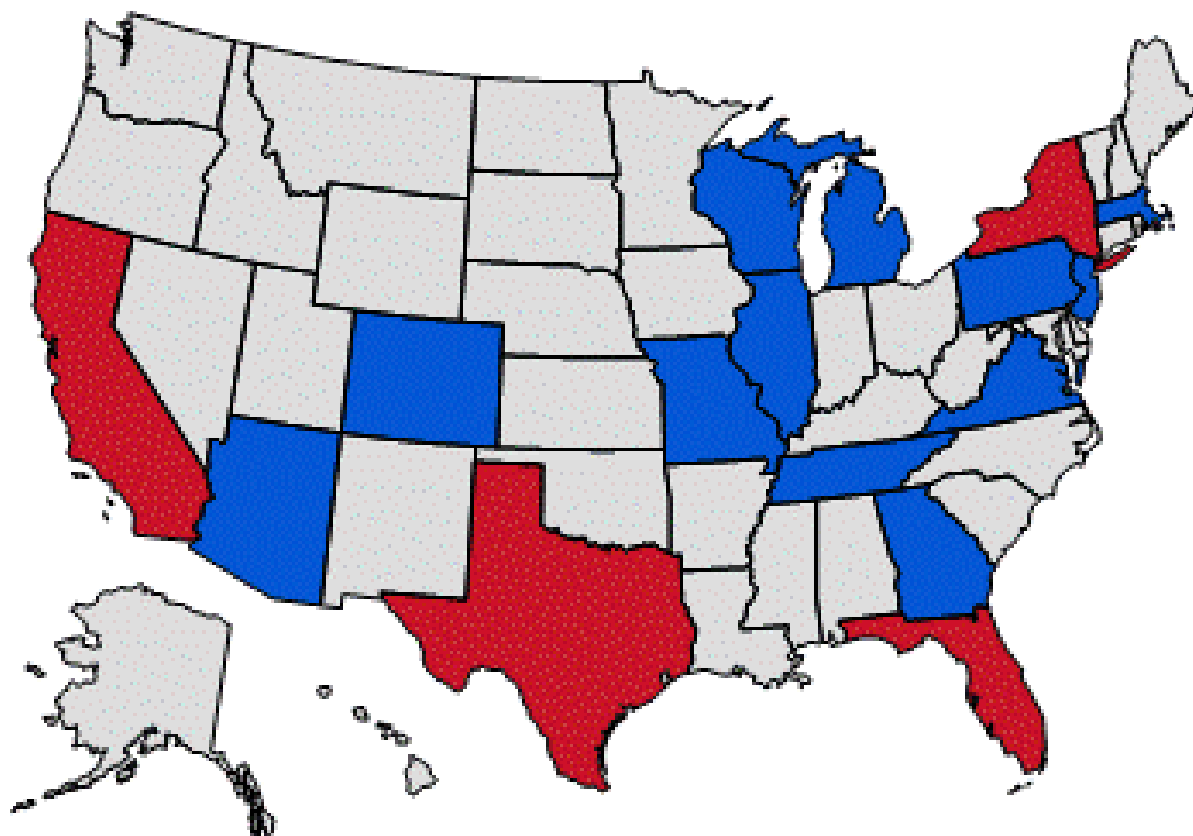


FUEL MODEL	SP Heat	A/C	W Heat	Appl/Elec/Light
EL	X	X	X	X
NG	X		X	X
LPG	X		X	X
FO	X		X	
KE	X			

RECS captures **WHAT** devices consume energy, **HOW** the household consumes them, and **HOW MUCH** energy they consume

- Space Heating (Main and Secondary)
- Air-Conditioning (Central and Room)
- Water Heating
- Appliances (Kitchen, Clothes Washing, etc)
- Electronics (TVs, Set-top Boxes, PCs, etc)
- Lighting and other uses

Coverage for 2009 RECS expanded to include estimates for 16 states



Red: Historical RECS states (4)

Blue: Additional states for 2009 RECS (12)

Estimates produced for groups of remaining states
Ex: NC/SC

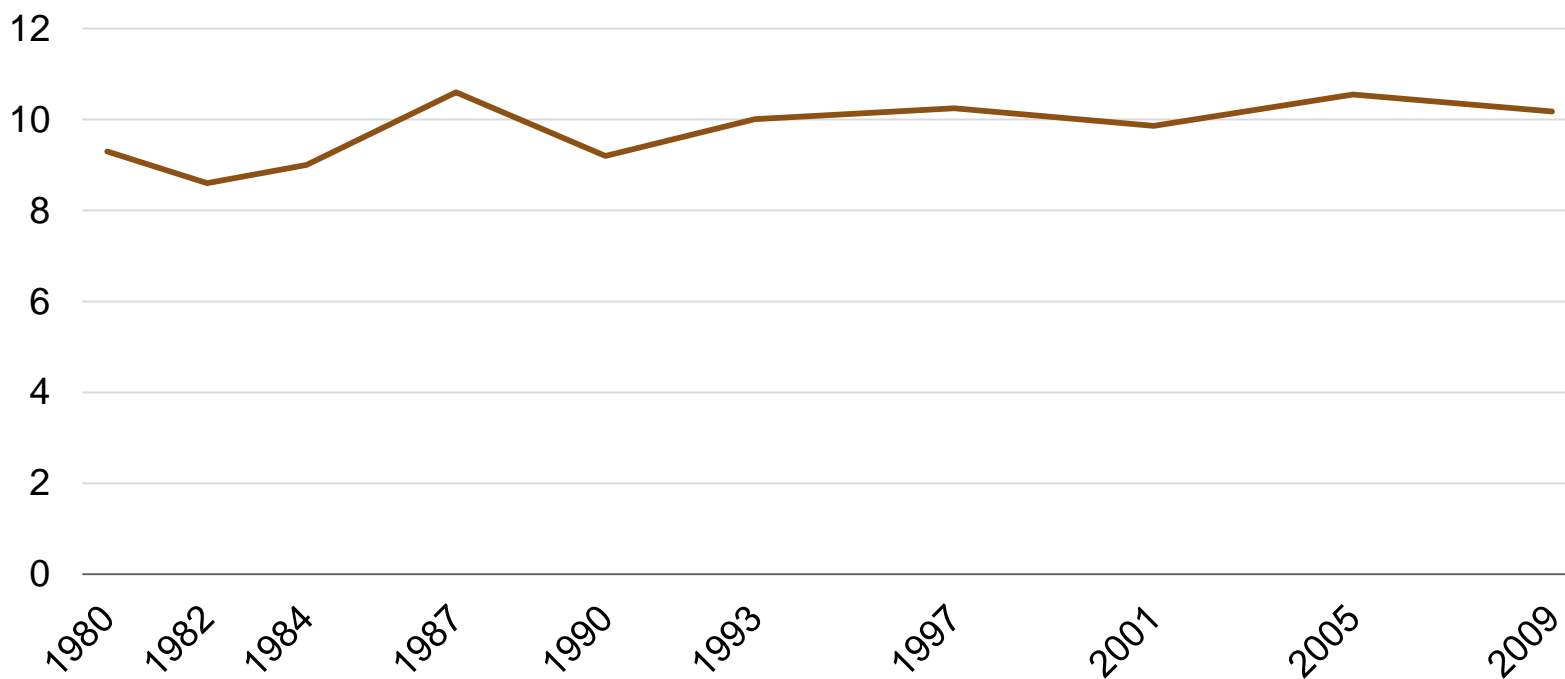
EIA produced two main sets of 2009 RECS data tables

1. [Household Characteristics](#): counts of households using fuels, equipment, etc.; behavioral characteristics; square footage
2. [Consumption and Expenditures](#): totals and averages by fuel and end uses

Total site consumption relatively flat over last 30 years

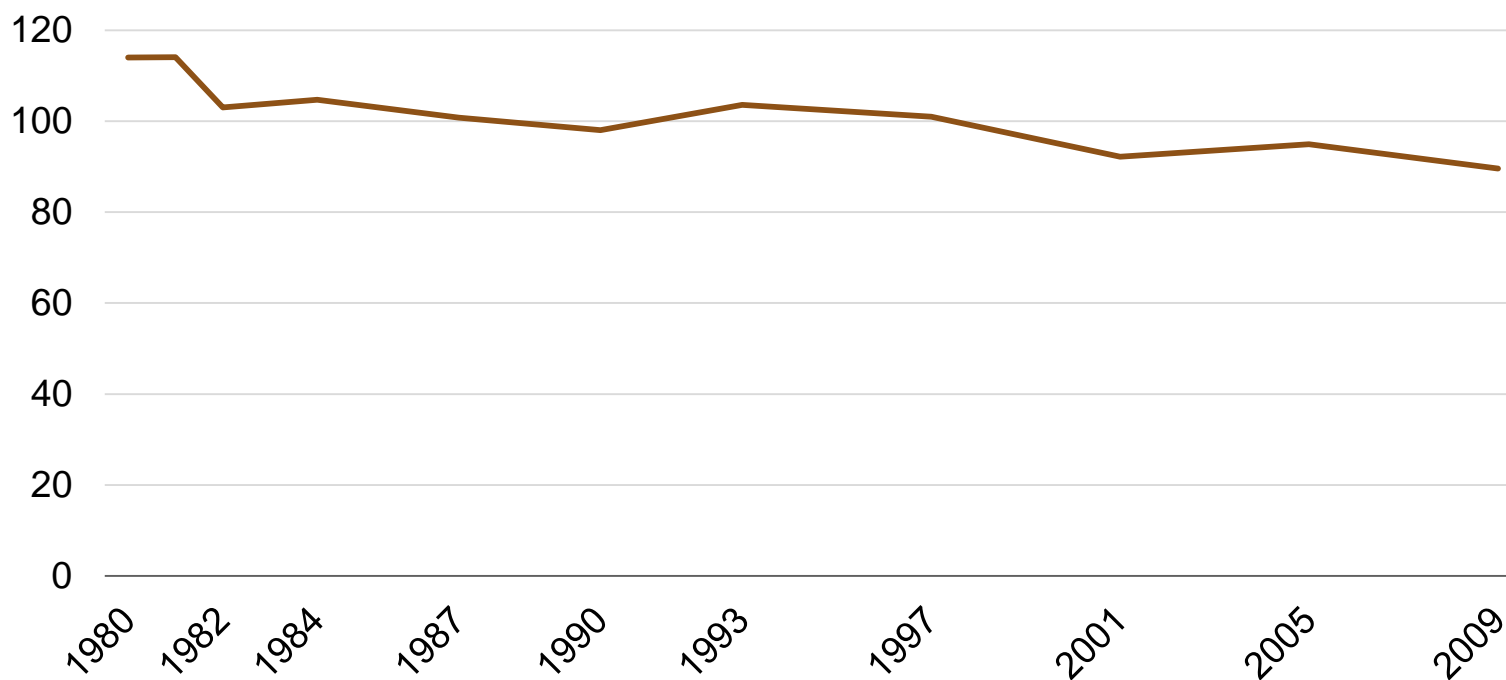
Total energy consumption in homes, 1980-2009

quadrillion Btu



Average site consumption trends downward

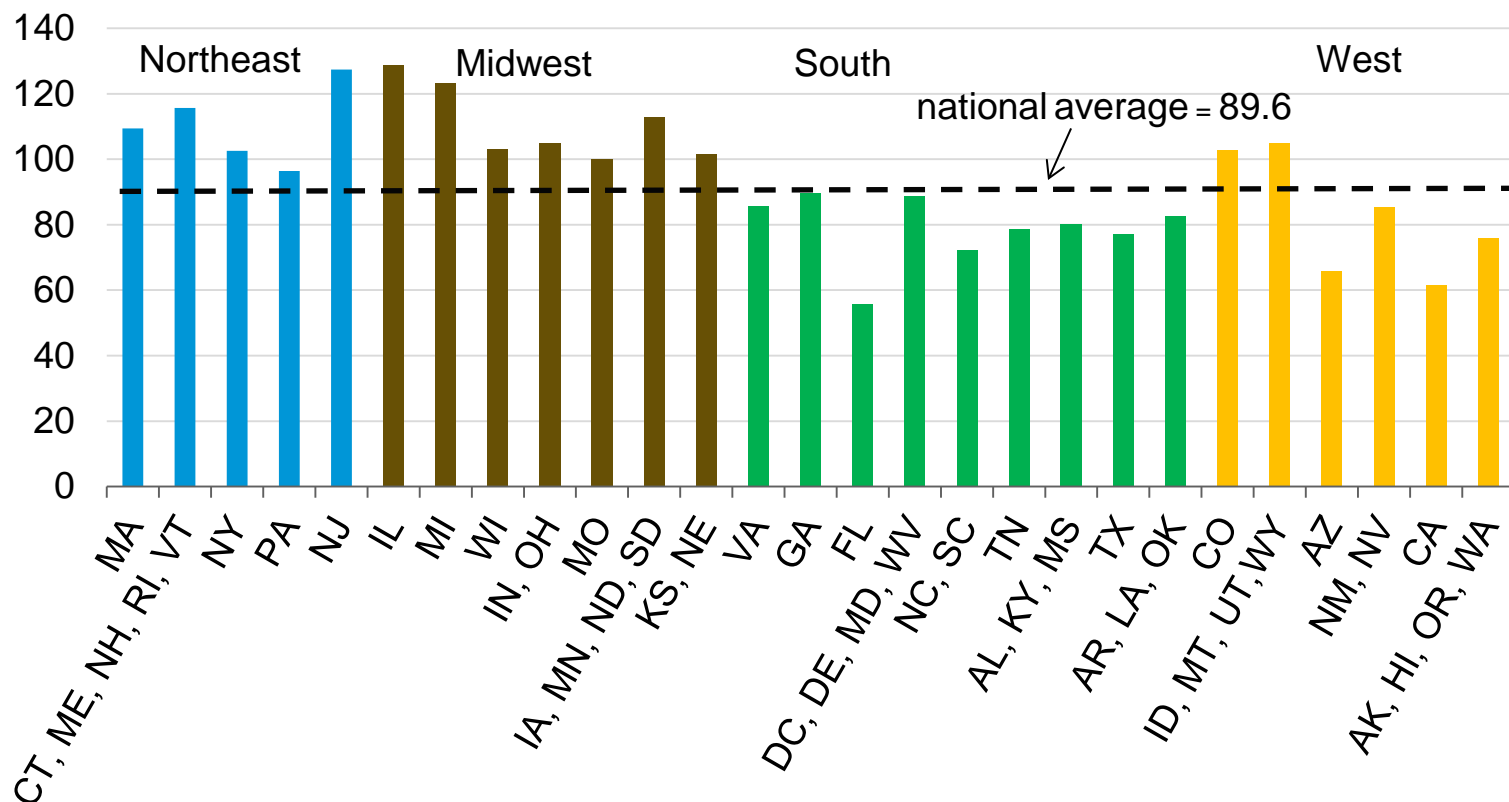
Average energy consumption per home
million Btu per housing unit



2009 RECS highlighted by more state-level data

Average home energy consumption for selected states, 2009

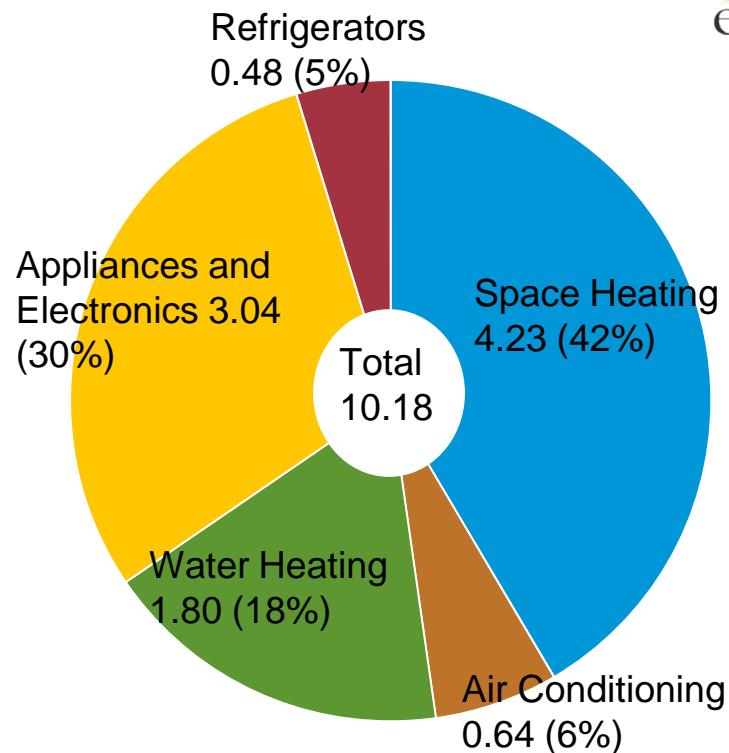
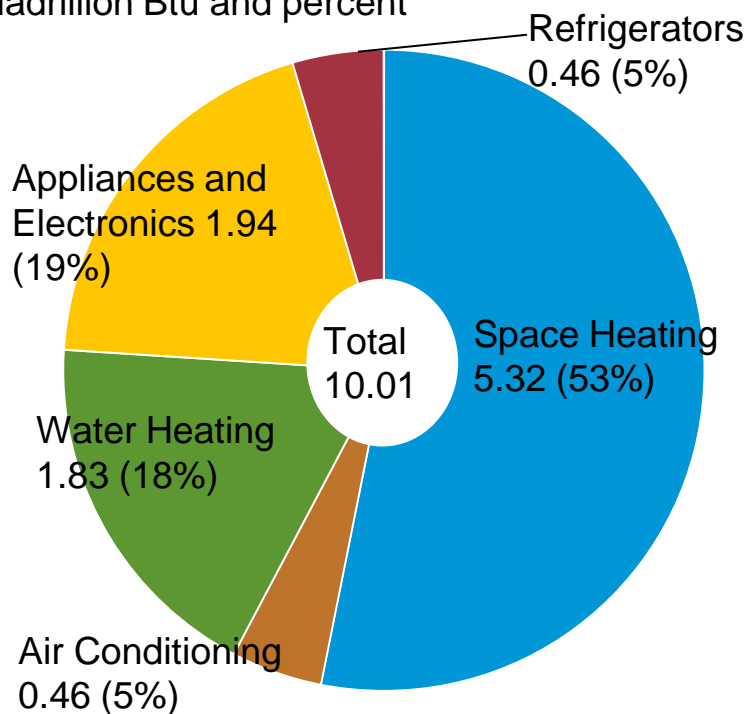
million Btu per housing unit



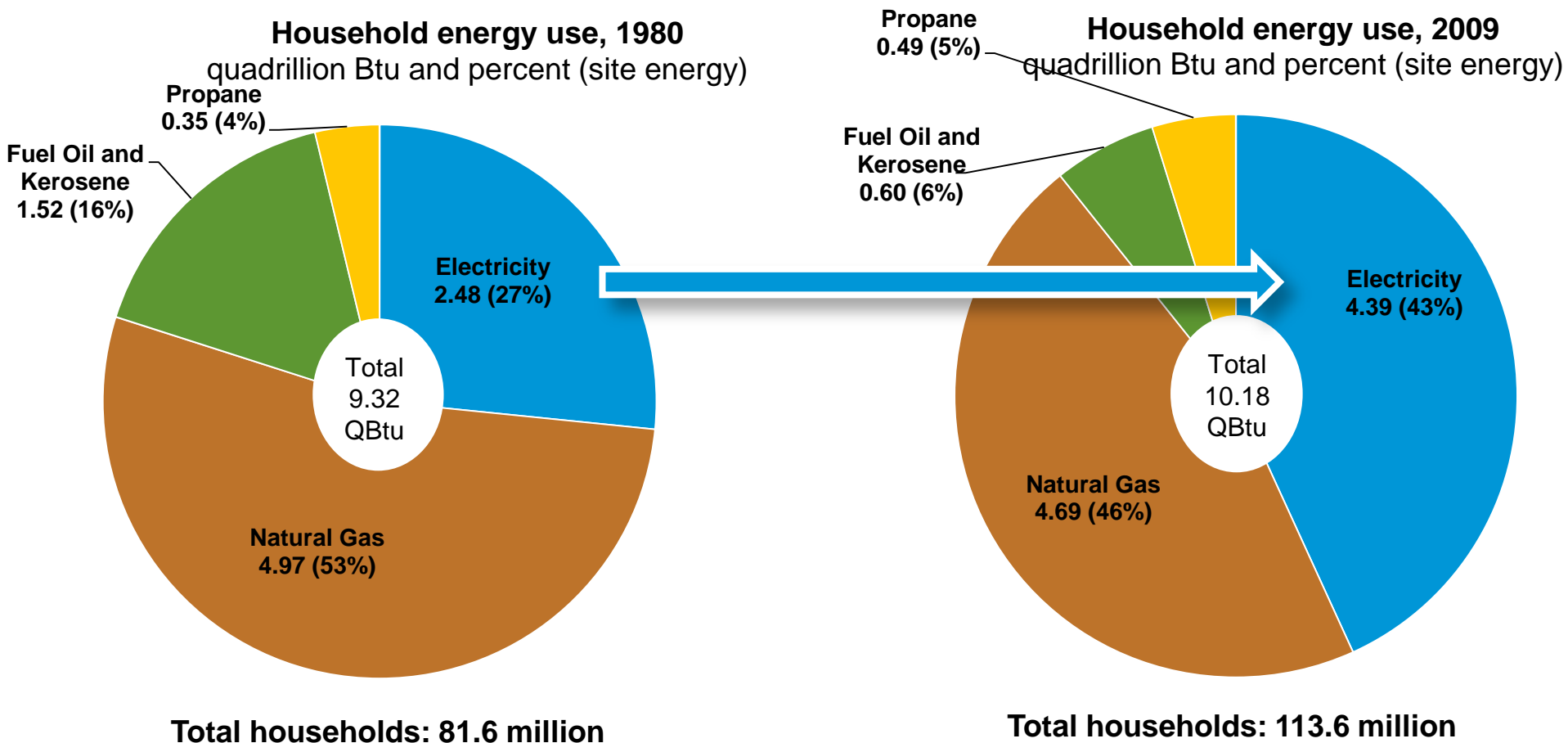
Shares of energy end uses have changed significantly

Total energy use in homes, 1993 and 2009

quadrillion Btu and percent

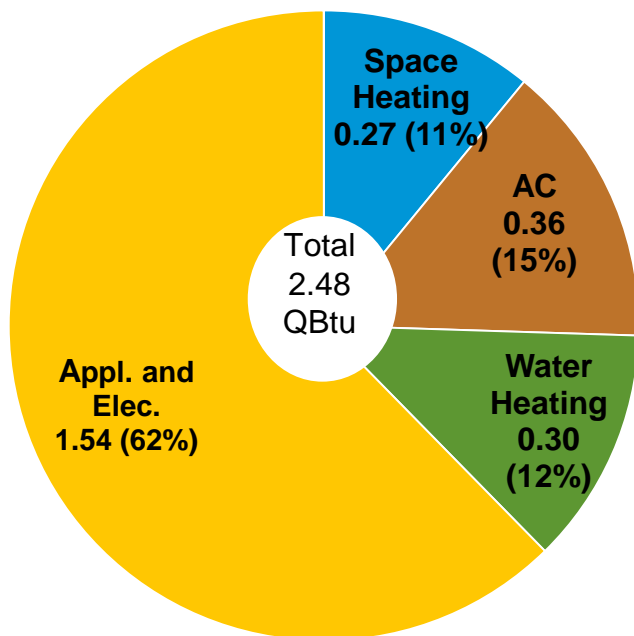


As total household consumption has remained relatively constant, the **shares** by fuel have changed substantially

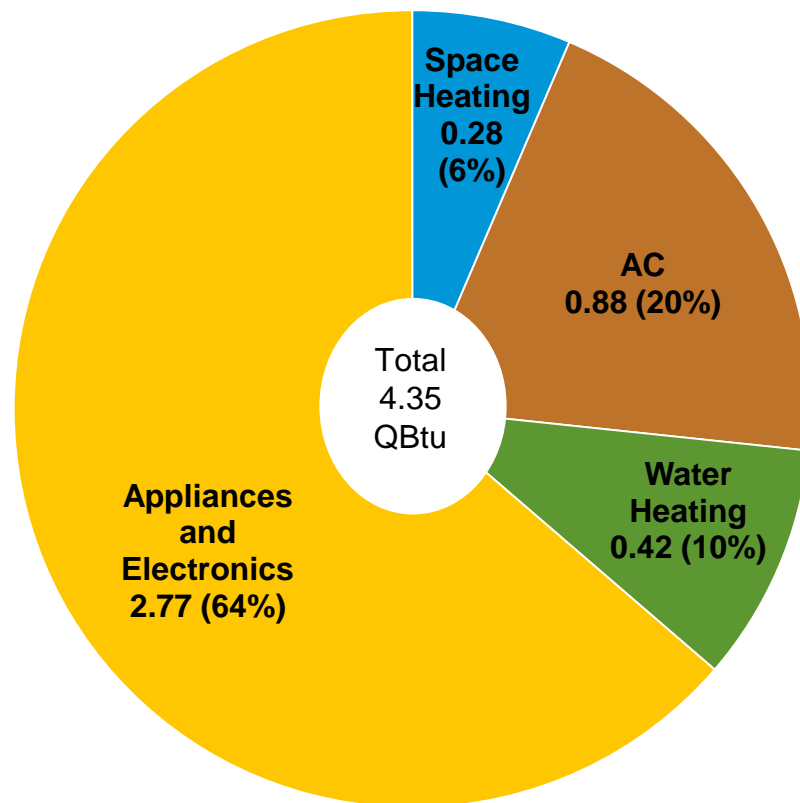


Electricity consumption has increased dramatically, but the share by end-use has been more consistent

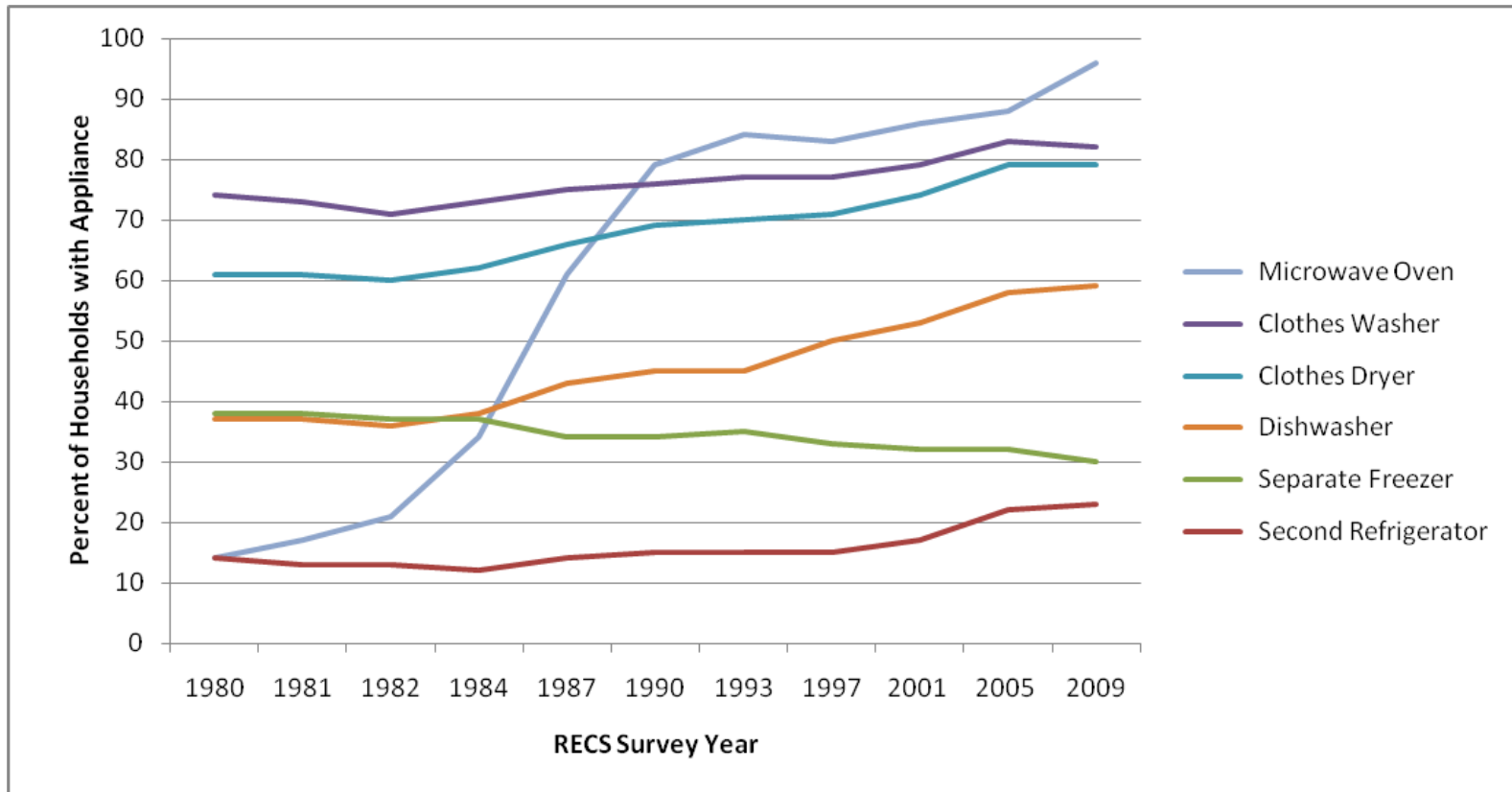
Household electricity use, 1980
quadrillion Btu and percent (site energy)



Household electricity use, 2005
quadrillion Btu and percent (site energy)



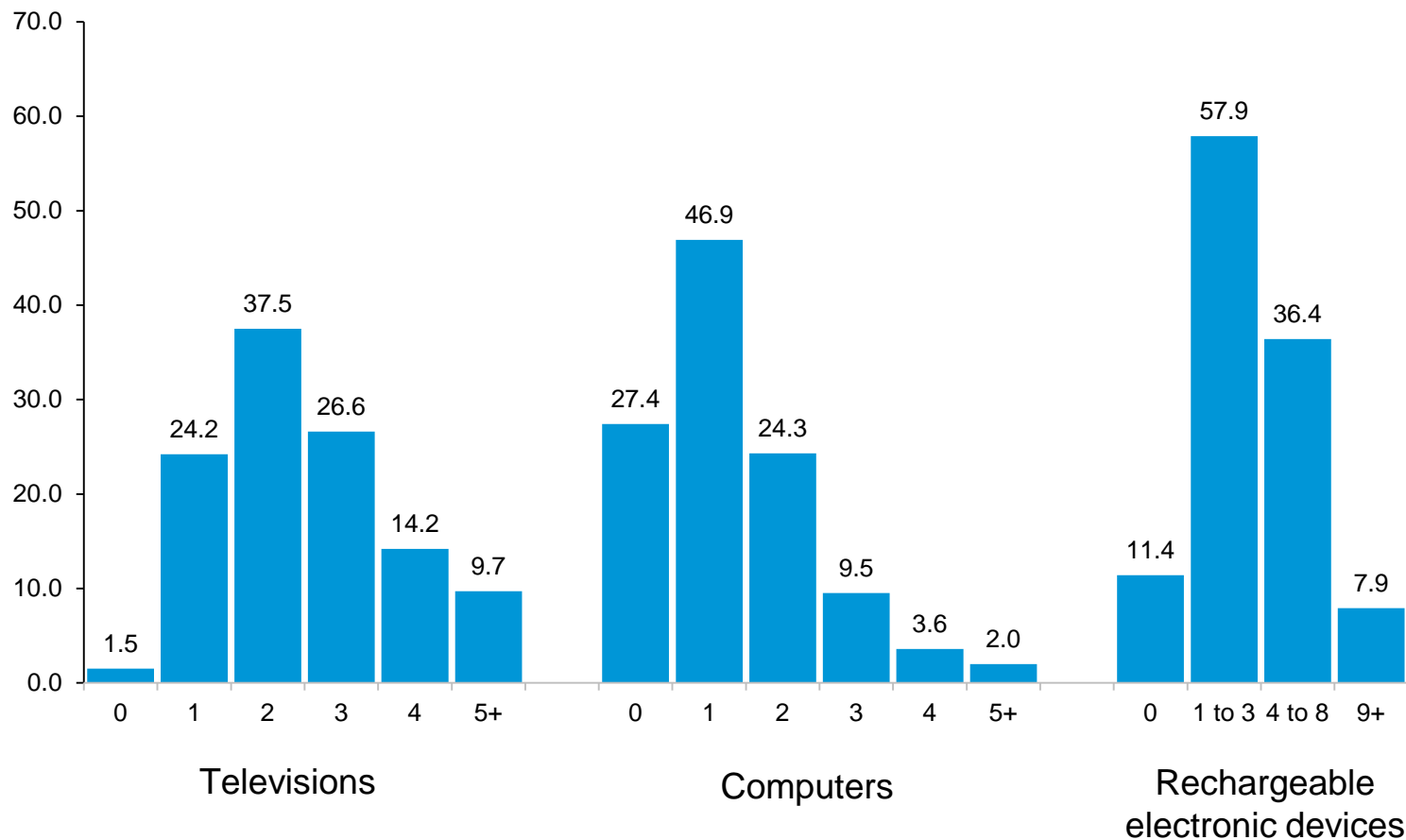
Increased saturation of appliances



...as well as increased number of energy consuming devices

Number of electronic devices, 2009

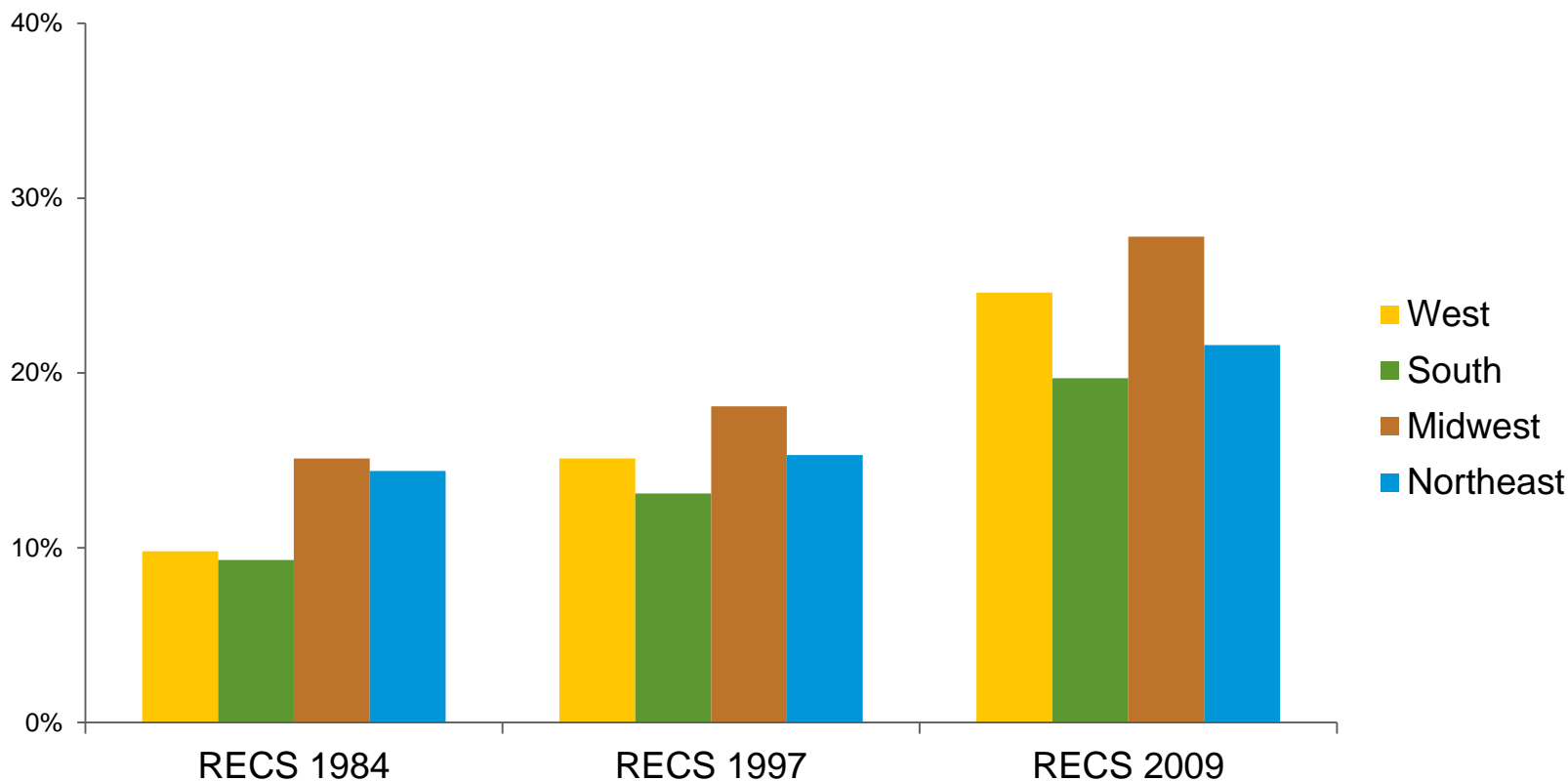
million households



Number of homes with 2 or more refrigerators is approaching 30% in the Midwest

Homes with 2+ refrigerators, selected survey years

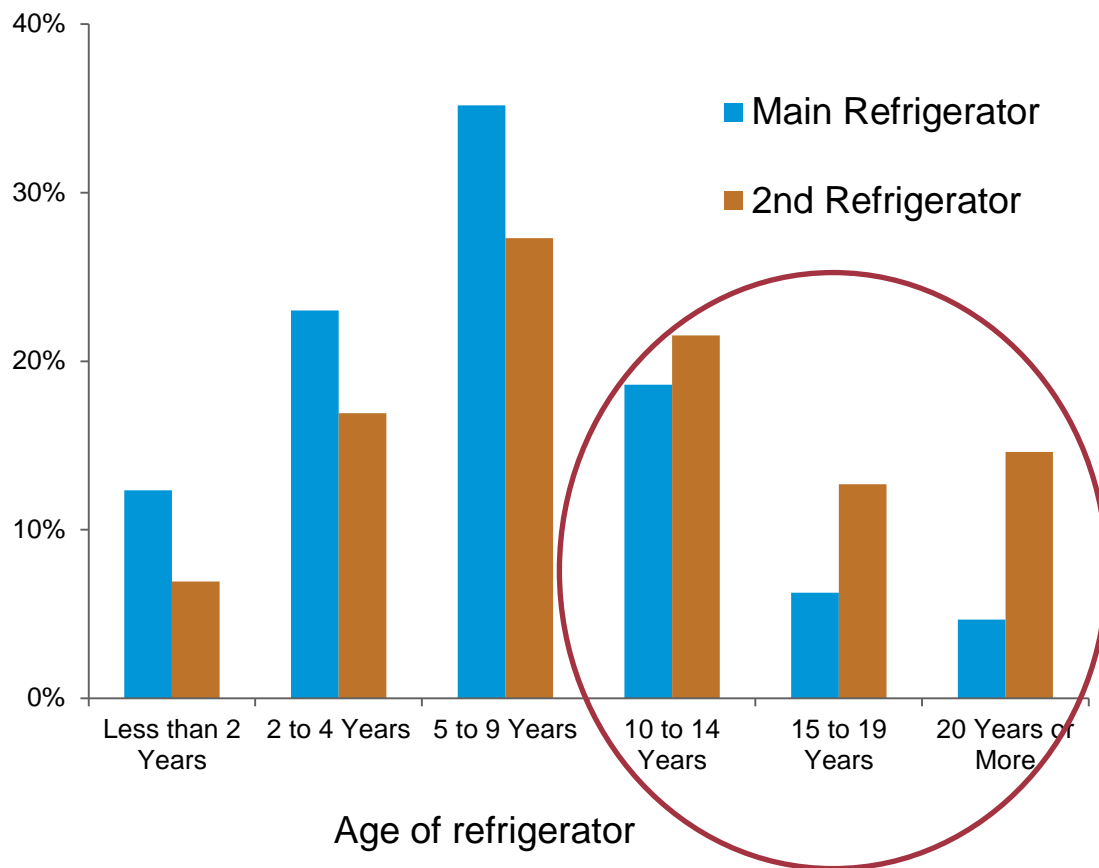
Percent of homes



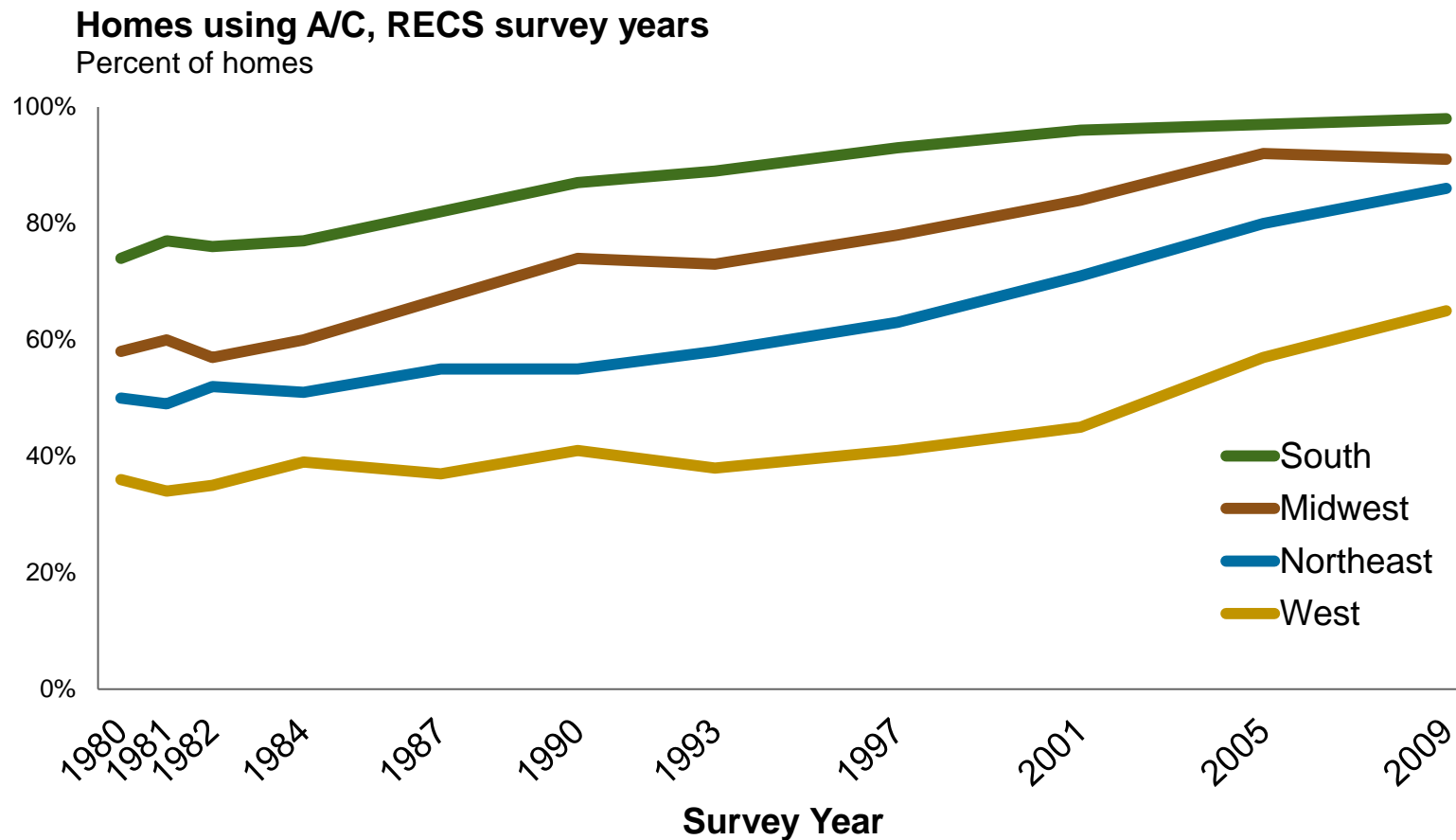
2nd Refrigerators are more likely to be older and less efficient than main refrigerators

Age of refrigerators, 2009

Percent of homes

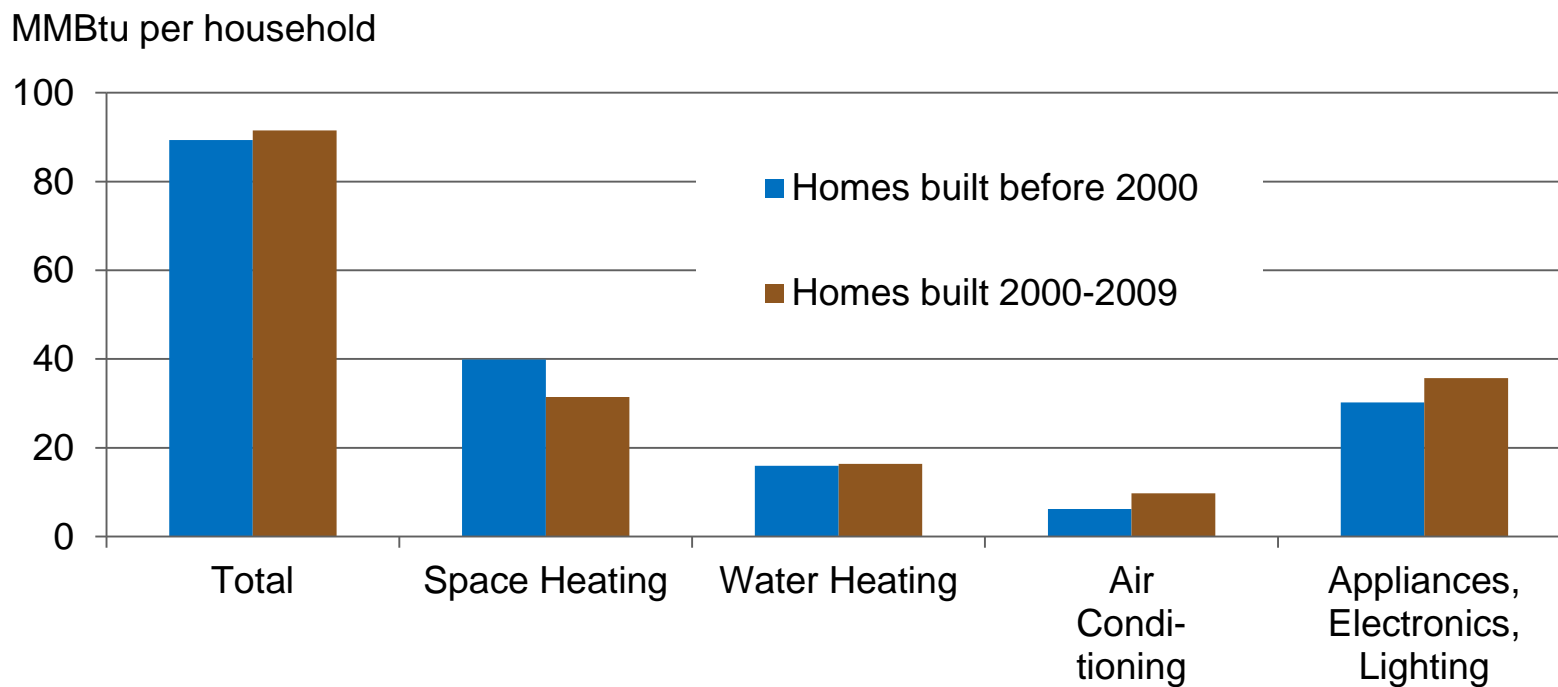


Steady rise in homes with A/C in all regions of the U.S. over last 30 years



2009 RECS data show newer homes consume more energy on average than older homes

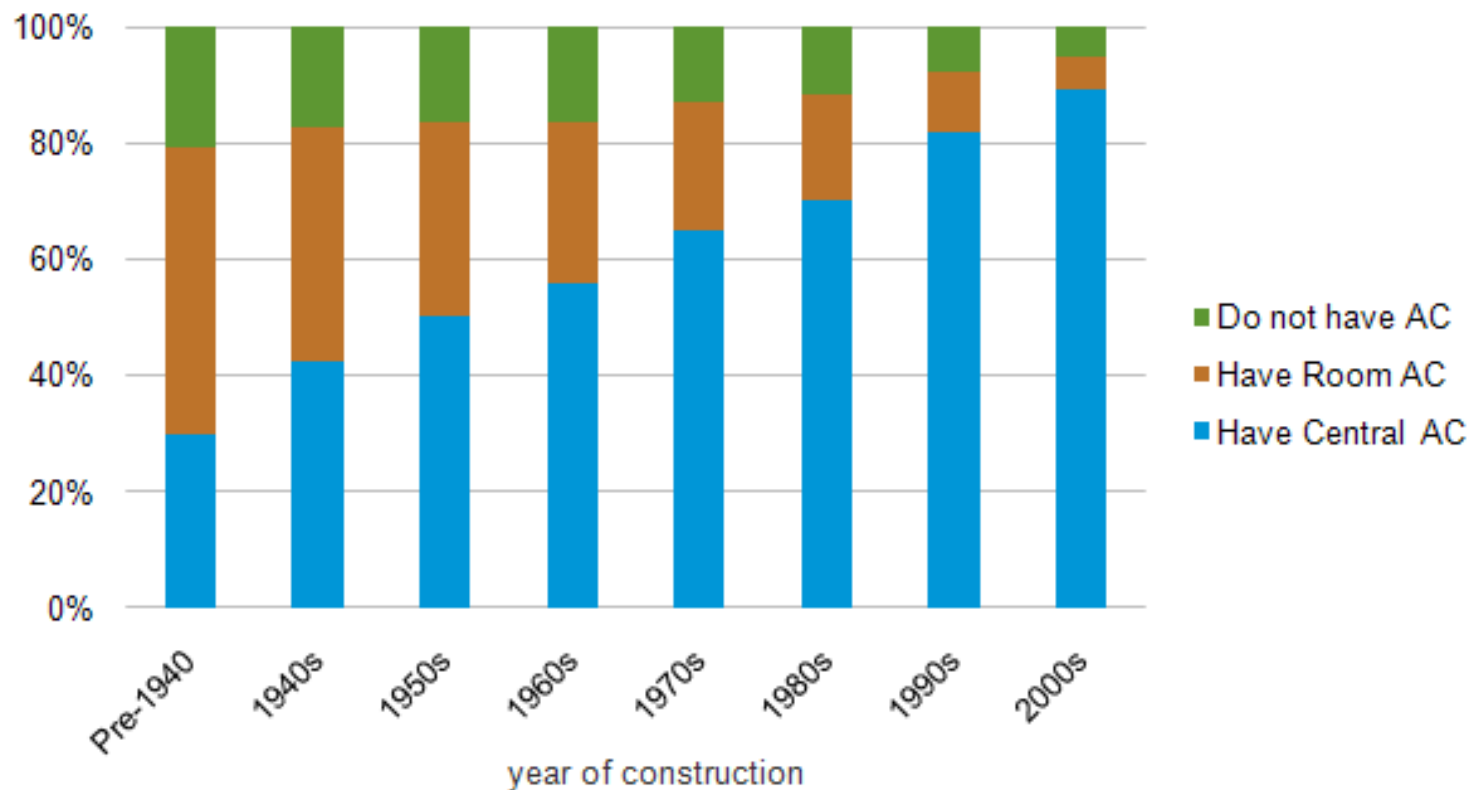
Average household site energy consumption by end use, 2009



2009 RECS data show newer homes have more central air conditioning

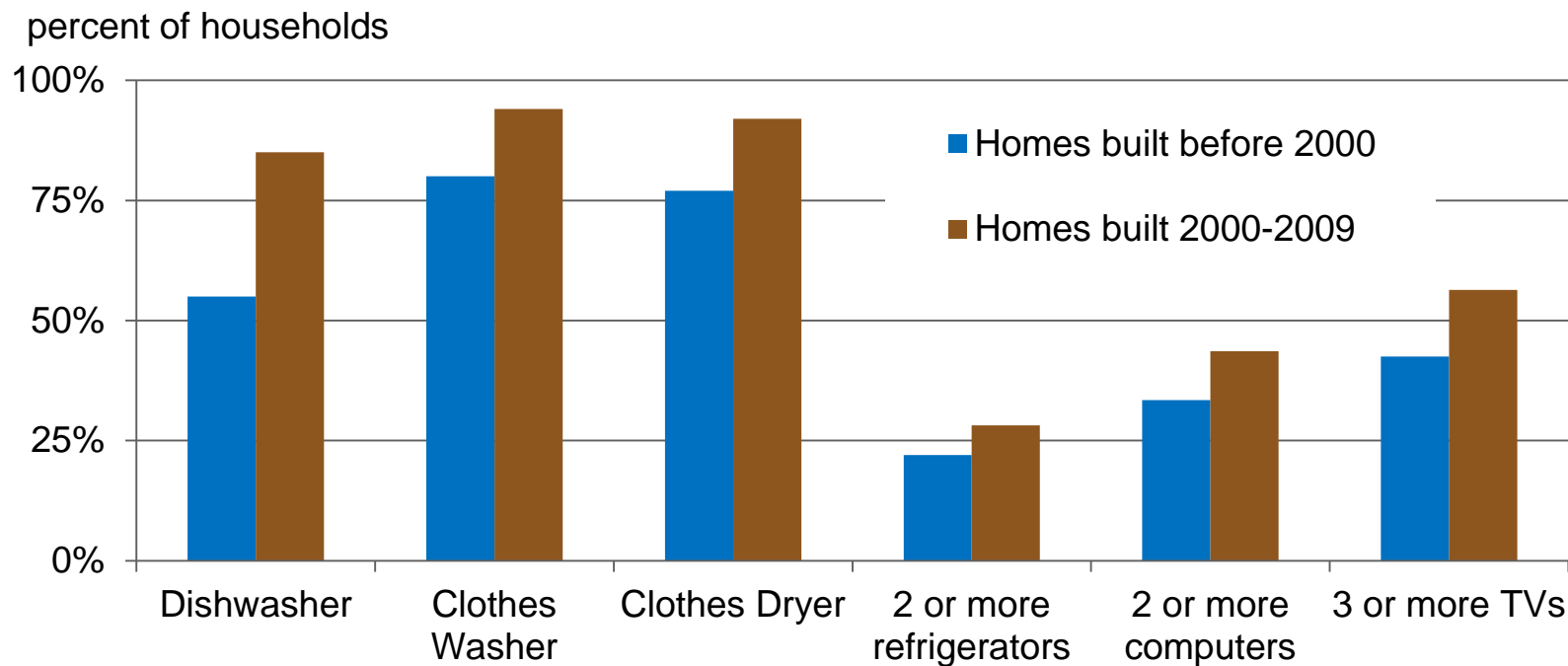
Figure 2. Increase in central air conditioning in newer homes

percent of homes

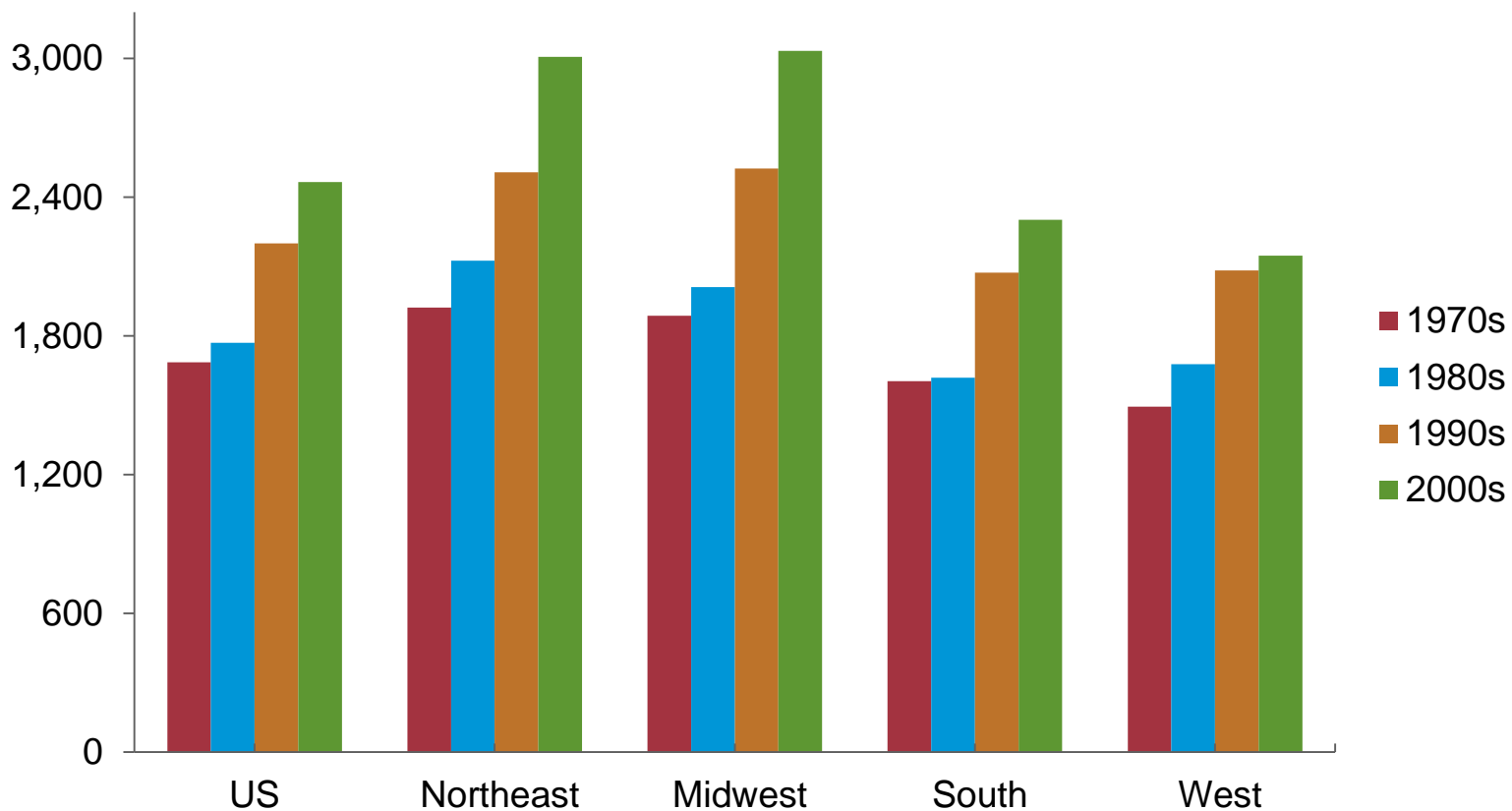


Source: U.S. Energy Information Administration, 2009 Residential Energy Consumption Survey

2009 RECS data show newer homes have more appliances and electronics



Homes are also larger across the country



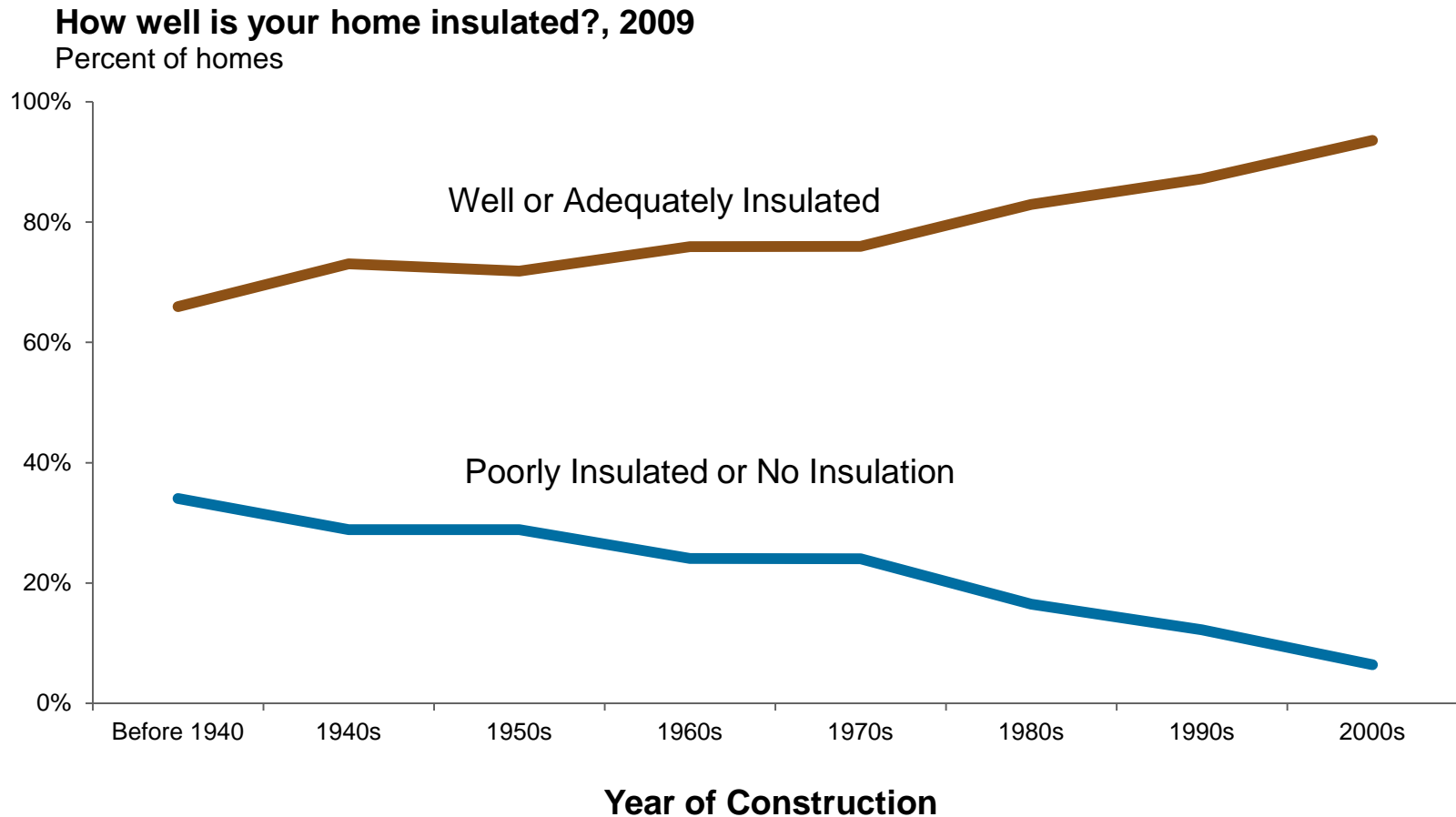
New homes do have more efficient windows

Use of energy-efficient windows rises
percent



Source: U.S. Energy Information Administration, 2009 Residential Energy Consumption Survey

and respondents in newer homes say their homes are **better insulated**



RECS data availability

- Tables are posted on the EIA website at <http://www.eia.gov/consumption/residential/data/2009>
- Housing Characteristics tables - March 2011.
- Square Footage tables - April 2012.
- Summary Consumption & Expenditures tables - June 2012.
- Fuel Consumption & Expenditures tables - July 2012.
- Detailed end-use tables – January 2013.
- Final microdata file – January 2013.

Public-use microdata

- Public use microdata is available at <http://www.eia.gov/consumption/residential/data/2009/#microdata>
- For each of the 12,083 RECS households, hundreds of variables are included
- Data is available as both a SAS file and as a .csv
- The full 2009 data file includes characteristics, consumption, and expenditures data.

User-friendly updates to RECS microdata

- Common coding for “not-applicable” responses (-2)
- Consistent coding for derived variables makes it easier to filter sub-populations
 - e.g., Natural Gas, Single-Family Homes, WI
 - USENG = 1...TYPEHUQ = (2,3)...ReportableDomain = 9
- Question wording revised to capture equipment and fuel “users”...as well as “have, but don’t use” for heating and cooling
- More descriptive variable labels and response codes

How to use RECS microdata

- RECS website includes layout file, response code labels, and questionnaire.
- For most analysis, NWEIGHT should be used. It is the sampling weight of each individual RECS household.
 - Sum of NWEIGHT values is 113.6 million, the total number of U.S. households.
 - A household with NWEIGHT of 10,000 represents itself and 9,999 others like it.
- Ex: Average consumption of all homes built before 2000.
 - In Excel, filter YEARMADERANGE to values 1 through 6. There are 10,425 RECS households that meet this description.
 - Multiply the values for TOTALBTU (Column AHX listed in thousands) and NWEIGHT (Column F) for each filtered row. Divide the total by the sum of the NWEIGHT column for the average consumption. Total is 89.3 million BTU.
- Caution, there is sampling variation!

Potential Changes to RECS Supplier Data

Next RECS should be 2014. Interested in whether we could collect:

- Smart Meter data – CBECS may ask for data as part of the supplier survey. Main issue is how it would be used.
- Kilowatt data – only collect monthly kWh data currently.
- Pricing data – we get monthly data now but would like to get variable pricing data if available.
- Breaks in service.

RECS Website and Contact Info

RECS homepage

<http://www.eia.gov/consumption/residential/>

RECS data release notification

http://www.eia.gov/listserv_signup.html

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Questions and Discussion