



So We Think We Understand Energy Efficiency!!

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Department of Engineering and Public Policy
Carnegie Mellon University

Arshad Mansoor, EPRI
Vice President, Power Delivery & Utilization



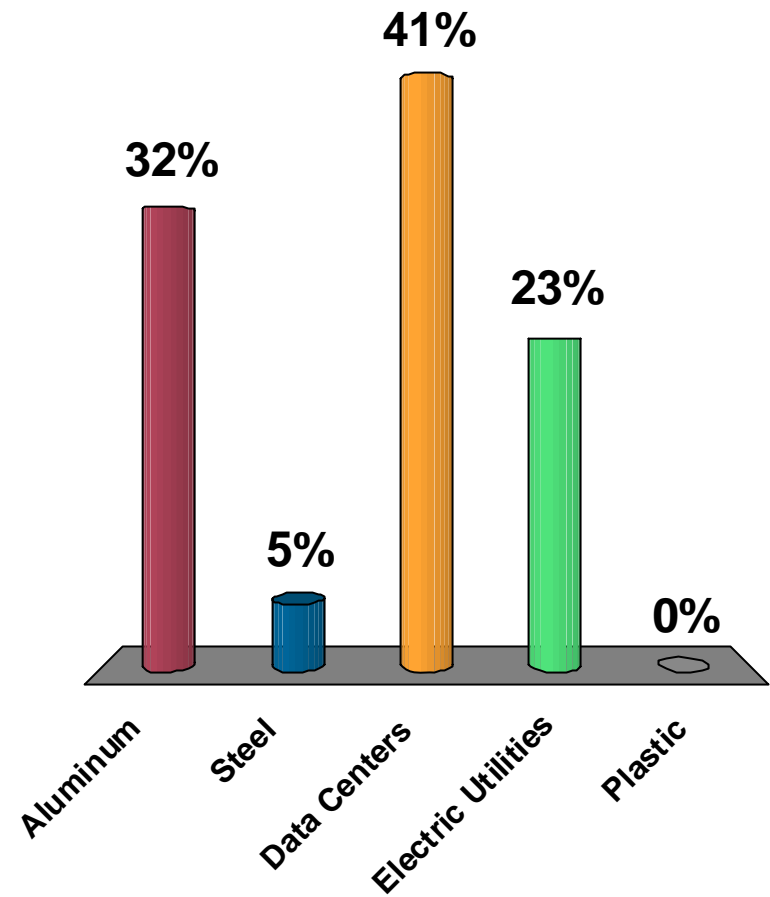
Traditional Energy Efficiency “Stuff”

- Compact Fluorescent Light (CFL)
- LED Lighting
- High efficiency Air Conditioners
- High efficiency refrigerators
- Window caulking, ceiling insulation
- Energy Star appliances
- Commercial Lighting
- Space heating
- Space cooling
- High efficiency chillers
- Utility/State energy efficiency programs/rebates



Which Industry is the Single Largest User of Electricity?

1. Aluminum
2. Steel
3. Data Centers
4. Electric Utilities
5. Plastic



Significant Opportunity to Improve End to End Efficiency

Breakdown of Electricity Use

Generation



~6%

Transmission



~3%

Distribution



~6%

**Residence/
Buildings**



~60%

Industries



~25%

Electricity Industry is the Single Largest End User of Electricity

Reducing T&D Losses by 10% in Essence Doubles our Installed Wind Capacity (~2006)



Efficient T&D systems for a Carbon-Constrained World

Reducing 10% T&D Losses = kWh generated by 11GW of wind generation in US

EPRI Distribution Green Circuits Project Update

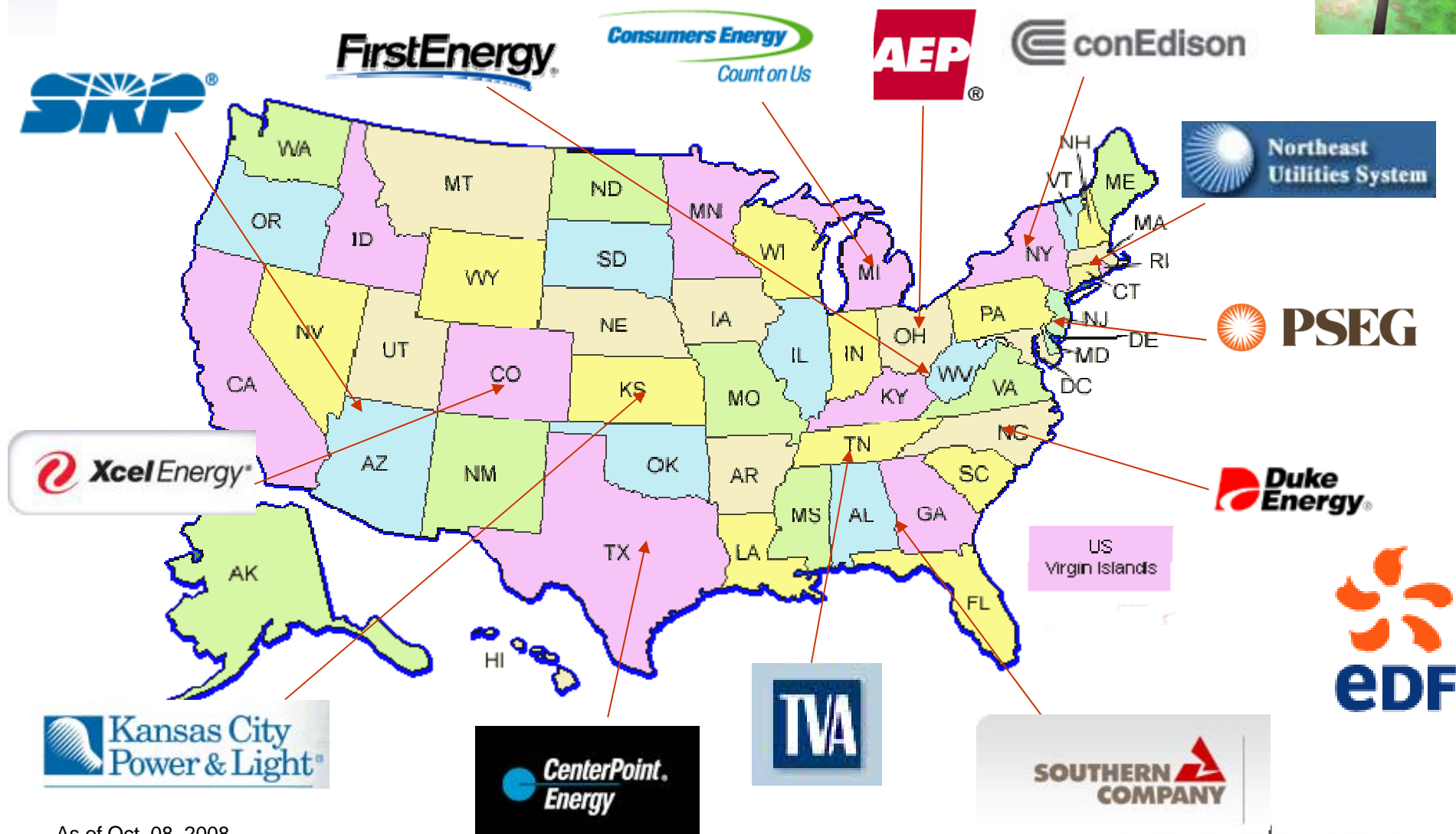
Project Goals & Objectives

- Develop and demonstrate consistent method to quantify losses
- Compile credible data to quantify the costs, benefits, and risks of using energy efficiency and loss mitigation as part of planning
- Demonstrate real life examples where loss mitigation options have been implemented and validate realized loss reduction



Green Circuit Project

Today: 61 ckts, 24 states and 2 countries

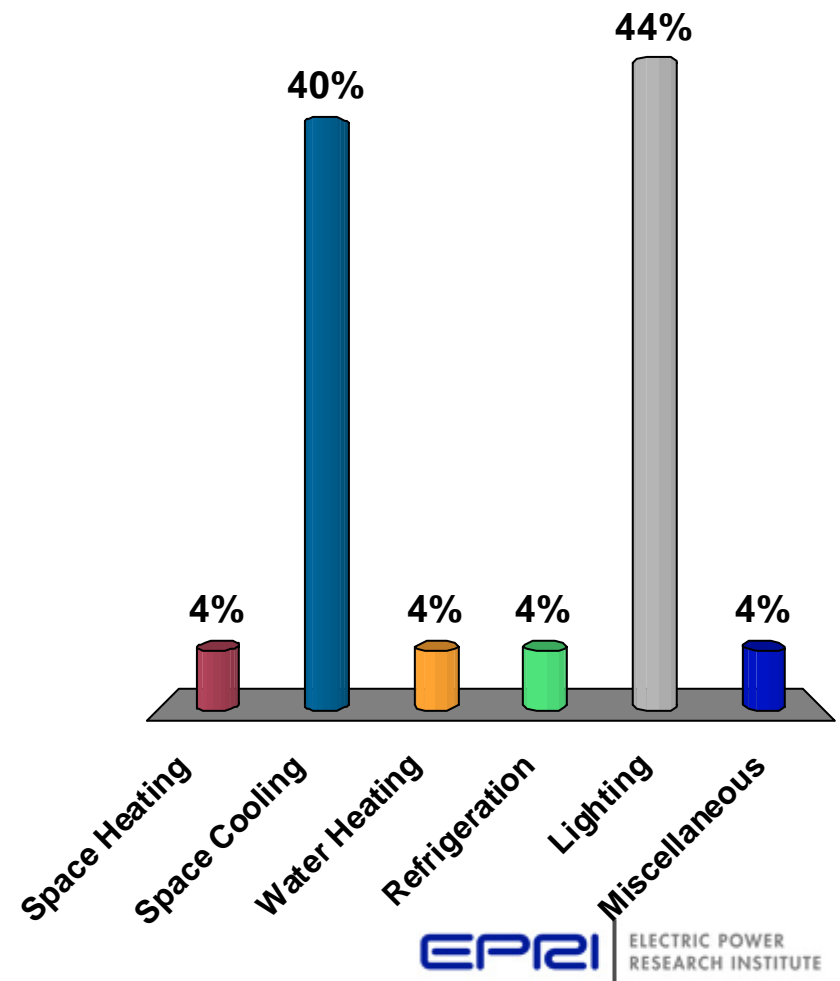


As of Oct, 08, 2008

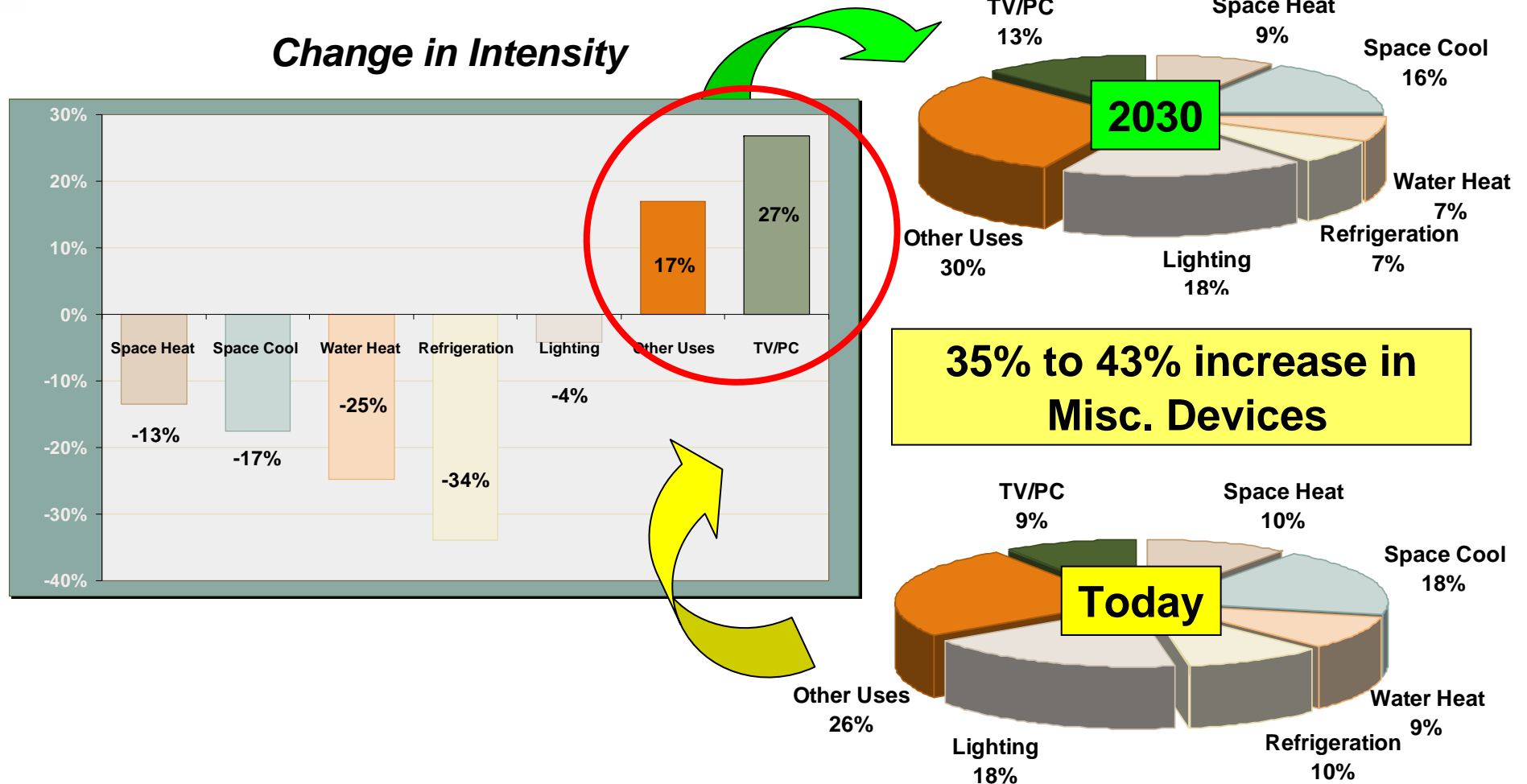
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What is the single largest category of electricity consumption in US residential buildings?

1. Space Heating
2. Space Cooling
3. Water Heating
4. Refrigeration
5. Lighting
6. Miscellaneous

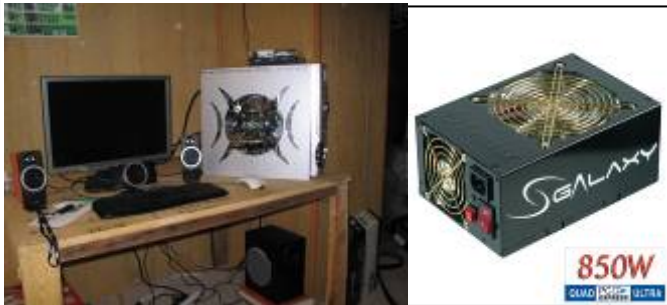


Change in Residential Electricity Intensity



Source: DOE/EIA Annual Energy Outlook 2007, with Projection to 2030

Growth in Plug Connected Loads



PC with High End Video Card
350W during gaming



Digital photo frame
(6W-15W)



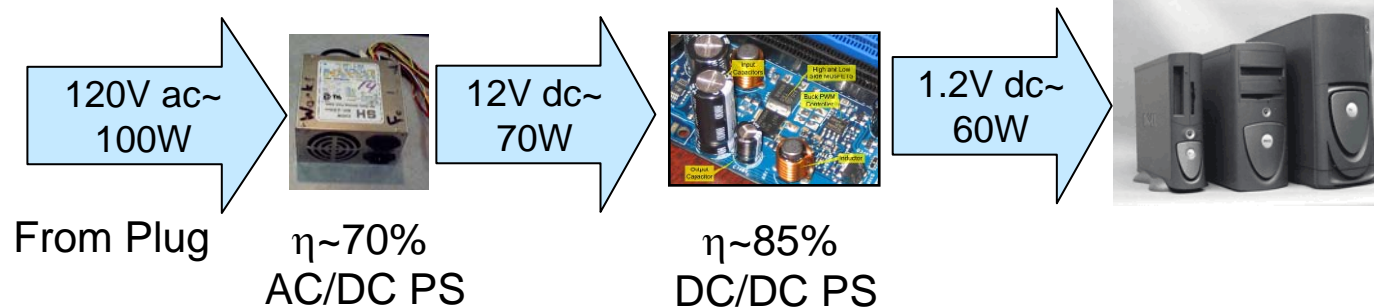
Plasma TV
300W, ~5.5 hrs/day



Set Top Box
30W, 100% duty cycle in a year

Limited Load Research Data on Plug Connected Loads

Making Electronics More Efficient: Key Focus Area of EPRI Energy Efficiency R&D



**The μ Processor world runs on 1V-2V dc
Converting 120V ac to 1V-2V dc could result in 40% Losses
About 6 to 10% of all U.S. electricity use requires ac/dc conversion**

Tier 1 Power Supply and Power Management Requirements:

Effective July 20, 2007

New EPA Energy Star Standard
for Computers Directly Influenced
by EPRI Research

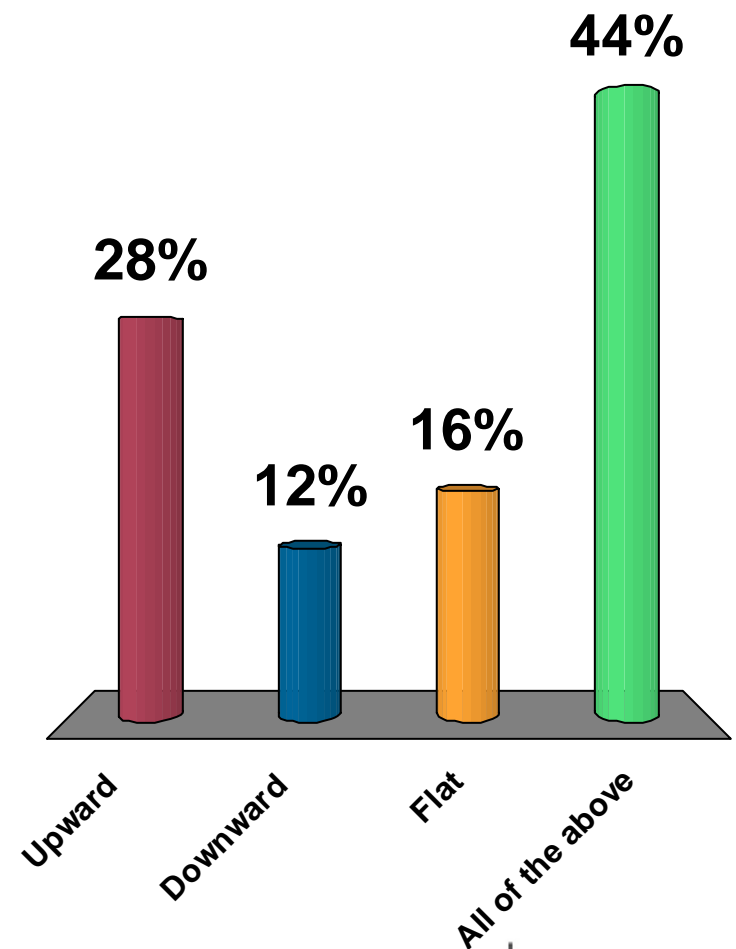
80% minimum efficiency at 20%,
50%, and 100% of rated output and
minimum Power Factor 0.9



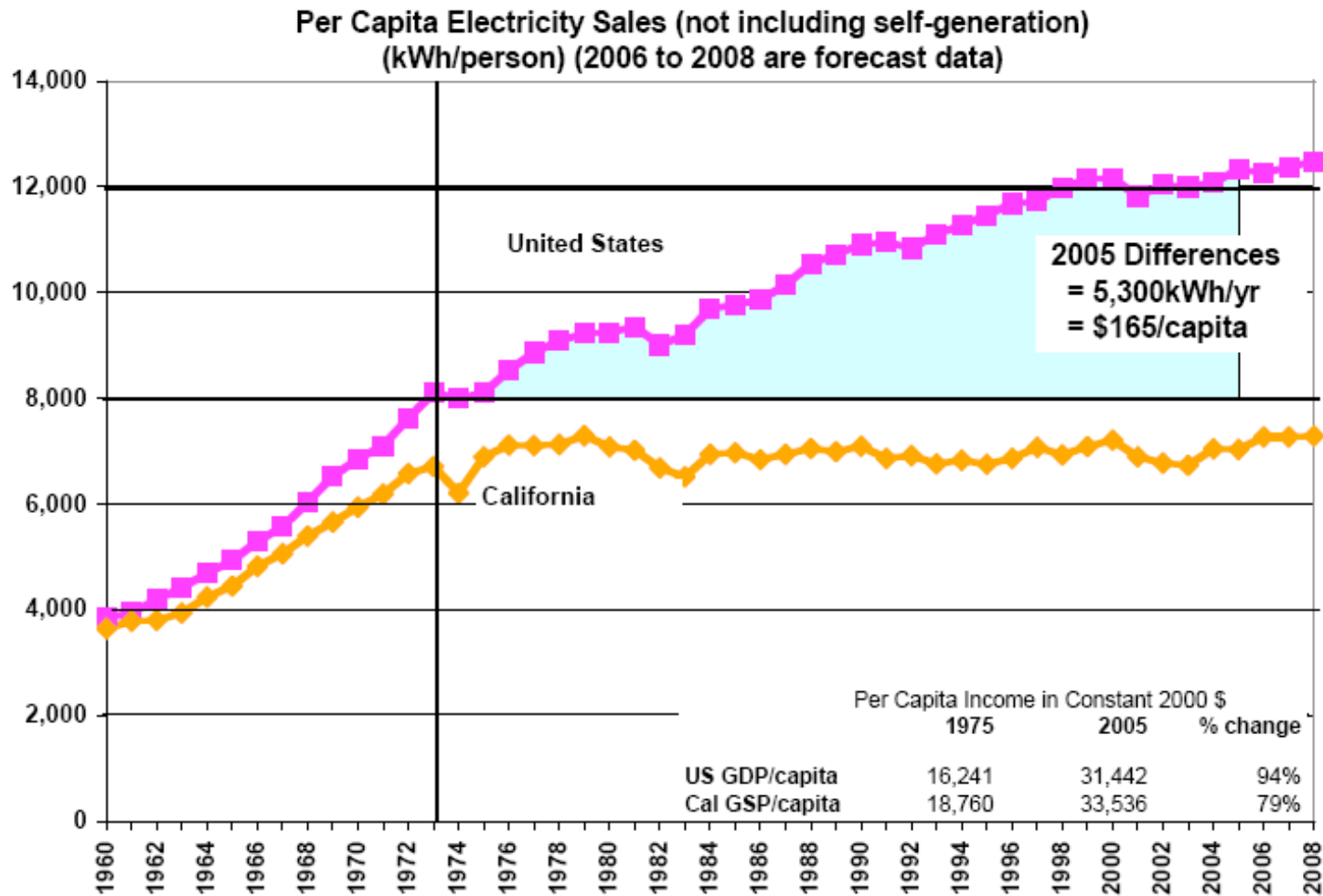
EPRI Research Resulted in New Energy Star Specification for Computer Power Supplies

What is the trend of electricity consumption in California over the past 10 years?

1. Upward
2. Downward
3. Flat
4. All of the above

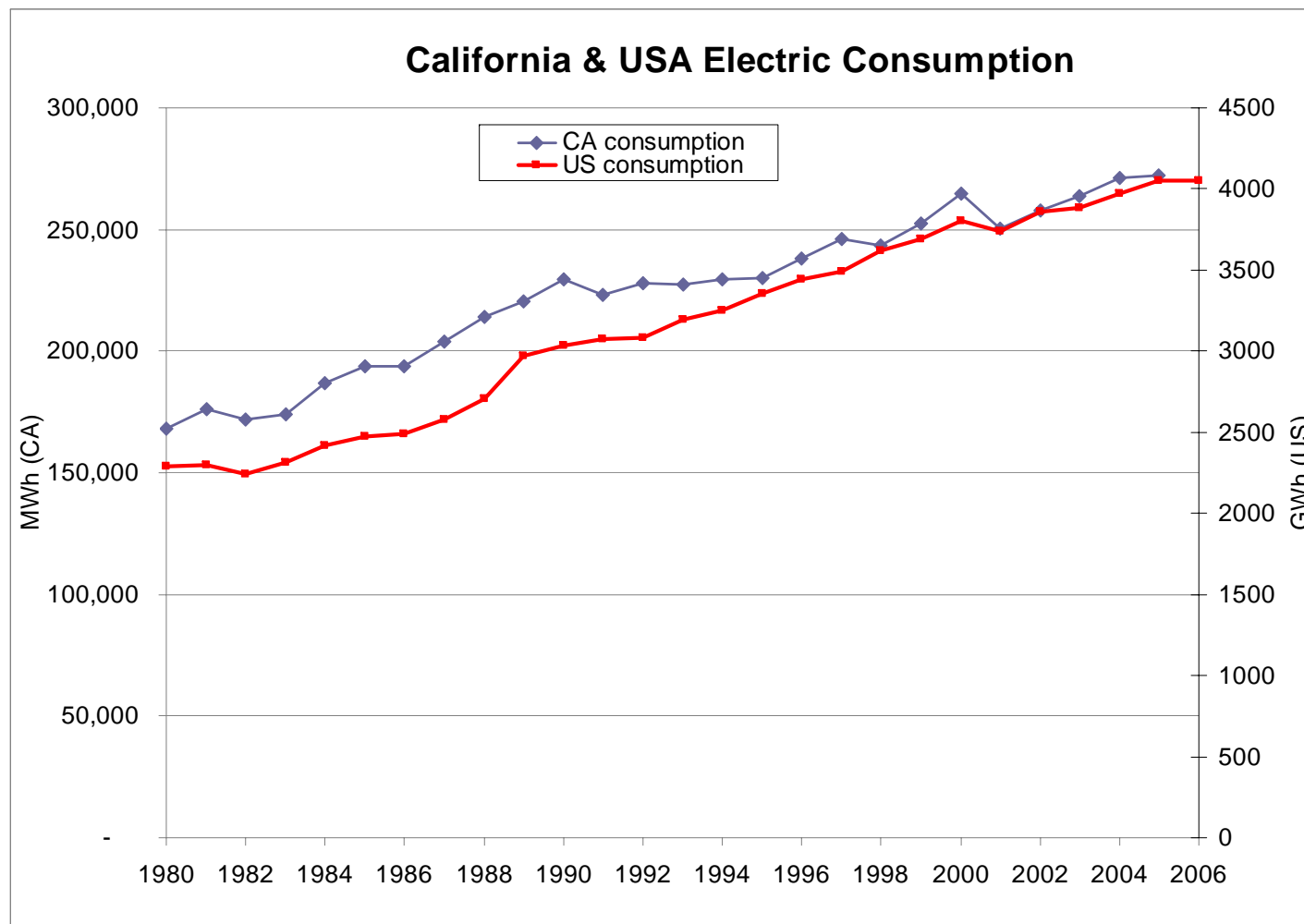


The Chart that you most likely have seen.....



CA's flat per capita consumption as a result of their EE efforts

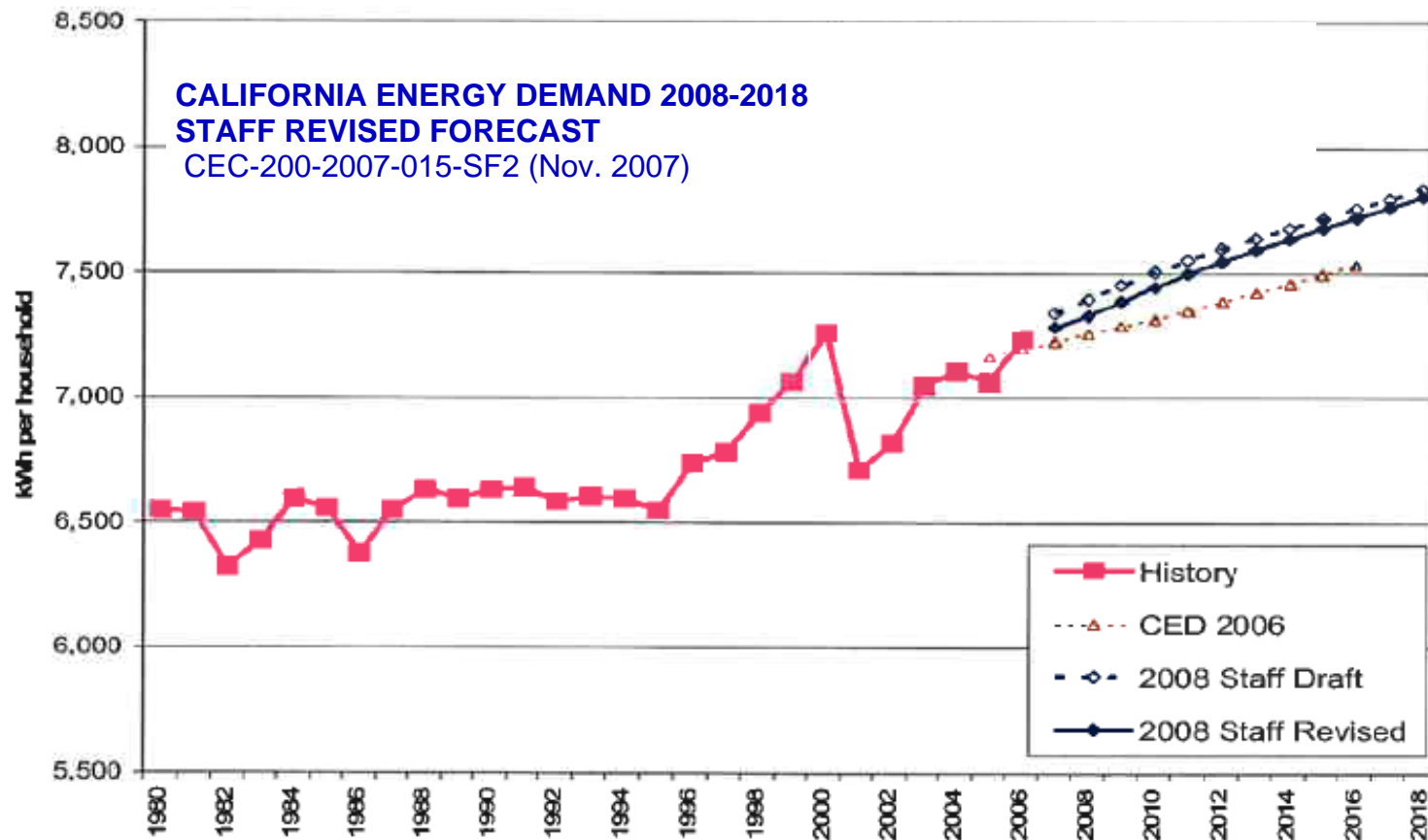
The Chart that you most likely have NOT seen.....



Total Electricity Consumption Growing at the Same Rate as US

The Chat that you most likely have NOT seen.....

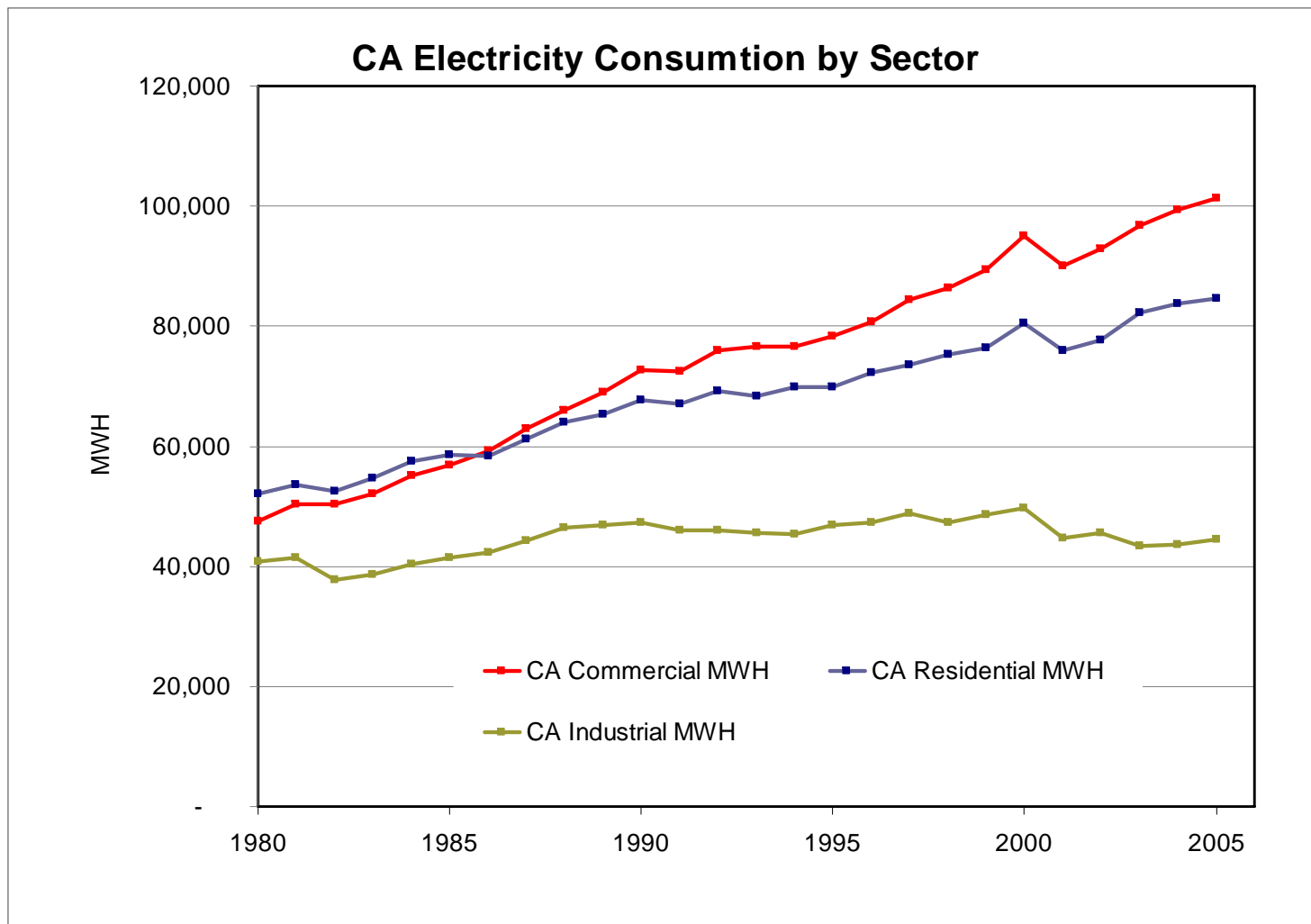
Figure 25: PG&E Planning Area Use per Household



Source: California Energy Commission, 2007.

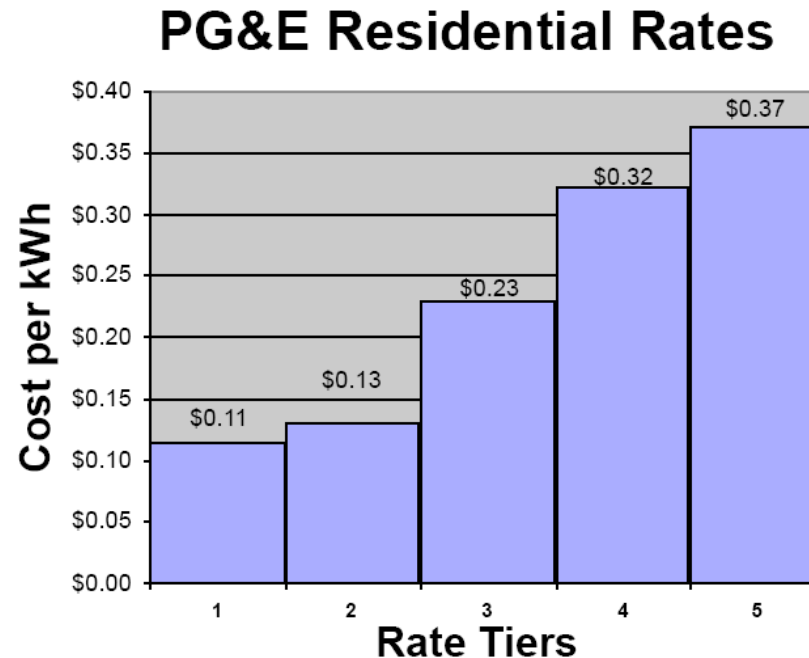
per household electricity use is increasing

Contribution of Energy Efficiency and Change in Sectoral Activity



Economic Activity Moving from Industrial base to Service base

Price Induced Energy Efficiency

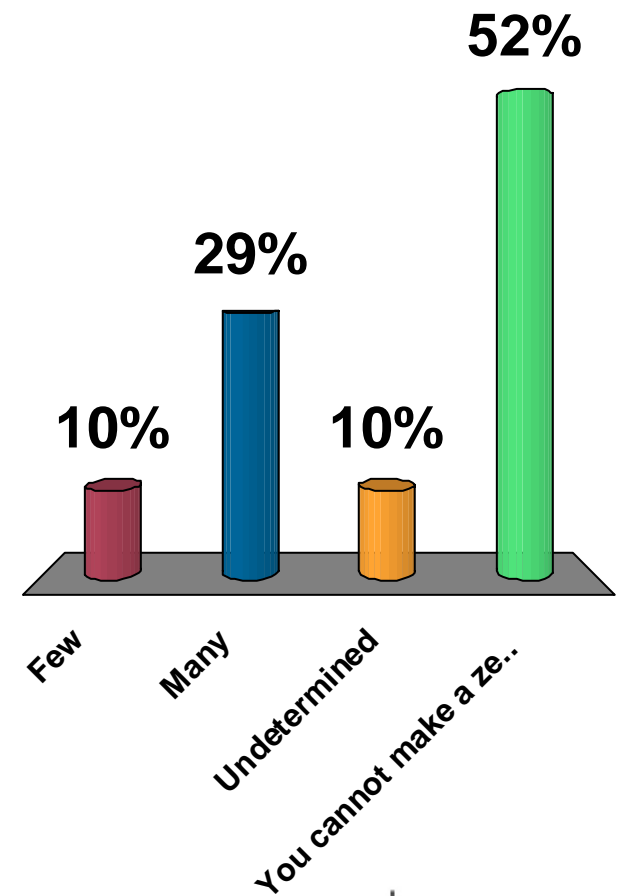


Tier 1: Baseline	up to \$41	361 kWh
Tier 2: 101 - 130% of Baseline	\$42 - \$55	469 kWh
Tier 3: 131 - 200% of Baseline	\$56 - \$113	721 kWh
Tier 4: 201 - 300% of Baseline	\$114 - \$194	1082 kWh
Tier 5: 301+% of Baseline	over \$195	1083+ kWh

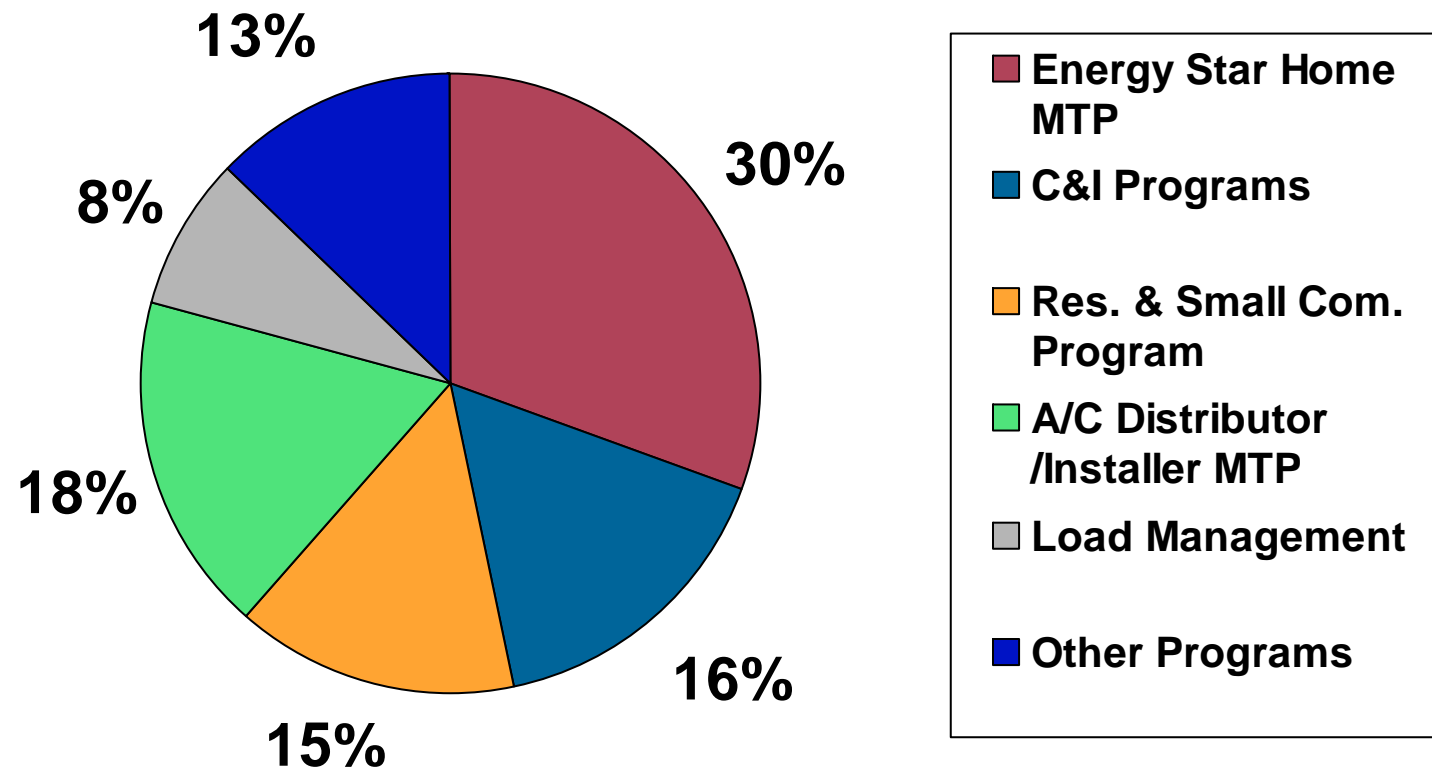
@ 37 cents/kWh Tier 4 Rate It will cost \$195/yr to power a 60W incandescent light bulb that costs 50 cents to buy

How many refrigerator magnets does it take to make a zero energy refrigerator?

1. Few
2. Many
3. Undetermined
4. You cannot make a zero energy refrigerator with magnets



Sample of a EE Program Elements



Market Transformation Activities Could be a Large Portion of Deemed Savings

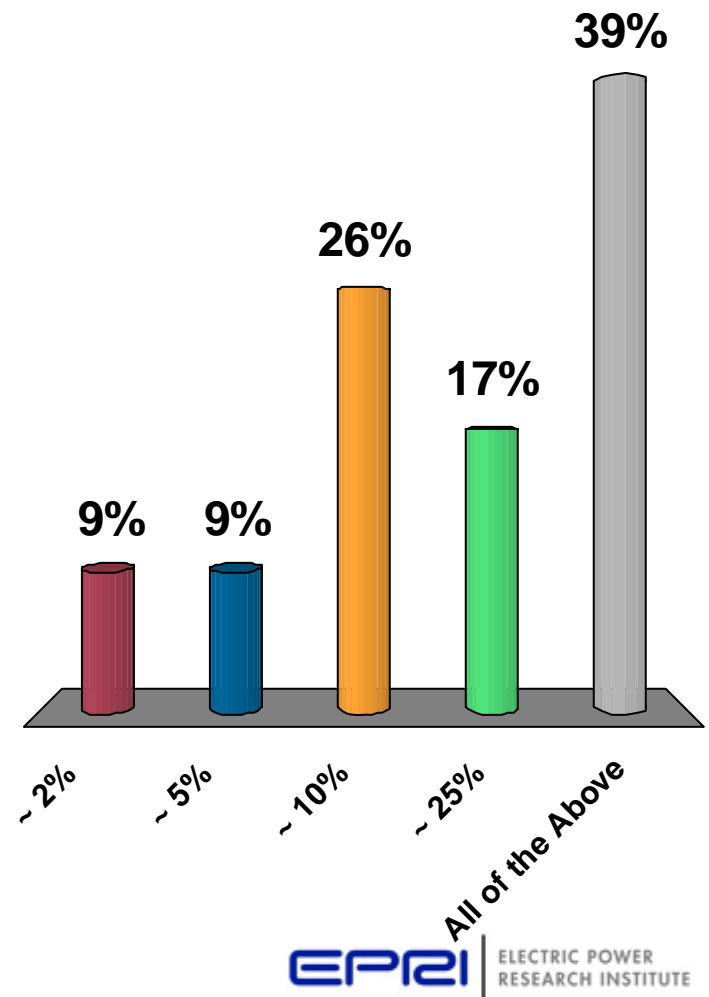
Risk and Uncertainty in Measuring “Saving a Watt”

- Uncertainty in estimating savings from Market Transformation Programs (MTP)
- Uncertainty in extrapolating limited set of measurement data to estimate program wide savings
- Uncertainty in estimating energy savings coincident with utility peak demand
- Uncertainty in tracking the persistence of energy savings measures – takeback effect
- Uncertainty in estimating free riders taking advantage of programs that they would have otherwise undertaken

These Uncertainties Need to be Accounted in an Integrated Resource Plan and Could Result in a Wide Band of Estimates for Energy Savings Potential

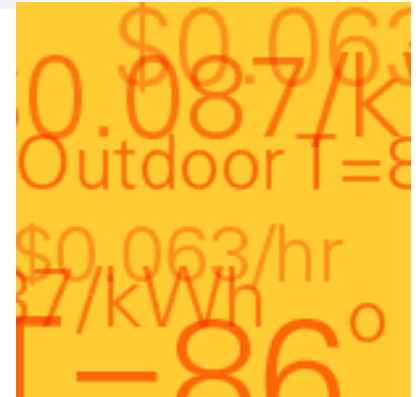
How much kWh savings can be achieved by making customers aware of their electricity consumption through real time displays and other direct feedback?

1. ~ 2%
2. ~ 5%
3. ~ 10%
4. ~ 25%
5. All of the Above



Information Is Critical to Energy-Use Decisions

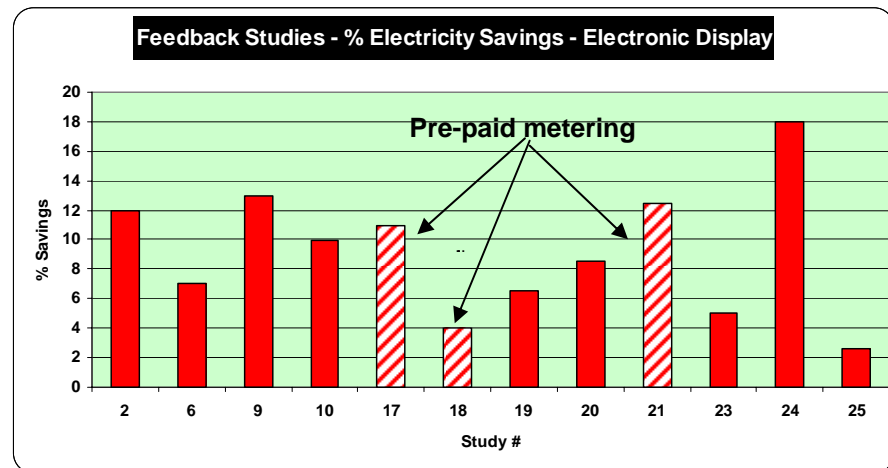
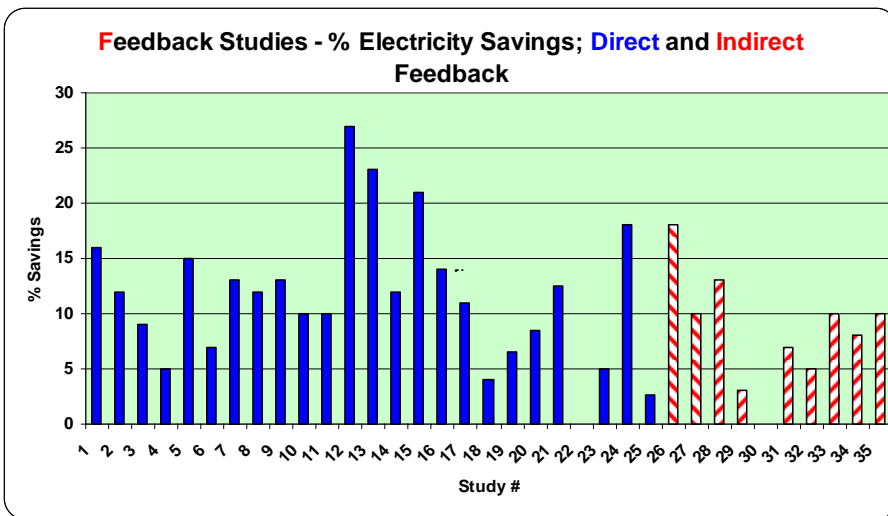
- Habits of residents greatly affect energy use
- Feedback helps customers understand the cause-effect link
- Time between action (behavior) and consequence (resulting energy use and cost) is very important
- Feedback most useful when accompanied by goal (\$ savings, prevent blackouts, reduce carbon emissions)



Display Devices



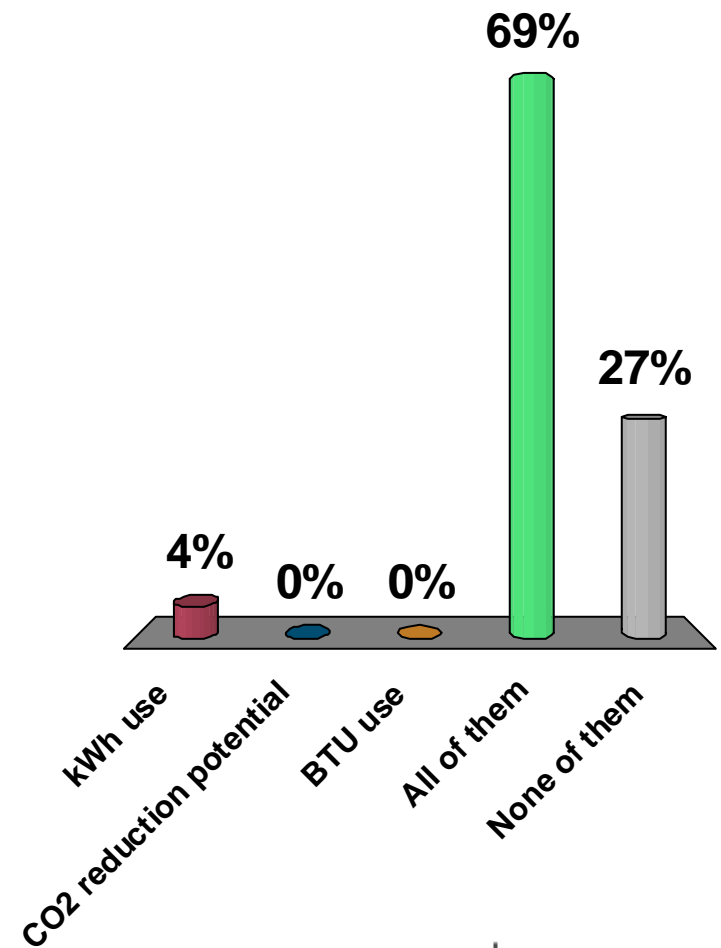
Improved Utilization Efficiency- Feedback



- A wide variety of studies have been conducted over the past 20 years to quantify the impact of information on electricity consumption:
 - **Indirect feedback** – provides consumers with more detailed and in-depth analyses of billing information
 - **Direct feedback** – provides consumers direct access to the meter contents
- The reported impacts over both feedback types, reductions in total kWh consumed, range from zero to 25%
- Electronic display results also exhibit a wide range of energy reduction values
- Most studies involved only very few (under 150) participants for a year or less.

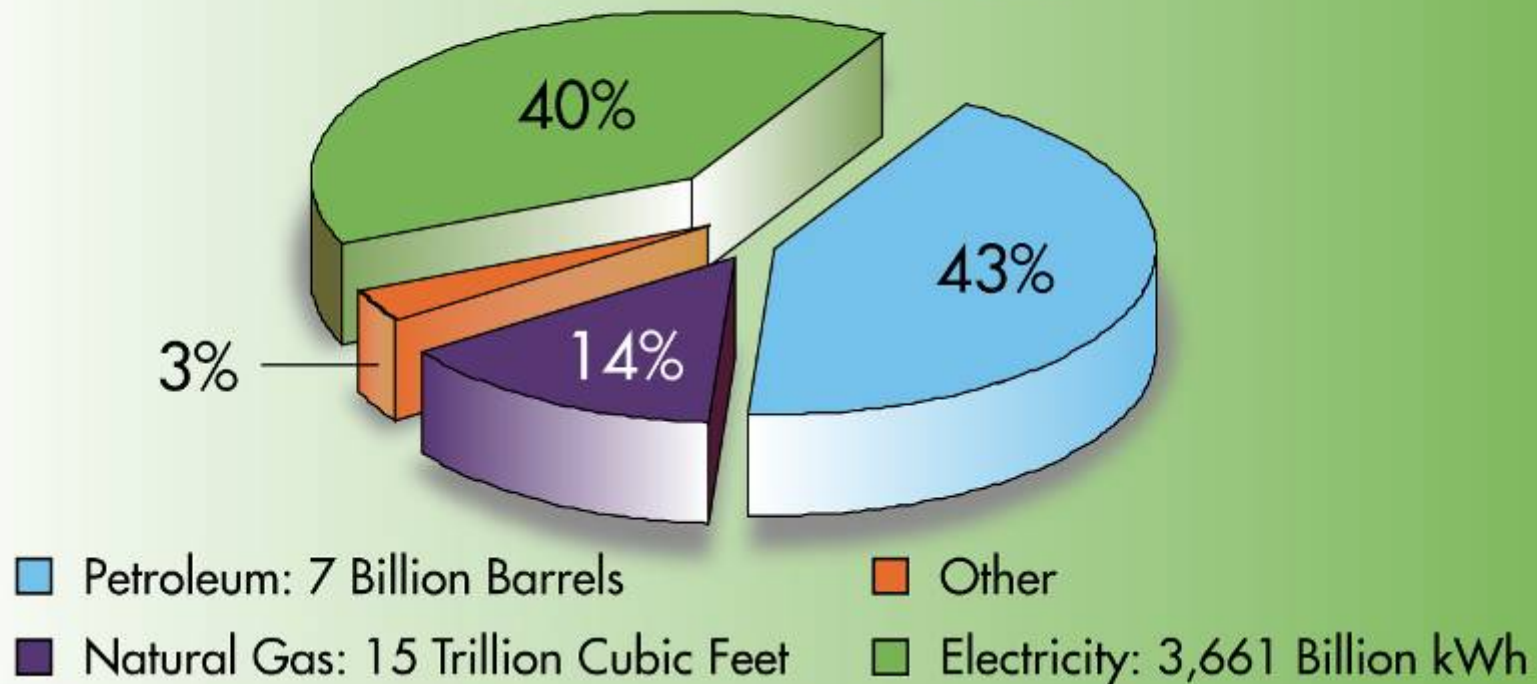
What is the metric of energy efficiency?

1. kWh use
2. CO2 reduction potential
3. BTU use
4. All of them
5. None of them



Carbon Footprint of End Use Energy in U.S., 2006

Total U.S. CO₂ Footprint of **Delivered Energy**
– 5.9 Billion Metric Tons



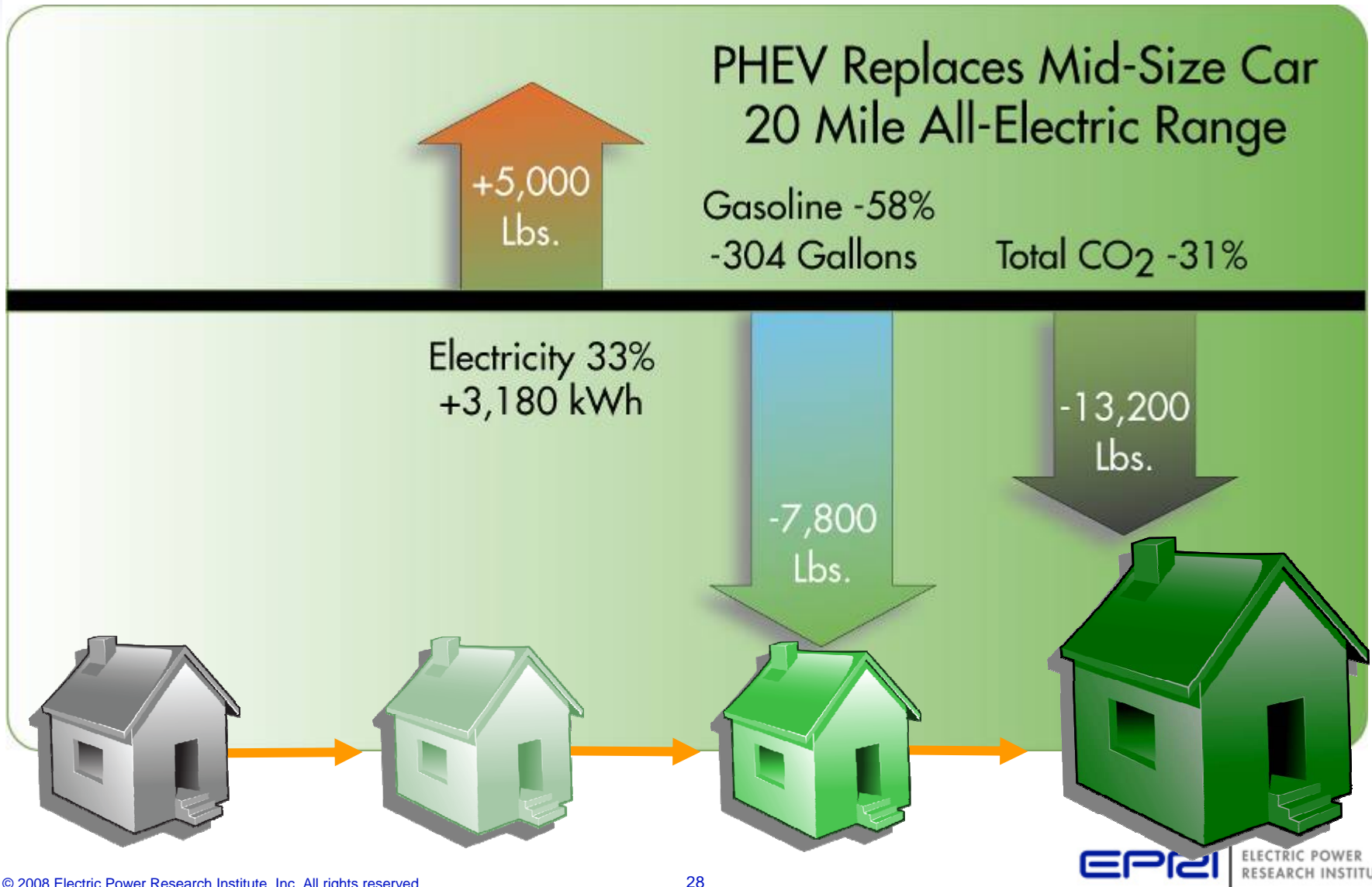
In a Low Carbon Future Carbon Footprint Becomes the Primary Metrics to Gauge the Scale of Energy Efficiency

The Expanded Scale of Energy Efficiency

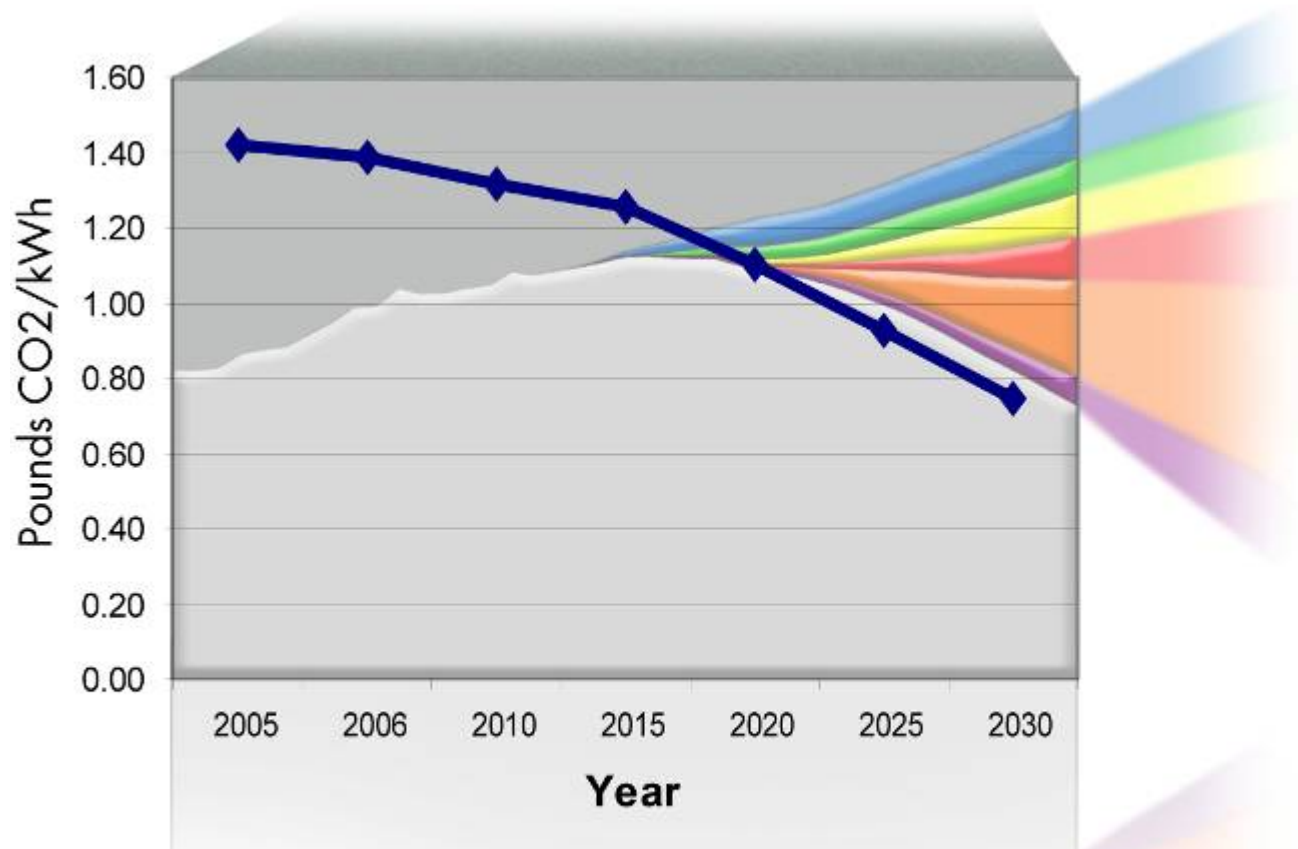
- **Traditional Energy Efficiency Measures**
 - Reducing carbon footprint by reducing use of electricity through increasingly higher efficiency
- **Electrifying End Use Processes**
 - Reducing carbon footprint by replacing direct combustion of fossil fuel in end use processes with low carbon electricity
- **Electrifying Transportation**
 - Reducing carbon footprint by replacing direct combustion of petroleum with low carbon electricity

Significant Opportunity to Expand the Scale of Energy Efficiency

Energy Efficiency + Heat Pump + 20 Mile PHEV

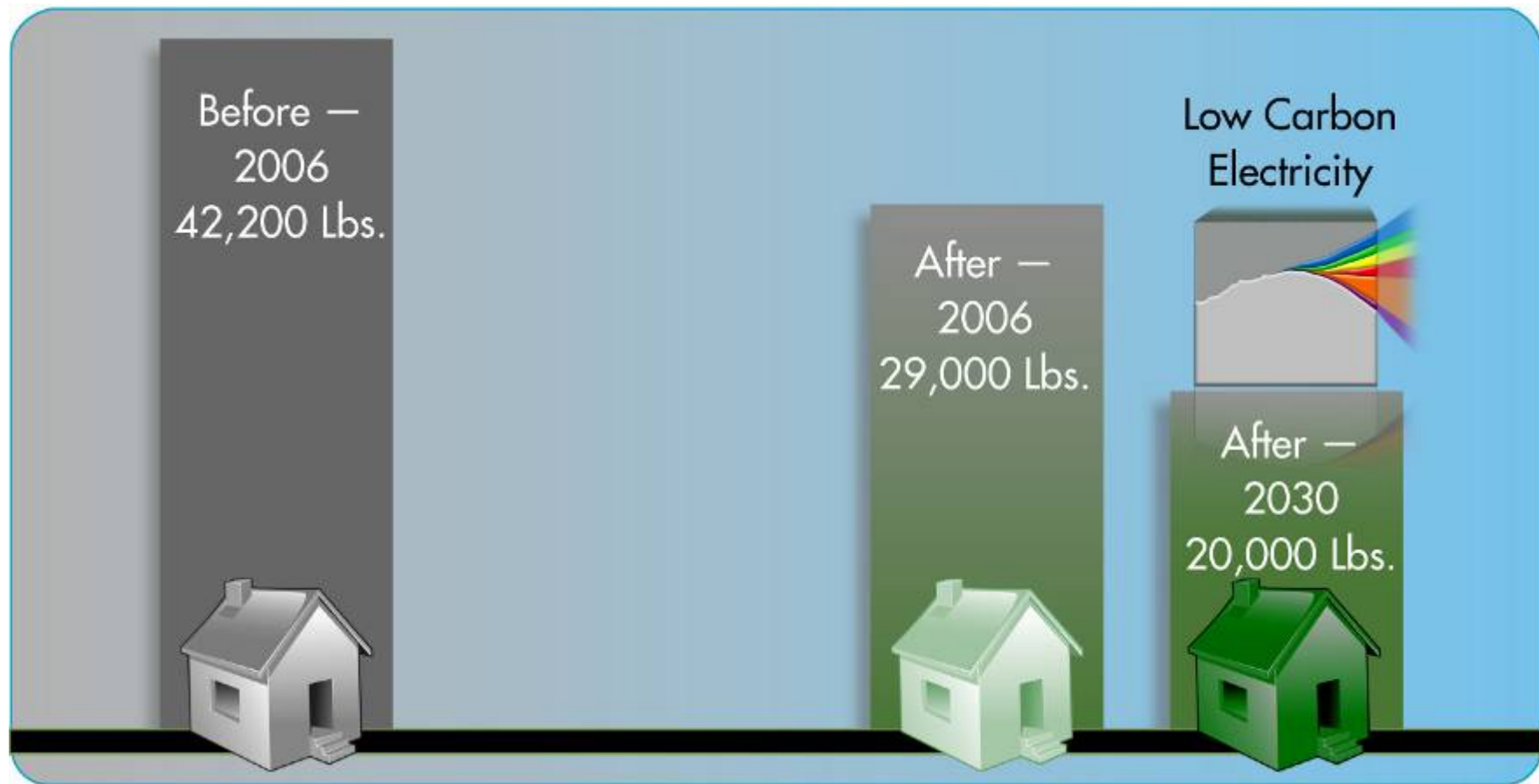


Electricity as a Low Carbon Fuel



Decarbonizing the Electricity Sector Increases the Opportunity to Reduce Carbon Footprint Through Efficient Use of Electricity

Opportunity for Expanding Scale of Energy Efficiency



Effects of Traditional Energy Efficiency, Heat Pump Heating & Cooling, Mid-Size PHEV, and Low Carbon Generation

There is Much More to EE Than Traditional Energy Efficiency “Stuff”

- Compact Fluorescent Light (CFL)
- LED Lighting
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