

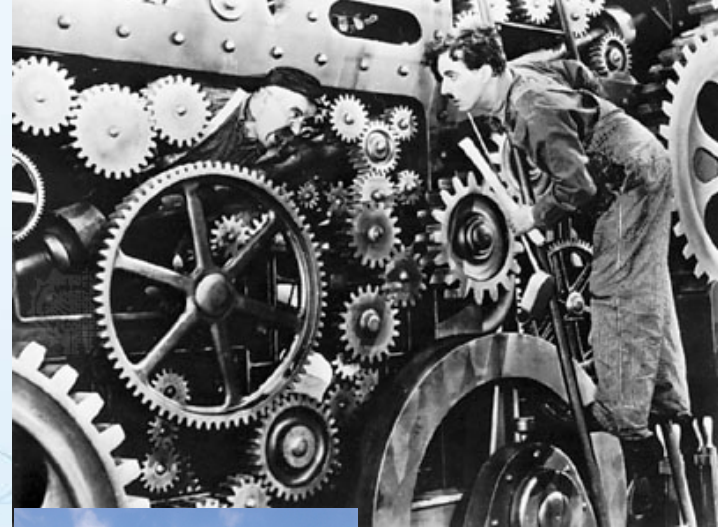


Summer Studies, Productivity and Technical/Policy Innovation

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**American Council for an Energy-
Efficient Economy (ACEEE)**

February 2016



Summer Study



Summer Study: (1) A place where energy efficiency professionals gather to talk about energy efficiency from dawn to the wee hours while also enjoying sun, sand, wine and beer; (2) A place for out-of-the-box thinking and exploration of new ideas.

ACEEE Summer Study

- Began in 1980; held in even years in California; 1000+ attendees in 2014



ECEEE Summer Study

- Held in odd years since 1993, generally on the French Riviera; 400+ attendees in 2015



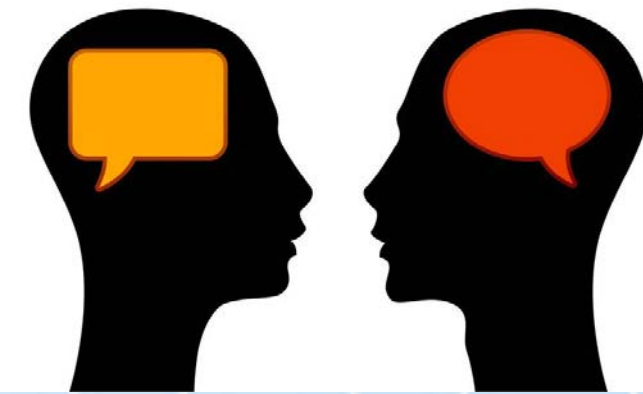
Making the Most of a Summer Study

- Disconnect from the home office – it's only a few days.
- Attend informal sessions or even set one up.
- Connect with people – e.g. share a beer with the person who's presentation you really liked that day.
- Rest up when you get home.

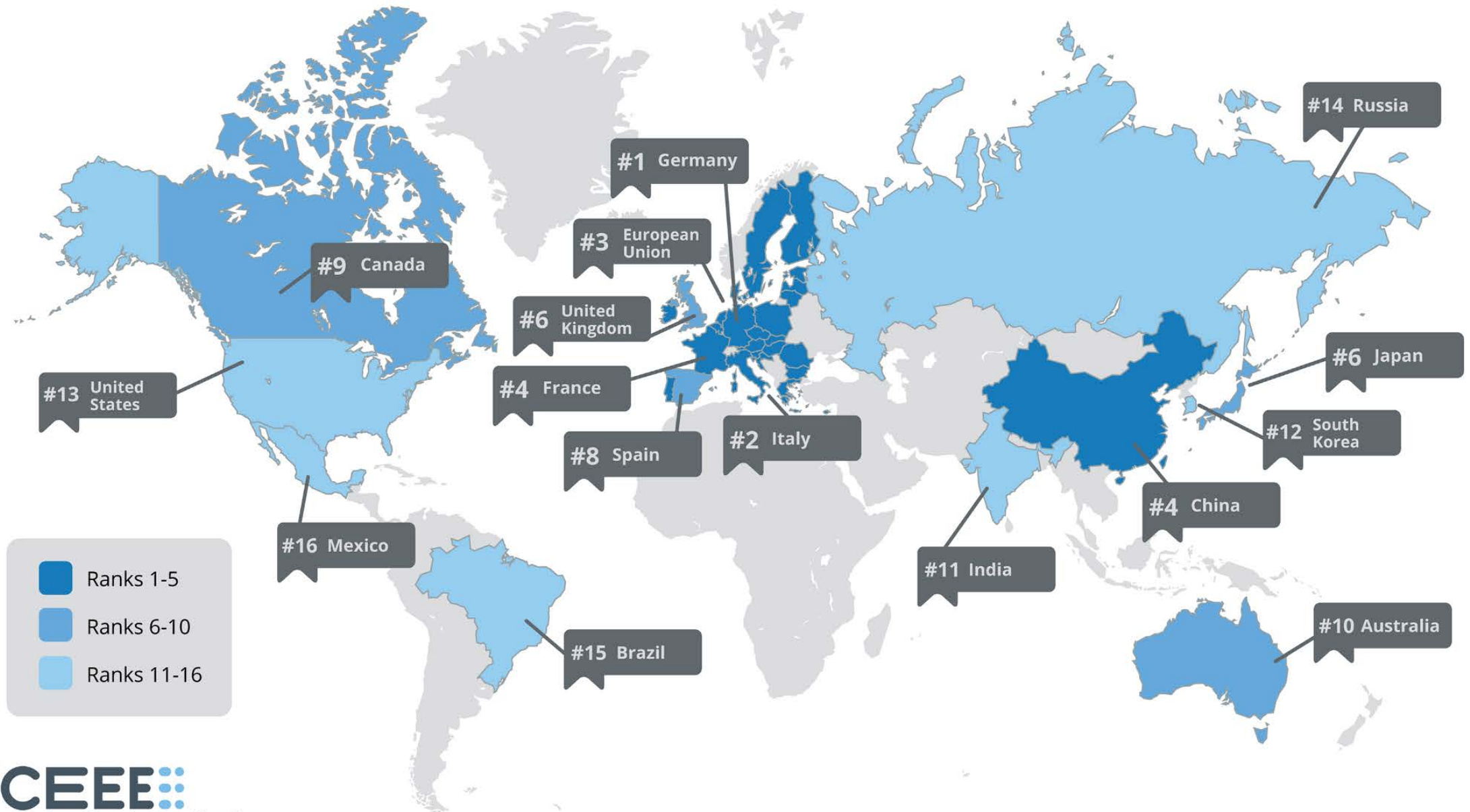


This Talk

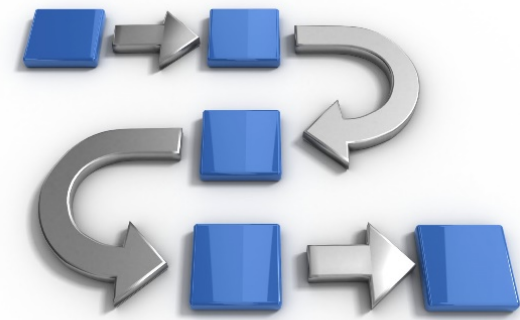
1. ACEEE International Scorecard
2. Energy productivity progress & opportunity in the US
3. Utility energy savings targets
4. Appliance, equipment & building efficiency standards
5. Vehicle fuel economy standards
6. Innovation



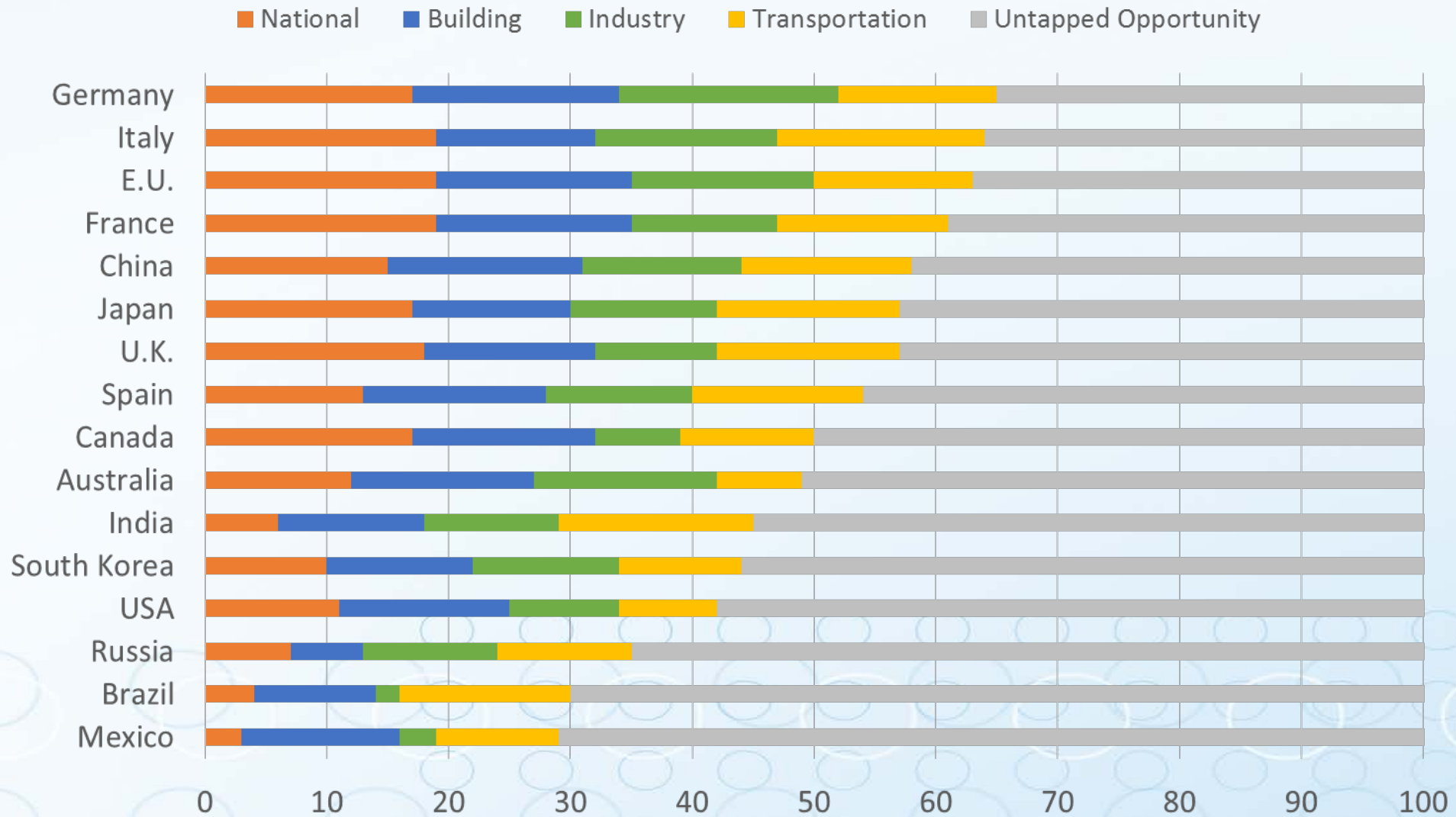
2014 International Energy Efficiency Scorecard



Methodology: Limitations

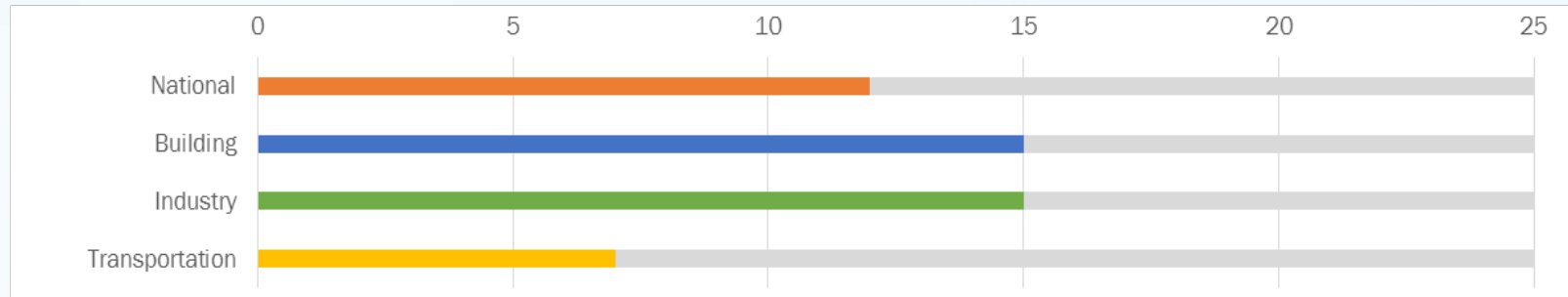


- There is no perfect measure of energy efficiency economy-wide
 - 31 different measures provide a high-level snapshot
- Differences in countries impact the results (geographic size, population, climate, intensity of industry, etc.)
 - Attempted to mitigate this by normalizing results where possible
- Consistent and comparable data is challenging
 - Used internationally recognized sources and country experts



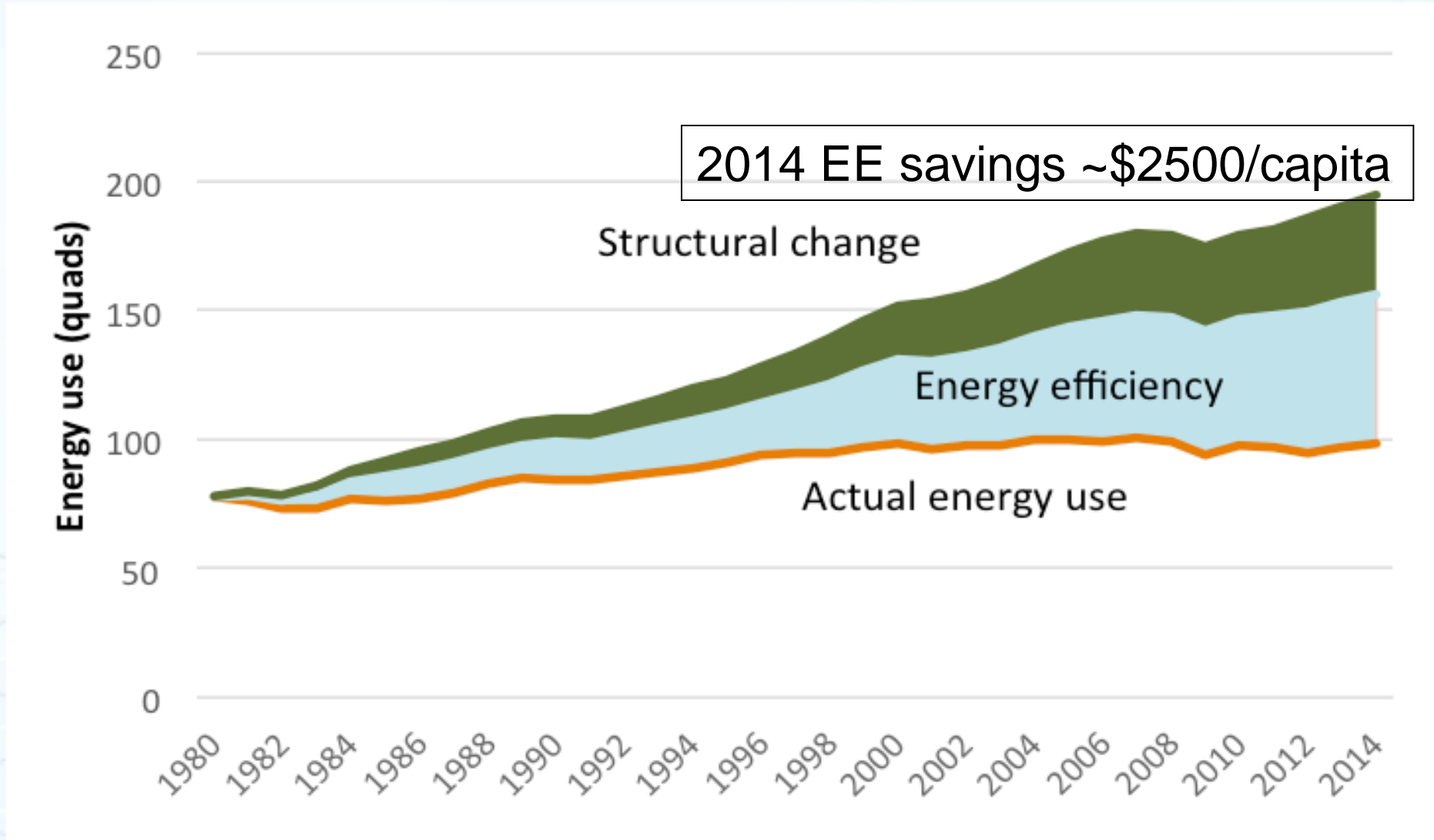
- Highest score available for a given metric is always awarded to at least one country; average score was 50, highest was 65

Australia

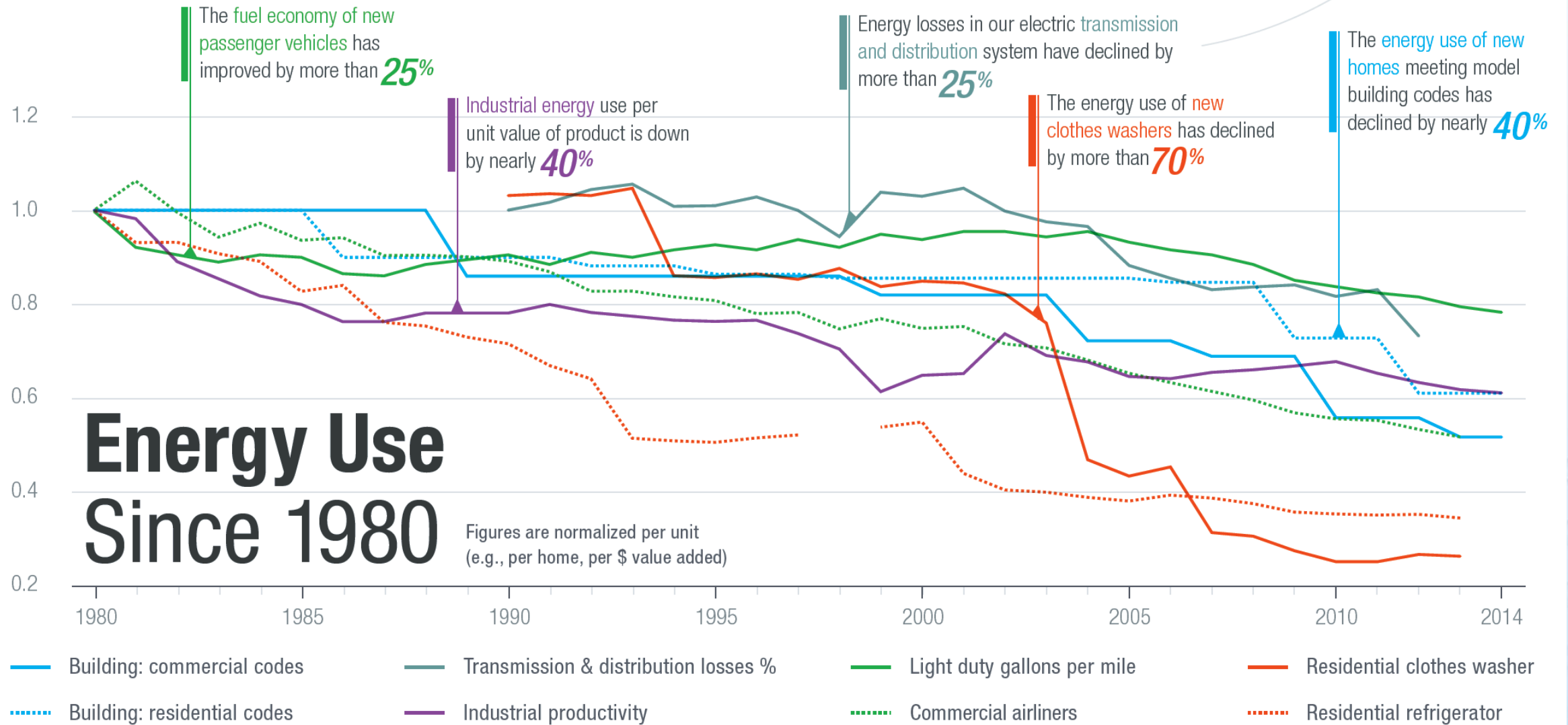


- Australia was 6 of 12 in 2012 scorecard
- Strong in buildings and industry – building codes and labeling; equipment standards & labeling; voluntary agreements with industry, low manufacturing energy intensity, Clean Energy Future Package
- National policies weakened since prior scorecard (savings targets, grant programs)
- No vehicle fuel economy standards, limited non-road transportation

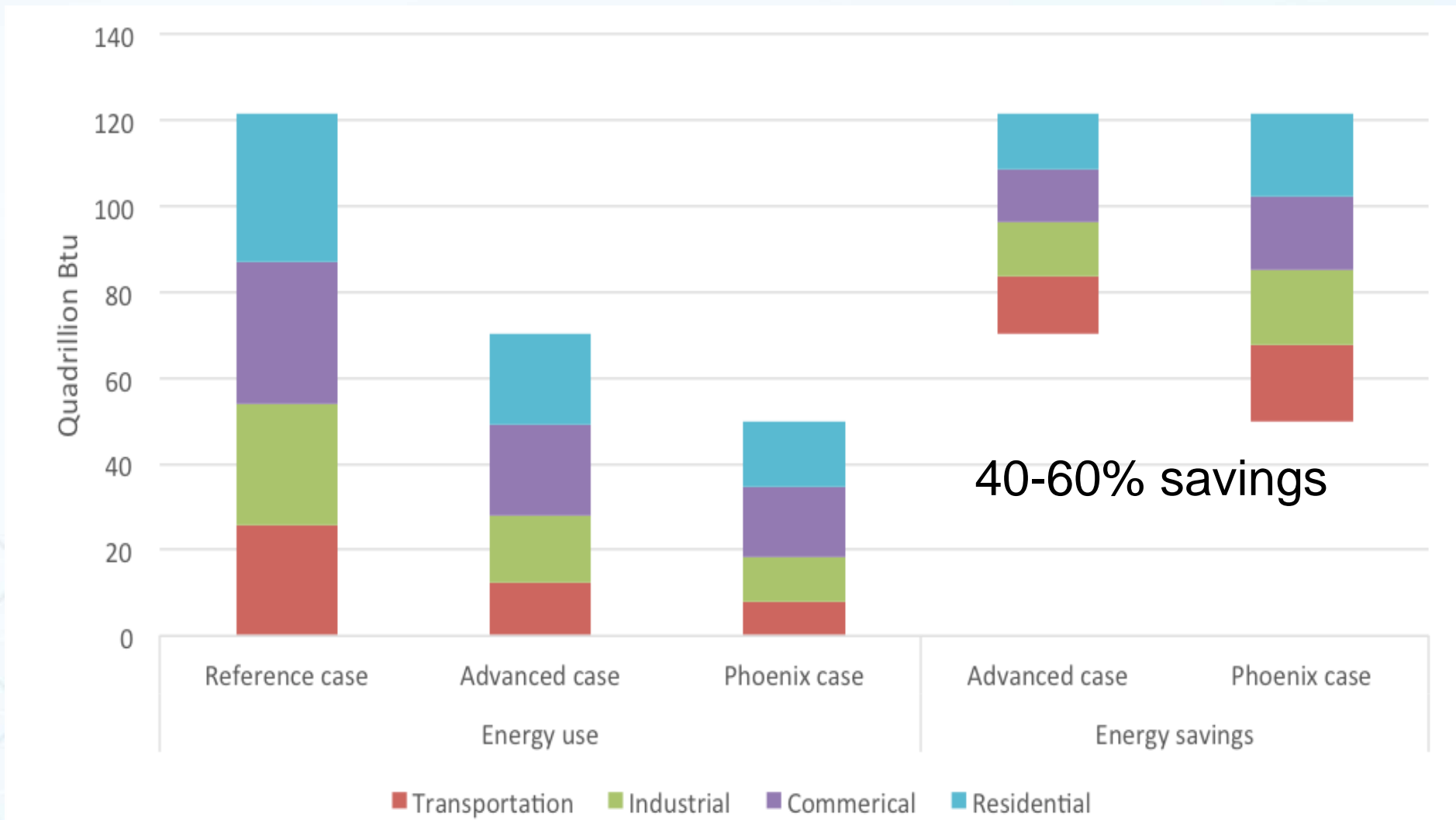
U.S. Energy Use Since 1980



U.S. Trends

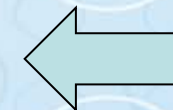


U.S. 2050 Savings Potential



Long-Term Efficiency Macroeconomic Impacts

| Financial and Economic Indicators | Advanced Case | Phoenix Case |
|---|---------------|--------------|
| Energy Savings from 2050 Reference Case | 42% | 59% |
| Implied Cost of Technology | | |
| Simple Average Payback 2012 | 3.5 | 3.6 |
| Simple Average Payback 2050 | 5.6 | 9.9 |
| Cumulative Financial Impacts 2012-2050 (Billion 2009 Dollars) | | |
| Program Cost | \$500 | \$1,200 |
| Total Investments | \$2,400 | \$5,300 |
| Annual Payments on Investments | \$2,900 | \$6,400 |
| Energy Bill Savings | \$15,000 | \$23,700 |
| Net Savings | \$11,600 | \$16,200 |
| Net Present Value at 5% Discount Rate | \$3,000 | \$3,900 |
| Total Resource Cost Ratio at 5% Discount Rate | 2.8 | 2.1 |
| Net Macroeconomic Impacts in the Year 2050 | | |
| Employment (millions of jobs) | 1.3 | 1.9 |
| Percent from Reference Case | 0.4% | 0.6% |
| GDP (billion 2009 dollars) | 100 | 200 |
| Percent from Reference Case | 0.3% | 0.4% |



ACEEE New Horizons Study: 22% savings available by 2030

1. Appliances & standards (RF, CW, CD)
2. New construction programs & codes
3. Advanced lighting design & controls
4. Very efficient packaged AC for residential & commercial
5. Smart manufacturing and buildings
6. Strategic energy management for large C&I
7. Reduce key plug loads
8. Real-time feedback
9. Advanced thermostats
10. Whole building retrofits
11. Combined heat & power
12. Conservation voltage reduction
13. Advanced water heaters
14. Residential LEDs
15. Industrial fans, pumps & compressors



Top Ten Measures by Savings Potential

| | |
|---|------|
| Large reductions in miscellaneous plug loads | 3.4% |
| Conservation voltage reduction | 2.1% |
| New construction programs | 1.9% |
| Comprehensive commercial retrofits | 1.7% |
| Smart manufacturing | 1.6% |
| High efficiency residential air conditioners and heat pumps | 1.5% |
| Combined heat and power systems | 1.3% |
| Advanced commercial lighting design and controls | 1.3% |
| High efficiency heat pumps replacing electric resistance furnaces | 1.2% |
| Smart commercial buildings | 1.2% |

Savings are percentage of total electricity demand in 2030
(above values are from medium scenario in ACEEE analysis)

Productivity Benefits Beyond Energy Savings



- In single-family homes, energy efficiency can improve health, safety, comfort, increase property value and reduce maintenance.
 - Benefits 50-300% of energy cost savings
- In multifamily buildings, similar benefits plus renter satisfaction, higher occupancy and reduced turnover
 - Benefits 3-250% of energy cost savings

Source: ACEEE, Multiple Benefits, 2015



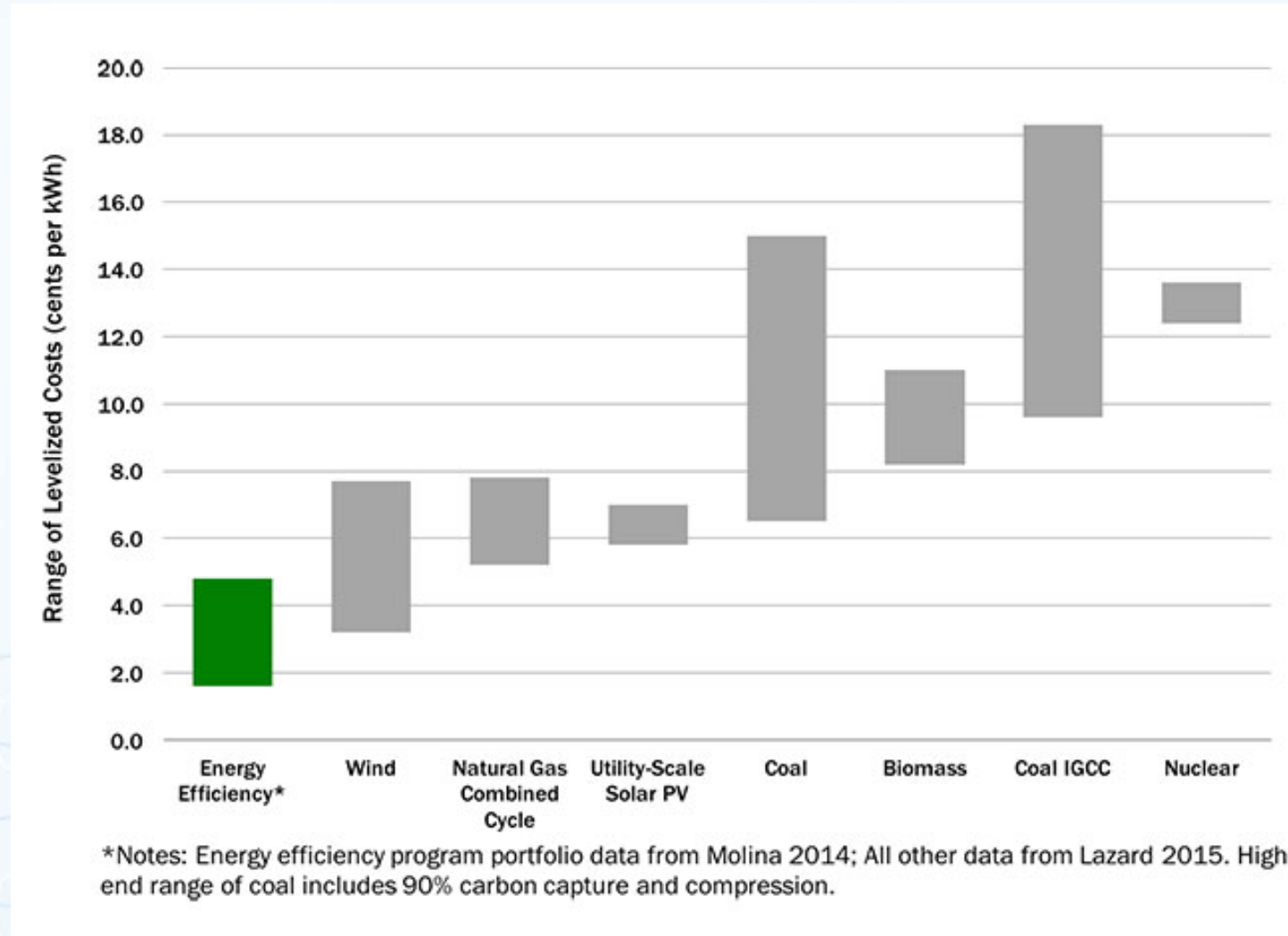
Productivity Benefits for Business

- In the commercial sector, increased employee comfort, satisfaction and health, improved public image, reduced maintenance and capital cost, higher occupancy rates
- In the industrial sector, improved product quality & safety, increased production, reduced waste & emissions
- Benefits of 42-122% of energy cost savings

Source: ACEEE, Multiple Benefits, 2015



Energy Efficiency – A Low-Cost Utility Resource



Source: Energy efficiency data represent the results from Molina 2014 for utility program costs (range of four-year averages for 2009-2012); supply costs are from Lazard 2015.

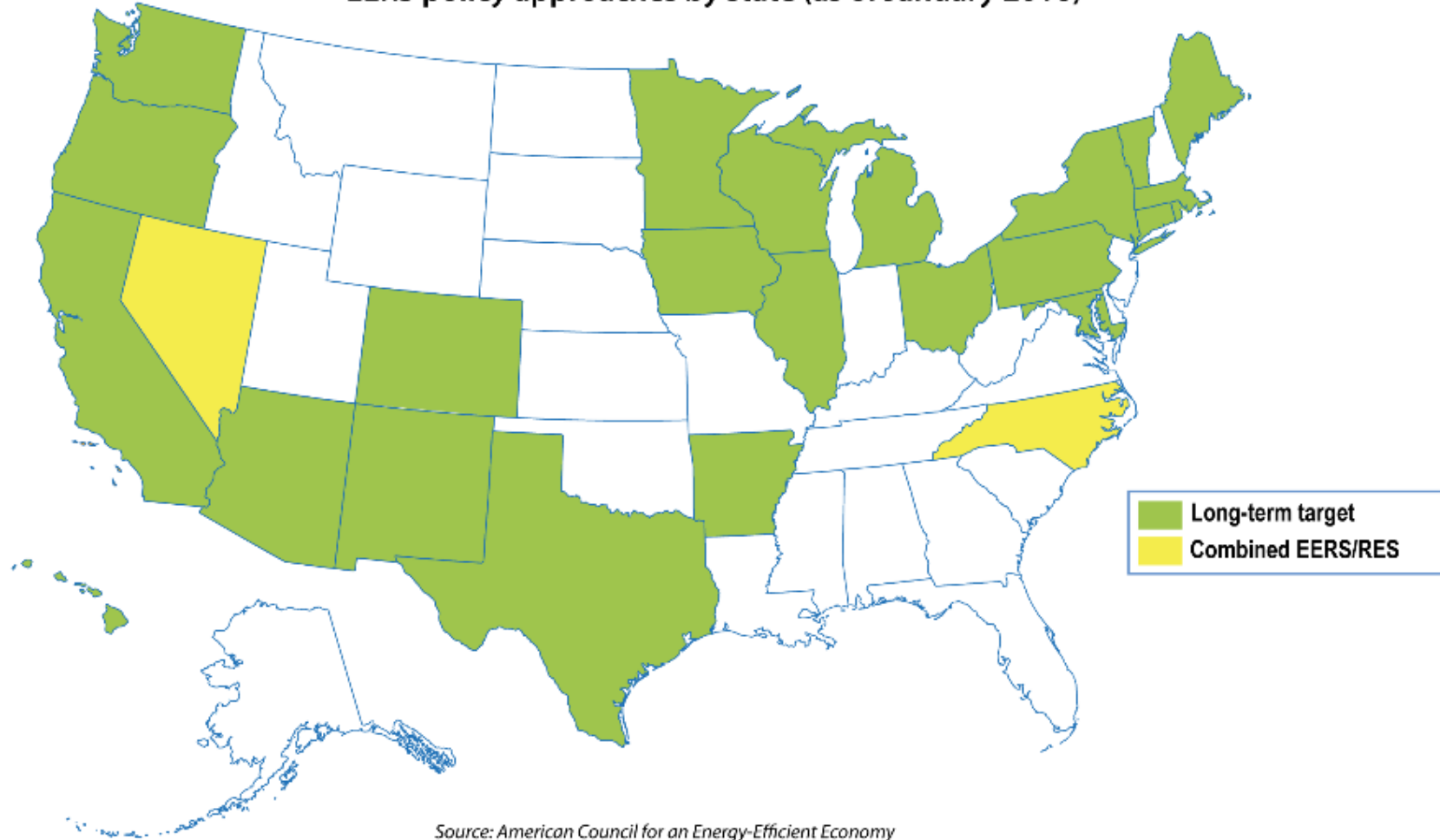
Energy Efficiency Resource Standard



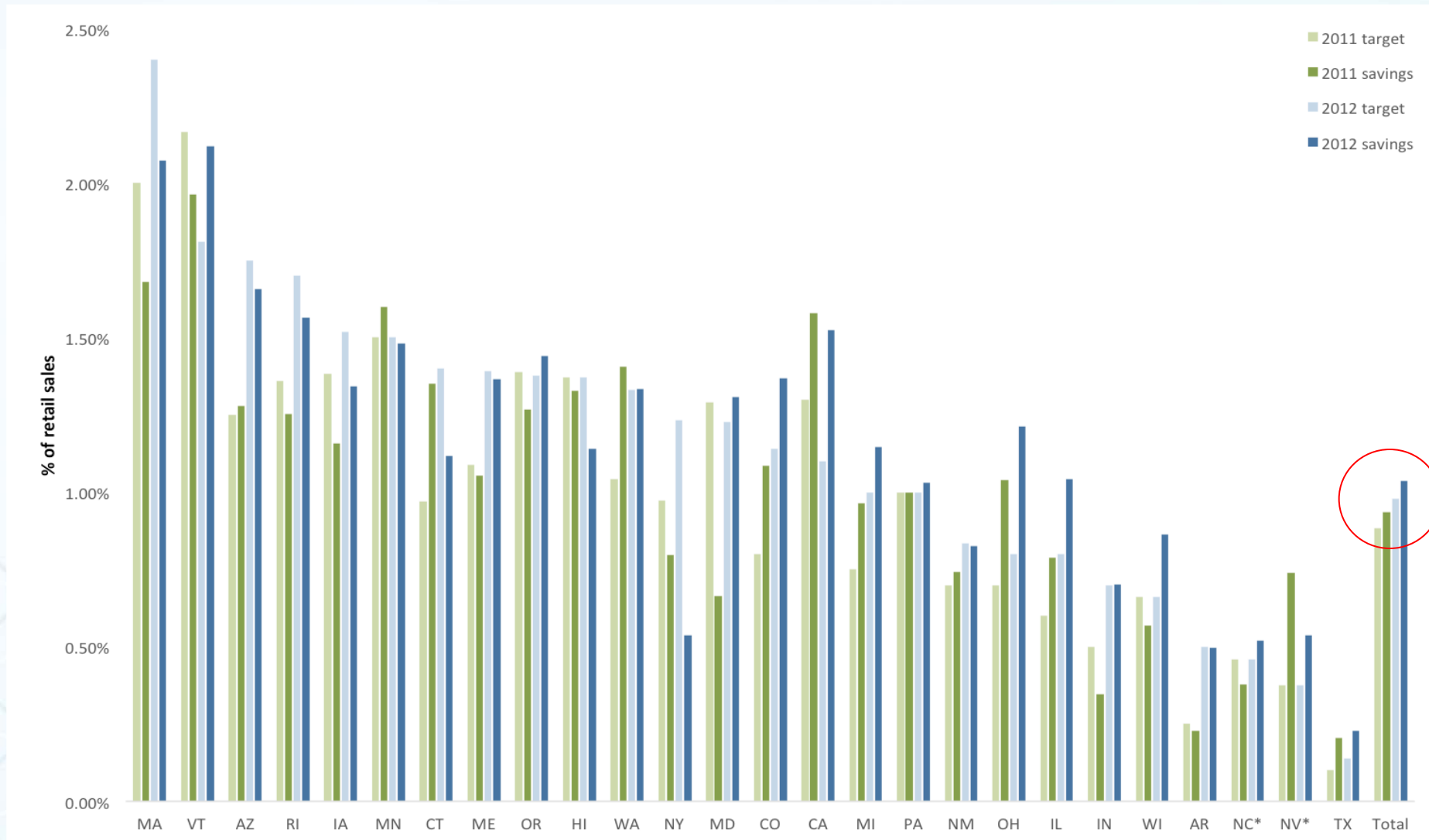
- Mandatory energy savings target
 - Some consequences if not met
 - Adequate funding to meet targets
 - Targets more than short-term – at least 3 years
- Drive more savings
 - Of the 19 U.S. states with the most electric savings in 2013, all have targets

Current EERS Policy Status

EERS policy approaches by state (as of January 2016)



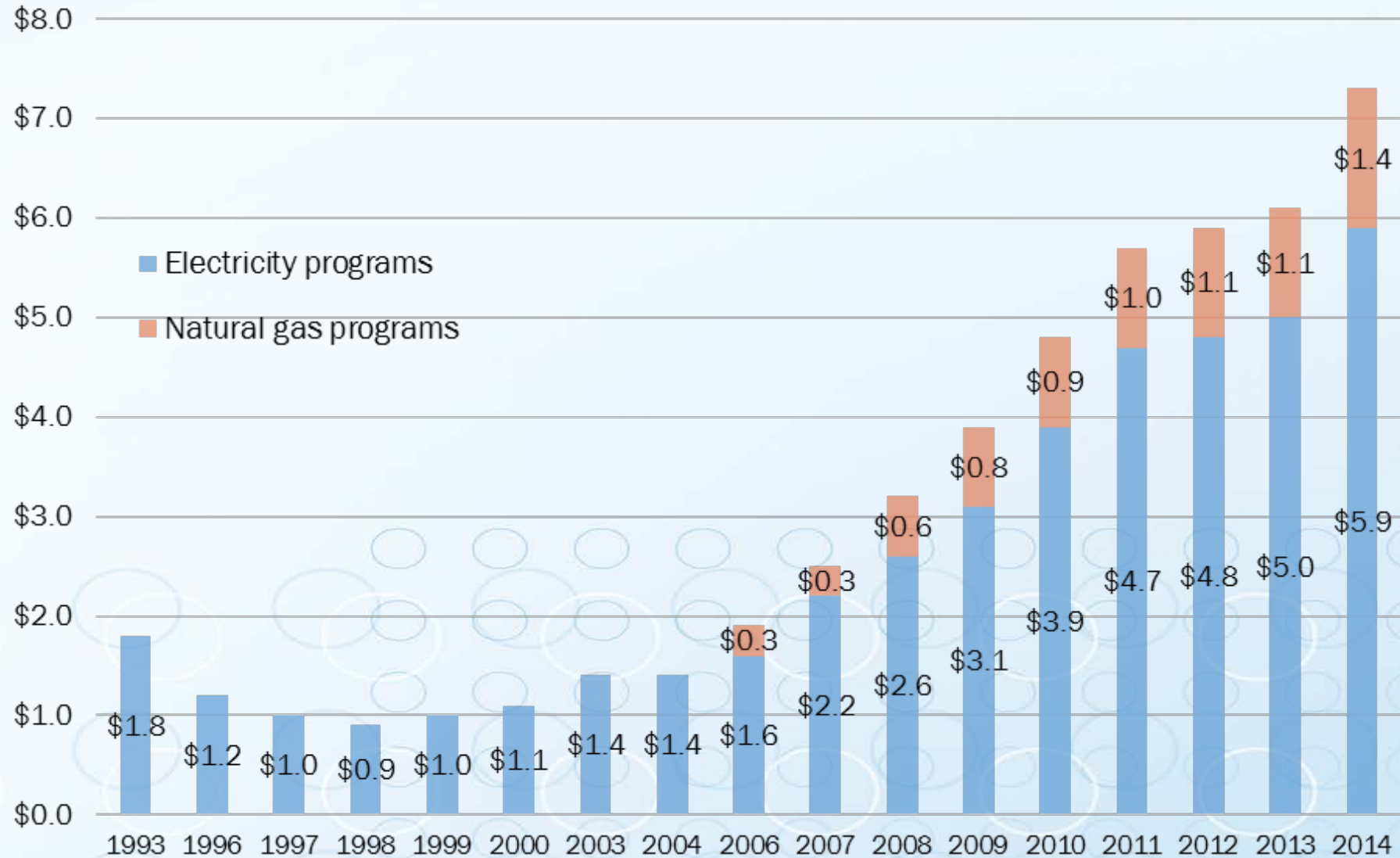
Electric Savings & Targets, 2011-2012



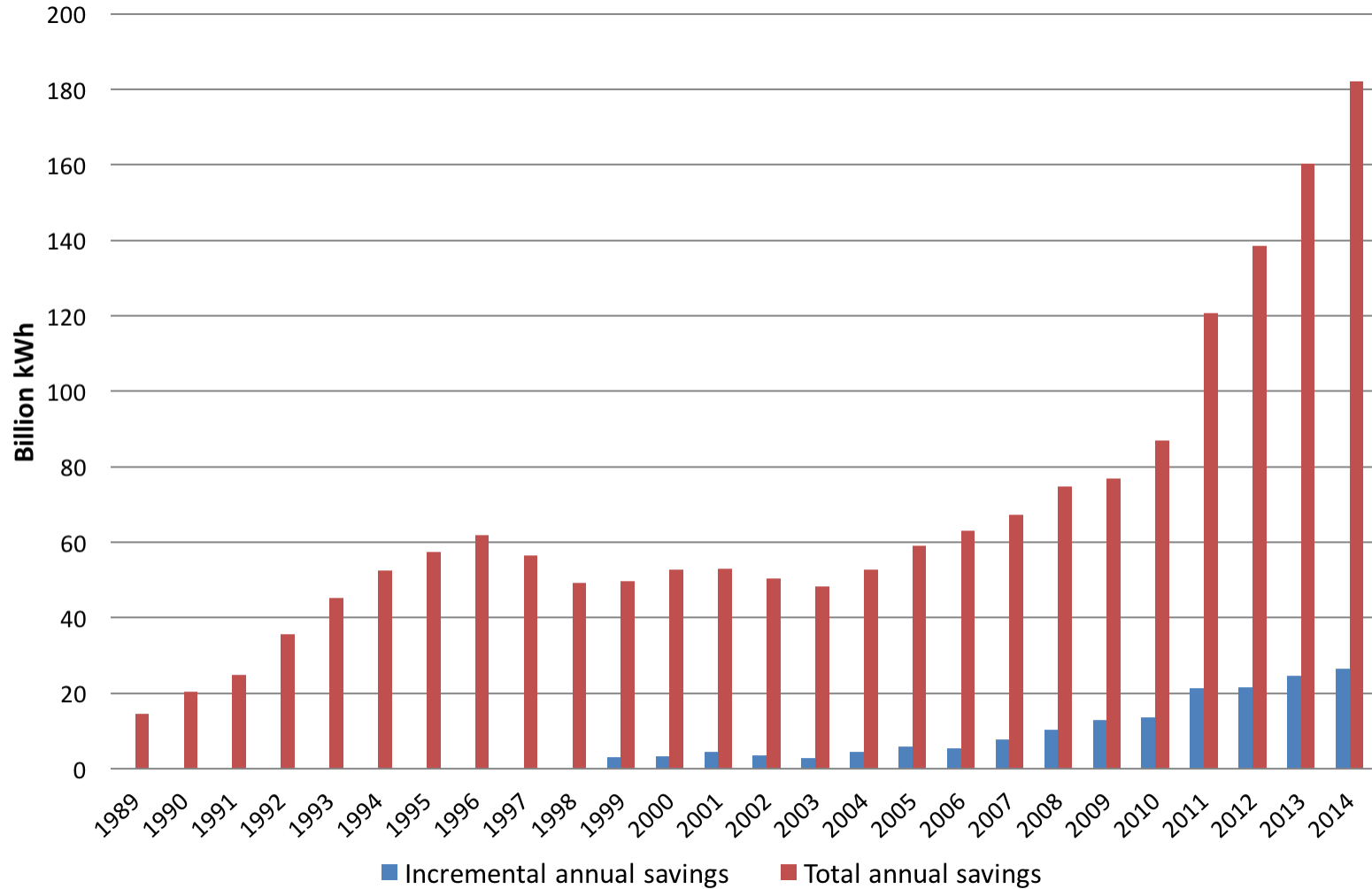
Impact of EERS (2013 data)

| Policy | No. of states | Average EE investments as % of revenues* | Average EE savings as % of sales* |
|----------|---------------|--|-----------------------------------|
| No EERS | 24 | 0.7 | 0.3 |
| Yes EERS | 26 | 2.6 | 1.1 |

Utility Energy Efficiency Spending



Savings from Utility EE Programs



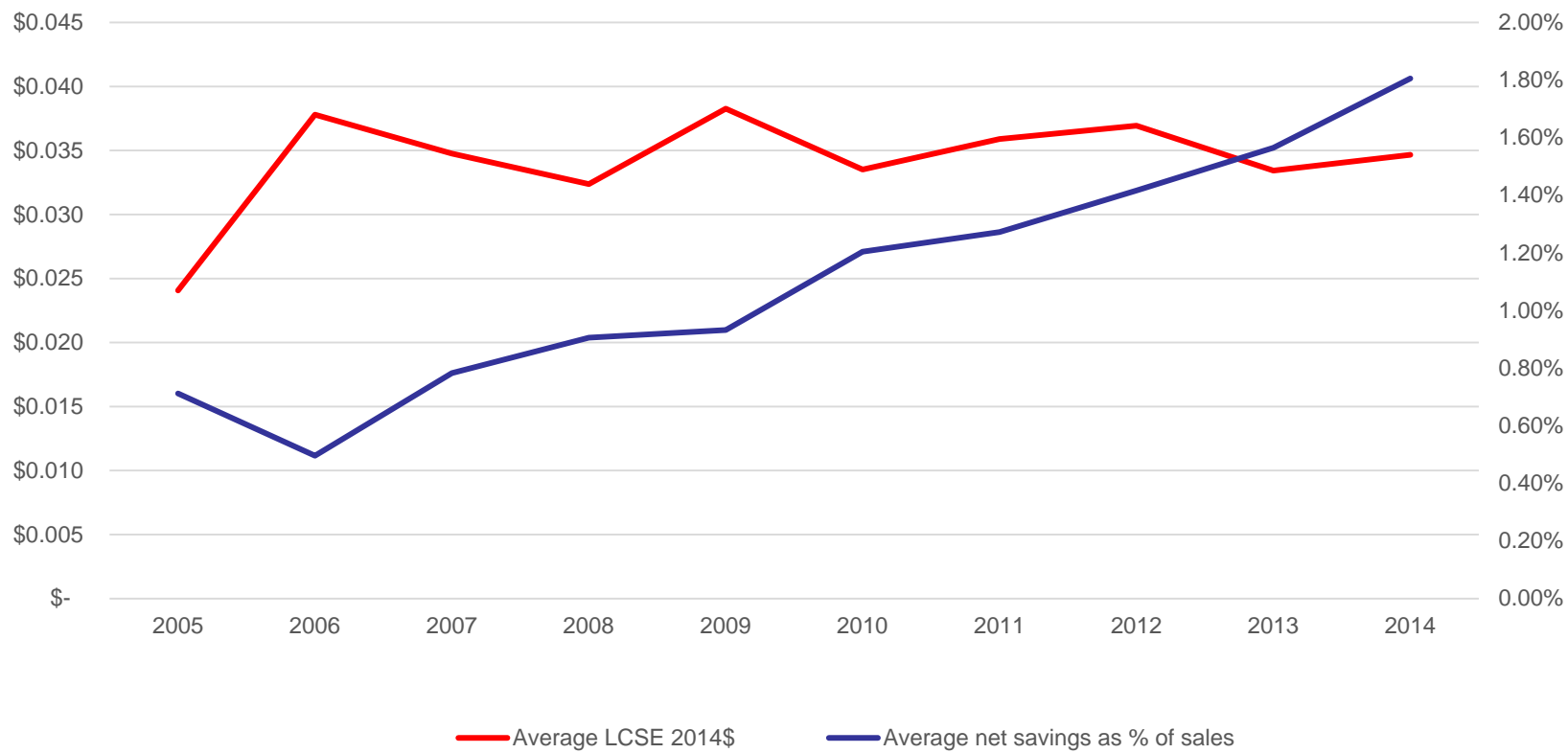
Total savings are 4.8% of total sales in 2014

Incremental savings are 0.7% of total sales in 2014

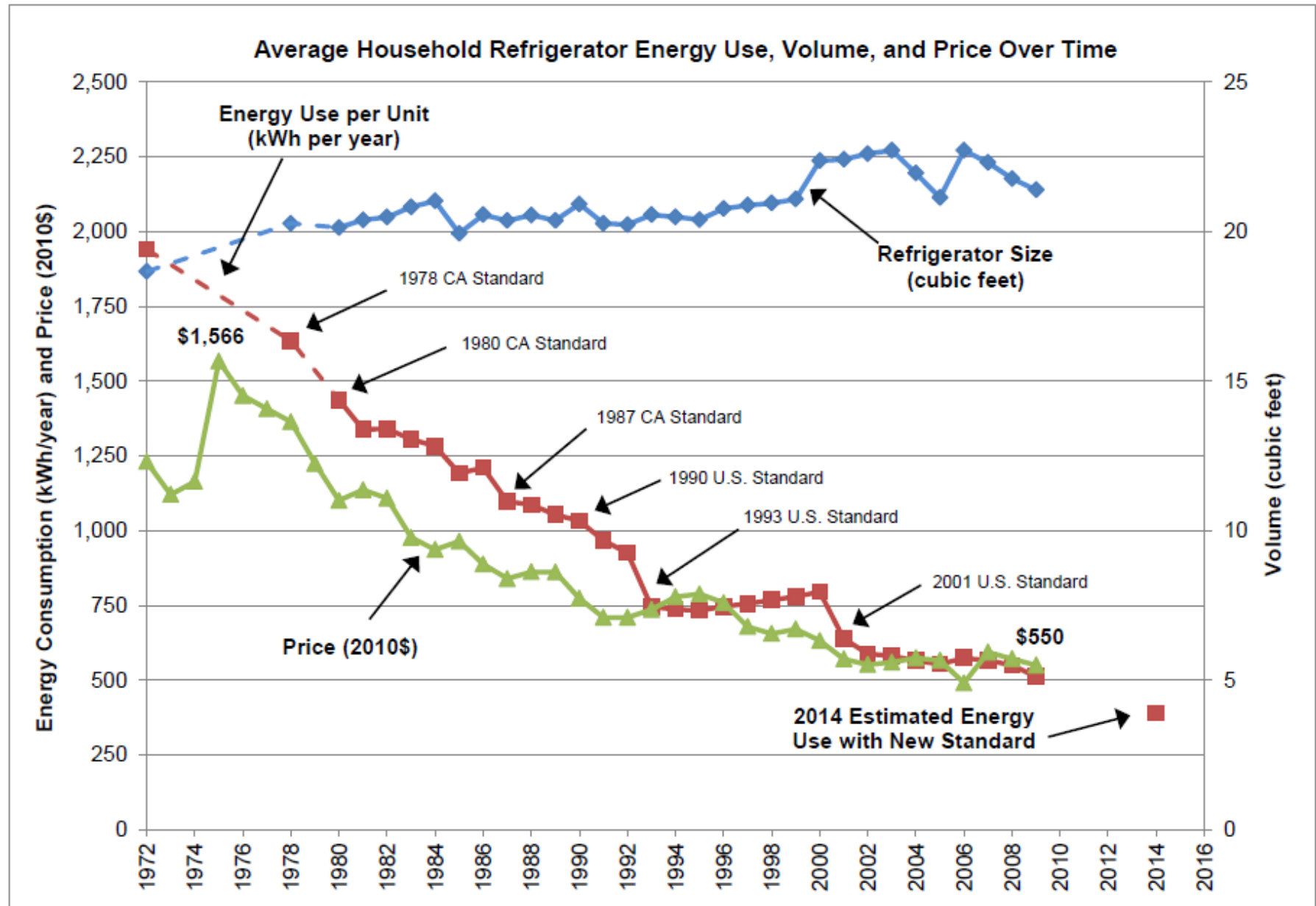
Electric Savings of Leading States

| <u>State</u> | <u>Savings as % of Sales (2014)</u> |
|---------------|-------------------------------------|
| Rhode Island | 3.51 |
| Massachusetts | 2.50 |
| Vermont | 1.85 |
| Arizona | 1.74 |
| Hawaii | 1.67 |
| California | 1.58 |
| Hawaii | 1.53 |
| Michigan | 1.35 |
| Connecticut | 1.32 |
| Maryland | 1.29 |
| Oregon | 1.27 |

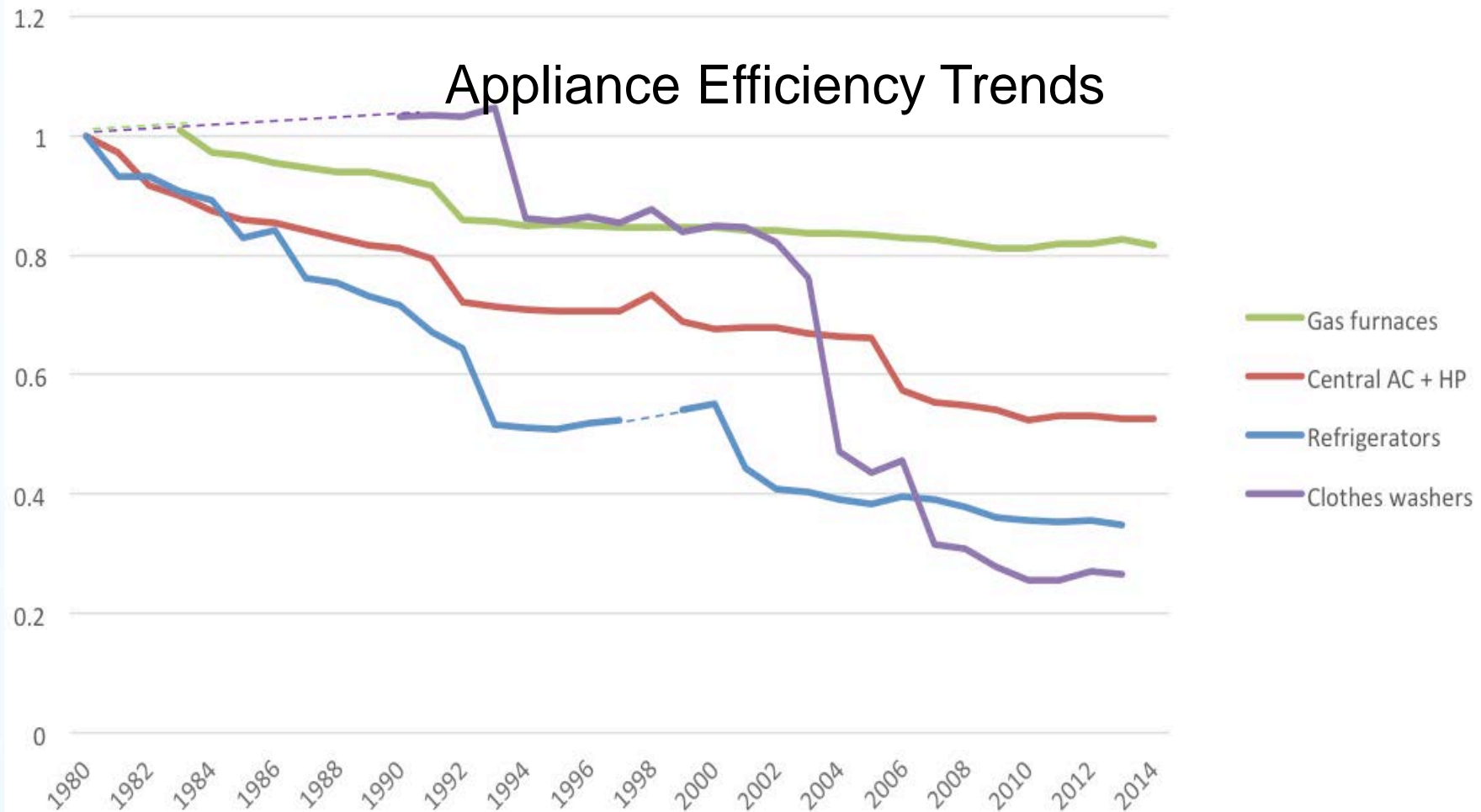
Cost and Savings by Year for 14 Program Administrators with Large Savings



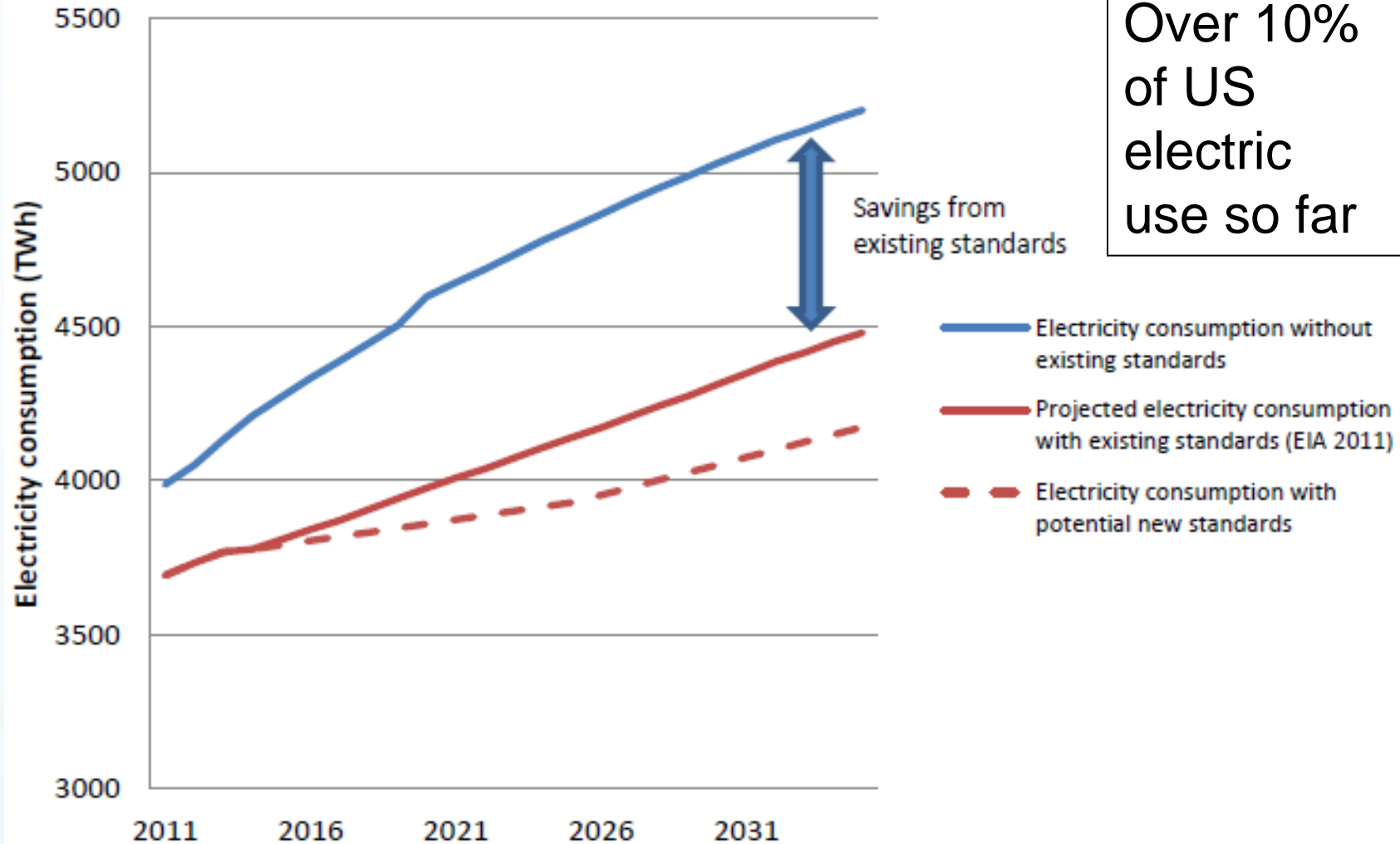
Appliance & Equipment Standards



Appliance and Equipment Efficiency Standards



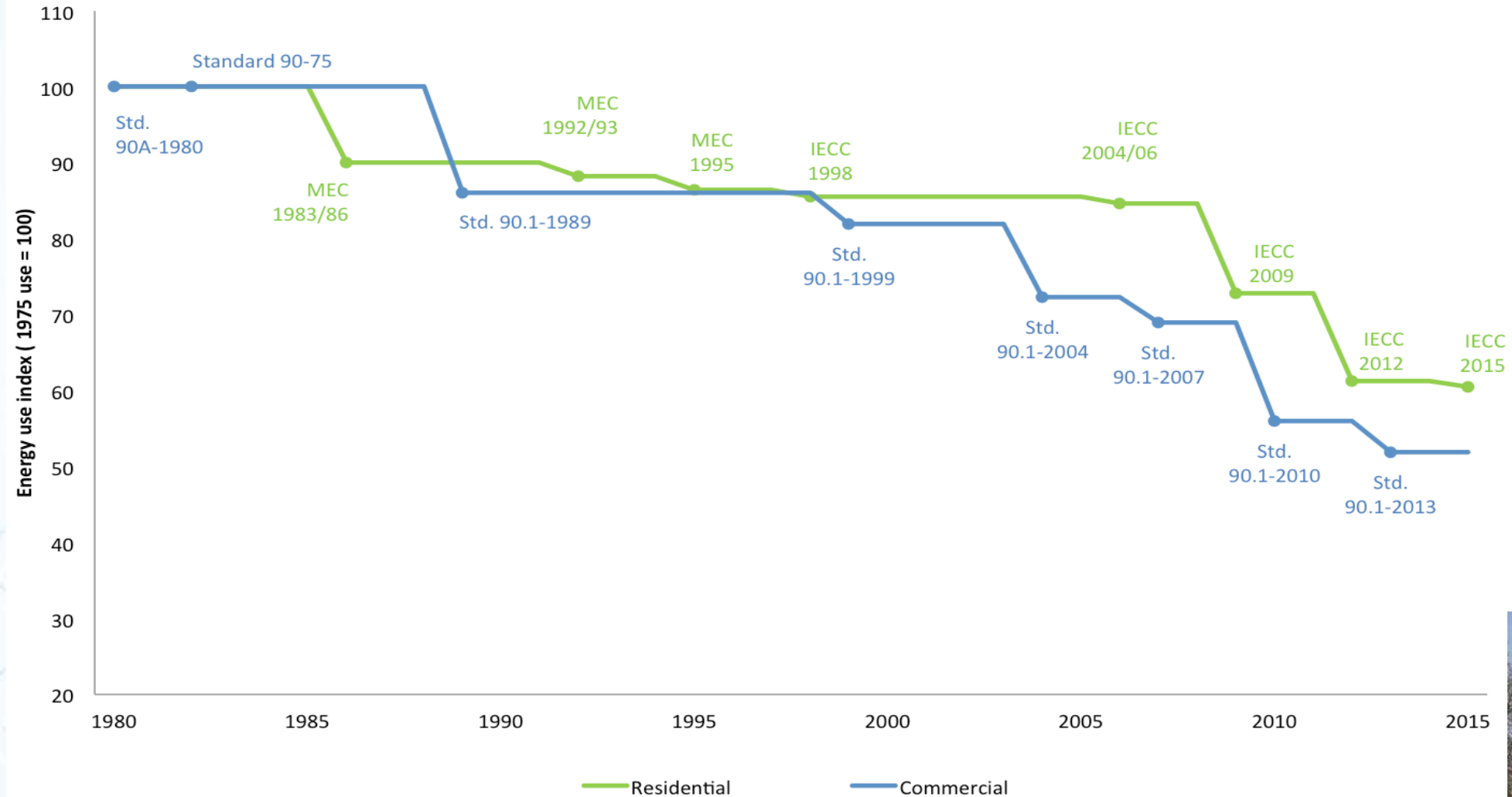
Electricity Savings from Potential Future Standards



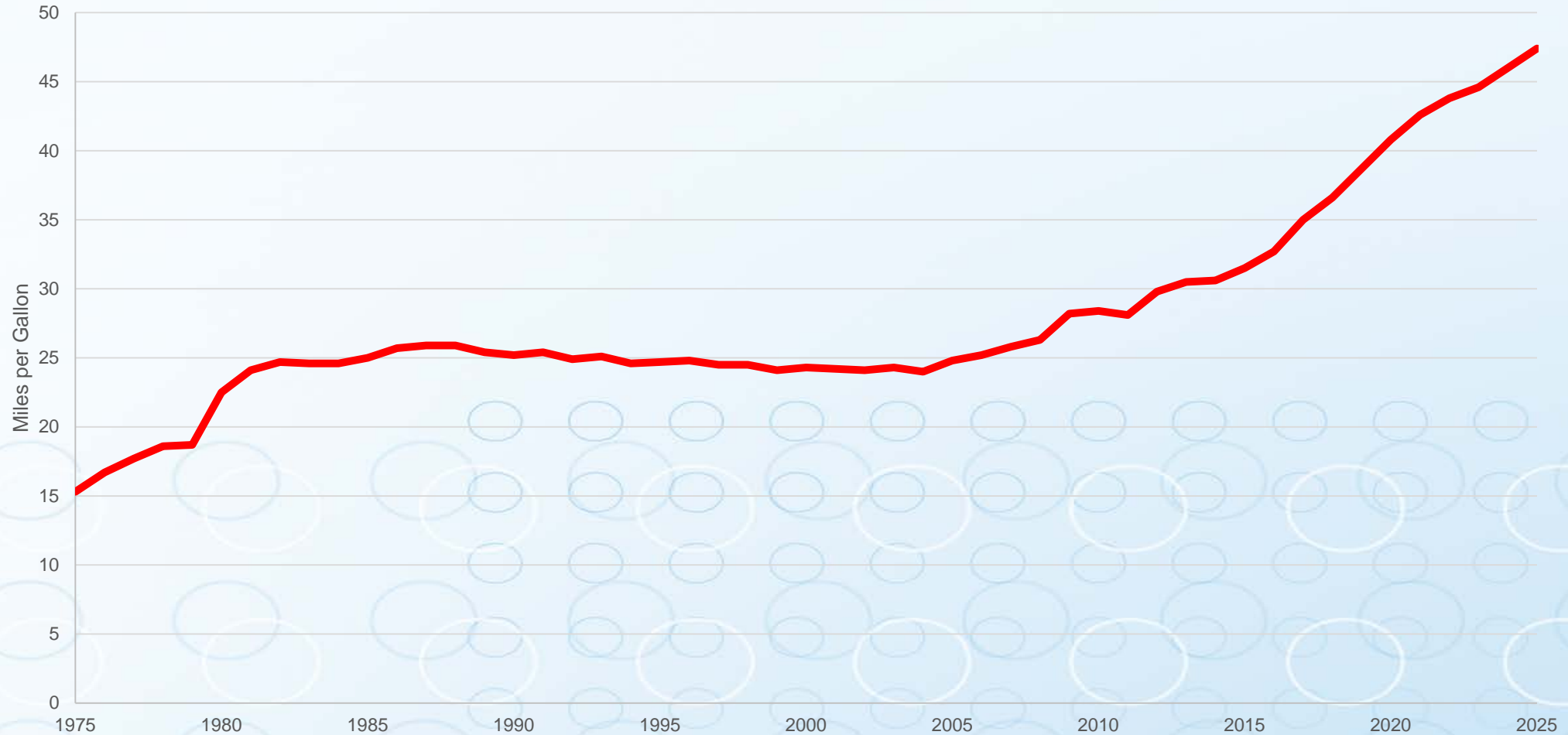
Some Notable Recent and Pending Standards



Progress on Building Energy Codes

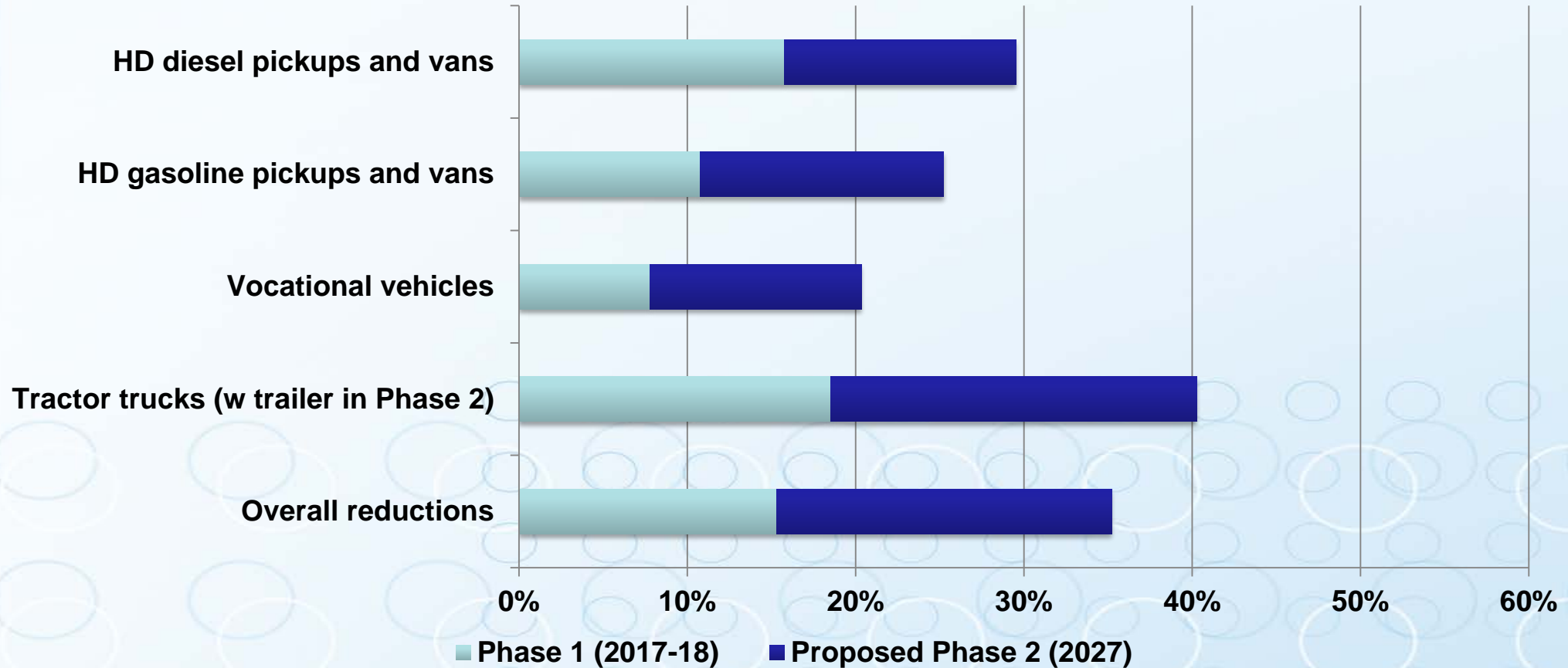


Average Actual and Estimated U.S. Passenger Vehicle Fuel Economy

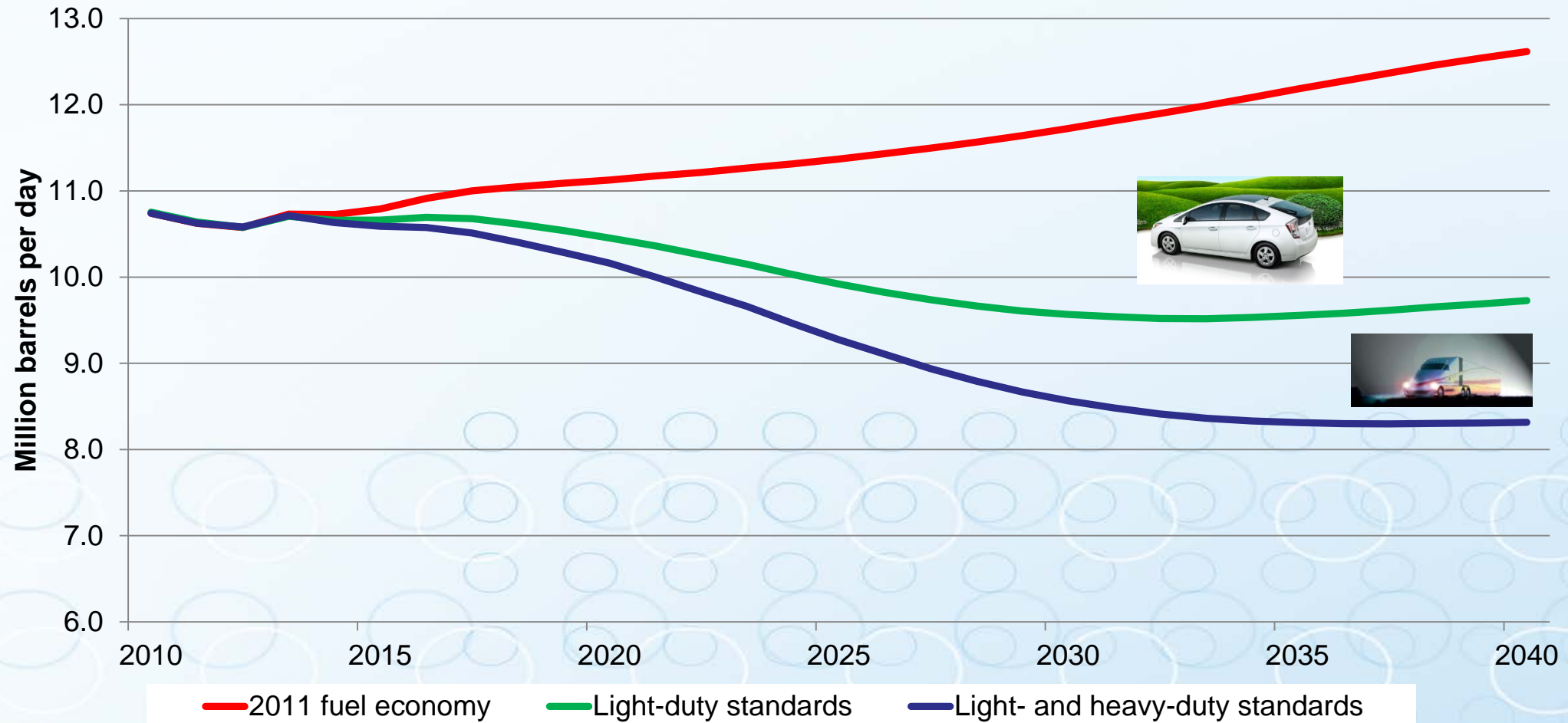


Heavy Duty Fuel Economy Standards

Required Fuel Consumption Reductions in Phases 1 and 2, Relative to 2010

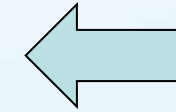


Oil Savings: Light- and Heavy-Duty Standards (including Proposed Phase 2)

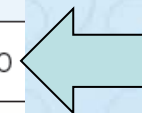


Light Duty Vehicle Standards & Jobs

| | 2017 | 2020 | 2025 | 2030 |
|-------------------------------------|--------|--------|---------|---------|
| Employment (net change) | 16,000 | 76,000 | 320,000 | 570,000 |
| Percent change from reference | 0.01% | 0.04% | 0.18% | 0.30% |
| Wages (Million 2010 dollars) | 1,200 | 6,000 | 27,000 | 49,000 |
| Percent change from reference | 0.01% | 0.07% | 0.28% | 0.46% |
| GDP (Million 2010 dollars) | 1,900 | 9,000 | 41,000 | 75,000 |
| Percent change from reference | 0.01% | 0.05% | 0.19% | 0.30% |



| | | | 2025 | 2030 | 2017 | 2020 | 2025 | 2030 |
|--|---|-------|--------|--------|---|--------|--------|--------|
| | *Lower Bound (7 percent discount rate and flat purchase price)* | | | | *Upper Bound (3 percent discount rate and higher purchase price)* | | | |
| Increased spending (\$MM2010) | 880 | 6,400 | 15,000 | 15,000 | 930 | 7,000 | 16,000 | 17,000 |
| Below are employment results of above spending | | | | | | | | |
| Iron and Steel Production | 50 | 350 | 760 | 740 | 53 | 380 | 820 | 810 |
| Parts Manufacturing for LD Vehicles | 1,300 | 8,500 | 16,000 | 14,000 | 1,400 | 9,200 | 18,000 | 16,000 |
| LD Vehicle Manufacturing | 100 | 700 | 1,400 | 1,300 | 110 | 760 | 1,500 | 1,400 |
| Below is the sum of the above sectoral employment effects | | | | | | | | |
| Total Auto Manufacturing Supply Chain* | 1,500 | 9,600 | 18,000 | 16,000 | 1,600 | 10,000 | 20,000 | 18,000 |



Note: Numbers may not appear to add up due to rounding.

Intelligent Efficiency

INTEGRATED, RELIABLE, and SMART.

People-Centered Efficiency

Providing real-time information and management tools that enable users to lower energy consumption in response to changing information

Technology-Centered Efficiency

Using sensors, controls, and software to automate and optimize energy use

Service-Oriented Efficiency

Shifting behavior and organizational structures to reduce energy-intensive activities

FUEL ECONOMY DISPLAY

HOME ENERGY MONITOR

BUS ARRIVAL APPS

GPS FLEET MANAGEMENT

BUILDING CONTROL SYSTEMS

POWER GRID CONTROLS

INTELLIGENT TRANSPORT SYSTEMS

FUEL-SAVING SYSTEMS

TELECOMMUTING

VIDEO CONFERENCING

EBOOKS & DIGITAL MUSIC

E-COMMERCE

Smart Commercial Buildings

- Use data and sensors to identify problems, then solve them
- NRDC study of 3 ~Energy Star offices using OnSite achieved 13% average savings. Other vendors report similar results



| | Square Feet | 2012 Occupancy | KWH Used | | Study Period Savings | | |
|-------------|-------------|----------------|--------------|-------------------|----------------------|--------------|-------------------|
| | | | 2011 | 2012 | % | \$ | |
| 1707 | 109,926 | 302 | 1,965,135 | 1,516,274 | 23% | \$ 58,352 | |
| 1828 | 332,928 | 928 | 5,590,937 | 5,227,183 | 7% | \$ 47,288 | |
| 1909 | 239,128 | 462 | 5,197,305 | 4,327,589 | 17% | \$ 113,063 | |
| | | | Total | 12,753,377 | 11,071,046 | 13.2% | \$ 218,703 |

Innovation – Some Ripe Targets



Conclusions

- Summer study is a place to learn, think out-of-the box and have fun
- Countries can learn from each other -- all can do better
- Utility savings targets work
- Continue to update appliance and building standards
- Time for fuel economy standards?
- Innovate!



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