



American Council for an Energy-Efficient Economy

Electricity Distribution & End- Use: Challenges & Opportunities

Steven Nadel

American Council for an
Energy-Efficient Economy

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Opportunities

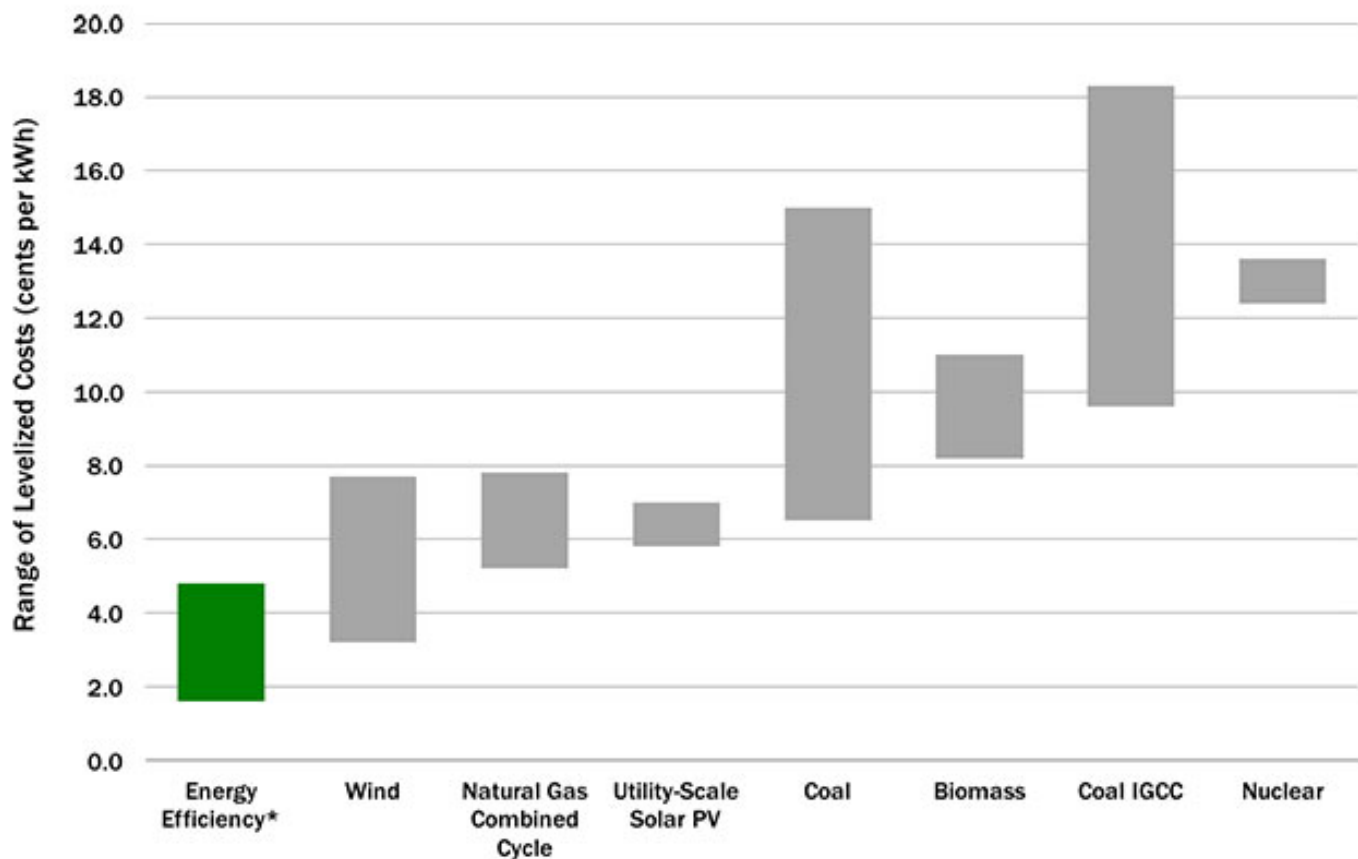
1. Direct and indirect benefits from EE
2. Can use EE to defer some grid investments
3. EE as a customer service
4. Decoupling, incentives, PBR
5. Spur EV's, HP's and benefits of distributed grid

Challenges

1. Don't over-invest in grid
2. Don't size PV for inefficient loads
3. Relying too much on the market and underinvesting in EE
4. Getting rates right



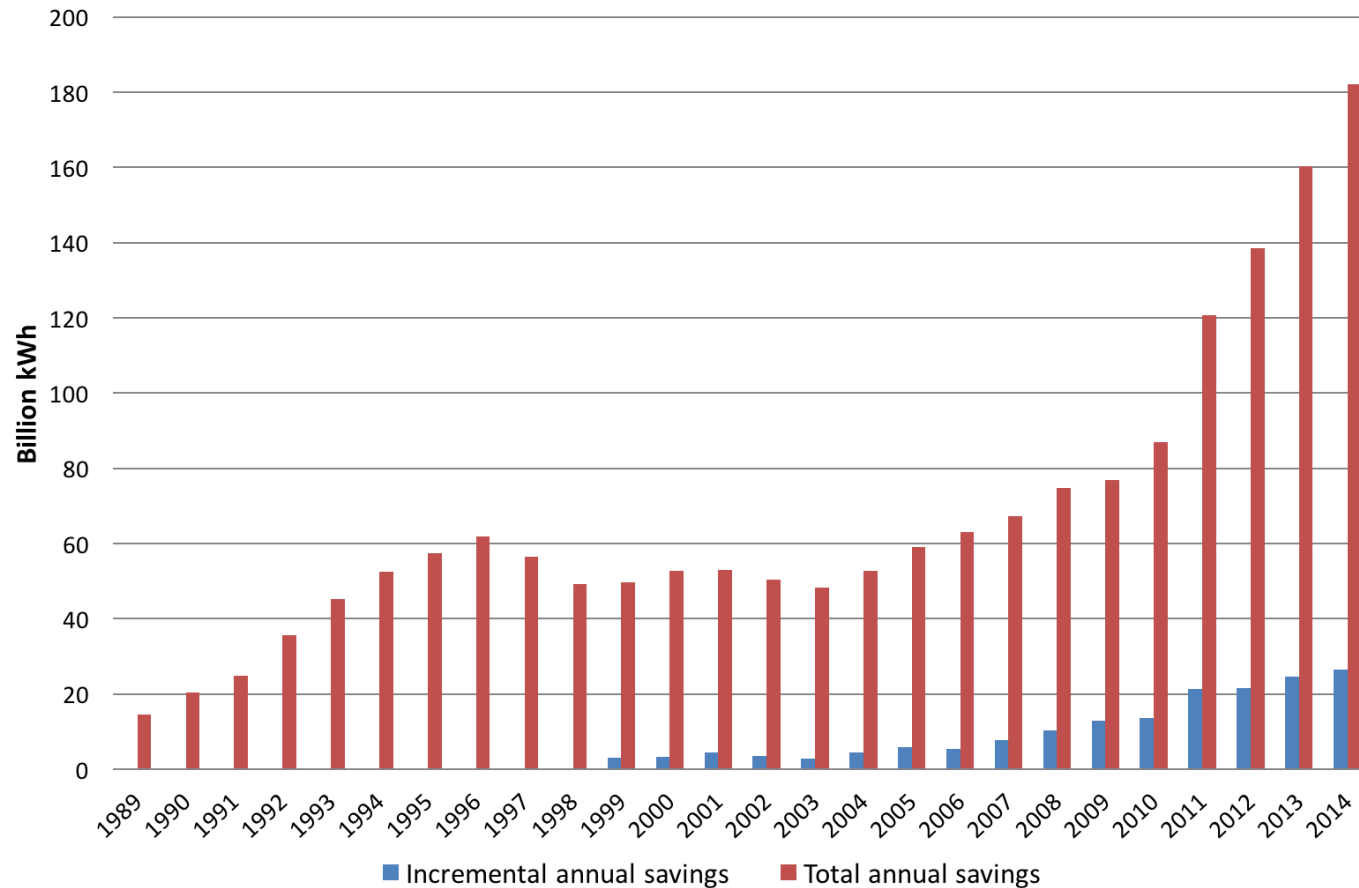
Energy Efficiency – A Low-Cost Utility Resource



*Notes: Energy efficiency program portfolio data from Molina 2014; All other data from Lazard 2015. High-end range of coal includes 90% carbon capture and compression.

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.

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

Emerging Efficiency Opportunities

Measures in ACEEE New Horizons Study

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 mgmnt for large C&I
7. Reduce key plug loads
8. Real-time feedback & advanced thermostats
9. Whole building retrofits
10. Combined heat & power
11. Conservation voltage reduction
12. Advanced water heaters
13. Residential LEDs
14. Industrial fans, pumps & compressors



ACEEE New Horizons Study

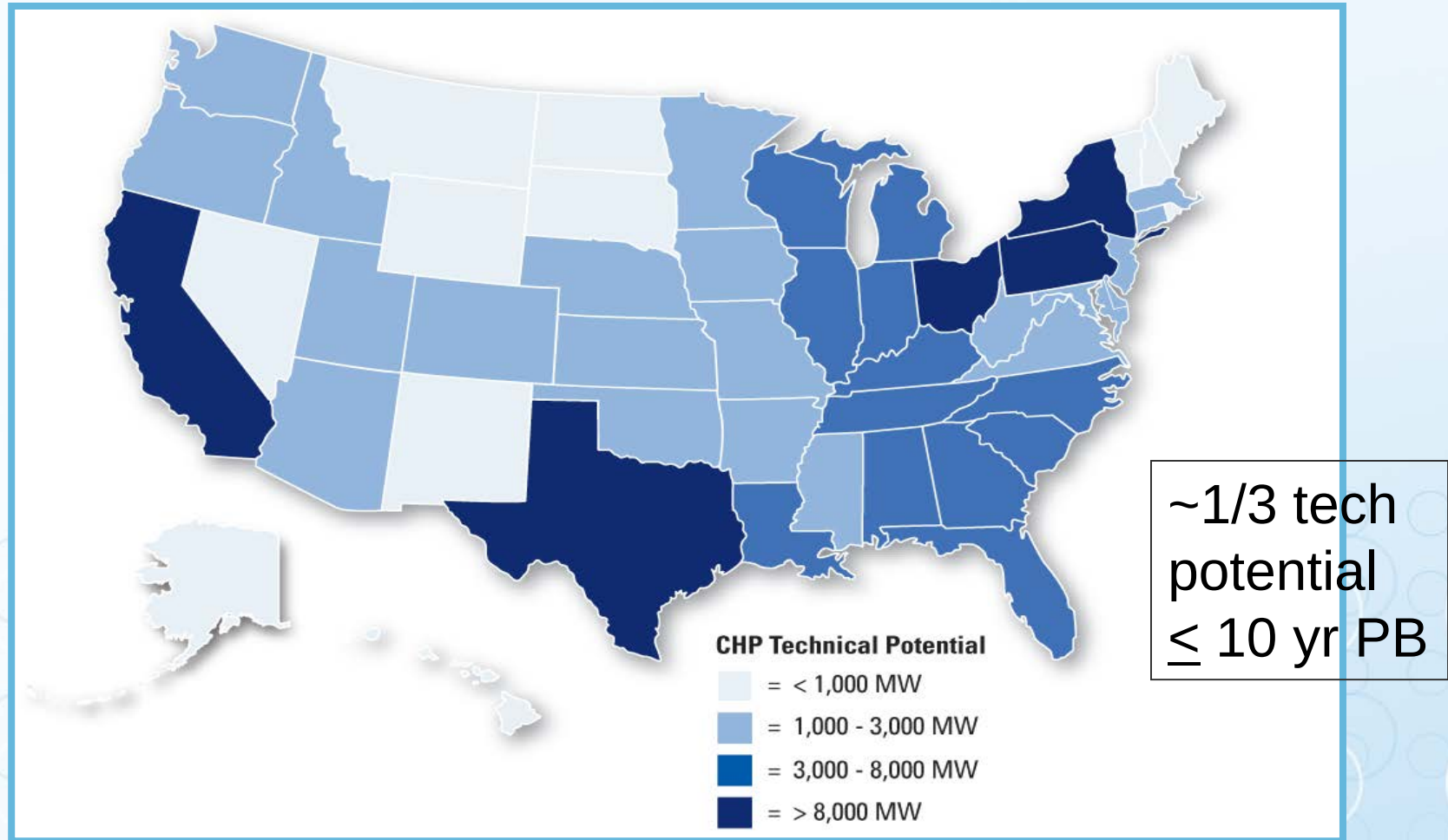
-- 22% savings available by 2030

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)

CHP Technical Potential



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



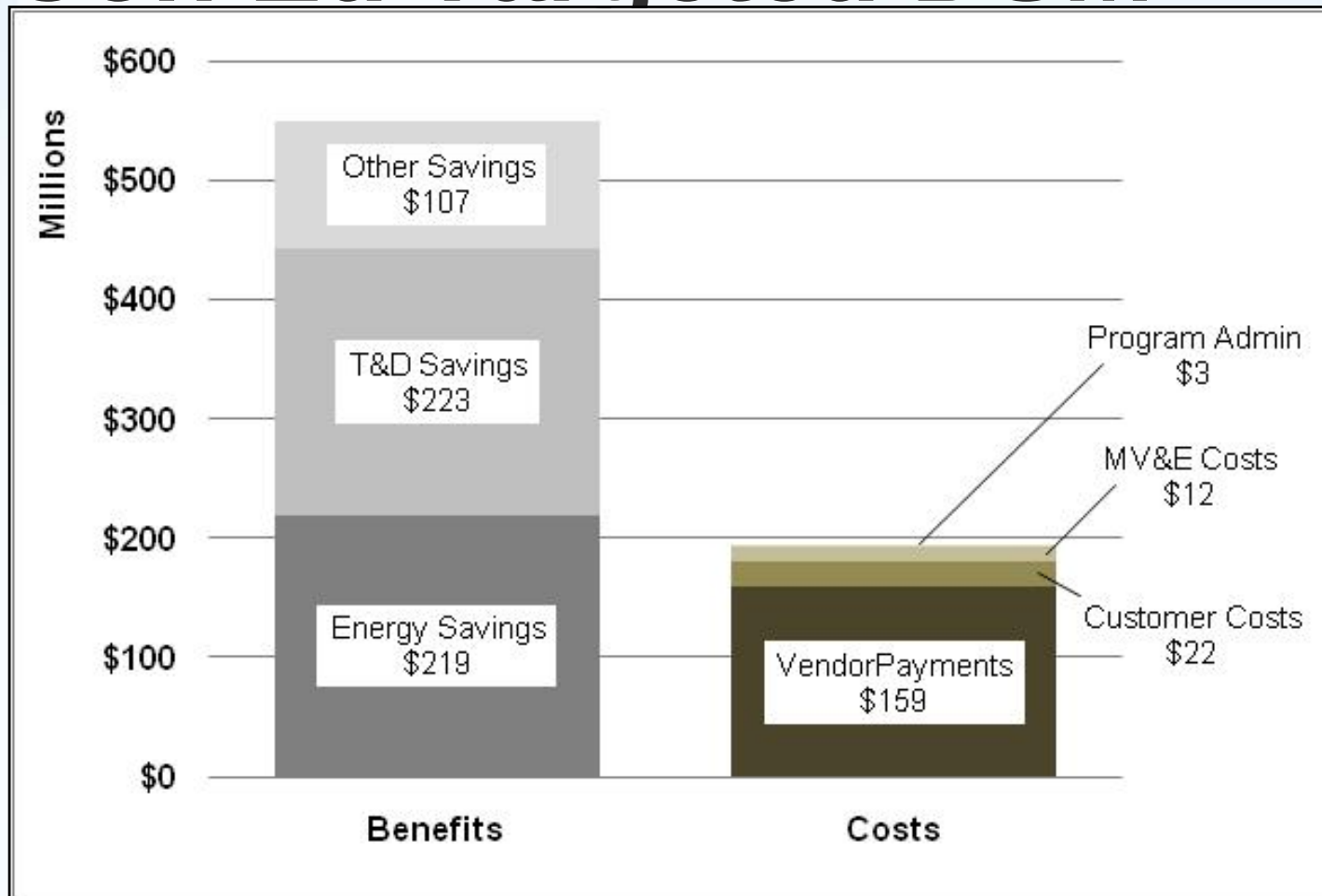
Additional Benefits for Business

- 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



Benefits and Costs of Con Ed Targeted DSM

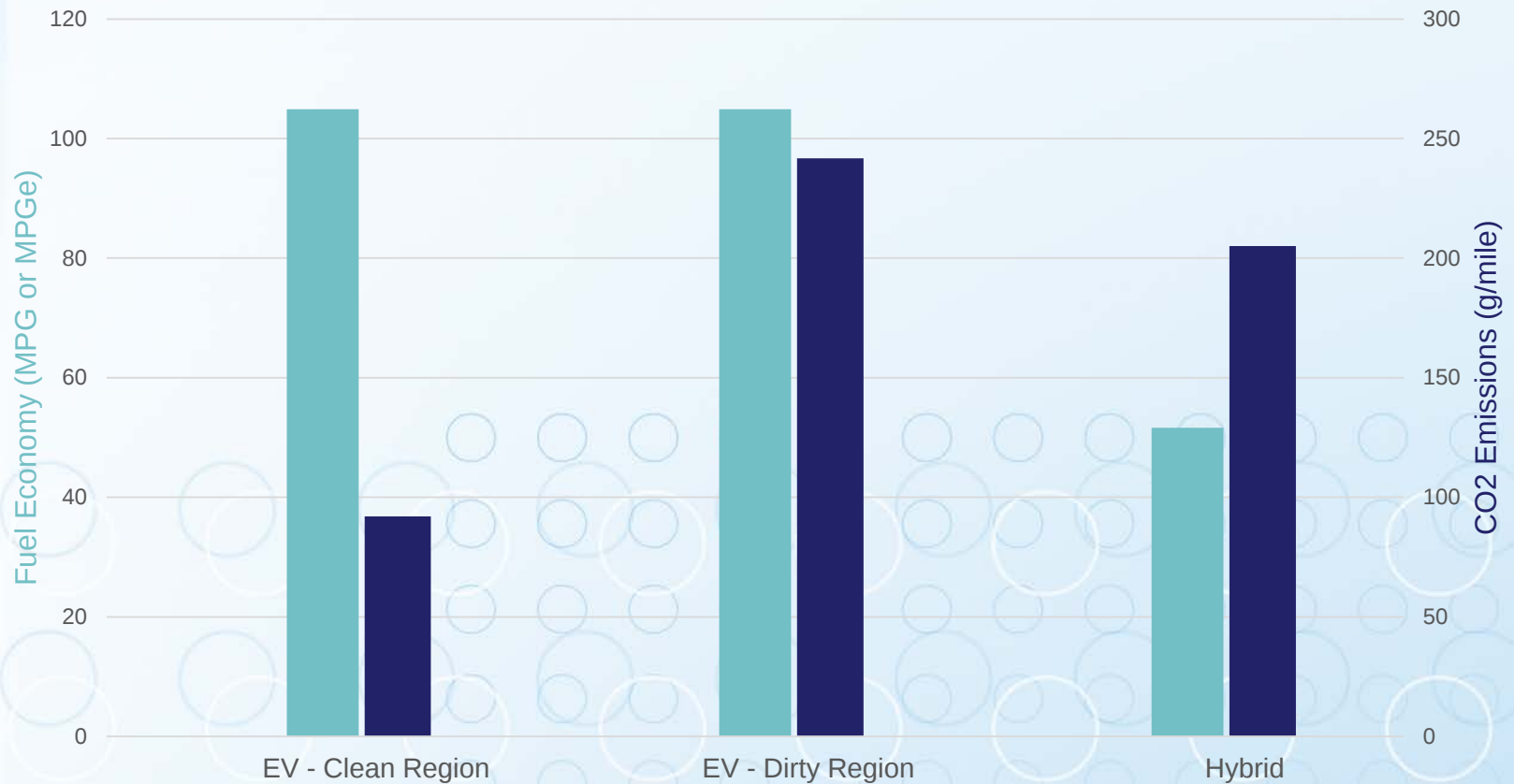


Utility Value-Added Services

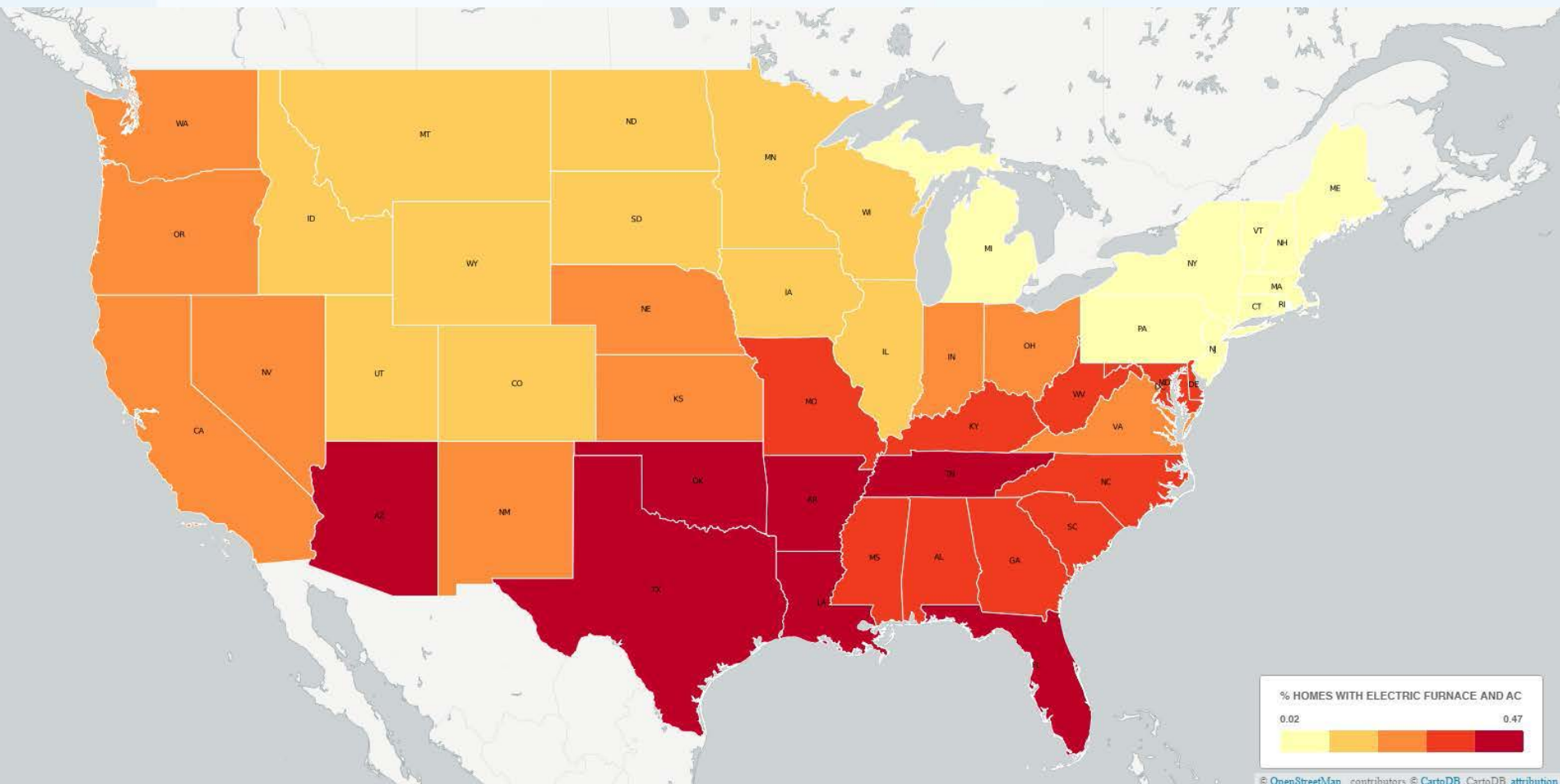
- Provides an opportunity to earn profits
- Should build on existing expertise, e.g. EE, EV, larger DG (CHP, community solar)
- Need level playing field with competitors
 - Clear rules so utility is neither advantaged nor disadvantaged



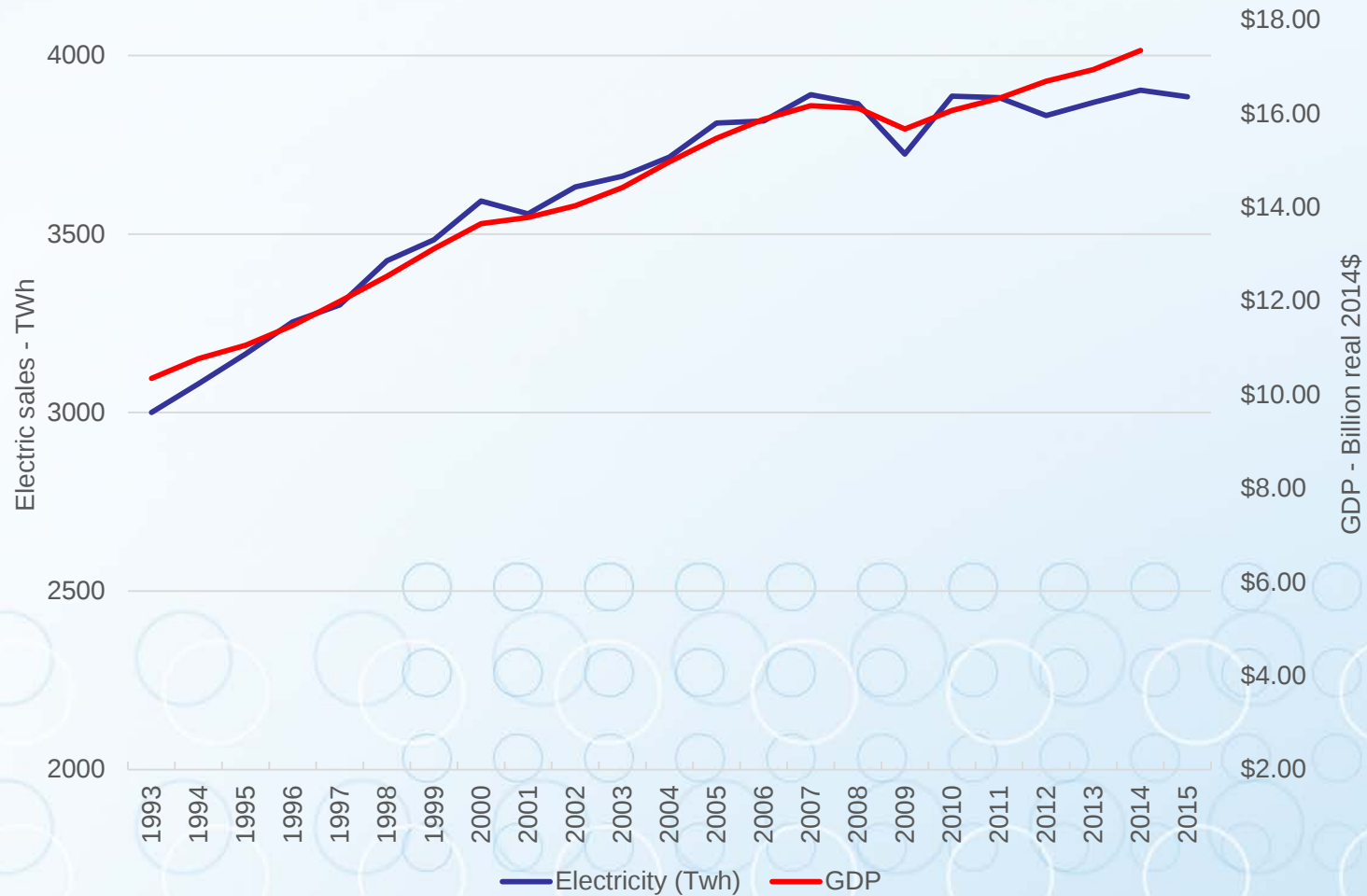
EV's – An Opportunity Where Generation is Efficient/Clean



Opportunity for Heat Pumps -- Houses with Electric Furnaces & Central AC

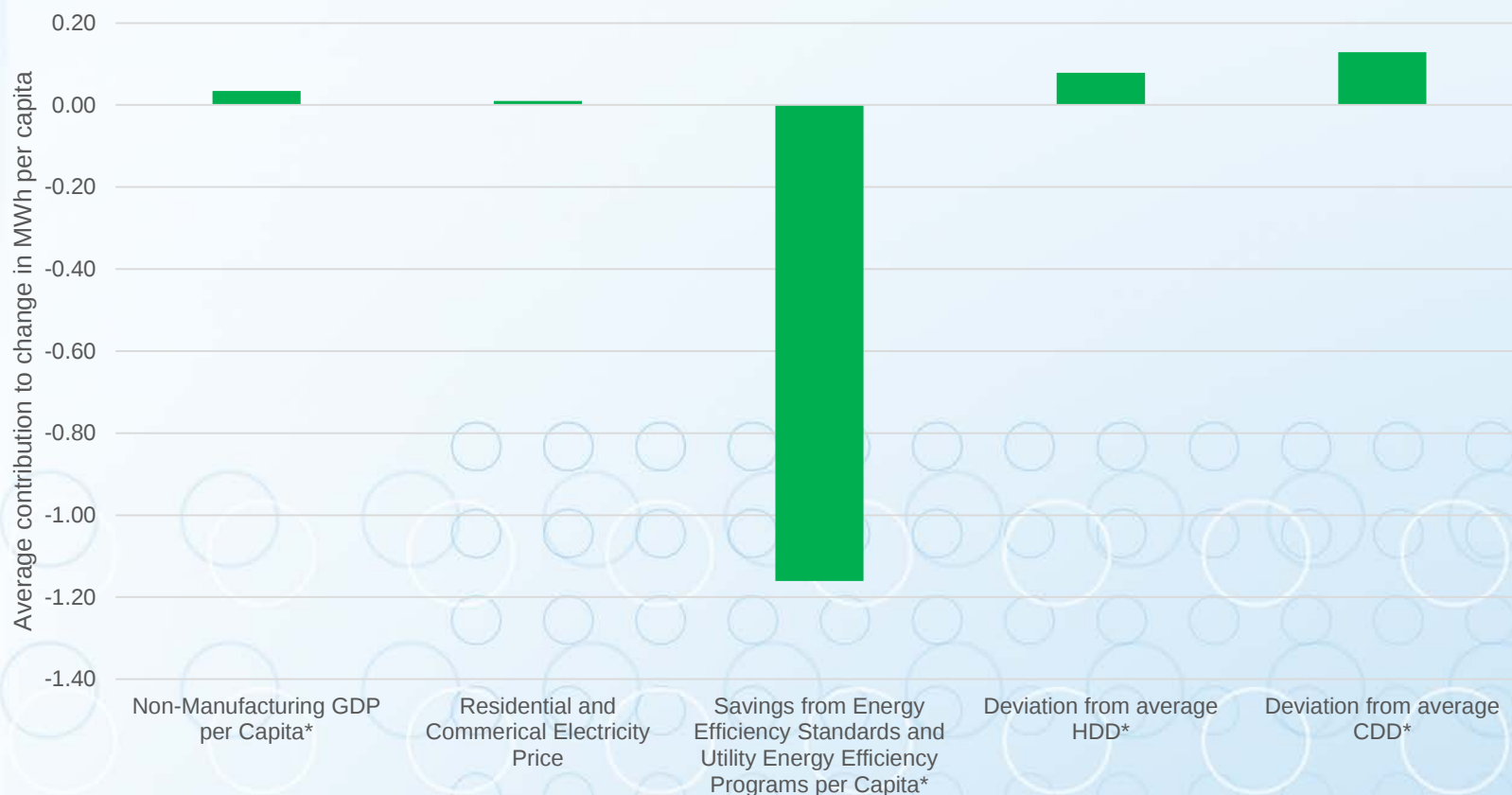


Electricity Use Declining Recently

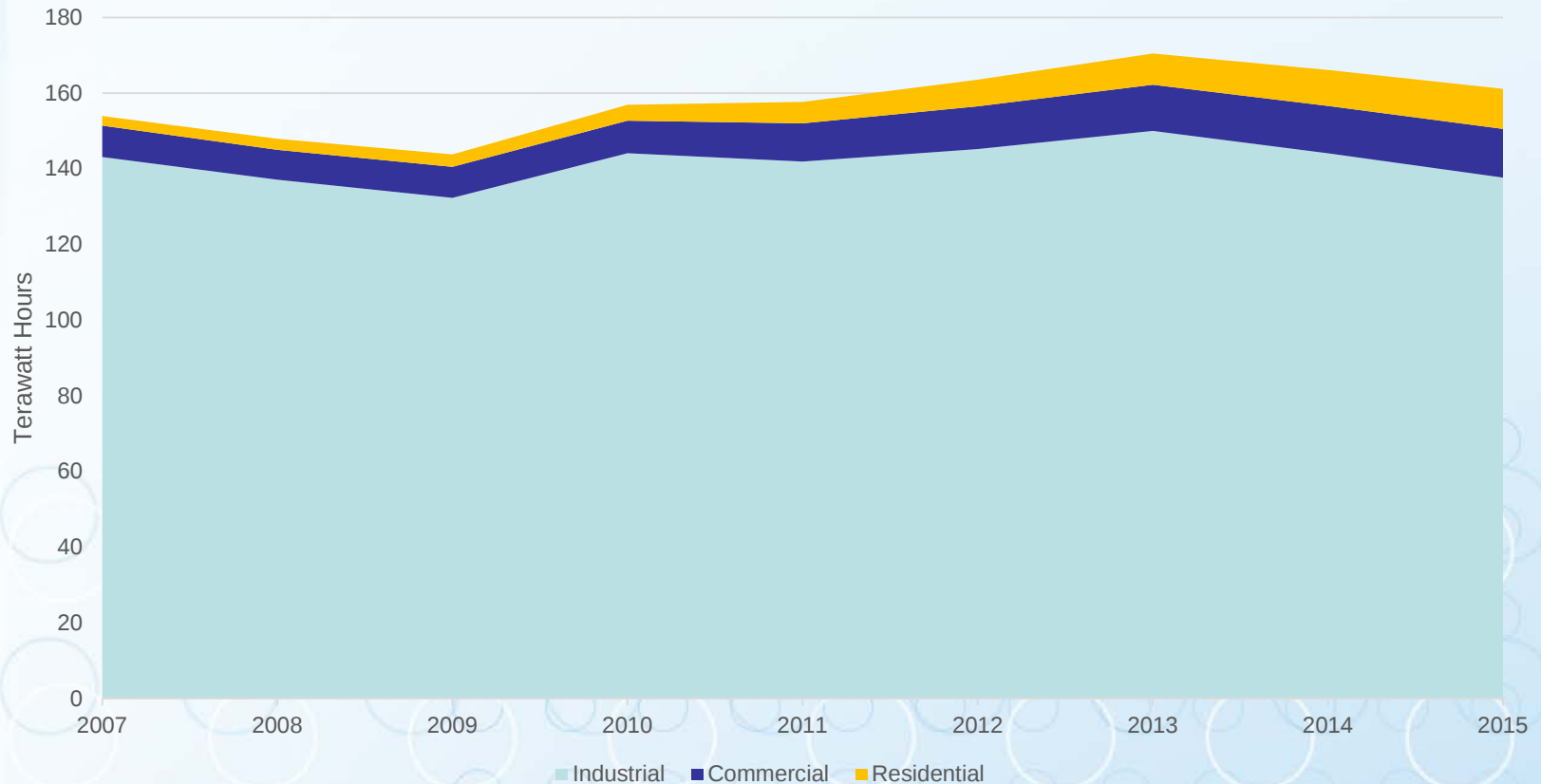


Source: ACEEE analysis of data in EIA Monthly Energy Review

Contributors to Change in Res. & Comm. Electric Consumption, 2008-2013

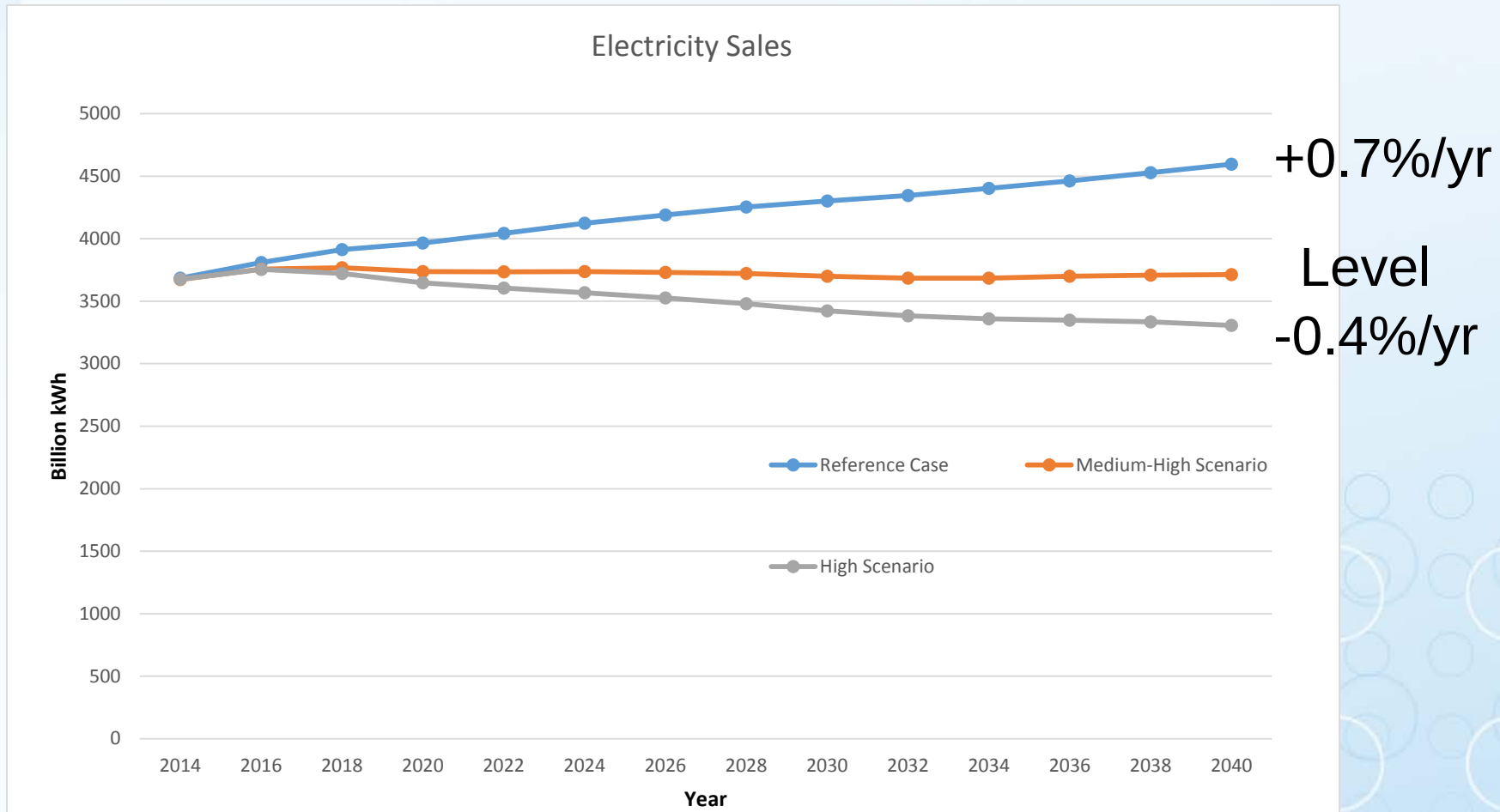


Production from Distributed Generation (R, C & I sectors)



Source: ACEEE analysis of data in EIA Monthly Energy Review

National Results

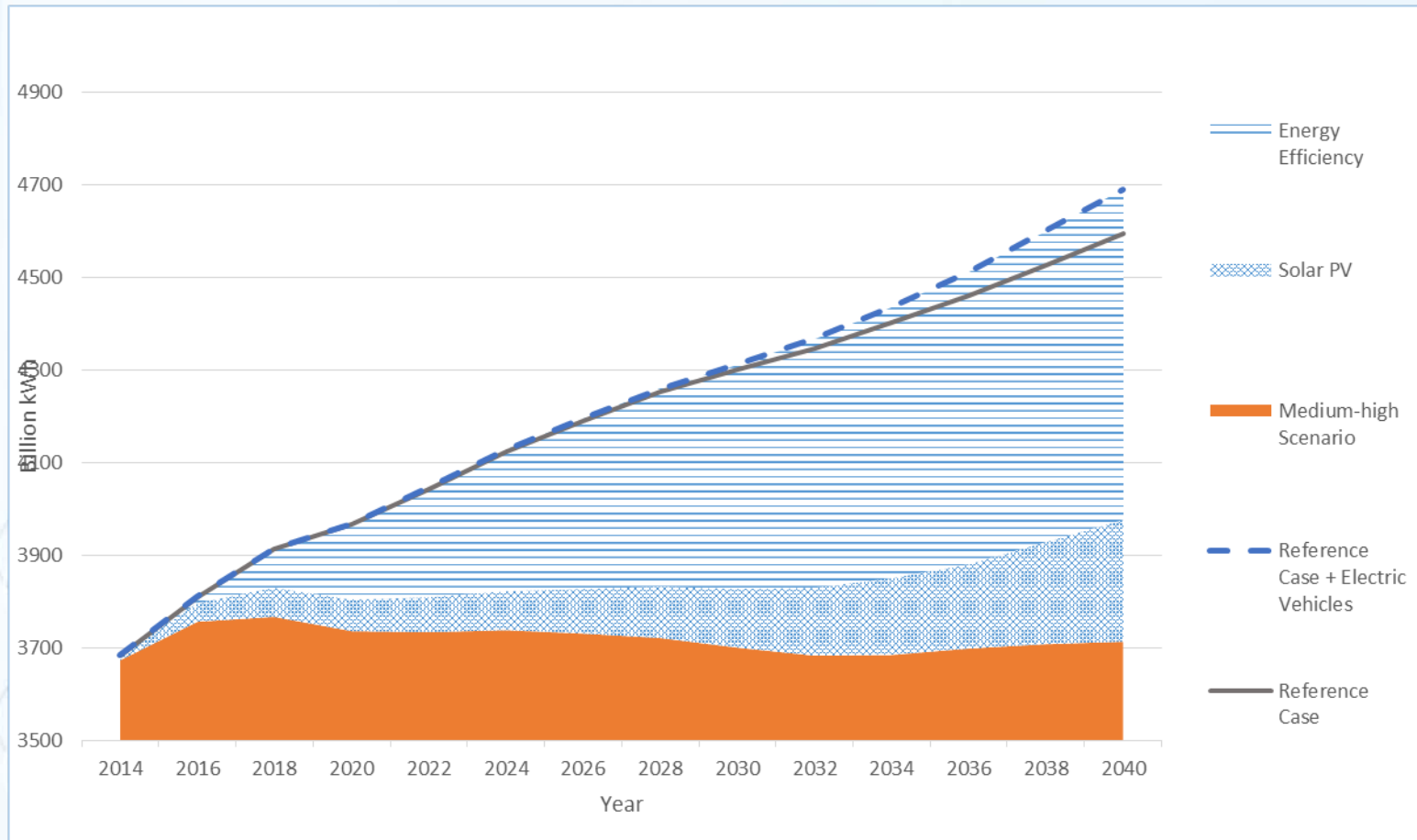




Sales Scenarios

- AEO 2014 our medium change scenario
- Augment EE, solar, EV
 - Medium-high change – clearly feasible
 - High change – plausible but unlikely
- For EE, ramp up to 1.5% & 2%/yr
- For PV, grow 10% & 15% per year, capped at 80% of tech potential
- For EV based on plausible and optimistic National Academy estimates

Contributions in Medium-High Change Case



Need to Avoid Overbuilding Generation or the Grid

Stock Price of a German Utility

RWE AG (RWE.DE) - XETRA Ticker: 703712/SIN: DE0007037129

28.72 +0.30 (1.03%) 3 Mar 16:35

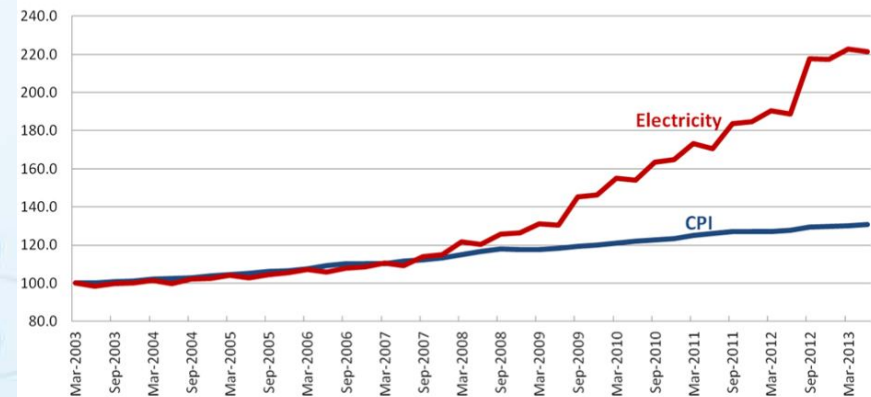
Enter name or symbol Get Chart COMPARE EVENTS TECHNICAL INDICATORS CHART SETTINGS RESET

Week of 13 Apr 2009: RWE.DE 58.38



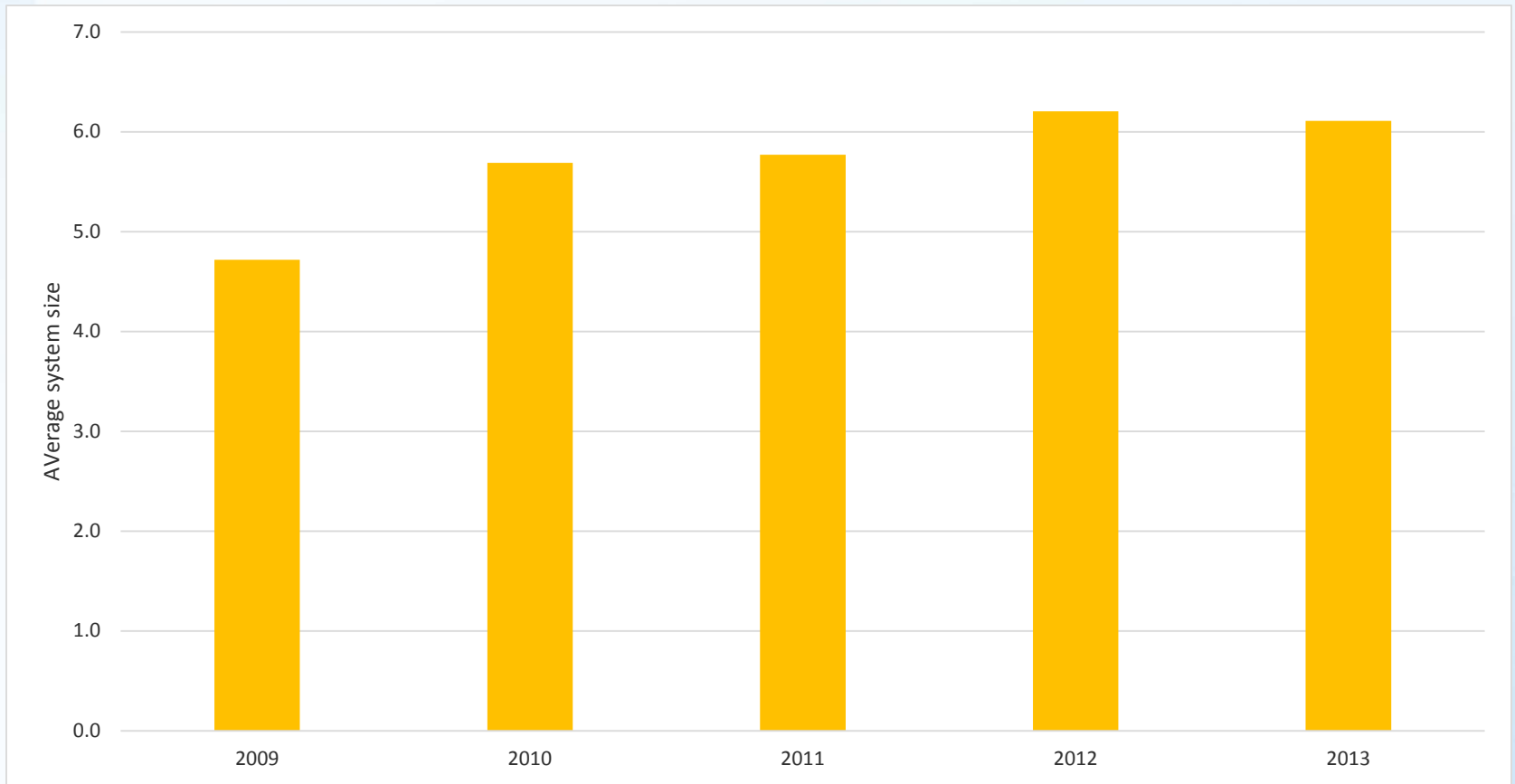
Electric Prices in Australia

Consumer Price Index and Retail Electricity Prices
(March 2003 = 100)

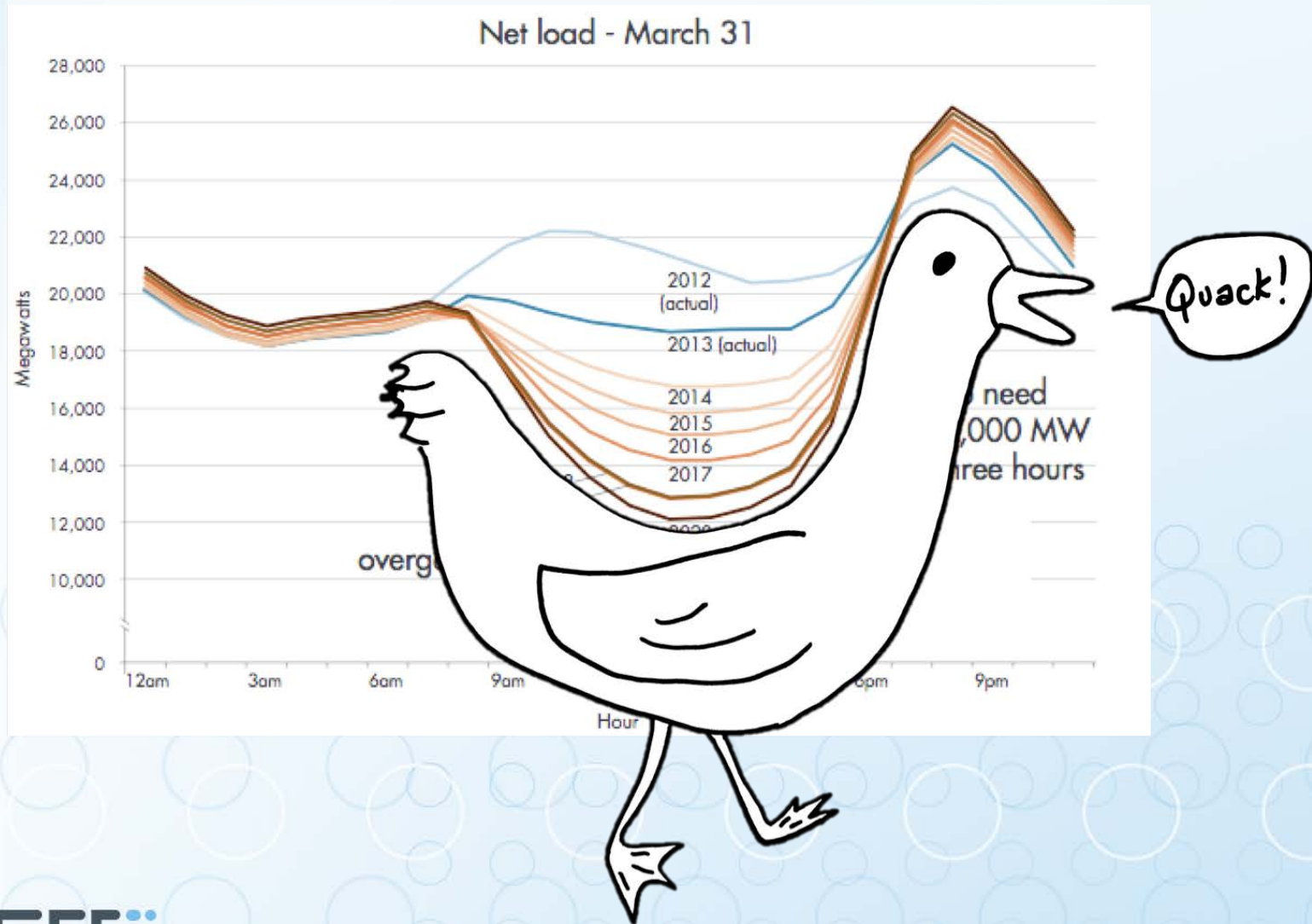


Source: ABS 6401.0

Don't Size Solar for Inefficient Loads



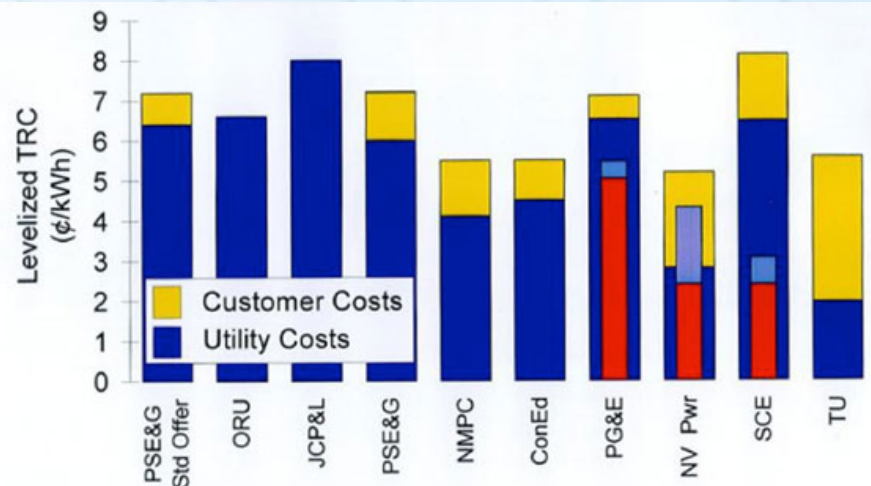
Load Shapes are Changing



Don't Rely on Markets Alone to Drive Cost-Effective EE Savings

- ESCo's primarily serve MUSH market
- Most EE financing programs have cumulative participation rates <5%
- Bidding for efficiency resources tends to result in higher prices than utility-run programs as well as “cream skimming”

Cost/kwh from DSM bidding programs in the 1990s (from LBL)



Impact of Decoupling and EERS on Utility EE Investments & Savings

Policy	No. of states	Average EE investments as % of revenues	Average EE savings as % of sales
No decoupling	38	1.1	0.5
Yes decoupling	12	3.8	1.4
No EERS, no decoupling	23	0.7	0.3
No EERS, yes decoupling*	1*	2.1*	0.8*
Yes EERS, no decoupling	15	1.6	0.9
Yes EERS, yes decoupling	11	4.0	1.4

Rates – What are the Fairest Ways to Recover Costs?

- Fixed charges for truly fixed costs
- Variable charges for variable costs – energy and demand
 - Time of use rates might address
 - Some believe there is also a role for demand charges
- Decoupling to address changes in sales

Some Research Needs

- Better documenting multiple benefits of EE beyond energy savings
- Batteries – for grid and EV
- ZNE strategies & integration into grid
- Reducing cost of variable speed residential and commercial AC/HP
- Cold-climate heat pumps
- Plug-load efficiency



Role of Energy Efficiency



- Generally low-cost resource
- Often provides benefits beyond energy savings
- Can use to replace some retiring generation
- Meet environmental requirements (e.g. CPP)
- Provide a valued customer service
- Can be alternative to some transmission and distribution investments
- Lowers customer bills and therefore can help ameliorate rate increases
- Policies have important role to play – due to market barriers can't just rely on market