

Spire/OMB Furnace Rule Meeting

August 3, 2016



- Why are we here?
 - DOE proposes to eliminate non-condensing furnaces nationwide
 - DOE is not proposing similar stringencies for electric heating equipment
- Why is this a problem?
 - DOE's efforts shift the market to higher levels of electrification which, in turn:
 - Increase the consumption of finite energy resources
 - Increase the costs energy consumers pay for such resources
 - Increase the emissions associated with the combustion of fuels necessary to supply such resources
- What Federal policies has DOE violated?
 - DOE has not made it's "determinations" as required by [10 CFR 430 Appendix A](#), §
 - (e) Fully consider non-regulatory approaches.
 - (f) Conduct thorough analysis of impacts
 - (g) Use transparent and robust analytical methods.
 - (j) Reduce time and cost of developing standards.
 - DOE has not lived up to numerous "data quality" guidelines that OMB has oversight of
 - DOE has not lived up to numerous Executive Orders including EO 12898 (and many more)



Consequences of Current NOPR or Other Rules Eliminating Non-Condensing Furnace for Any Consumer Segment

- “Category IV” (condensing) furnaces are more expensive to purchase and install.
- Installation options for condensing gas furnaces are limited, particularly in the replacement market:
 - Condensing gas furnaces cannot be connected to most existing vent systems.
 - **These venting systems are integral to the building structure and represent consumer features outside of DOE’s “covered product” authority.**
 - Other issues: Furnace location, condensate handling, consequences for continued use of other appliances (i.e., gas fired storage water heaters).

DOE wrongly attributes changes in venting systems as “installation costs.” Venting system serve other appliances, are building features, and are not part of the covered products.



Options for New Home Construction

- 1. The builder accepts increased costs and home design constraints, and installs a condensing furnace and a gas water heater**
- 2. The builder accepts home design constraints and installs a condensing furnace, but reduces overall cost impacts by installing an electric resistance water heater**
- 3. The builder goes all electric by installing an electric heat pump and an electric resistance water heater**
- 4. The builder goes all electric by installing an electric heat pump and an electric resistance water heater**



Options for Replacement Market

1. The owner decides to continue operation of a furnace beyond its useful life: energy savings lost and **potential safety issues**.
2. The owner replaces a gas furnace with a condensing gas furnace
3. The owner replaces a gas furnace with a condensing gas furnace, and must also replace a “orphaned” gas water heater with an electric resistance water heater
4. The owner replaces a gas furnace with an electric heat pump, and must also replace a “orphaned” gas water heater with an electric resistance water heater
5. The owner replaces a gas furnace with an electric resistance furnace, and must also replace a “orphaned” gas water heater with an electric resistance water heater



Problems with gas to electricity fuel switching:

- Electric heating appliances require over three times the full fuel-cycle Btu's as gas appliances
- About 70% of all electrical power is produced through fossil fuel combustion (including coal combustion)
- On average, for appliances of equivalent energy input:
 - Electric appliances produce more than 3.5 times the carbon emissions of gas appliances
 - Electric appliances produce dramatically higher emissions of particulate, mercury, and other air pollutants than gas appliances
- On a Btu-equivalent basis, the average price consumers pay for electricity is roughly three times higher than the price consumers pay for natural gas



An EPA Illustration

Example: Electric and Gas Water Heaters Site vs. Source Energy Comparison

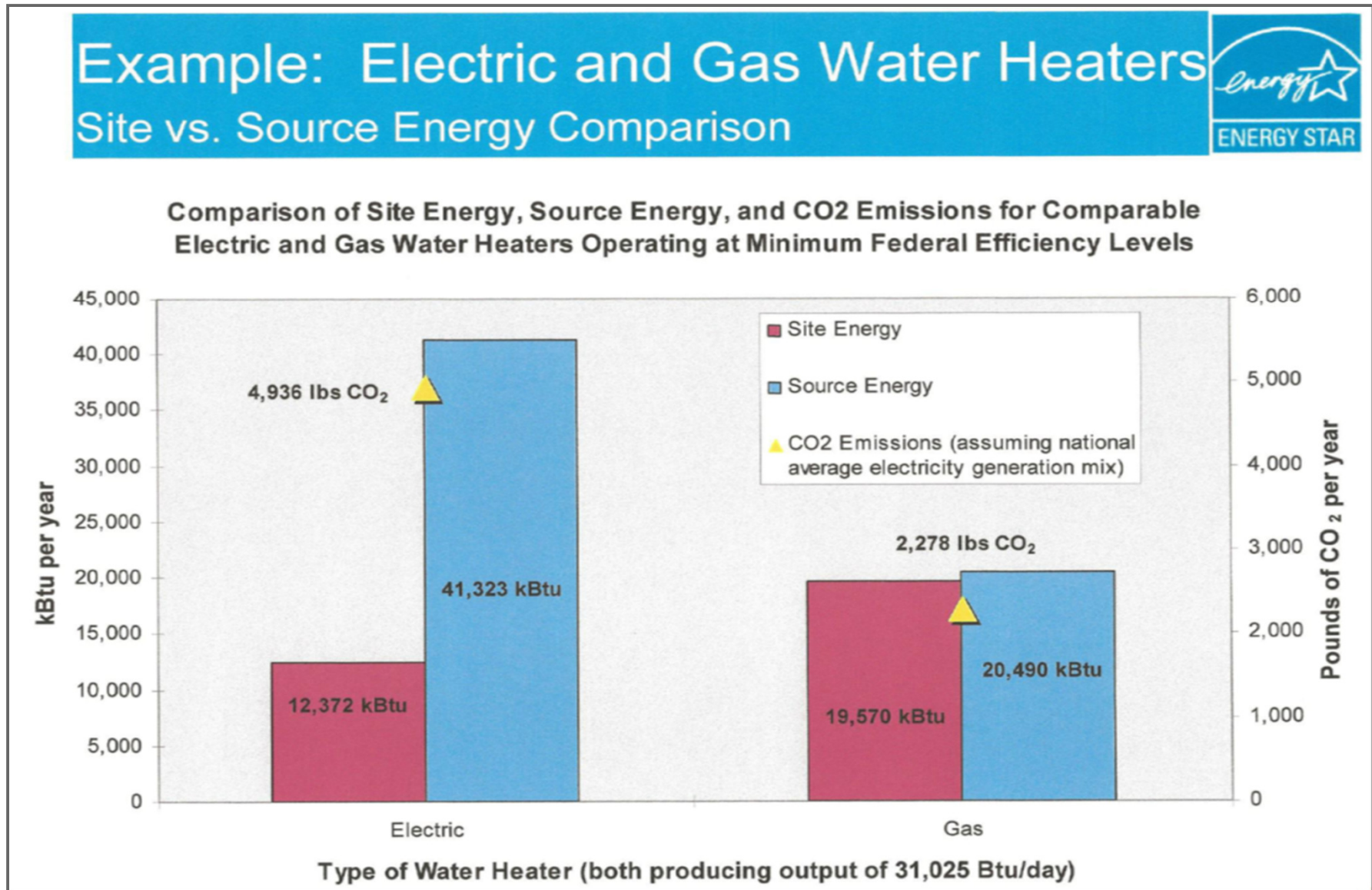


Comparison of Site Energy, Source Energy, and CO ₂ Emissions for Electric and Gas Water Heaters		
	<i>Electric Water Heater</i>	<i>Natural Gas Water Heater</i>
Energy factor (overall efficiency)	0.917*	0.594*
Output (Btu/day)	31,025	31,025
Annual site energy use in fuel-specific units	3,625 kWh	19,000 CF
Annual site energy use in kBtu	12,372	19,570
Annual source energy use in kBtu**	41,323	20,490
Annual CO₂ emissions (lbs) at national average emissions factors (0.399 lbs/kBtu electricity; 0.11638 lbs/kBtu natural gas)***	4,936	2,278
Annual CO₂ emissions (lbs) at the lowest US regional emissions factor for electricity (0.141 lbs/kBtu)	1,744	2,278
Annual CO₂ emissions (lbs) at the highest US regional emissions factor for electricity (0.597 lbs/kBtu)	7,386	2,278
* Minimum federal efficiency for a new 40 gallon tank with given fuel source		
** The following source-site ratios were applied (see: http://www.energystar.gov/ia/business/evaluate_performance/site_source.pdf)		
Electricity: 1 unit site = 3.340 units source; Natural Gas: 1 unit site = 1.047 units source		
*** See: http://www.energystar.gov/ia/business/evaluate_performance/Emissions_Supporting_Doc.pdf		

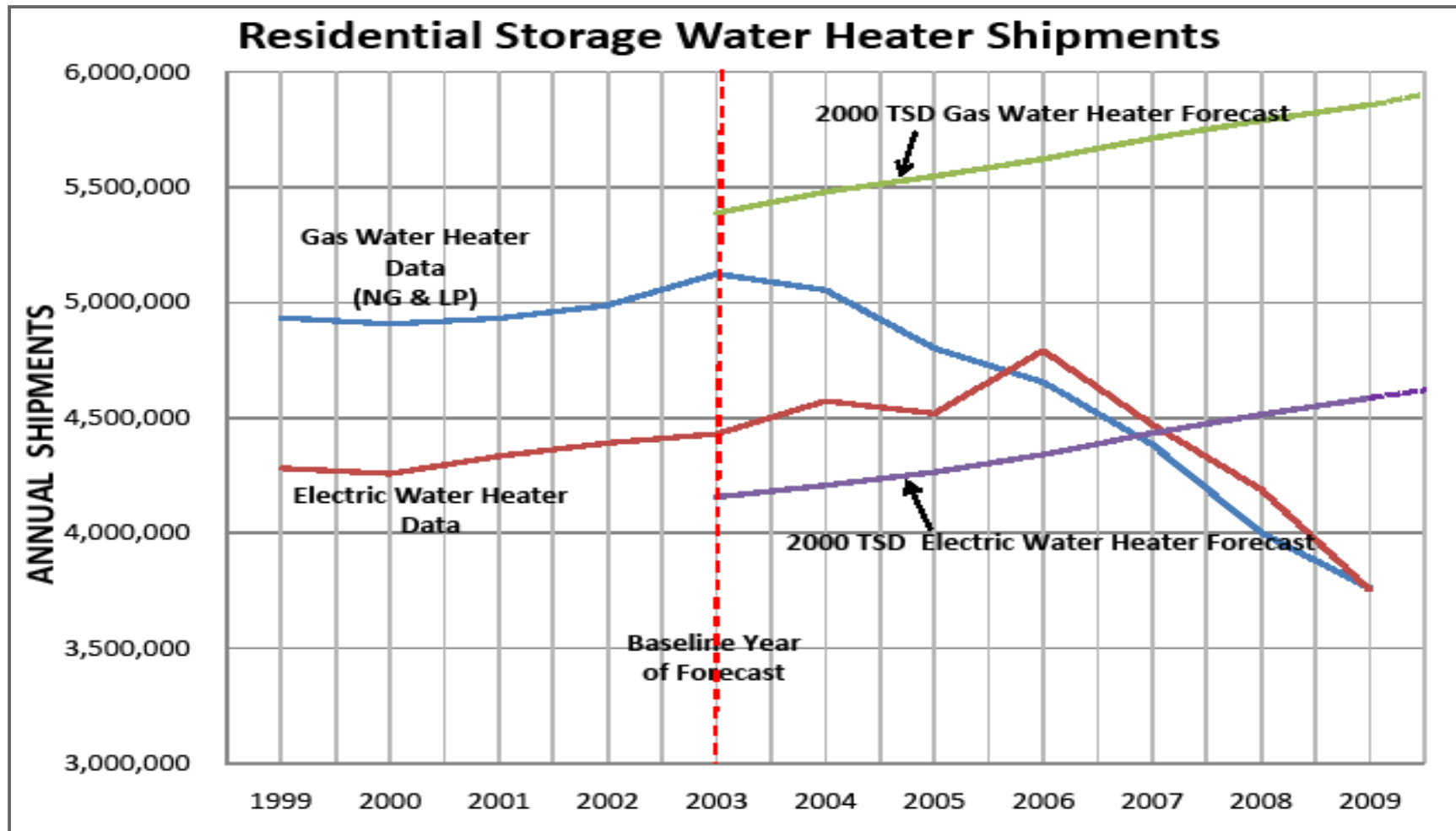
Electric water heaters produce 2 to 3 times the CO₂ while viewed as over 90% (site) efficient



EPA's Graph for Water Heaters



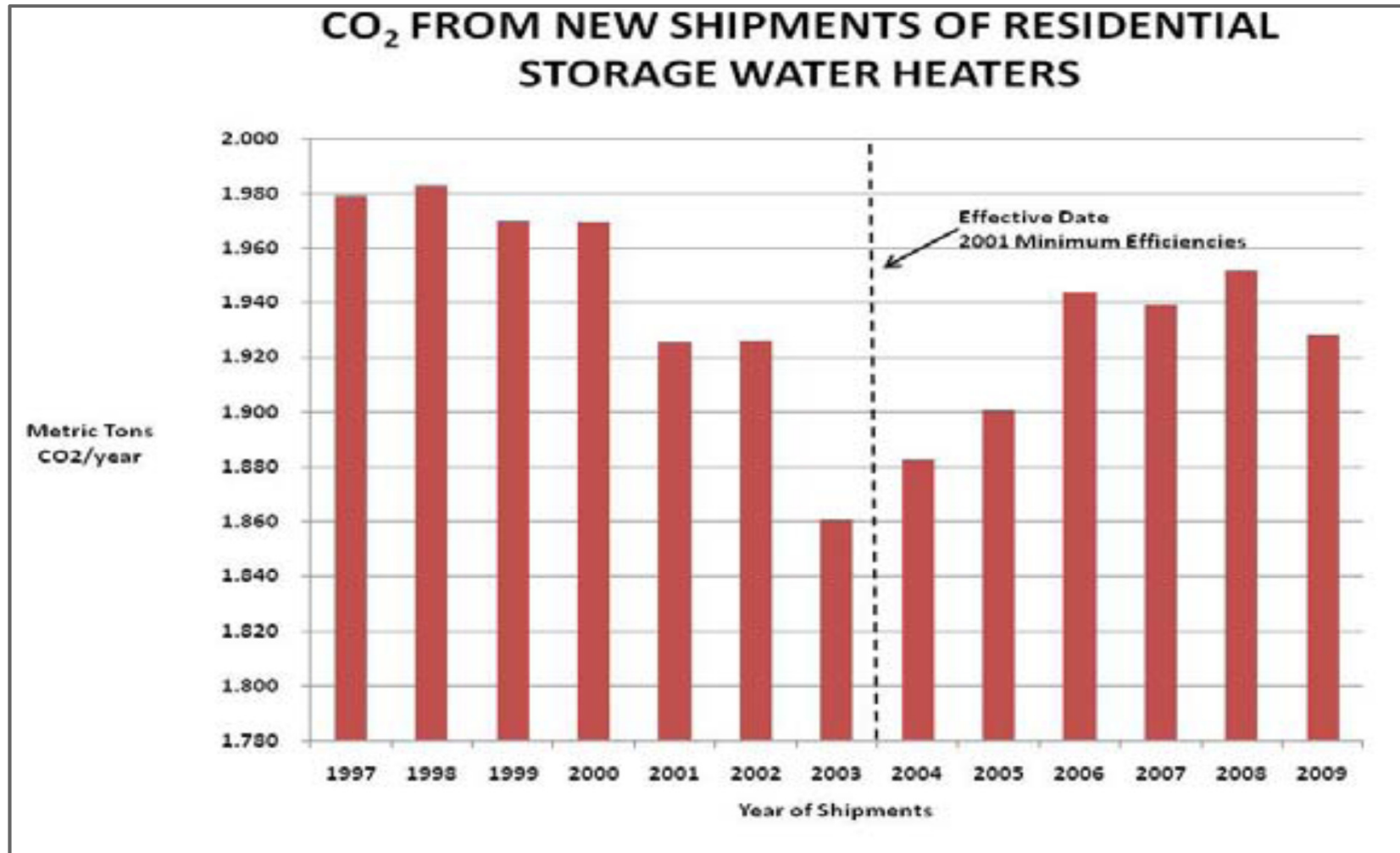
DOE was way off on water heater shipments



DOE grossly overestimated shipments resulting in artificially high benefits and they never looked back to see what really happened.



DOE's final rule did more harm than good



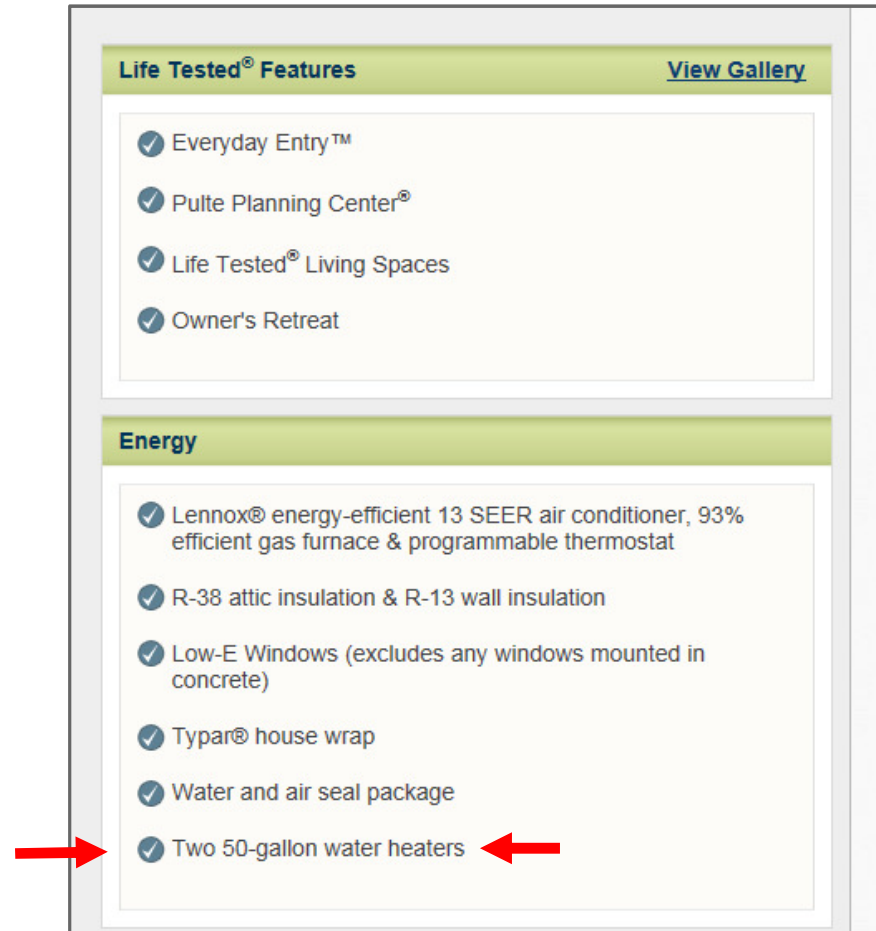
CO₂ increased as fuel switching occurred.



Fuel Switching is no longer theoretical

The nation's third largest homebuilder with 17,196 home closings in 2015. They are the third largest home builder in the greater St. Louis area building hundreds of homes each year.

“In St. Louis, Pulte is installing gas high efficiency furnaces with an electric water heater for all developments as standard equipment”



<http://www.pulte.com/communities/MO/town-and-country/TheEstatesatTownandCountryCrossin/home-features/682913/Stockton.aspx#.V5YfK2Ao670>

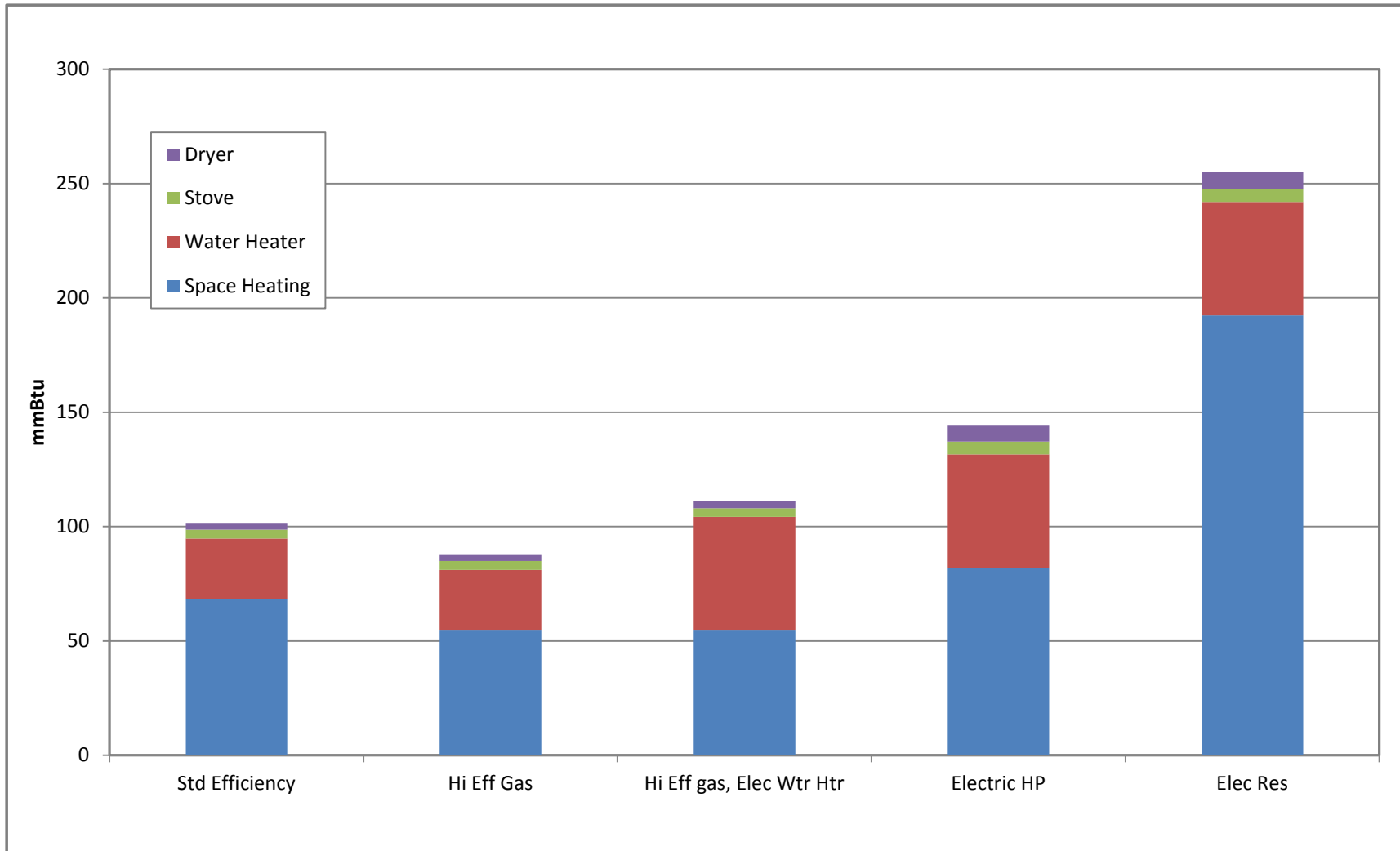
St. Louis' largest homebuilders all expressed a high potential to switch to electric resistance water heaters if they are forced to spend more on high efficiency furnaces.



DOE Will Likely Repeat the
Same Errors in this SNOPR



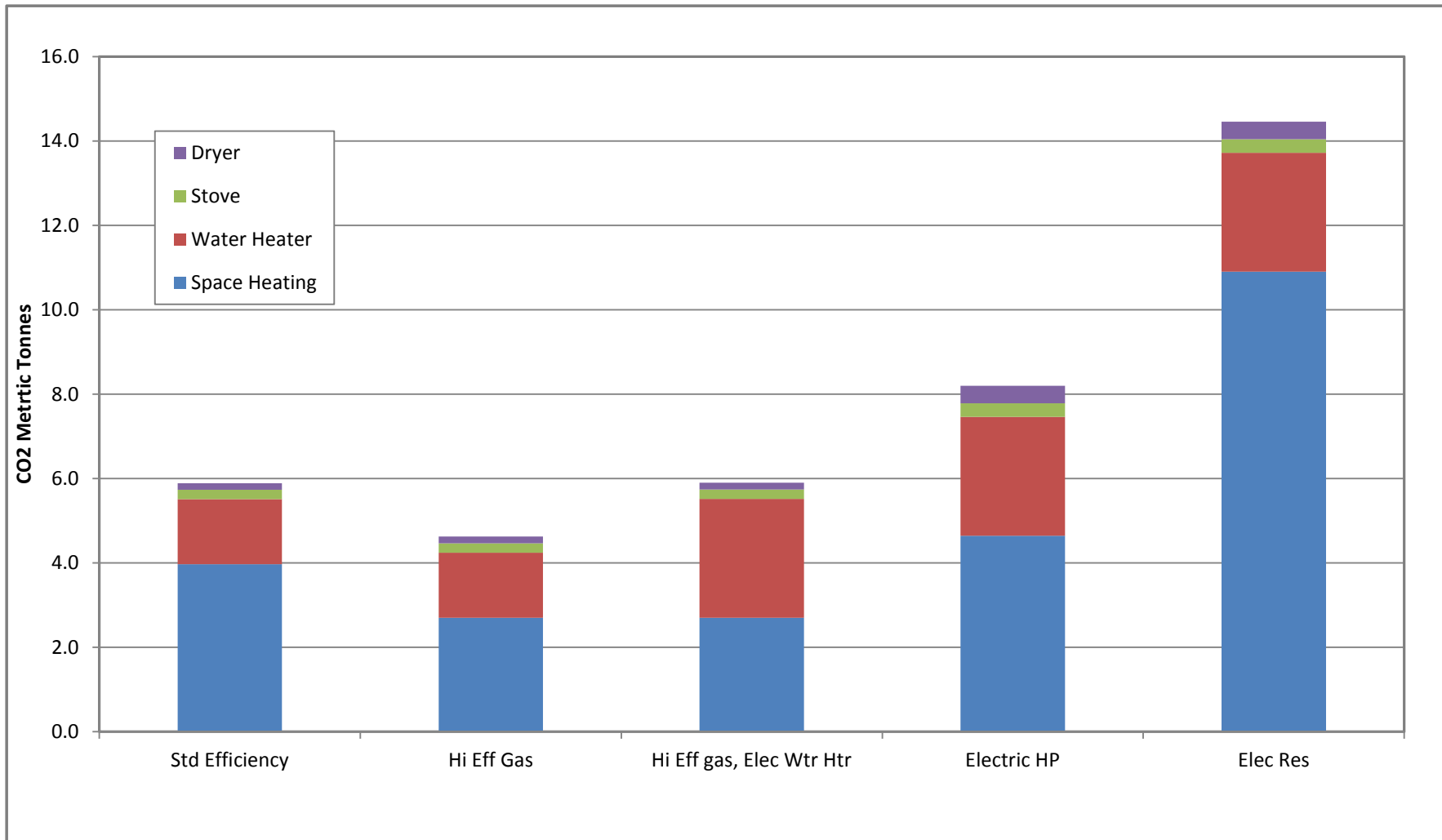
Energy Consumption



DOE's claimed energy savings can easily be obliterated by fuel switching.



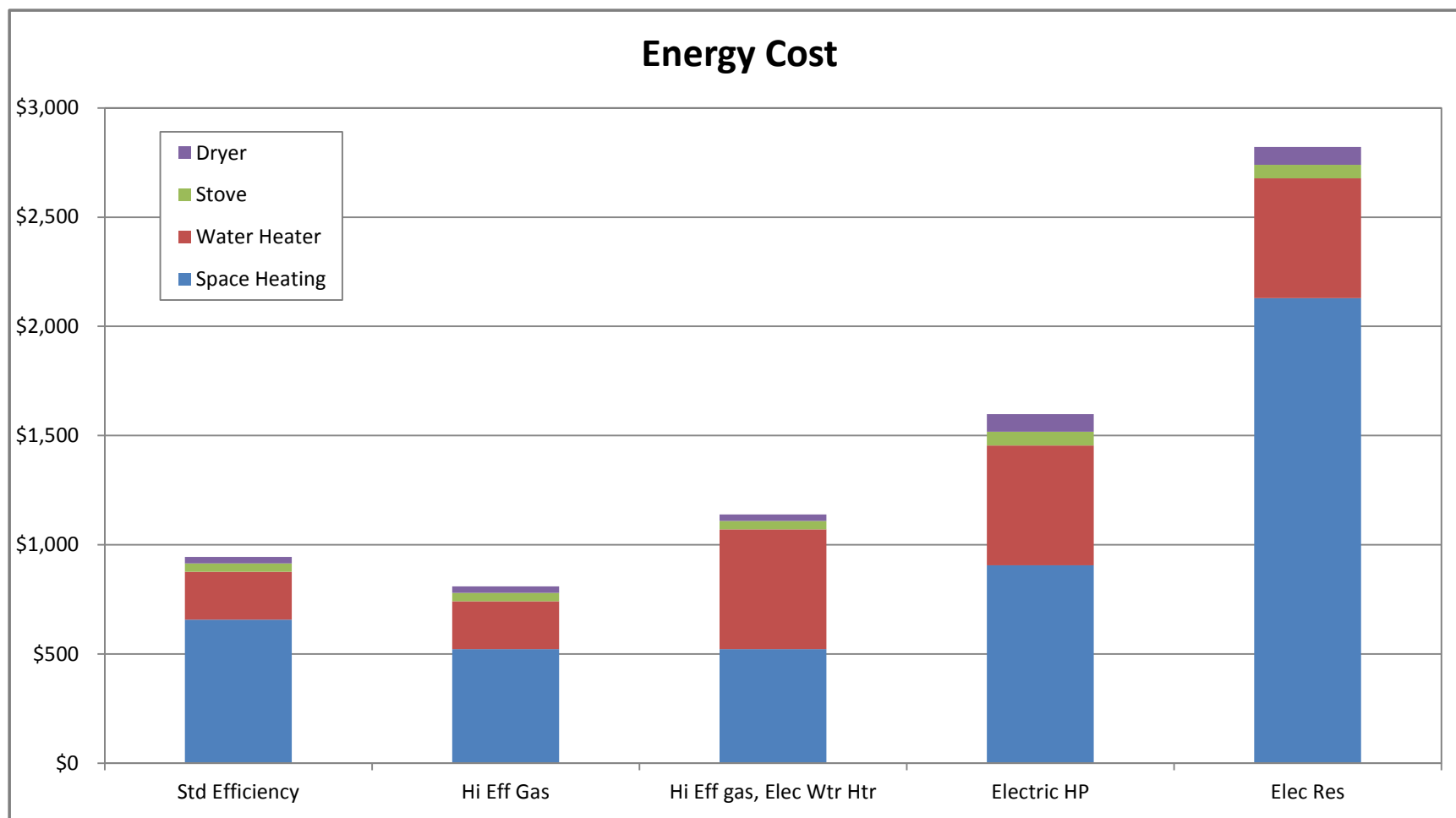
CO₂ Emissions



DOE's claimed environmental benefits can easily be obliterated by fuel switching.



Energy costs for consumers



DOE's claimed economic benefits can easily be obliterated by fuel switching.



DOE's Flawed Technical Analyses



DOE's opaque analysis inexplicably generates wildly different results

Compare two different Rulemakings

- **Massive & unexplained changes in life cycle cost between 2011 & 2015 rulemakings**
- DOE's analyses included:
 - Non-Public Data
 - Complex Crystal Ball Analyses
 - Propriety Inputs

	AFUE	<u>2011</u> <u>Average</u> <u>LCC</u> <u>savings</u>	<u>2015</u> <u>Average</u> <u>LCC</u> <u>savings</u>	Delta	% Change
National - All Installations	90%	\$87	\$236	\$149	170.9%
	92%	\$136	\$305	\$169	124.1%
	95%	\$205	\$388	\$183	89.1%
	98%	\$46	\$441	\$395	859.1%
North - All Installations	90%	\$155	\$208	\$53	34.0%
	92%	\$215	\$277	\$62	29.0%
	95%	\$323	\$374	\$51	15.7%
	98%	\$198	\$467	\$269	135.9%
South/Rest of Country - All Installations	90%	-\$13	\$267	\$280	2156.3%
	92%	\$19	\$336	\$317	1667.2%
	95%	\$28	\$404	\$376	1341.4%
	98%	-\$181	\$412	\$593	327.7%
National - Replacements	90%	-\$11	\$113	\$124	1130.2%
	92%	\$39	\$179	\$140	355.5%
	95%	\$111	\$264	\$152	136.8%
	98%	-\$26	\$319	\$346	1309.0%

Notes to table:

2011 data from EERE-2011-BT-STD-0011-0010 LCC spreadsheet, summary tab, cells K9:K58, L9:L58 & AI9:AI58

2014 data from EERE-2014-BT-STD-0031-0021 LCC spreadsheet, summary tab, cells O8:O41, AE8:AE41 & AT:AT41



DOE Ignores the Crystal Ball Modeling Guidance

- **Oracle Prescribes Six Steps in Developing a Crystal Ball Model in Its “Essentials” Training:***
 1. *“Create a system flow diagram and algorithms*
 2. *Design models*
 3. *Model assumptions and forecasts*
 4. *Run simulations and analysis results*
 5. **Validate the model**
 6. *Analyze options and decide.”*
- **Oracle Recommends Four Means for Validating Crystal Ball Models**
 1. *“Compare simulated results to actual process data.*
 2. *Ask subject matter experts (SMEs) to compare their experiences with simulated results. If a distinction can be made, use SME feedback to refine the model.*
 3. *Test extreme conditions.*
 4. *Compare your model to any similar models.”*

DOE does not validate according to Crystal Ball guidance



Differences in Equipment Costs are Systematically and Consistently Underestimated

DOE Table 8.2.11

Product Class	AFUE	Average Total Installed Cost 2013\$	Incremental Cost 2013\$
Non-Weatherized Gas Furnace	80%	\$2,218.35	-
	90%	\$2,696.28	\$477.93
	92%	\$2,712.31	\$493.96
	95%	\$2,846.57	\$628.22
	98%	\$3,038.88	\$820.53

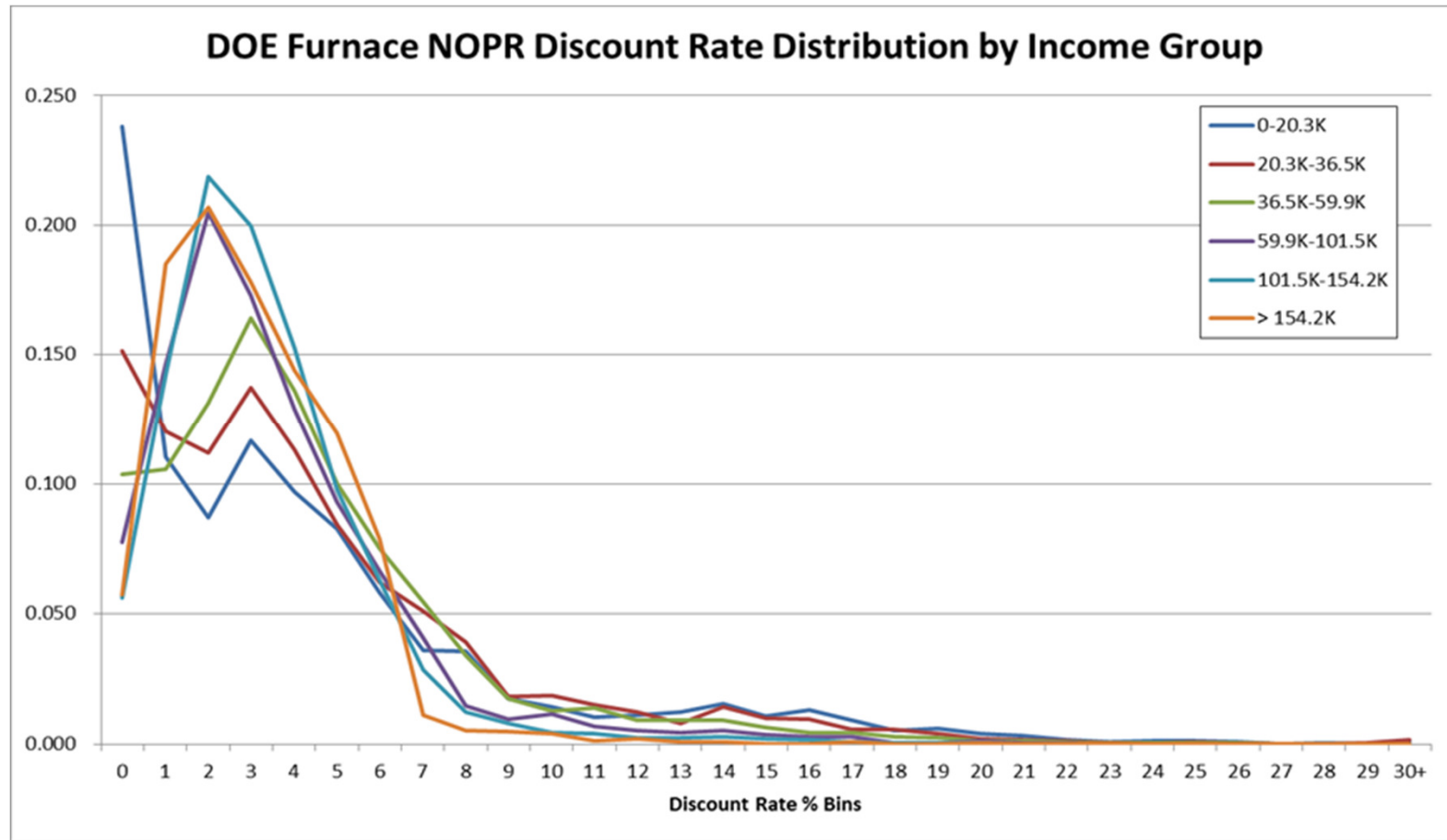
Compare:
Real world costs are more than double DOE's synthetic costs

A 2-story, 20-year old home with no significant installation problems

- 1st bid: 96% furnace – 80% furnace = \$3862 - \$2,927
= \$935 with standard PSC motor + \$390 for ECM motor =
= **\$1,325 incremental cost**
- 2nd bid: 95% furnace – 80% furnace = \$3896 - \$2,903
= \$993 with standard PSC motor + \$423 for ECM motor
= **\$1,416 incremental cost**
- 3rd bid: 95% furnace – 80% furnace = \$3,910 - \$2,415
= \$1,495 with standard PSC motor + \$425 for ECM motor
= **\$1,920 incremental cost**
- 4th bid: 80% AFUE gas furnace, single stage, standard PSC motor = \$1,655.



DOE's Discount Rates are Consistently and Systematically Way Too Narrow



DOE assumes very low discount rates



DOE's Discount Rates are Especially Unjustified for Low Income Consumers

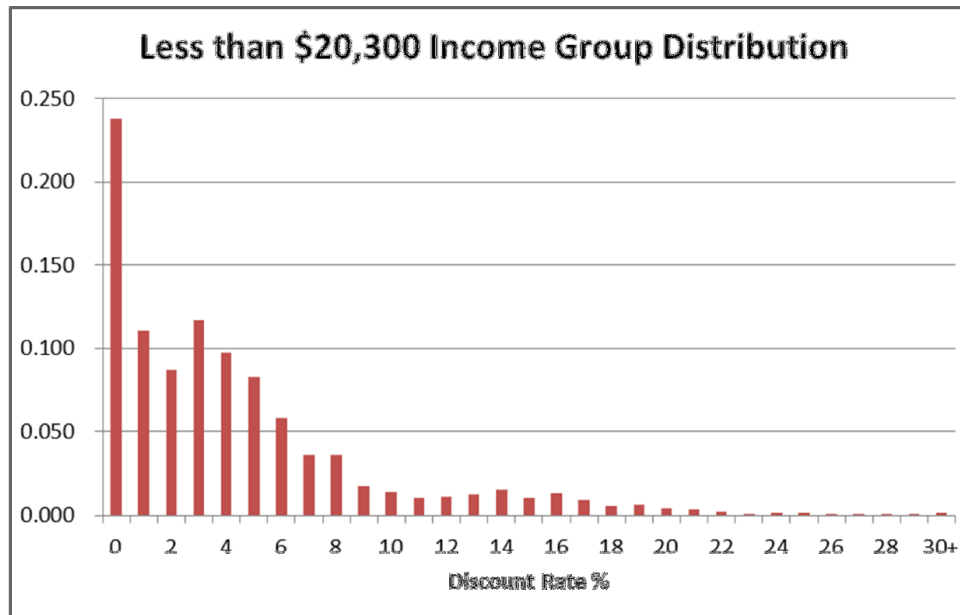


Table 5. -- Aggregate Market Discount Rates for Appliances, 1972-80
Based on ADL Cost-Efficiency Curves

Appliance	1972	1978	1980
Gas Central Space Heater	39	51	56
Oil Central Space Heater	52	78	127
Room Air Conditioner	20	22	19
Central Air Conditioner	19	25	18
Electric Water Heater	587	825	816
Gas Water Heater	91	146	166
Refrigerator	105	96	78
Freezer	379	307	270

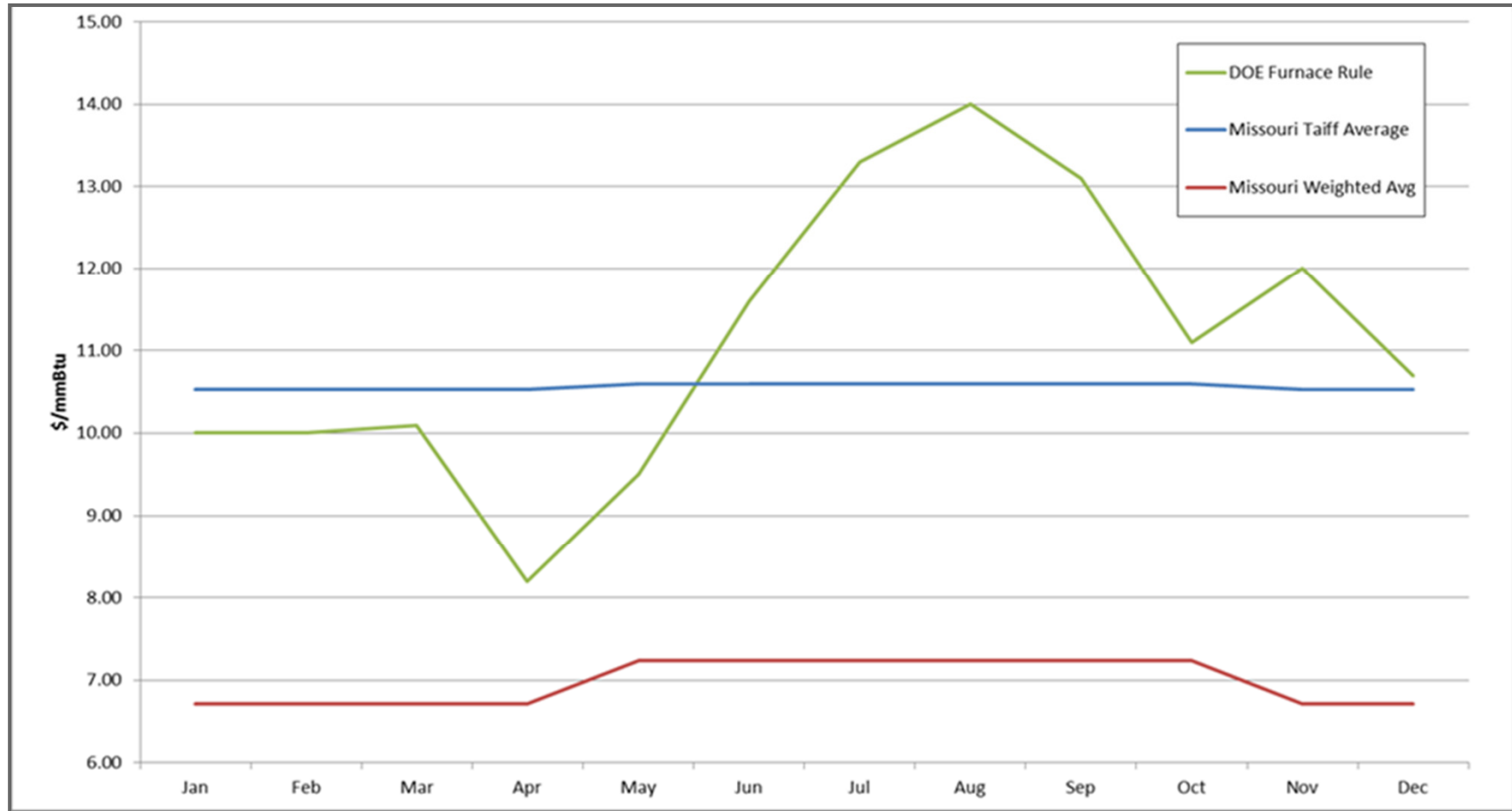
Table from Rudeman, Levine, and McMahon Study

- DOE assumes that 24% of the lowest income group (less than \$20,300) has an opportunity cost less than 1%.
- OMB Circular A-94 recommends using other discount rates to show the sensitivity of the estimates to the discount rate assumption.
- OMB Circular A-4 indicates the values cited by footnote 8 of DOE's DFR were based upon 1992 statistics for corporate capital.



DOE Systematically Overstates Natural Gas Prices

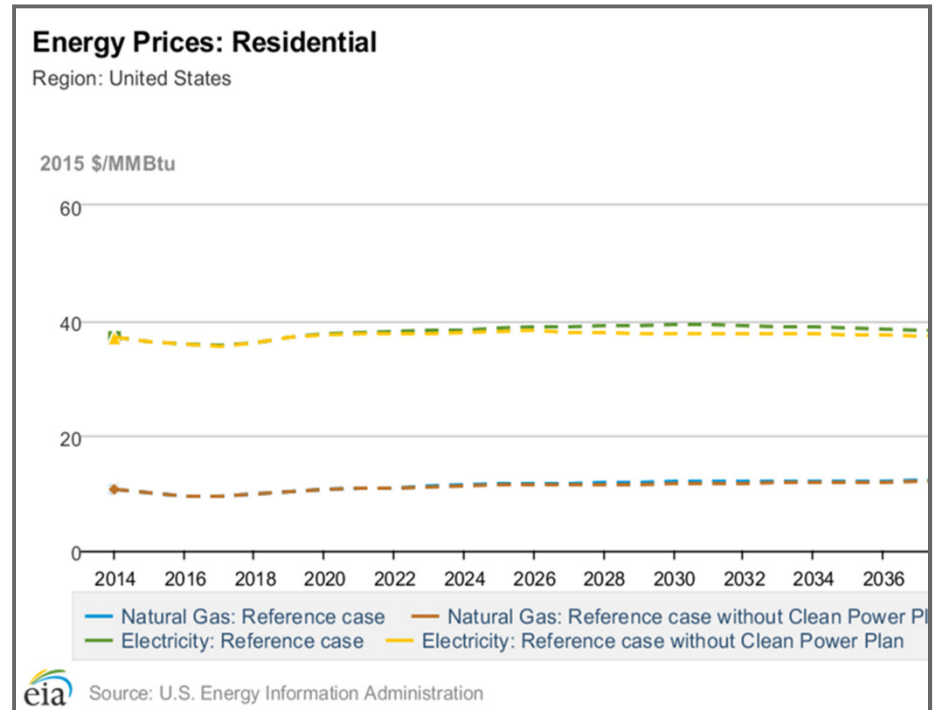
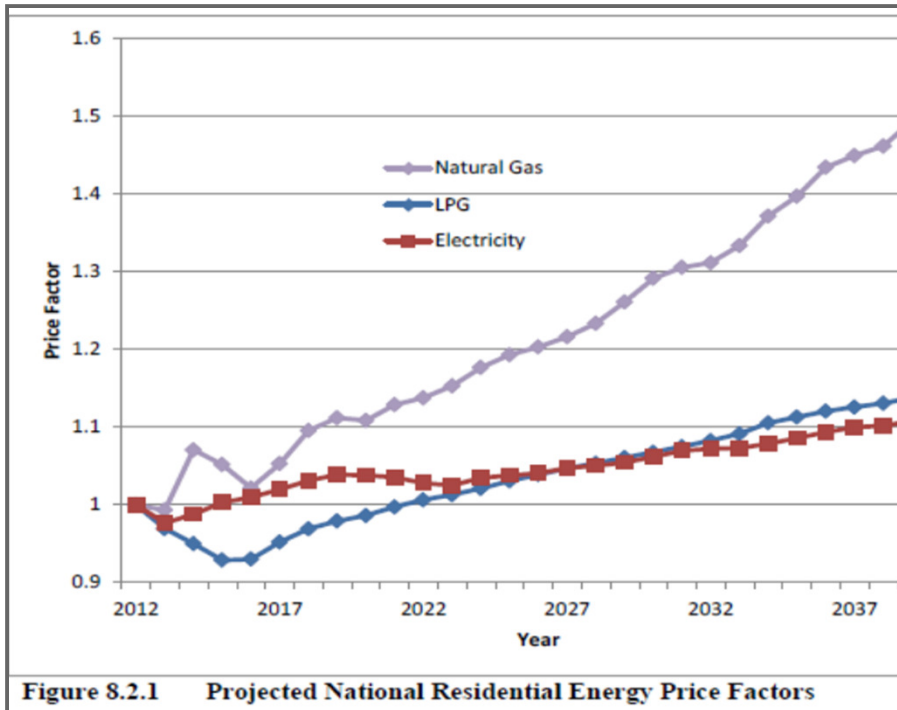
Missouri Natural Gas Prices



DOE estimates for “Marginal Monthly Natural Gas Prices” are more than double actual marginal prices utility customers pay via their utility bills.



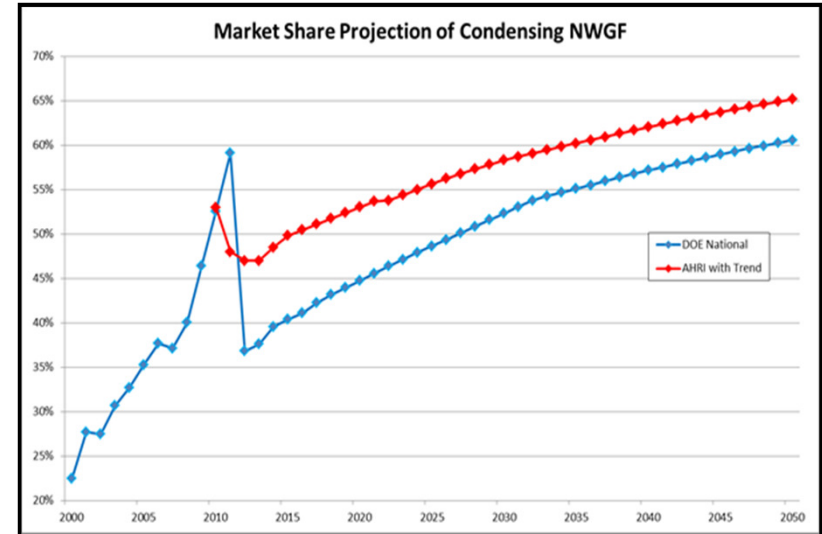
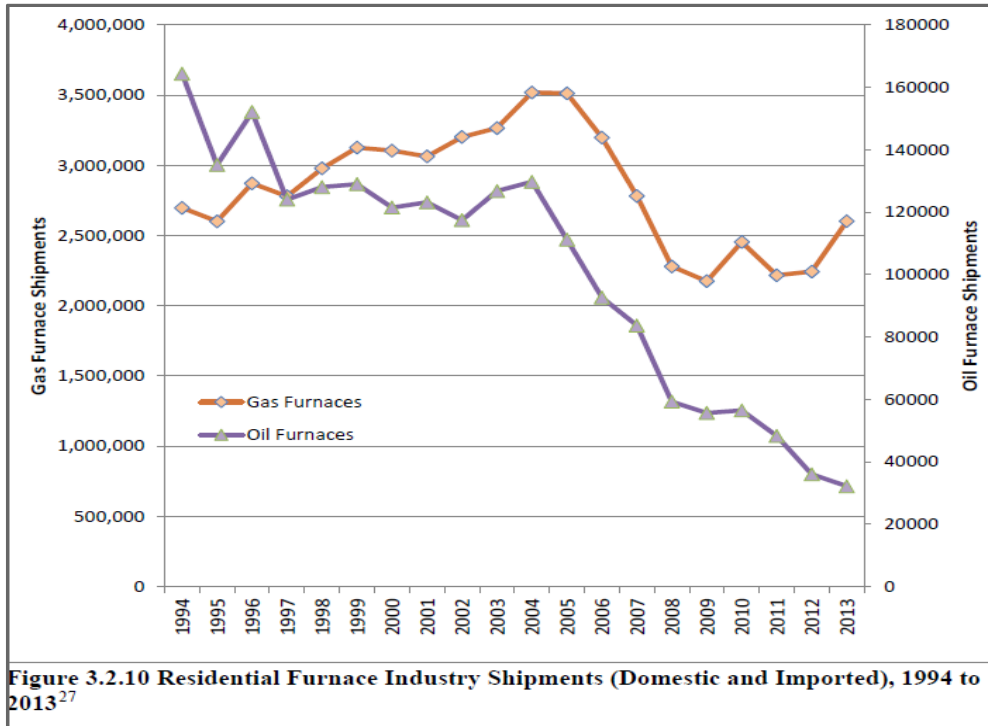
DOE's Energy Price Forecasts are in Error



DOE's projections understates natural gas price stability



DOE's Shipment Forecasts are Inaccurate



- ***DOE's history and projections conflict with AHRI data.***
- ***AHRI 2014 market data shows condensing market share already above DOE forecast.***



DOE Must Further Consider
Disproportionate Adverse
Impacts on Low Income
Consumers



Adverse Impact on Low-Income Customers

- DOE did not separate low-income data by the new and replacement market
- Low-income families and consumers in the Southern U.S. would be the hardest hit, with 39% of low-income households in the South bearing higher costs as a direct result of the Proposed Rule.
- The ratios of consumers with net costs versus net benefits are substantially worse after correcting for equipment costs, discount rates, and marginal natural gas prices
- DOE's analysis to date on low-income consumer impacts does not take into account the true costs of furnace replacement.

DOE should not find that a standard is economically justified when such a significant share of consumers will be made worse off under the Proposed Rule.”



Safety Issues

In the case of a furnace replacement, a change from a non-condensing to a condensing furnace will encounter technical and cost obstacles that, based on experience, lead to safety issues:

- Modifications to venting systems will not always be made
- Consumers will continue to use older, potentially unsafe equipment
- Excessive condensation will result in premature corrosion of the furnace and vent.
- Frequency of non-professional installations will increase
- Low-income customers will turn to unsafe practices (i.e. using cooking appliances to heat, space heaters near combustibles, etc.)



Environmental Justice

- Executive Order 12898 directs Federal agencies to identify and address any “disproportionately high and adverse human health or environmental effects” its actions may have on minority and low-income populations.
- The proposed standards can be expected to have disproportionate and adverse human health impacts on low income populations:
 - Increased operating costs result in adverse health effects
 - Increased heating outages result in adverse health effects
 - Safety risks are an obvious concern.
- DOE must assess the adverse human health impacts of its proposed standards pursuant to Executive Order 12898.

This is only one of many Executive Orders that DOE routinely glosses over. For a more complete list, refer to [our comment filed on October 17th, 2011](#).



Recommendations

- DOE should transparently open up its analytical process for proposed efficiency levels to broad stakeholder review and comment prior to development of standards proposals.
- DOE should conform to regulatory reforms implemented in 10CFR430, Appendix A covering transparency, credible assessment, utility impact analysis, fuel switching analysis, and other reform measures.
- Ensure that DOE validates its analysis against real-world installed costs and other economic considerations.
- Ensure that DOE identifies and addresses real-world impacts of its proposed standards on low income consumers.



Careful Review is Warranted

- The Market is already moving toward higher efficiency in the absence of new standards.
- DOE's NOPR can easily do more harm than good.
- There is no deadline or other exigency that justifies a failure to conduct a regulatory analysis that is sufficiency to ensure that these issues are properly considered and addressed.
- A settlement to allow “small” furnaces to remain non-condensing is not a substitute for transparency.

