# Including Energy Efficiency in Load Forecasts

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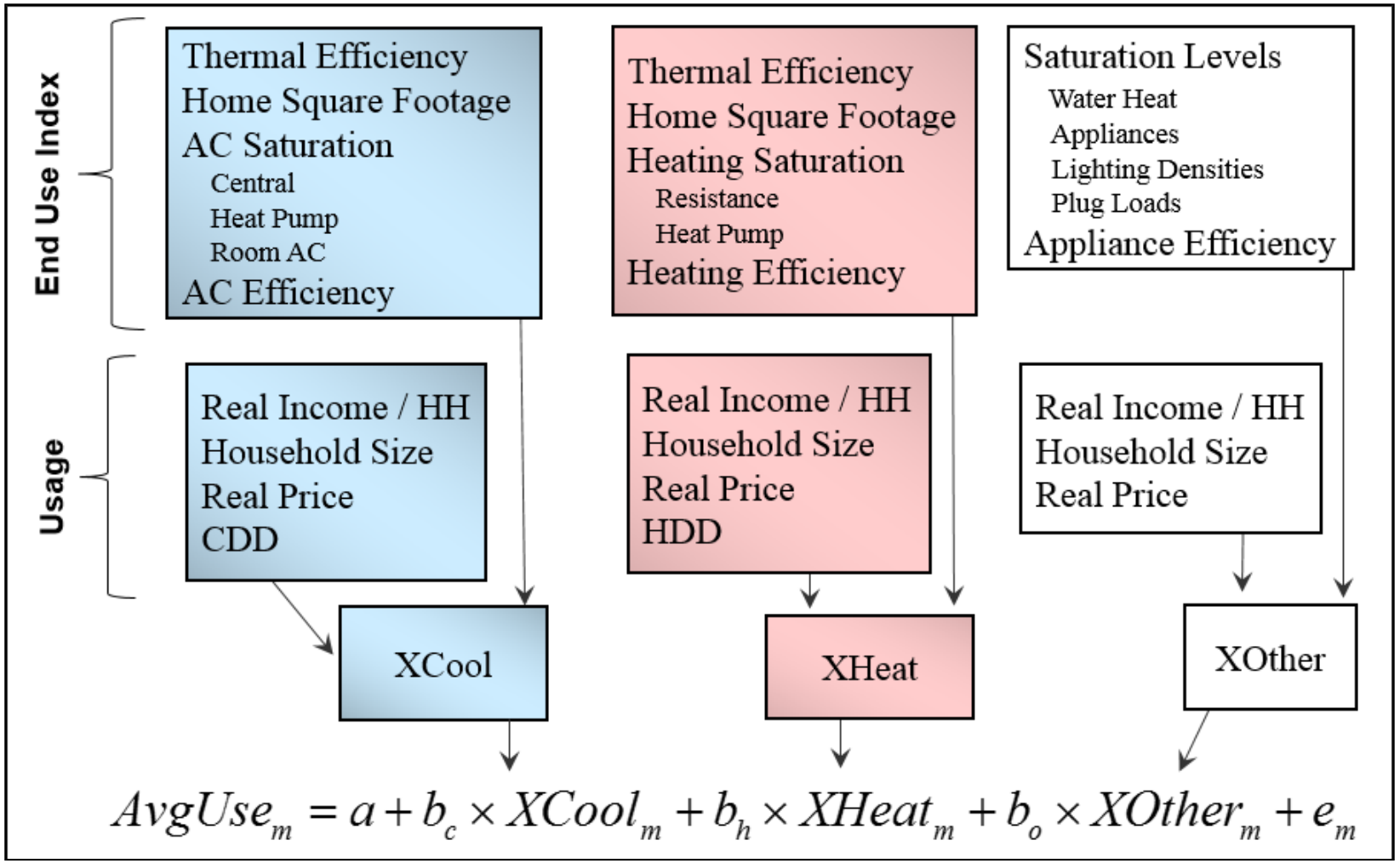
# Agenda

- Itron SAE Load Forecasting:  Brief Model Overview
- Two types of EE:  Organic and Utility-sponsored
- How Organic EE is Captured
- How Utility-sponsored EE is Captured
- IRP Load Forecast Development

# Itron Statistically Adjusted End Use **Residential Model**

Key forecast inputs:

- Historic Sales & Customers
- Moody's Economics Data
- EIA End Use Data
- Weather
- Prices

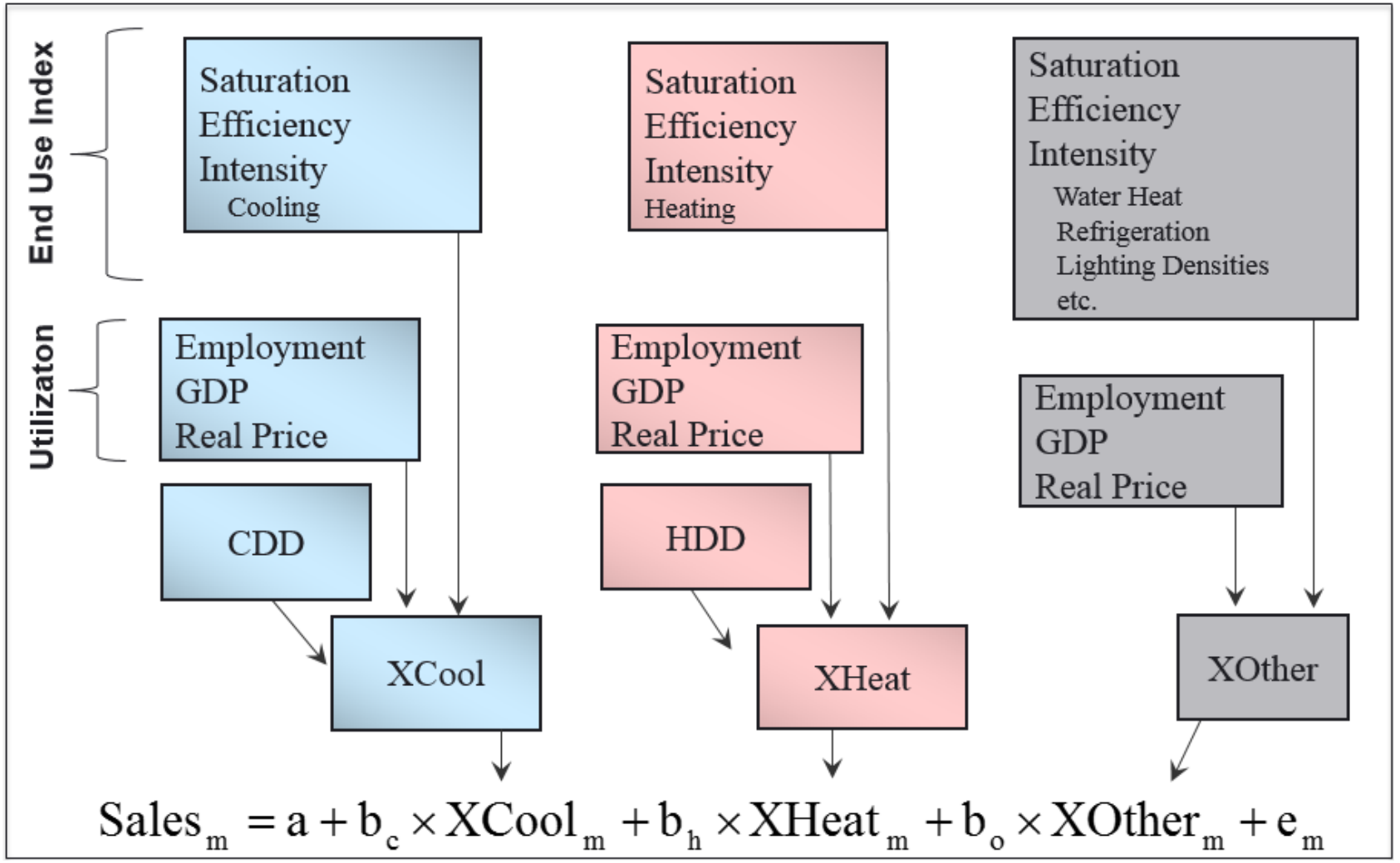



Source: Itron

# Itron Statistically Adjusted End Use **Commercial Model**

Key forecast inputs:

- Historic Sales & Customers
- Moody's Economics Data
- EIA End Use Data
- Weather
- Prices




Source: Itron

# Itron Industrial Model

**Industrial sales are estimated with a generalized econometric model**

Key forecast inputs:

- Historic Sales & Customers
- Moody's Economics Data
- Weather
- Prices

Cooling Degree Days

Manufacturing Employment
Manufacturing Output
Price

$$Sales_m = a + b_{cdd} \times CDD_m + b_{Econ} \times EconVariable_m + e_m$$

Source: Itron

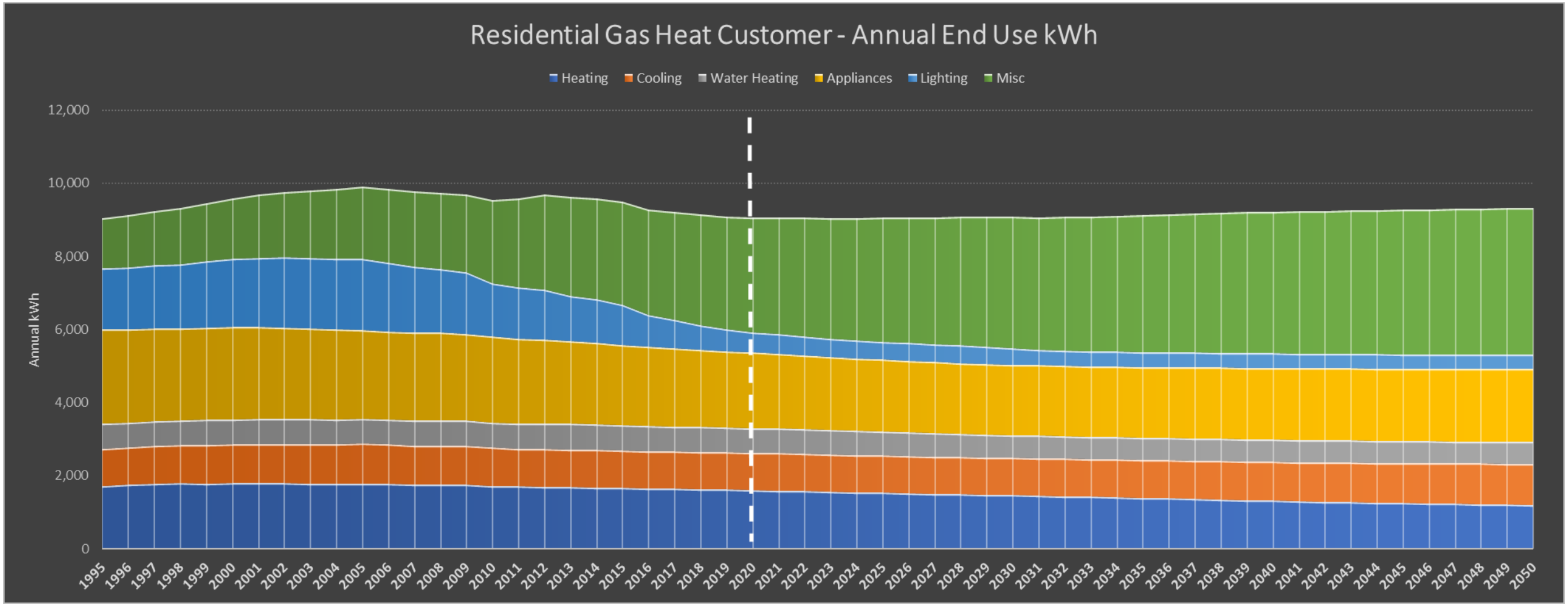
# Two Types of Energy Efficiency to Capture in Load Forecast

1) Organic EE
   - EE that results in the market from codes and standards
   - Itron SAE methodology captures through the EIA's forecasts of saturations and efficiencies of equipment

2) Utility-sponsored EE
   - EE implemented by the utility through incentive programs
   - Utility incentives help speed up the adoption of efficient technologies that would happen organically, but more slowly
   - Trickier to accurately capture in the load forecast

# 1) Organic EE captured through EIA SAE data

*Example of EIA SAE data inputs to the load forecast*




Cool AAGR 2021 - 2030: -0.04%

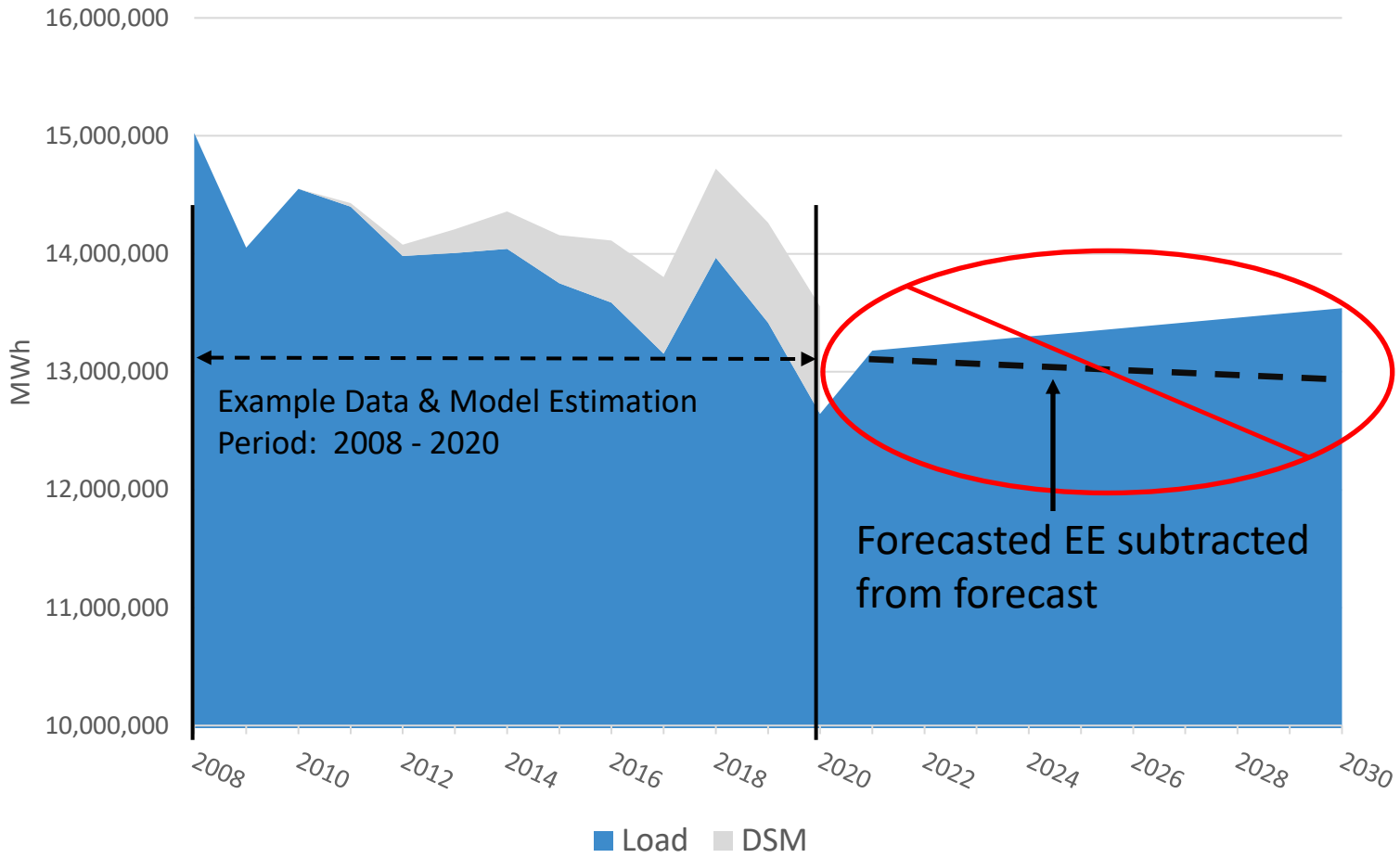
Heat AAGR 2021 - 2030: -0.90%

GR = Average Annual Growth Rate

Source: 2020 EIA Annual Energy Outlook

# 2) Utility-sponsored EE – Forecasting Challenge

**If utility sales history includes Utility-sponsored EE, then some will be embedded in the forecasted sales**



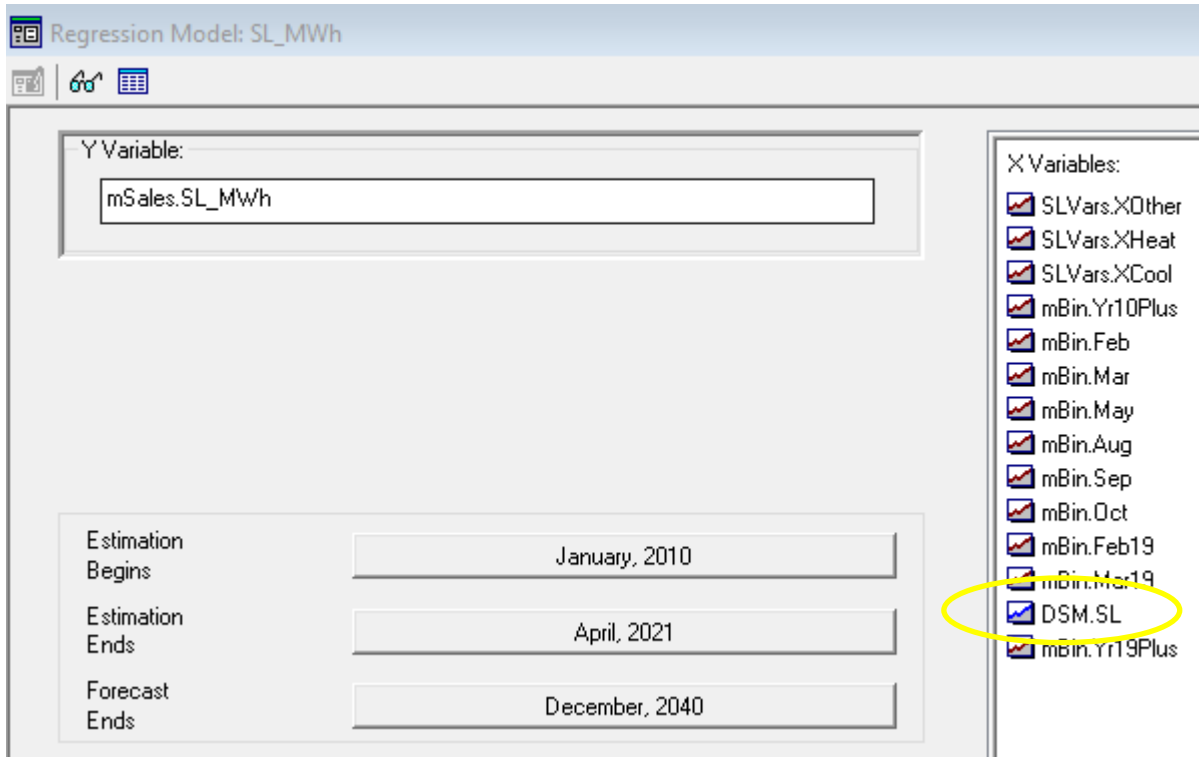

- Model estimation period includes historic EE
- Thus, model forecast will have some embedded EE in the sales trend
- **Double-counting Issue: Need to quantify this embedded EE – you can't just subtract the off the full volume of forecasted cumulative EE from the sales forecast – this will double count some EE because some is already in the sales trend**

# How do we quantify the embedded Utility-sponsored EE?

**Include historic and forecasted Utility-sponsored EE in the model as an independent variable – DSM Variable**

$$Sales_m = a + b_c \times XCool_m + b_h \times XHeat_m + b_o \times XOther_m + b_d\, DSM\ Var$$

- Including EE as an independent variable isolates and quantifies the EE trend embedded in the sales data
- Forecasted EE included in the variable data stream will automatically be adjusted out of the forecast at the appropriate level



# DSM Variable Coefficient and Model Statistics

Example of DSM Variable Coefficient:

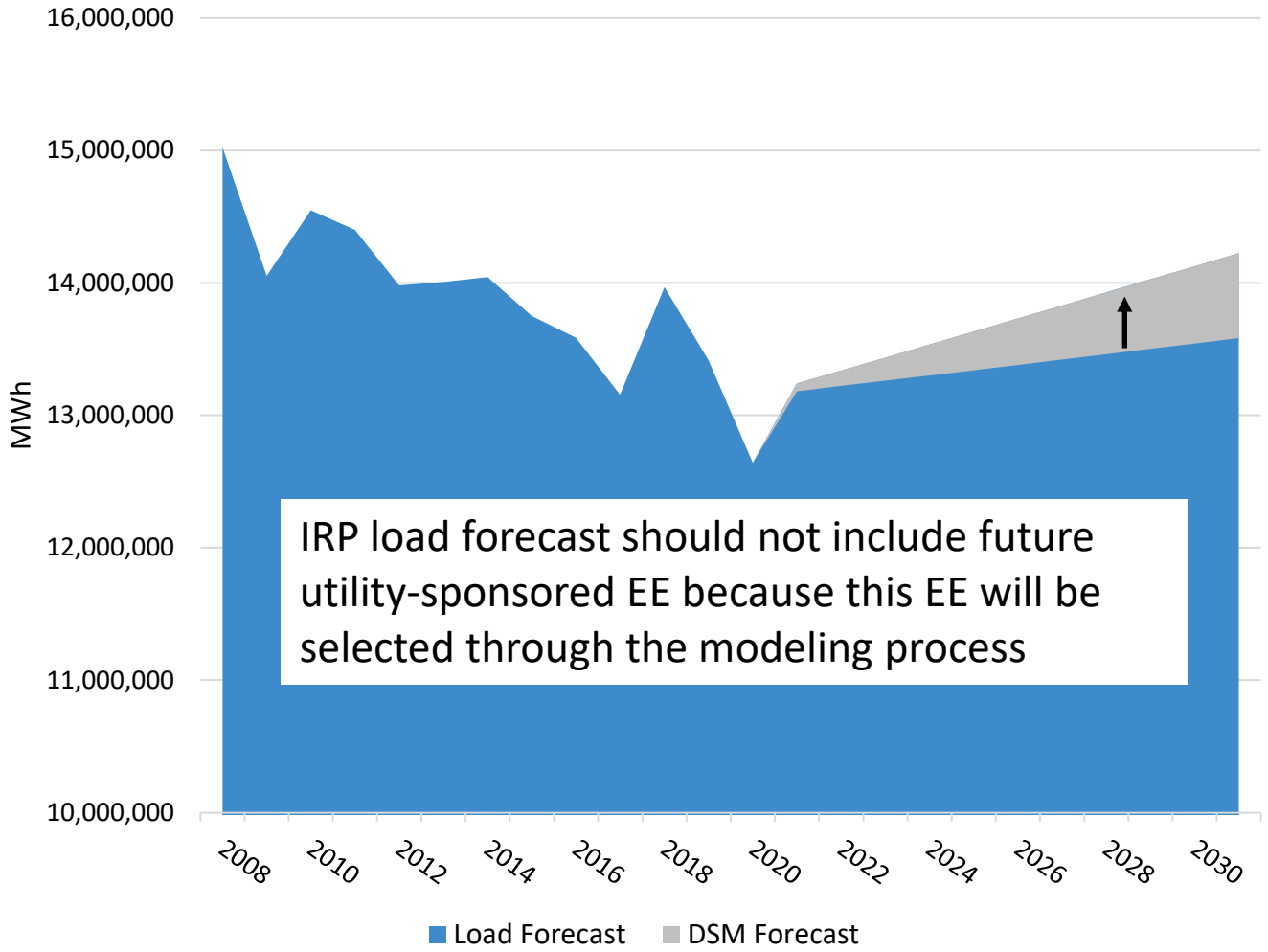
Regression Model: SL_MWh

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Variable | Coefficient | StdErr | T-Stat | P-Value |
| 2 | SLVars.XOther | 279427.542 | 16107.824 | 17.347 | 0.00% |
| 3 | SLVars.XHeat | 81184.029 | 19799.239 | 4.100 | 0.01% |
| 4 | SLVars.XCool | 117130.051 | 3781.565 | 30.974 | 0.00% |
| 5 | mBin.Yr10Plus | 13247.816 | 14378.187 | 0.921 | 35.87% |
| 6 | mBin.Feb | 9191.114 | 1888.885 | 4.866 | 0.00% |
| 7 | mBin.Mar | 8242.167 | 1560.427 | 5.282 | 0.00% |
| 8 | mBin.May | 2206.416 | 1236.070 | 1.785 | 7.68% |
| 9 | mBin.Aug | 9450.914 | 1468.977 | 6.434 | 0.00% |
| 10 | mBin.Sep | 7393.328 | 1581.802 | 4.674 | 0.00% |
| 11 | mBin.Oct | 5962.627 | 1352.890 | 4.407 | 0.00% |
| 12 | mBin.Feb19 | 16246.001 | 4295.297 | 3.782 | 0.03% |
| 13 | mBin.Mar19 | 21637.918 | 4285.347 | 5.049 | 0.00% |
| 14 | mBin.Yr19Plus | -17052.376 | 2177.469 | -7.831 | 0.00% |
| 15 | DSM.SL | -0.584 | 0.106 | -5.534 | 0.00% |
| 16 | AR(1) | 0.457 | 0.082 | 5.604 | 0.00% |
| 17 | | | | | |

R-square before: 0.971
R-square after: 0.981

- Model calculates coefficient for the DSM variable which quantifies embedded EE
- Example: coefficient interpretation - model will include 58.4% of the forecasted EE because 42.6% is already embedded in the sales trend
- Variable should only be included if T-stat and P-value indicate significance
- Generally, including the DSM variable will improve the R-square because it explains the declining sales

# IRP Load Forecast




**AES IN load forecast approach in 2019 IRP –**

- Historical and forecasted EE (IURC –approved DSM or selected DSM from 2016 IRP) included in the model's DSM variable data stream
- By including forecasted EE in the data stream, the resulting forecast assumes EE programs will occur in future years
- This EE needs to be removed from the forecast that goes into the IRP models because the IRP models will be selecting the EE that occurs in the future planning years
- To make this adjustment, AES IN grossed up the final IRP forecast for this forecasted EE using the appropriate EE coefficient