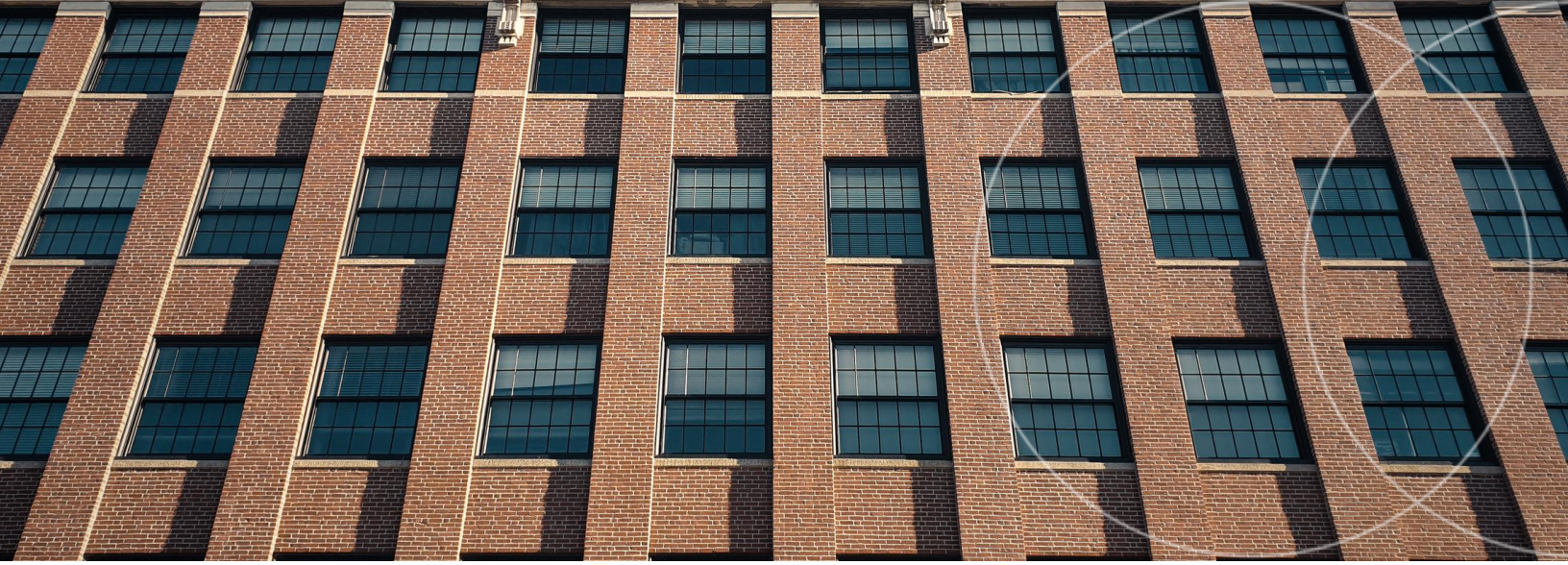


How Can Regional Data Improve the Accuracy of Commercial Building Simulations?

Overview

The Regional Technical Forum (RTF) uses building energy simulations (BES) to evaluate regional energy savings from a wide range of energy efficiency measures. Creating simulations that represent real-world buildings is imperative for regional power planning. To that end, the RTF turned to Resource Innovations' (RI) Advisory Services team (formerly the Cadeo Group) to align 10 commercial building prototypes–warehouse, stand-alone retail, residential care, medium office, large office, quick service restaurant, full-service restaurant, mid-rise multi-family, hi-rise multi-family, and hospital–using the most common respective heating, ventilation, and air conditioning (HVAC) systems to regional billing and metering data from the Northwest Energy Efficiency Alliance.

RI's Advisory Services team succeeded in aligning the commercial building prototypes and HVAC combinations by following these two steps:

1. Creating monthly, weather-normalized target energy use intensity (EUI) curves using Commercial Building Stock Assessment (CBSA) data for both gas-side and electricity-side energy usage. For multifamily buildings, target EUI curves were developed from NEEA's Residential Building Stock Assessment (RBSA) and Home Energy Metering Study (HEMS).
2. Adjusting commercial building prototype inputs to align models to gas and electric EUI target curves.

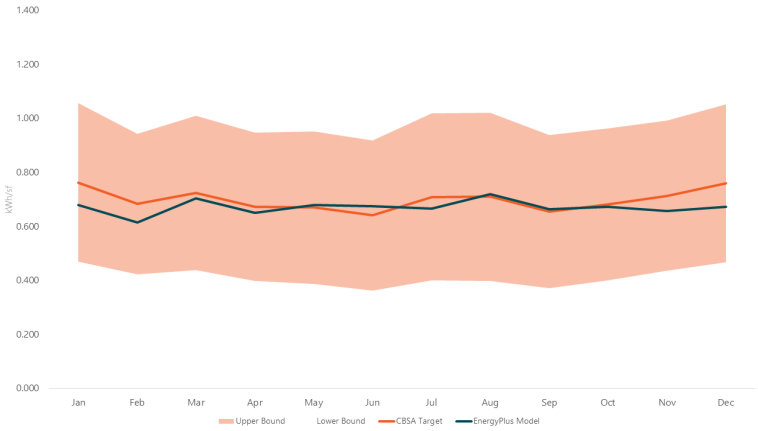
Adjusting inputs until BES results match consumption target curves is an iterative process. It can be extremely time-intensive as the number of models aligned increases. In total, we aligned 27 commercial prototypes and HVAC combinations. The RI team accomplished this by using the RTF's Modelkit Flannel commercial building simulation program. Modelkit Flannel is an EnergyPlus-based parametric analysis tool where users simultaneously define parameters for multiple models through an Excel workbook and run simulations for all models. This format allows for quick changes to multiple models, parameter comparisons between models, and a fast iterative simulation process when aligning simulation results to a target.

Results

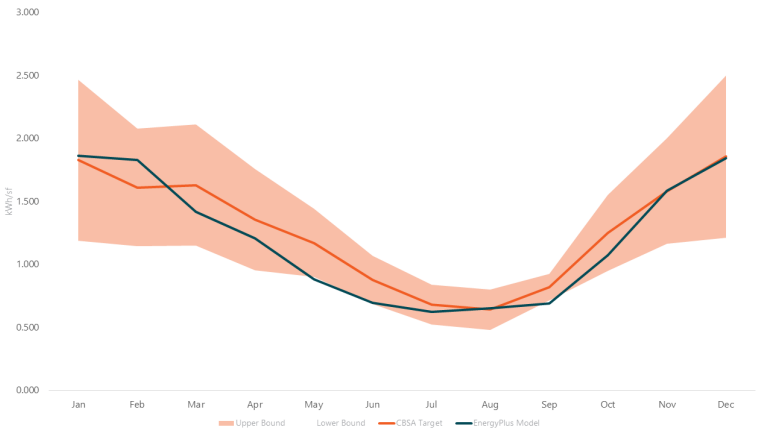
The figures below display all target curves (orange curves; because apartment buildings were calibrated to HEMS data instead of CBSA, the confidence interval acceptance range for these buildings is gray), 90% confidence interval acceptance ranges (orange areas), and aligned model curves (teal curves) generated from Modelkit Flannel for all 27 building-types and HVAC combinations. Each combination has varying number of instances (n) from the CBSA, RBSA, and HEMS data. The result of our efforts is commercial building prototypes calibrated to real-world buildings. Moving forward, the RTF can use these to estimate regional energy savings and develop a wide array of energy efficiency measures. The final workbook and presentation can be found on the RTF website.

Warehouse - Electric

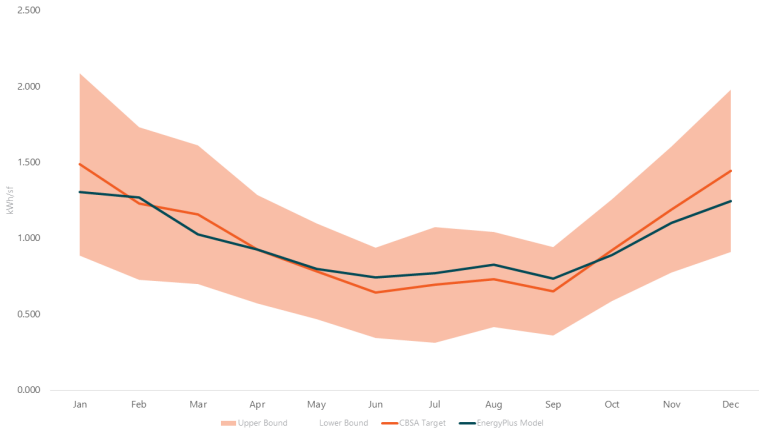
Gas furnace no cooling

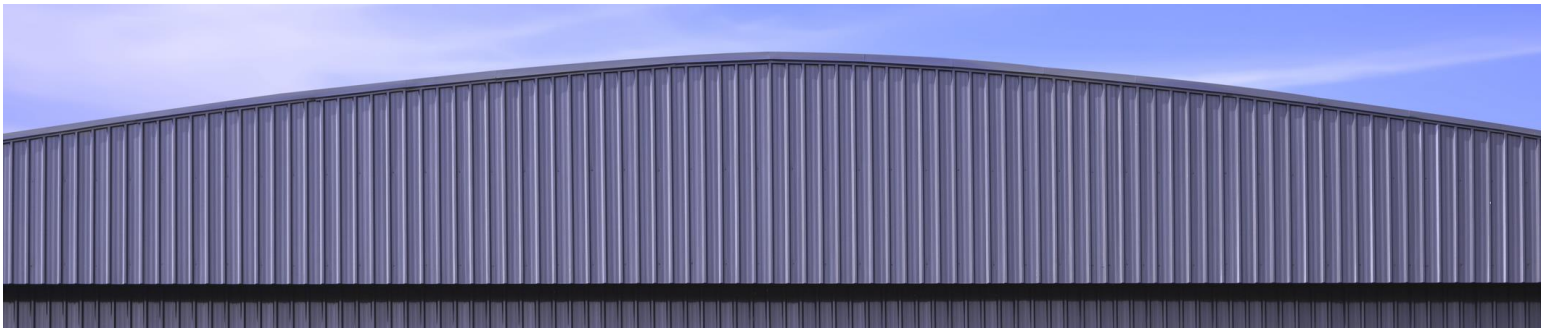


Zonal electric resistance



Heat pump





ABOUT RESOURCE INNOVATIONS

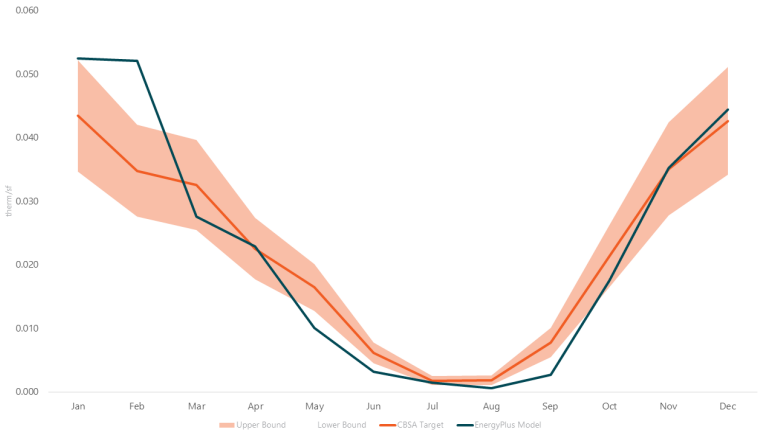
Resource Innovations (RI) is an energy transformation firm. Women-led, purpose built, and focused on impact, we're constantly expanding our portfolio of solutions to guide utilities through increasingly complex, connected challenges. For communities across North America, we're leading the charge to power change.

Contact

Find out how RI can transform your business:
ri.bd@resource-innovations.com

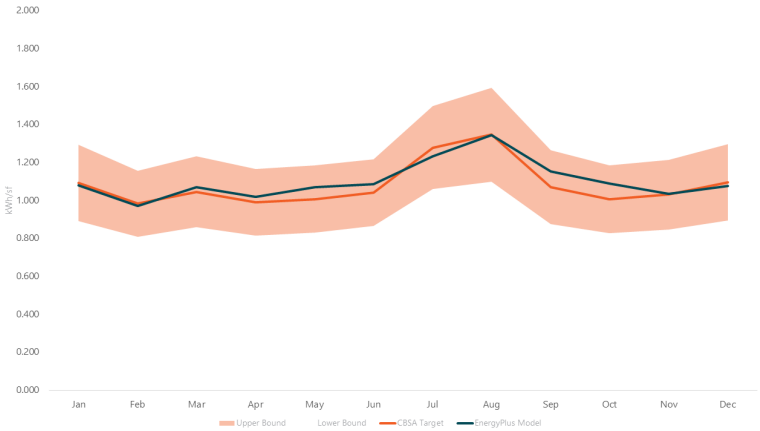
Warehouse - Gas

Gas furnace no cooling

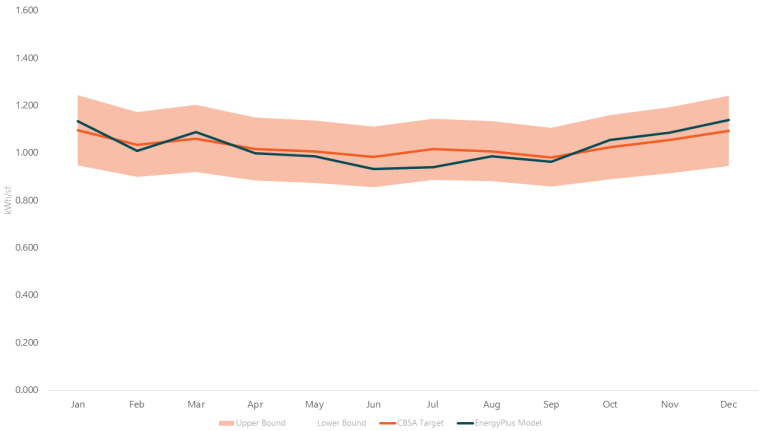


Retail, Stand-alone - Electric

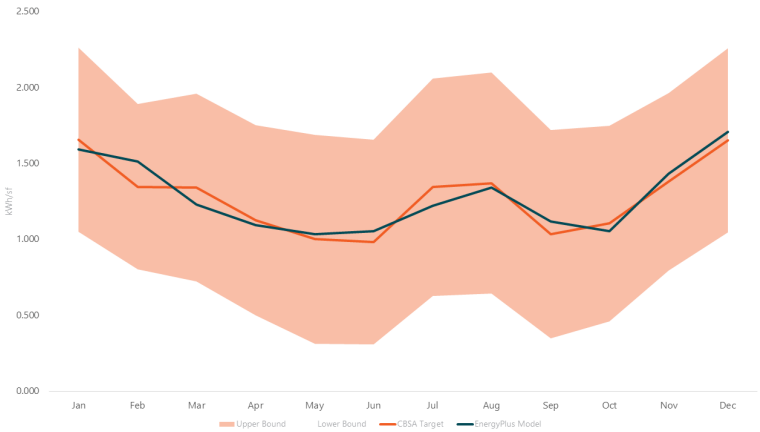
Gas furnace with DX



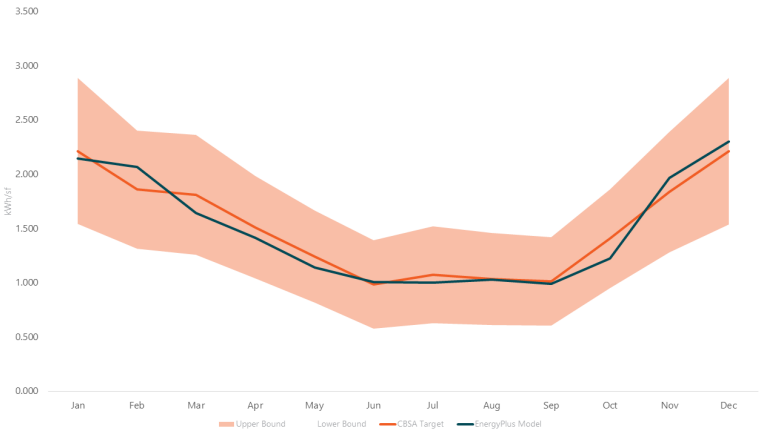
Gas furnace no cooling



Zonal electric resistance with DX

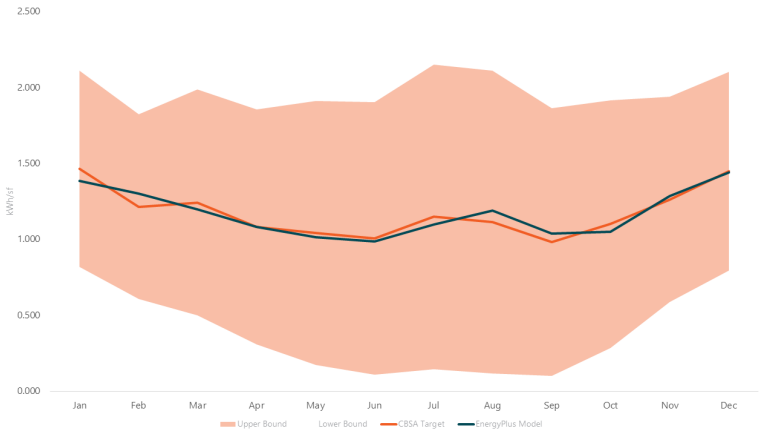


Zonal electric resistance no cooling



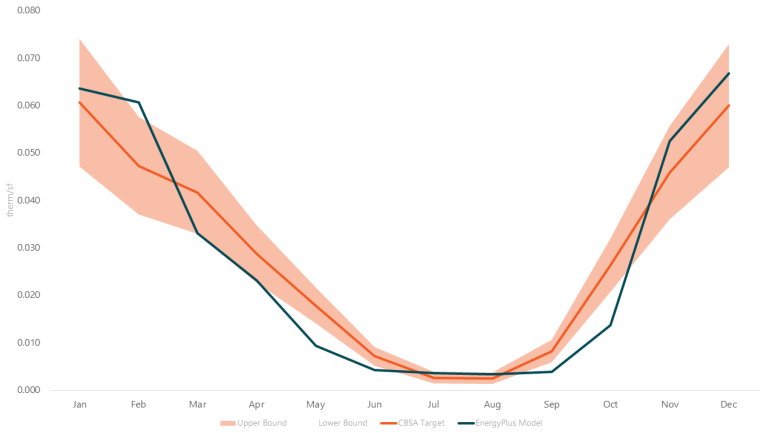
Retail, Stand-alone - Electric

Heat pump

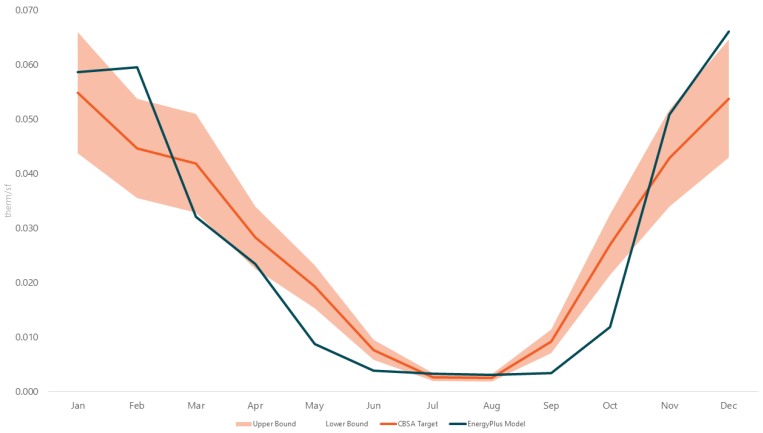


Retail, Stand-alone - Gas

Gas furnace with DX

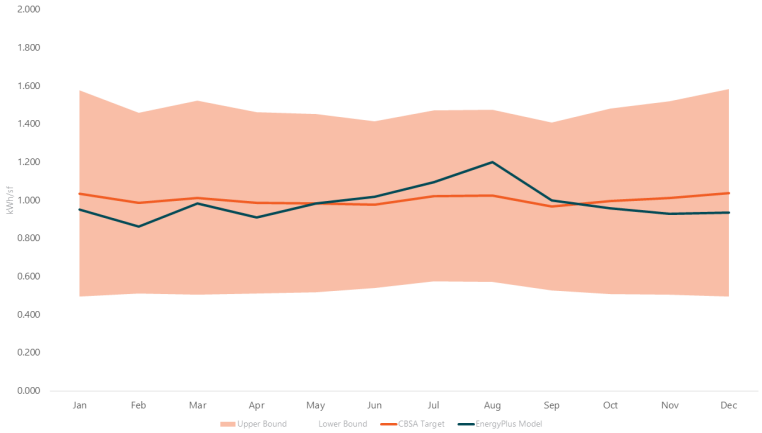


Gas furnace no cooling

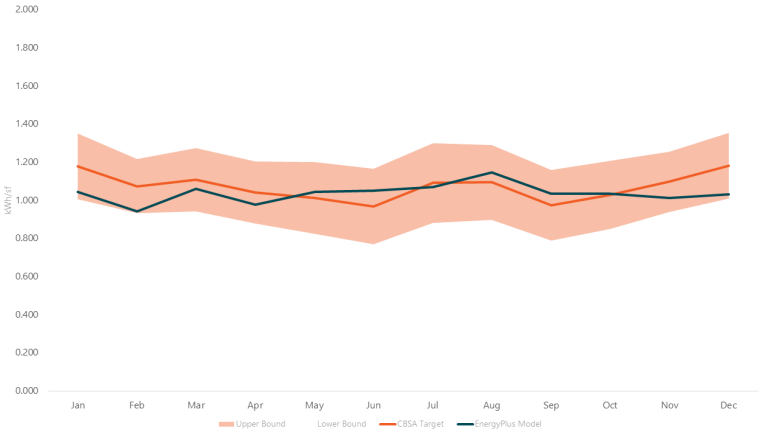


Medium Office - Electric

Gas furnace with DX

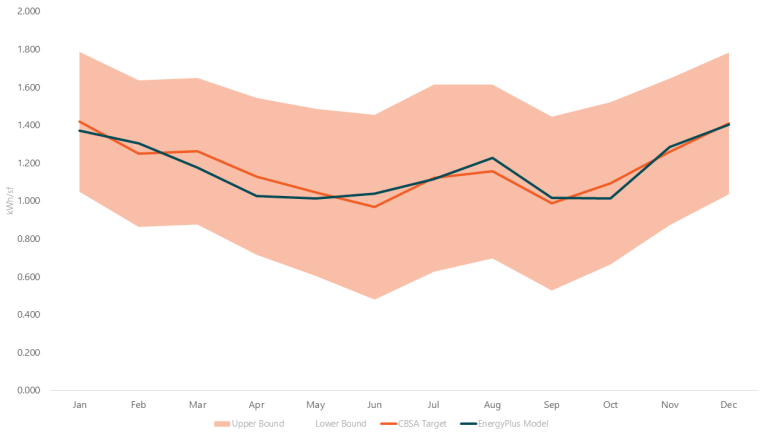


Gas furnace with heat pump

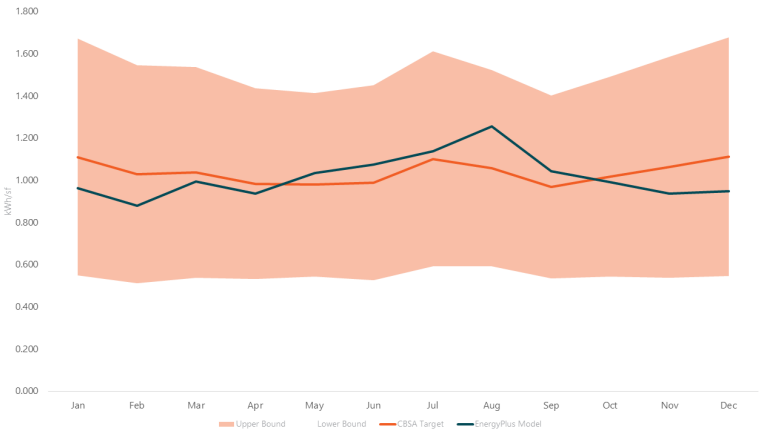


Medium Office - Electric

Heat pump

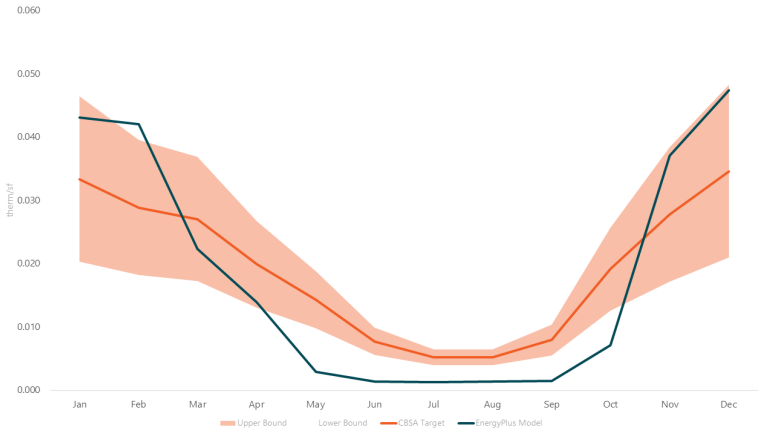


Variable air volume gas heat with DX

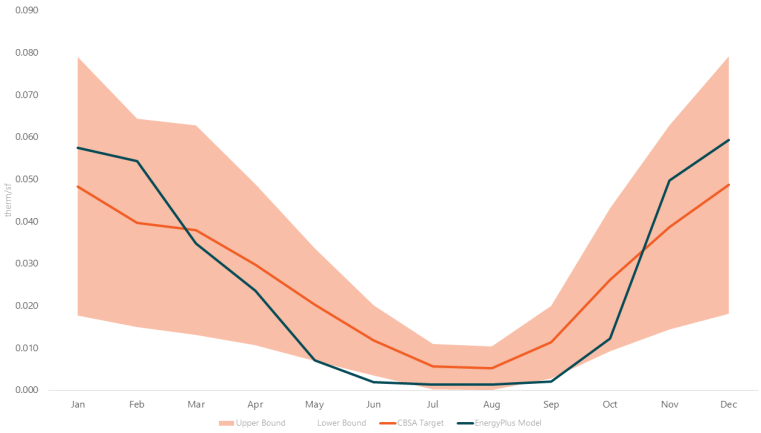


Medium Office - Gas

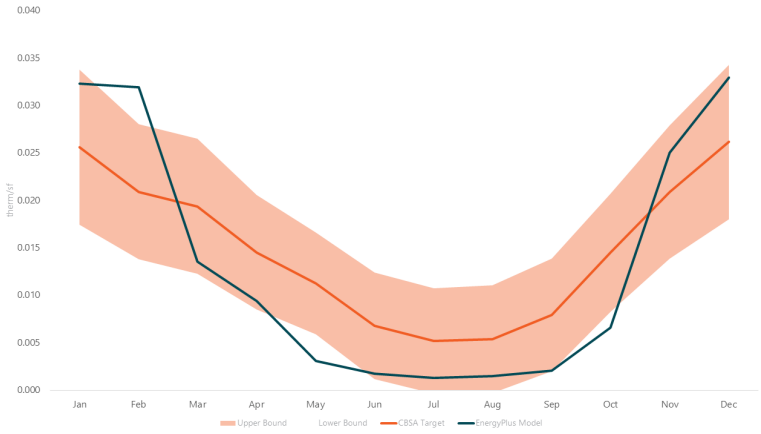
Gas furnace with DX



Gas furnace with heat pump

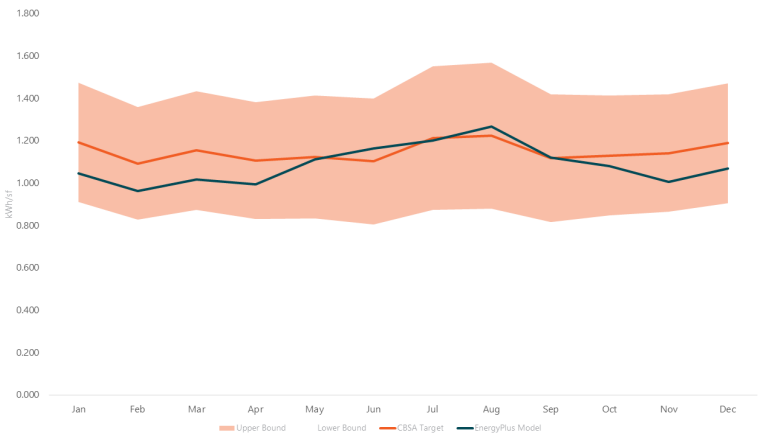


Variable air volume gas heat with DX

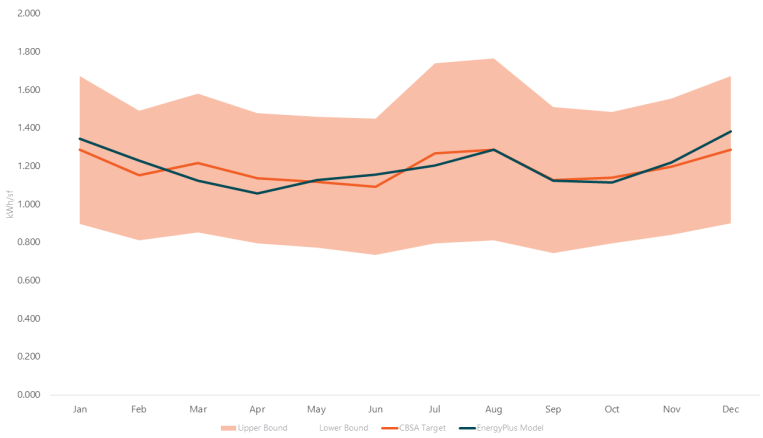


Large Office - Electric

Gas heat with cooling

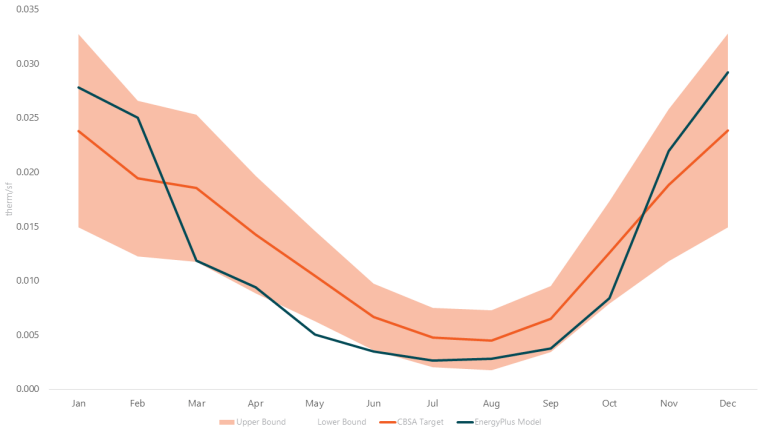


Variable air volume electric resistance with DX



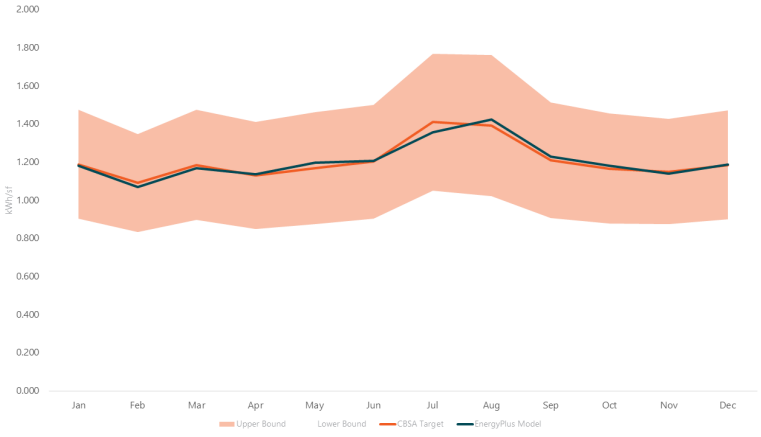
Large Office - Gas

Gas heat with cooling

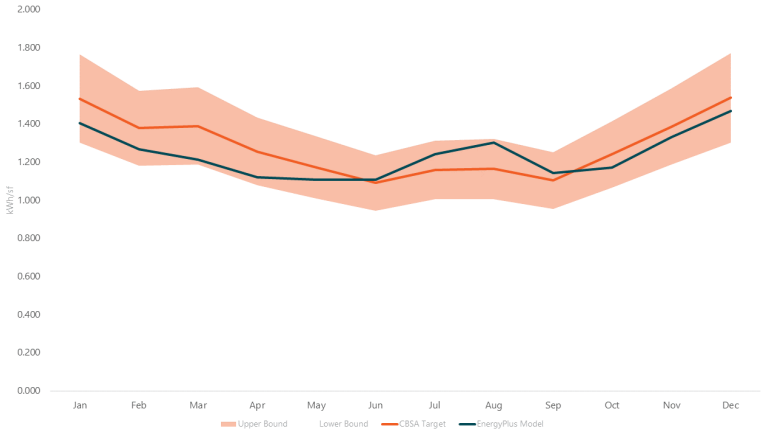


Residential Care - Electric

Gas furnace with DX

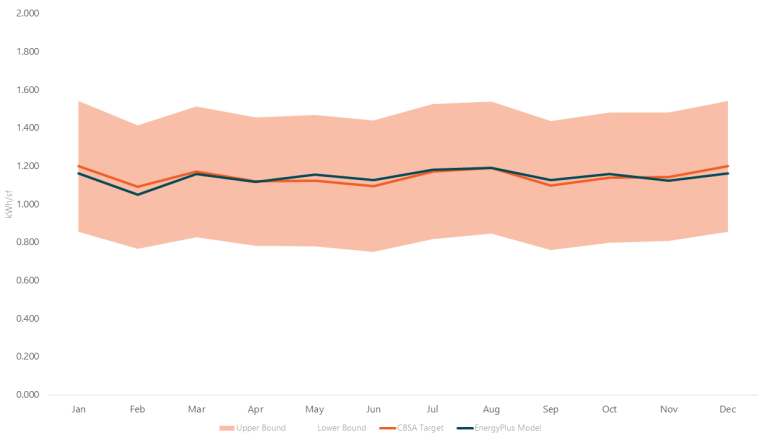


Gas furnace with electric resistance

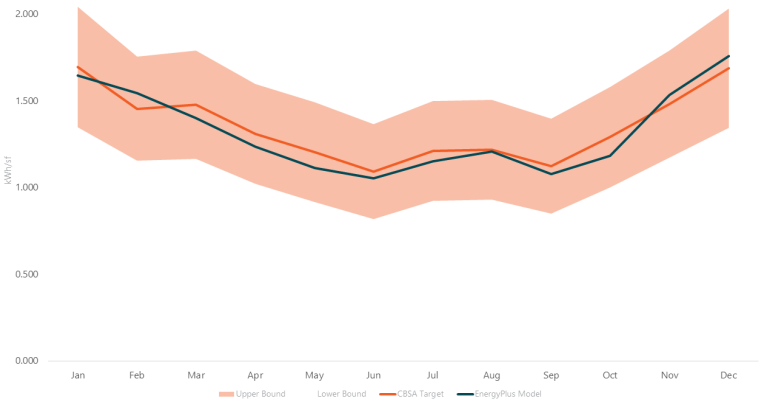


Residential Care - Electric

Gas furnace no cooling

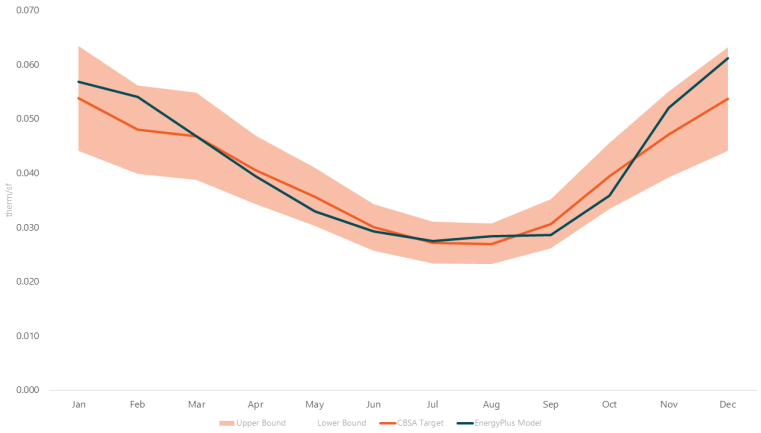


Heat Pump

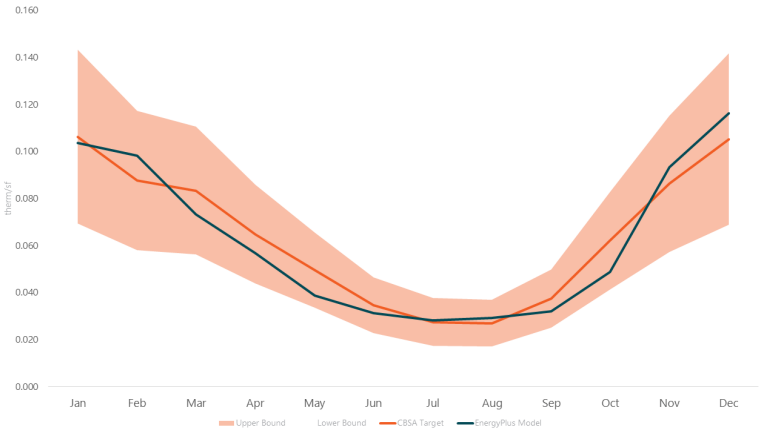


Residential Care - Gas

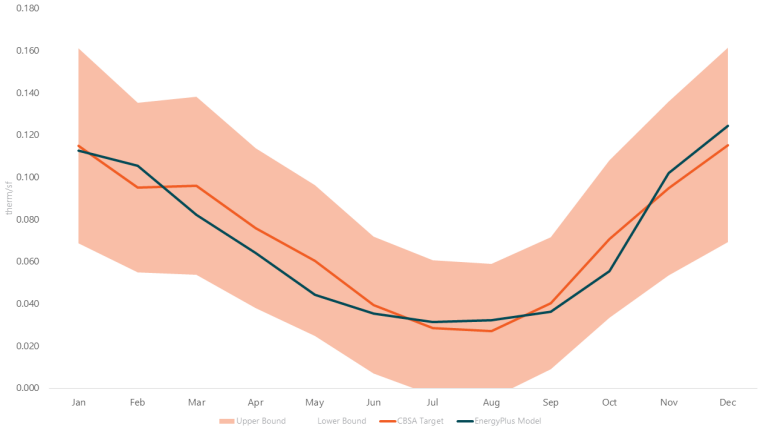
Gas furnace with electric resistance



Gas furnace with DX

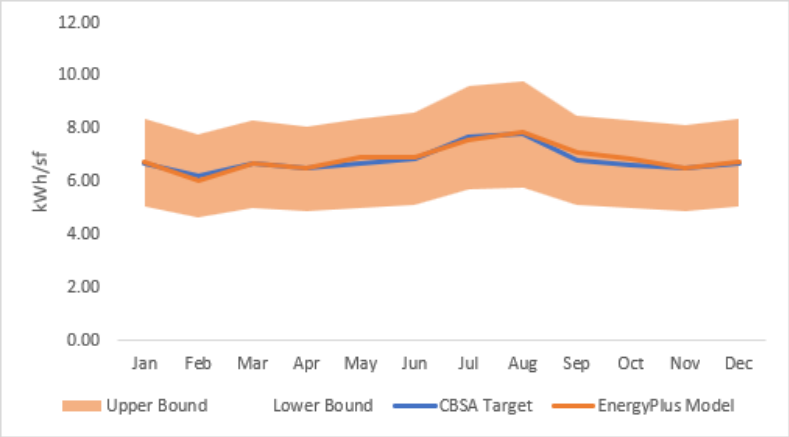


Gas furnace no cooling



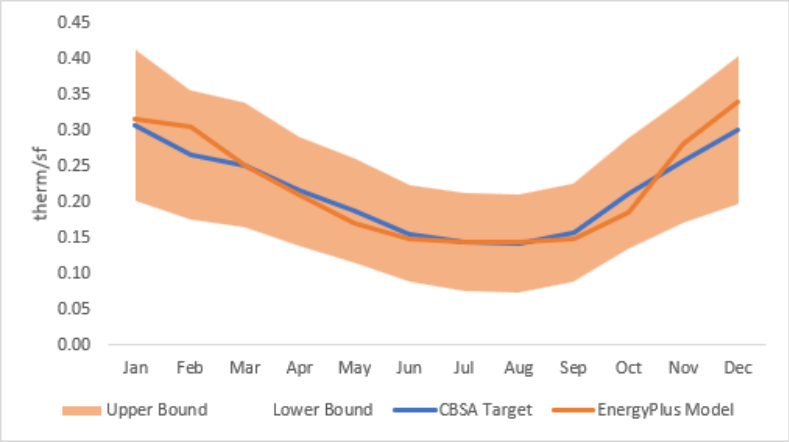
Quick Service Restaurant – Electric

Gas furnace with DX



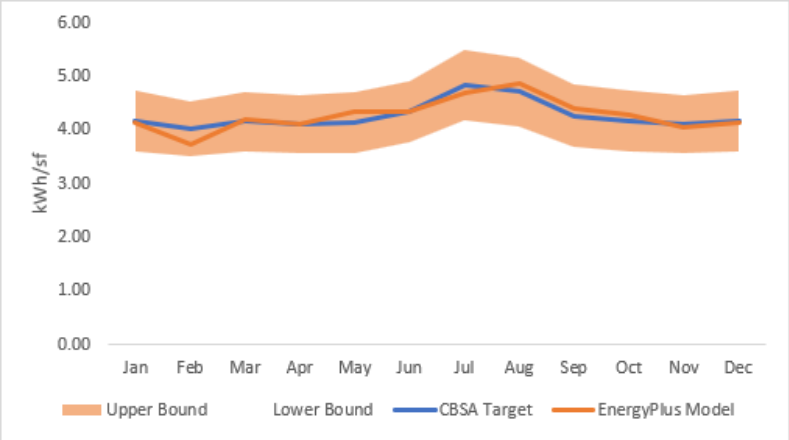
Quick Service Restaurant – Gas

Gas furnace with DX



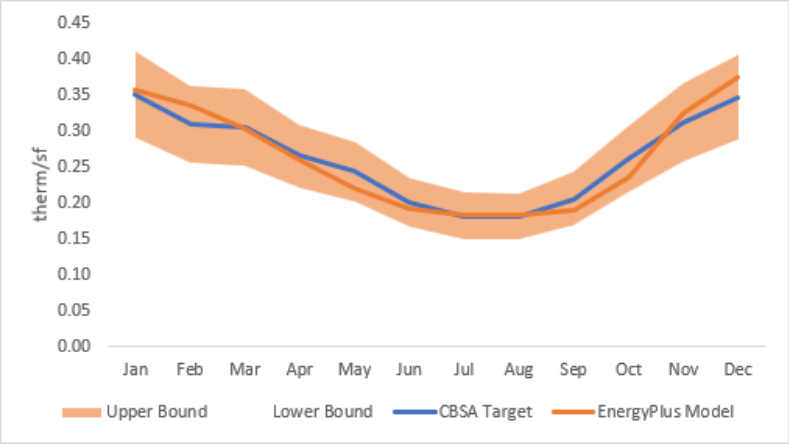
Full Service Restaurant – Electric

Gas furnace with DX



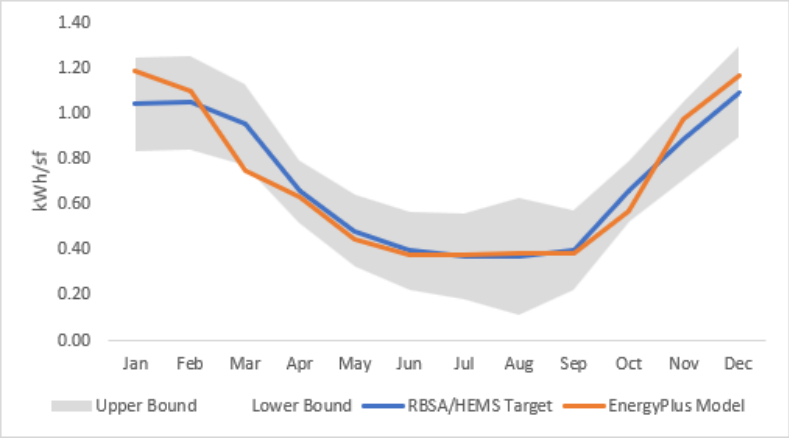
Full Service Restaurant – Gas

Gas furnace with DX



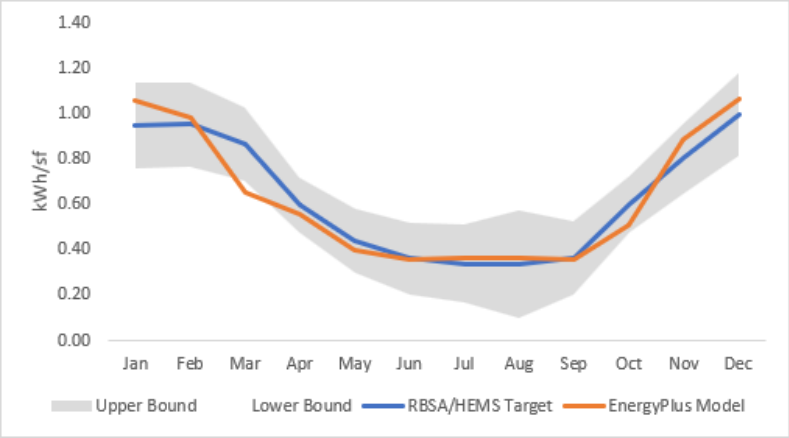
Mid-rise Apartment – Electric

Zonal electric resistance



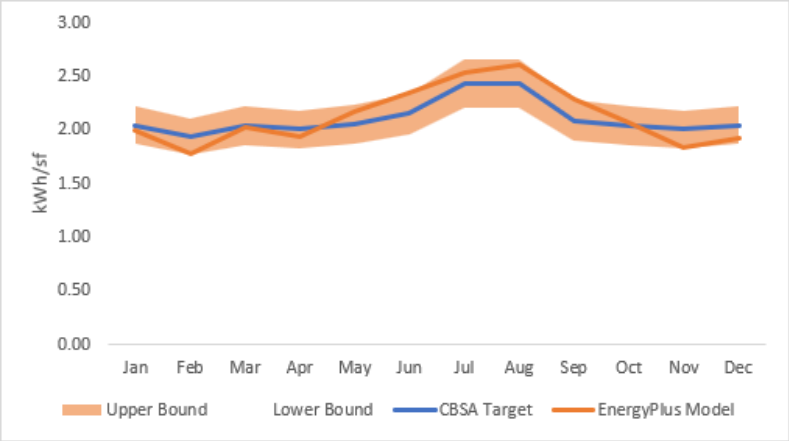
Hi-rise Apartment – Electric

Zonal electric resistance



Hospital - Electric

Hydronic air handling unit and chiller



Hospital - Gas

Hydronic air handling unit and chiller