

STUDY OBJECTIVES

1. Saturation, penetration, and end use load shapes for all major electric and gas appliances, equipment, electronics in Massachusetts (MA) homes
2. Identifying savings potential in existing residential home market
3. Energy efficiency and demand response program design
4. Energy and demand savings calculations for program evaluation and forward capacity market support

STUDY DESIGN



6,600 online surveys



356 homes metered for 25 end uses

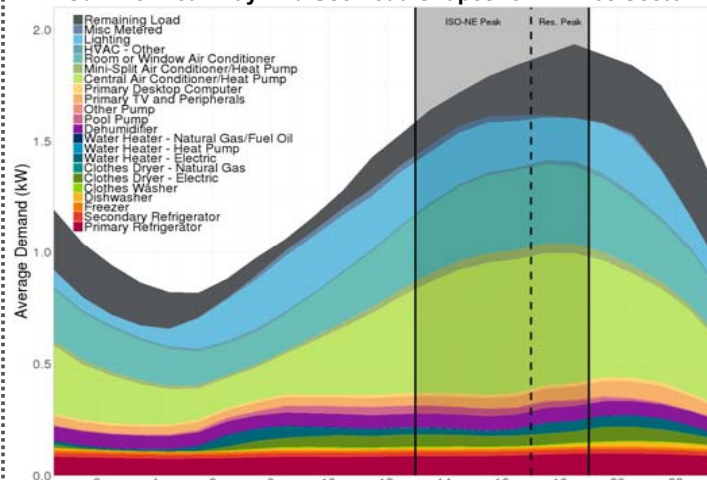


Analysis and weather normalization

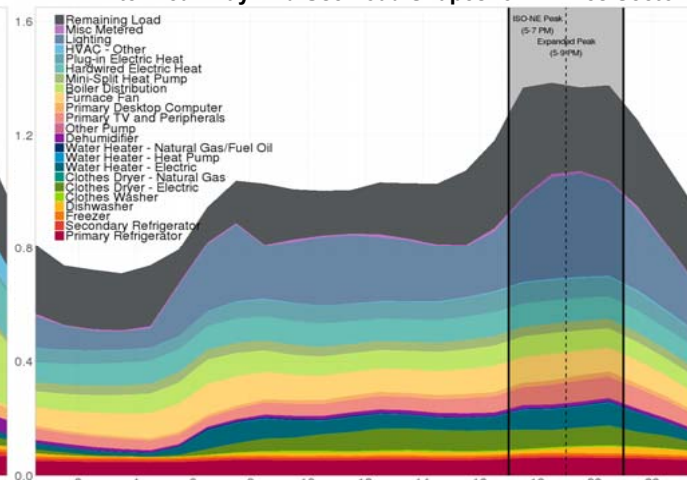


End use load shapes

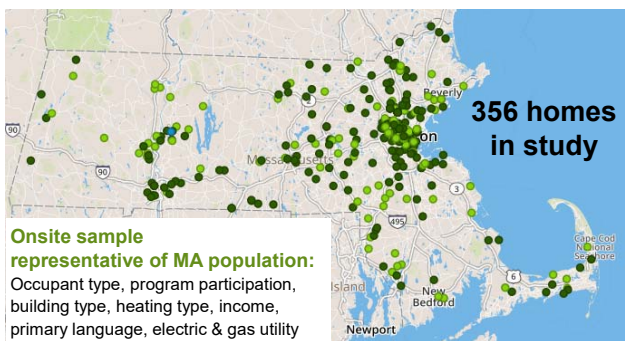
Summer Peak Day End Use Load Shapes for MA Res Sector



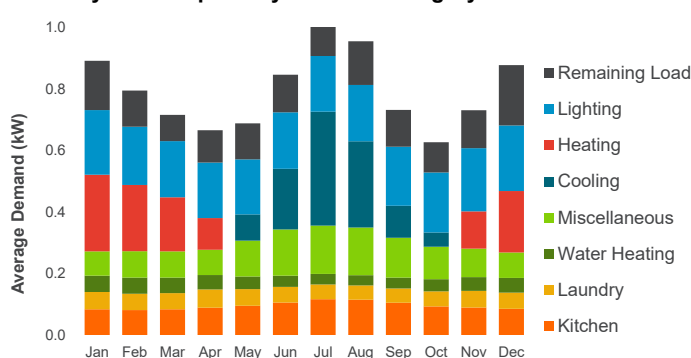
Winter Peak Day End Use Load Shapes for MA Res Sector



MASSACHUSETTS HOMES IN STUDY



Monthly Consumption by End Use Category for MA Res Sector



CONCLUSIONS

COOLING

Central ACs are the single most important end use driving summer peak demand. Room ACs are the next largest contributor, and their saturation is increasing. Central AC, room AC, and ductless heat pumps should be the focus of efforts to reduce peak demands.

HEATING

Hardwired and plug-in electric heat, furnace fans, and boiler distribution systems all consume energy within the same order of magnitude. Winter peak day consumption of these equipment exhibit flat load profiles. Ductless heat pump saturation is increasing.

WATER HEATING

Heat pump water heaters use 50% of the energy and peak demand of regular electric water heaters, which may result in significant reductions in peak demand.

LIGHTING

Lighting consumes the most electricity of any single end use, but its energy intensity is falling quickly due to program interventions and federal standards.

KITCHEN

Refrigerators are the second largest individual consumers of electricity; however, peak impacts are negligible. Refrigerators are ripe for upstream or midstream programs to save energy.

MISCELLANEOUS

Pool pumps have the largest non-cooling summer peak demand of any metered end use. Program administrators should consider targeting dehumidifiers, clothes dryers, and pool pumps for additional demand savings.

LAUNDRY

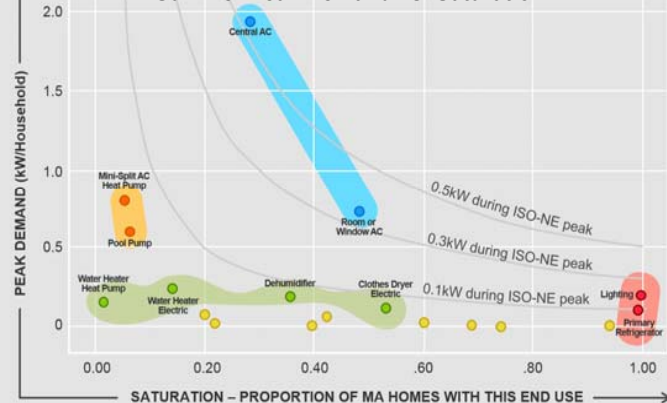
Some clothes dryers are used throughout the day, including during afternoon and evening peak.

ADDITIONAL USE CASES

End use load shapes can also be used for other utility functions:

- Load forecasting
- Rate design
- Grid modernization
- Resource and T&D planning
- Renewable energy integration
- Building model calibration

Summer Peak Demand vs. Saturation



Annual Energy vs. Saturation

