



# Connecticut R1706 Residential Appliance Saturation Survey and R1616/R1708 Residential Lighting Saturation Studies

## Final Presentation

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October 18, 2019



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## Agenda

1. Study objectives
2. Methods
3. Findings and considerations
4. Wrap-up
5. Database tutorial/demo



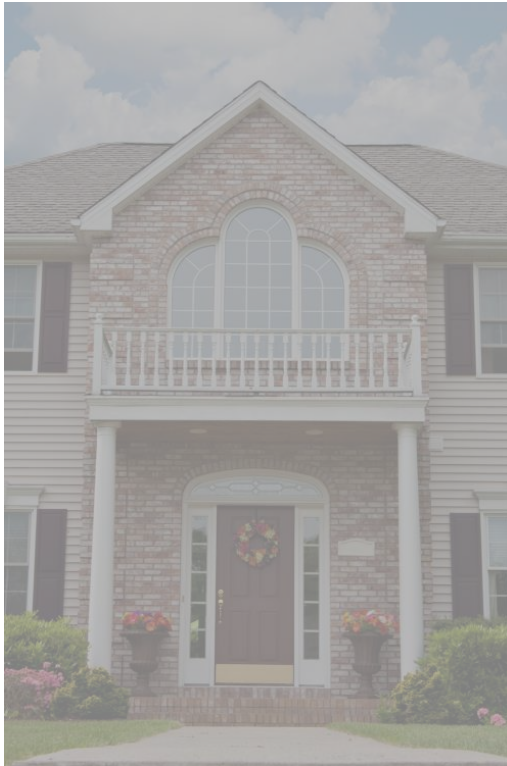
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## Objectives

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- Characterize Connecticut households
- Develop a database for future research
- Conduct a lighting market assessment
- Provide considerations for planning and PSD updates

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## Data Collection

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- Web surveys

- Presence, quantity, type, age, configuration of end uses
- Home characteristics and demographics
- Behavior, awareness, participation, attitudes



- On-site verification visits

- Verification of reported end uses
- Additional details on age, size, efficiency, etc.
- Lighting saturation and envelope characteristics
- Usage of advanced power strips

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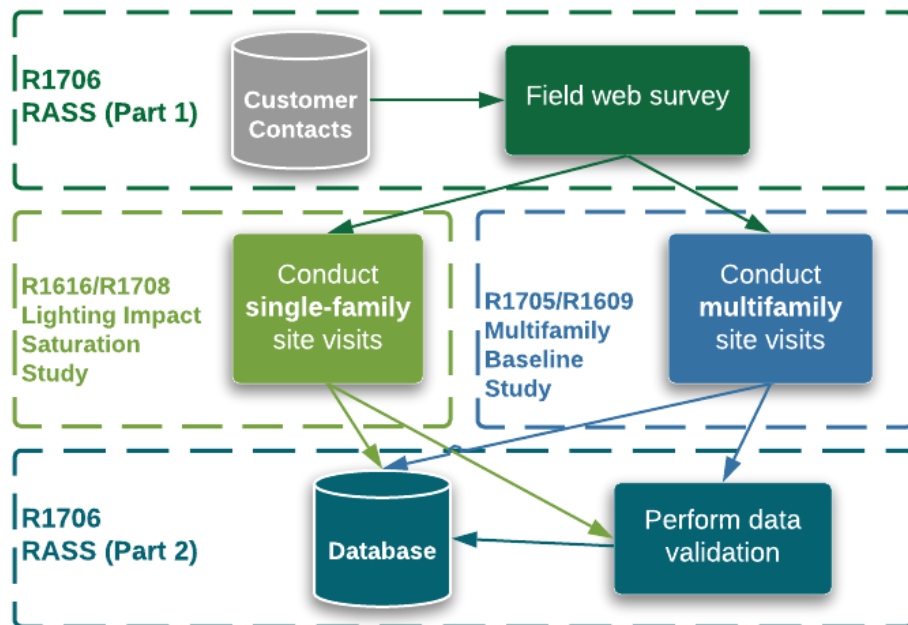
# Additional Tasks

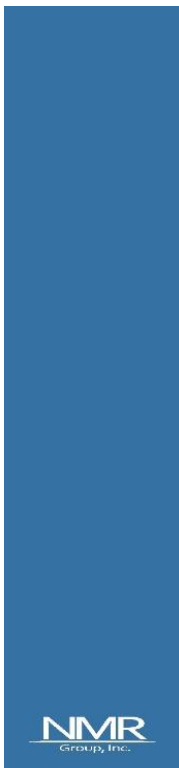


- Database development
  - Web and on-site results combined
  - Billing data amendment
  - Cross-tabulations
- Adjustment factors
  - Ratio of web and on-site results
  - Accept if statistical difference and adequate sample
- Analysis and report
  - Summary statistics of end uses
    - Penetration and saturation
    - Efficiency and age
  - Exploratory lighting NTG analysis
  - Considerations for future research and planning



# Cross-Project Coordination





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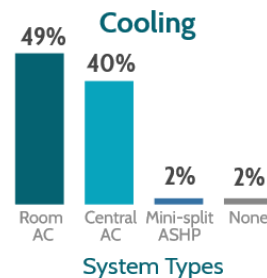
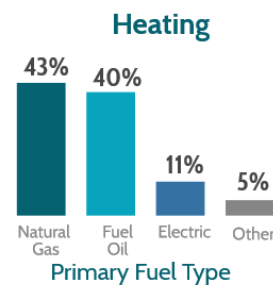
## High-Level Findings and Considerations

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- Fossil fuel-based heating is prevalent
- 98% of homes have cooling systems
- Heat pump penetration is low
  - Piloting HP incentives for customers with oil/propane heating is relevant
  - Consider for R1965 HP/HPWH study
- Average/median SF equipment ages differ from PSD EULs
  - Consider updating EULs for furnaces, boilers, RAC, and CAC (X1931 In-Depth PSD Review)

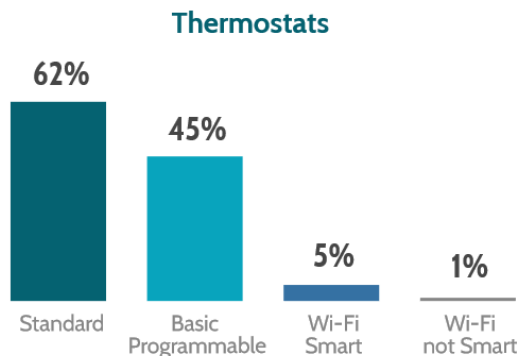


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# Thermostats



- Only 30% of those with programmable thermostats say they program them
- Smart thermostat penetration (5%) and knowledge are limited
  - Supporting smart learning thermostats is relevant



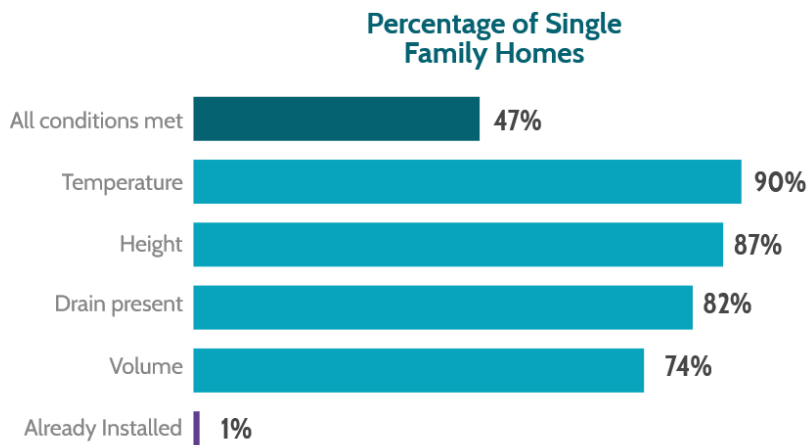
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# Water Heating



- HPWH penetration is low (1%)
- Technical feasibility in SF homes is high (47%)
  - Current HPWH incentives and efforts are relevant



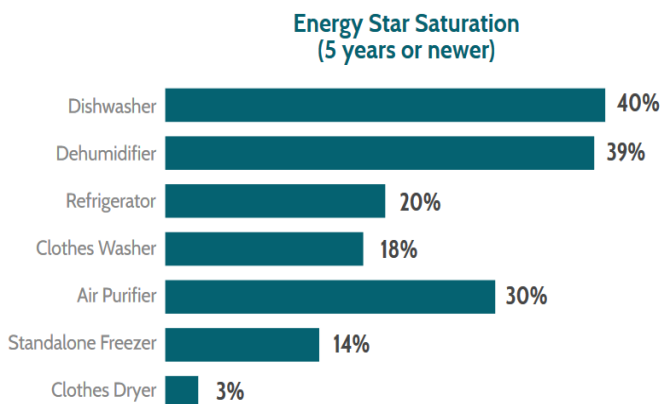
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# Appliances



- ENERGY STAR saturation is low
  - Incentives are relevant
- 20% have secondary refrigerator
  - Explore cost-effectiveness of an appl. recycling prog.
- Differences in assumptions for laundry/dishwashers loads
  - Consider reliability/inclusion into X1931 PSD updates
- 52% of laundry loads use warm or hot water
  - Educate customers about benefits of cold water



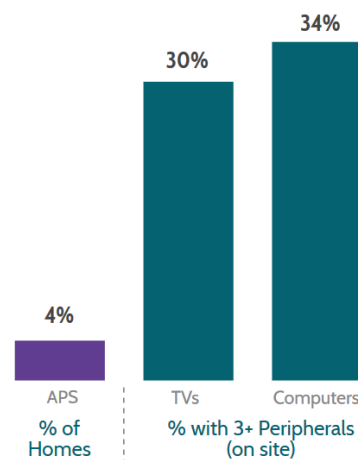
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# Advanced Power Strips



- Penetration was low (4%), but opportunities abound
- Penetration in RI (27%) is much higher, likely due to aggressive levels of program activity
  - Support of APS through E-Commerce Platform is worthwhile.
  - Explore including them in HES/HES-IE
- Adjustment factor was very low (0.06), indicating lack of awareness
  - Education on APS is critical for successful uptake



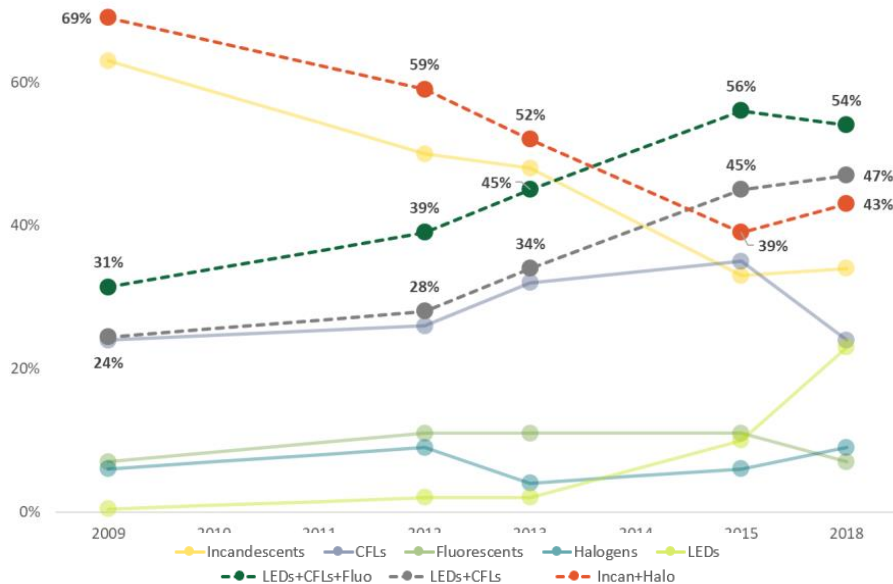
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Lighting



- LED saturation increased considerably in a short period, but 43% of sockets still have inefficient bulbs



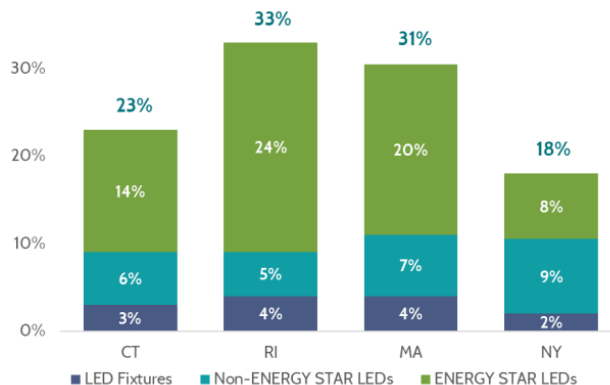
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Lighting



- Connecticut may not have as much impact on LED sales as neighboring states
- Only 14% of bulbs are ENERGY STAR
- 46% of bulbs in storage are incandescent



➤ Continued promotion of ENERGY STAR-qualified LEDs may be warranted. Yet, federal standards and naturally occurring market adoption may present risk

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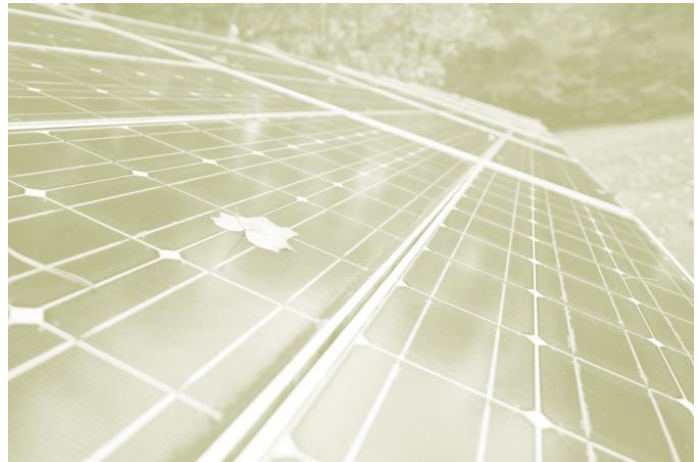
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## Miscellaneous End Uses

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- Only 2% of homes reported PV solar panels
- 14% had accompanying energy-storage batteries
- There is a great deal of space in the market to support solar and energy-storage measures



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## Building Characteristics

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- Existing housing stock still shows substantial opportunities for improvement
- Unlikely observed changes in single-family building envelope from 2011 to 2018: share of homes with little-to-no insulation increased from 14% to 23%!?
- Results imply the need to commission a more comprehensive weatherization study

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## Wrap-Up (then the Exciting Tutorial!)

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## Lessons Learned

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- Method
  - Recruiting through mail with email follow-up and \$10 Amazon gift card produced excellent web-survey response rate (8%)
  - On-site recruitment through the survey, with promise of \$150 gift card was effective
- Self-reported data has limitations
  - Strong understanding of heating/water heating fuel types, but little about system types
  - Even after seeing photos, there is still confusion between APS and other power strips

# Database



- Purpose
  - Inform program direction (relevance, opportunities, etc.)
  - Update PSD
  - Conduct advanced analysis (e.g., billing analysis)
  - Act as a baseline for future studies
- Likely uses for 2019 studies
  - R1965 HP/HPWH: Fuel/system penetration and HP config.
  - R1959 SF R&A: Fuel/system penetration for prototype models
  - R1982 HVAC/DHW: Sampling
  - X1941 MF Impact: Baseline
  - X1931 PSD Review: Behavior assumptions, EULs, etc.

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# Deliverables



- **Objective: Characterize Connecticut households**
  - **Deliverable:** Issued report including summary statistics on end uses and characteristics
  - **Deliverable:** Included extensive cross-tabulations in database
- **Objective: Develop a database for future research**
  - **Deliverable:** Shared database linking case-level primary data with billing data
  - **Deliverable:** Provided user guide as report appendix
  - **Retaining:** Contact info housed on secure site (can be requested via EA Team and shared privately with approved contractors)
- **Objective: Conduct a lighting market assessment**
  - **Deliverable:** Estimated saturation, comparison with neighboring states (with and without programs)
- **Objective: Provide considerations for planning and PSD**
  - **Deliverable:** Provided perspectives and context in report and suggested 2019 studies to leverage

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# Q & A



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## Questions?

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# Tutorial



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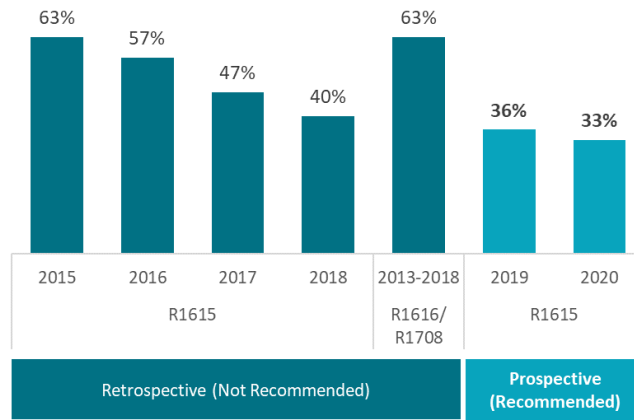
## Tutorial

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Lighting NTG



- Exploratory analysis showed differences in NTG between R1616 and R1615
  - Because inputs are interpolated, values are not recommended



Note: R1615 values represent recommendations for non-hard-to-reach markets. NTG estimates for hard-to-reach markets were higher. Additionally, the R1616/R1708 value excludes stored bulbs.