**R1705 Multifamily Baseline and Weatherization Study**

**Study Objectives**
- Study serves five primary research objectives:
  1. Determine statewide statistics
     - MF unit count, demographics, equipment saturation
  2. Assess compliance with weatherization standard
     - Apply similar protocols as 2014 single-family study
  3. Verify RASS self-reported information
     - Lighting, HVAC, appliances, demographics
     - Validate or true-up RASS data
  4. Calculate savings potential
     - Pair saturation data with secondary load shapes and statewide statistics
  5. Based on the above, provide recommendations to programs serving MF customers

**Utility Data Requests**
- Requested and already received:
  - MF contact data for RASS survey – underway
- For visited MF tenants:
  - Unit-level monthly electric and gas billing data
  - AMI data, if available
  - This request will be coordinated with the RASS request
  - Expected April 2018
- For visited MF tenants who have participated in EE programs:
  - PDF application files, if available
- For programs serving MF buildings/tenants:
  - Master tracking spreadsheets or databases with measure-level info
  - Expected April 2018
**OTHER DATA SOURCES**

- RASS study respondents self-reporting as MF and agreeing to host a site visit:
  - RASS information on equipment saturation, demographics
- For statewide analysis, additional sources of public housing data, including:
  - 2010 U.S. Census data
  - CT Dept. of Housing data
  - Housing authority data
  - Tax parcel data
- For equipment operation:
  - Secondary load shapes

**SAMPLE DESIGN**

- ERS and NMR are monitoring RASS participation and count of MF customers willing to host a visit
  - $200 incentive offered
- We estimate that 145 sites will be sufficient to achieve statewide savings potential results at 90/10 confidence/precision.
  - This number may be refined as RASS data comes in and preliminary research on the statewide population is completed.
- Due to differences between HES and HES-Income Eligible programs, we plan to calculate results by the following segments:
  - Low income vs. market-rate
  - Building size (e.g., high/medium/low based on number of floors)

**RECRUITING PLAN**

- Potential study participants have already cooperated by completing the RASS and indicating they are interested in hosting a visit.
- However, MF customers can be difficult to schedule around. We plan to:
  - Offer tenants flexible windows for visits, including nights and weekends
  - Offer a $200 gift card for hosting the site visit
  - Prior to recruitment calls, send out advance letters in English and Spanish to remind them of the study’s objectives and incentives

**DATA COLLECTION**

- Unit data collection protocol includes:
  - Demographic survey
  - Equipment inventory
  - Lighting inventory protocol
  - Weatherization assessment protocol
  - Photos
DATA COLLECTION - EQUIPMENT

- All visited MF units will receive an equipment inventory:
  - Characterize all major energy-consuming equipment, emphasizing largest, most variable, and/or that addressed by a program measure
  - For all RASS-surveyed equipment: validate self-report quantity data

DATA COLLECTION - DEMOGRAPHICS

- All heads of household will be administered a 10-min demographic survey
- Allows possible post-hoc segmentation of results
- Demographics of interest include:
  - Number of occupants & ages
  - Own vs. rent
  - Payment of utilities
  - Work schedules / number of jobs
  - Work at home?
  - Pets
  - Education level
  - Income level
  - Aware of and/or participated in CT EE programs?

DATA COLLECTION - WEATHERIZATION

- Assess building envelope components for comparison with weatherization standard (per 2014 R15 Single Family Weatherization study’s protocol):
  - Insulation
  - Air sealing
  - Windows
  - Duct sealing
  - Duct insulation
- In lieu of blower door testing, inspection and measurement of air/duct gap geometry
  - Qualitative scoring/feedback on potential program opportunities

DATA COLLECTION – COMMON AREAS

- While in-unit data collection is the focus, we will attempt to collect relevant common area data where possible through:
  - Contacting building management
  - Accessing relevant common spaces (e.g. laundry room)
- Anticipated common area data collection includes:
  - Lighting (predominant fixture type)
  - Central HVAC systems
  - Central water heating
  - Laundry
  - Building envelope
  - Others: solar PV, EV charging, CHP, pool pump/heater, parking lot lights, etc.
DATA COLLECTION - AGGREGATION

- Field data will be continuously aggregated and reviewed
- Field auditors will cross-check digitized data with supplementary notes/files
  - Photos
  - Equipment spec sheets
- Continuous senior review of database
- Project manager review before aggregate analysis phase

ANALYSIS – SITE LEVEL

- Site-level analysis will include:
  - Assessment of whether each sampled unit’s systems meet the efficiency threshold of current program offerings
  - Assessment of compliance with the weatherization standard, as assessed by R15 SF Weatherization study
  - Estimation of existing equipment energy use by combining collected characteristics with secondary load shapes
  - Supplemental utility bill analysis to determine normalized HVAC energy usage and inform savings potential for weatherization upgrades

ANALYSIS – LOAD SHAPES

- For equipment of interest, we will reference secondary data on equipment operation to assess energy use and savings potential:
  - Lighting
  - Window A/C
  - Refrigerator
  - Other appliances
  - Power strips
- Data references expected to include:
  - TRMs
  - Whitepapers
  - Technical potential studies
  - Other similar baseline studies

ANALYSIS – SAVINGS POTENTIAL

- Site-level analyses will be aggregated to inform statewide savings potential.
- This is where researched statewide census/housing authority/tax data will be valuable.

Site-level results
- Equipment saturation
- EE compliance
- Potential savings by measure

Statewide data
- Number of units
- Market rate vs. LI
- Ave. number bedrooms, tenants

Statewide savings potential
- By measure
- Per unit: market and LI
- Other post hoc?
DELIVERABLES

- Our final report and presentation will feature the following deliverables:
  - Statewide statistics on MF unit count and key demographics, when available
  - Verified equipment saturation in CT multifamily units, as well as average key characteristics such as quantity, size, age, and efficiency level
  - Referenced load shapes for equipment of interest
  - Assessment of compliance with the residential weatherization standard
  - Examination of the accuracy/expandability of RASS responses
  - Estimate of statewide savings potential by combining collected data with researched statewide data
  - Recommendations for programs offering measures to MF customers, and recommendations for future study
  - Comprehensive, well-documented dataset with full data dictionary for archive purposes

MANAGEMENT & COORDINATION

- Coordination with other studies
  - RASS – As discussed, RASS will form the basis of the MF sample and will provide points of comparison with verified data.
  - R1708 SF Lighting – For aggregation/comparison of results, ERS will follow this study’s lighting data collection protocols
  - Residential weatherization (R15) – ERS will follow data collection guidelines from prior weatherization studies, formatted similarly when possible, to allow aggregation/comparison.
  - Technical potential – ERS will seek to collaborate with recent or ongoing potential studies that address MF customers in CT.

- Biweekly meetings with Evaluation Advisory team
  - Track progress
  - Identify and mitigate issues
  - Relay any relevant field information

- Monthly reports submitted with invoices

SCHEDULE

- Finalize list of MF customers for potential site visit (mid-April)
- Request billing data and AMI (mid-April)
- First site visits (late April)
- Data aggregation and review (April – August)
- Draft report submittal (December)

WHAT’S NEXT?
QUESTIONS?

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