

Appendix C – Multifamily Sampling Protocol

Better Buildings Challenge Multifamily Partners commit to track and reduce energy usage across their entire portfolio, including common-area and tenant space for each of their properties. Obtaining this data can present challenges, depending on the metering and billing configurations at a given property. Common-area utility bills are generally paid by property owners or managers, and should be accessible. Utility bills for individual units can be paid by tenants, and therefore may be harder to obtain. In some cases, owners and managers can access whole-property energy consumption data through the utility company or by obtaining data authorization agreements from tenants. If this is not feasible, the Better Buildings Challenge encourages partners to sample tenant energy usage by following the protocol below. As a companion to this document, the Multifamily Sampling Calculator spreadsheet tool may assist in determining requirements for sampling and calculating total energy usage.

Procedure

1. **Determine the fuel types to be measured:** Sampling may be conducted for one or more fuel types at a property, depending on the billing configuration and data availability. If utility bills for a given fuel are tenant-paid, and energy use from the bills cannot be accessed through the utility or other means, partners should sample energy use. Sampling and extrapolated values may be calculated on a monthly or annual basis.
2. **Define the Sample Set:** To accurately reflect the energy usage of the property, sampled units should be representative of the range of units across the property.
 - **Determine the Level for Sampling:** Depending on the characteristics of the property being sampled, sampling may occur at different levels:
 - **Property Level:** If the buildings on the property share similar size, age, condition, and energy configuration, sampling at the property level is appropriate.
 - **Building / Building Type Level:** If a property's buildings have different sizes, ages, conditions, or energy configurations, then sampling at the building level may be appropriate. Buildings may be grouped into a single sample set if they are similar in size, age, condition, and energy configuration.

Examples of properties that may be sampled at the property level:

*A single, 200-unit apartment building
A campus of 4 garden-style apartments
Two high-rise apartment buildings*

Examples of properties that should be sampled by building/building type:

*A campus with 2 mid-rise buildings and 8 townhouse buildings
A campus of 3 buildings, one of which has undergone extensive renovation*

- **Account for Different Unit Types and Sizes:** Energy usage may vary between units based on the unit's characteristics. Partners are encouraged to sample a representative cross section of top floor, bottom floor, middle and corner units, and bedrooms. At the minimum, partners are encouraged to differentiate unit types by number of bedrooms.

3. **Determine the sample size and randomly select units:** Partners are encouraged to sample as many units as possible, in order to best represent the actual energy use for a property. **Figure C-1** provides a minimum threshold for sample size that should be met.⁸

- **Determine the number of units to be sampled:** At the level of sampling that is required (i.e., property level or building level), count the total units and use the sampling guidance table to select a total sample number.

If there is variation in unit types within the sample (e.g., multiple bedroom types within a property), the sample should be proportionally divided between unit types, rounding up.

Example for sampling for different unit types: A 200-unit high-rise building consists of 150 one-bedroom units and 50 two-bedroom units. The minimum sample size according to the above guidance is 10 units. For unit-specific sample sizes, the recommended total sample is multiplied by the proportion of units in the building, rounded up, as shown in **Figure C-2** below.

**FIGURE C-1:
MINIMUM SAMPLE SIZE**

TOTAL UNITS	SAMPLE (minimum)
5-9	2
10-19	3
20-29	4
30-49	5
50-74	6
75-99	7
100-149	8
150-200	9
>200	10

FIGURE C-2: EXAMPLE SAMPLE SIZE CALCULATION

	WHOLE PROPERTY	
Number of Units	200	
Recommended Sample Size	10	
	1-BEDROOM	2-BEDROOM
Number of Units	150	50
Proportion of Total	$\frac{150 \text{ (1 BR units)}}{200 \text{ (Total units)}} = .75$	$\frac{50 \text{ (2 BR units)}}{200 \text{ (Total units)}} = .25$
Recommended Sample Size (Rounding Up)	$10 * 0.75 \cong 8$	$10 * 0.25 \cong 3$

4. **Gather tenant data:** Given the challenges associated with obtaining tenant data, the Better Buildings Challenge recommends outreach to all tenants in order to collect as much data as possible. The procedure below to estimate whole property data normalizes the data received based on unit type. If outreach is only possible to a subset of units, the subset should be representative of the property as a whole and selected randomly.

An effective tenant outreach strategy ensures that the utilities involved are satisfied with the method of authorization and the tenants are informed and comfortable with energy authorization. Partners are encouraged to work closely with utilities and tenants to ensure a smooth tenant outreach process. A sample energy authorization form, along with an open letter to utilities from Secretary of Housing and Urban Development, Julián Castro, is available upon request. Better Buildings Challenge partners are encouraged to share their best practices for tenant outreach. For more information on sharing best practices, contact your Account Manager.

⁸ The minimum unit sample size was calculated by DOE's Weatherization Assistance Program as part of their Multifamily Retrofit Tools and Workforce Resources. It was developed with industry input and review as part of their technical guidelines for multifamily building energy audits.

5. **Calculate Total Energy Use and/or Cost.** Approaches for extrapolating sampled data to the building and/or property level and totaling all energy usage are covered below.

- **Extrapolating Total Energy Use for the Type Sampled:** Energy usage should be averaged for each unit type, then multiplied by the total number of units for each type (see table below):

FIGURE C-3: EXAMPLE OF CALCULATING UNIT AVERAGES

	1-BEDROOM	2-BEDROOM
Number of Units	150	50
# Units Sampled	18	6
Average Per Unit	Total energy use for sampled 1BR units / 18 = 102,000 kBtu/unit	Total energy use for sampled 2BR units / 6 = 156,000 kBtu/unit
Unit Type Total	$102,000 \left(\frac{\text{kBtu}}{\text{unit}} \right)$ * 150 total units = 15,300,000 kBtu	$156,000 \left(\frac{\text{kBtu}}{\text{unit}} \right)$ * 50 total units = 7,800,000 kBtu
Total Unit Energy	15,300,000 + 7,800,000 = 23,100,000 kBtu	

Note: Energy usage is tracked for the Better Buildings Challenge in Source kBtus. In the calculations above, energy usage has already been converted to source kBtus. Sampling may also be done by fuel type and converted later.

- **Calculating Whole-Building Energy Use and Energy Intensity:** Once total tenant-area energy usage has been extrapolated, add owner-paid utility usage (e.g., electricity for common area and leasing office, exterior lighting, master-metered natural gas for heating). This may include energy usage for any relevant non-sampled spaces (e.g., a retail or restaurant space included as part of the property). To obtain energy use intensity, divide by the gross floor area of the property.

FIGURE C-4: CALCULATING WHOLE-PROPERTY ENERGY USE

	METRICS FOR EUI CALCULATION
Total Unit Energy	23,100,000 kBtu
Total Owner-Paid Utilities	13,400,000 kBtu
Total Property Energy	36,500,000 kBtu
Property Floor Area	250,000 square feet
Property Energy Use Intensity	$\frac{36,500,000 \text{ kBtu}}{250,000 \text{ square feet}} = 146 \frac{\text{kBtu}}{\text{square foot}}$

6. **Consider approaches for periodic sampling.** It is recommended that the same sample be evaluated for the baseline period and subsequent reporting periods, to the extent it is possible. If data is not available for certain units, they should be replaced with similar units from the population.
7. **Reporting energy performance.** Partners should collect energy usage data from all of the properties in their portfolio into a single database. Better Buildings Challenge partners are encouraged to use ENERGY STAR Portfolio Manager, or other energy benchmarking tools, to manage utility data and report results. Portfolio Manager provides a 1-100 ENERGY STAR score for eligible properties, which normalizes for changes in weather and operation. While

properties that sample energy consumption data are not eligible for certification, the score may be used as a benchmarking tool for determining property energy performance. The tool also allows for easy sharing of data with the Better Buildings Challenge. Additional information about Portfolio Manager can be found in the 'Energy Tracking Software' section of the Data Tracking Manual.

For each fuel type being sampled, partners should extrapolate the total tenant-paid utility use and enter it as a separate meter in Portfolio Manager. Partners should check the box marked "Estimation" to indicate that the data is sampled, as shown in the figure below.



ENERGY STAR®
PortfolioManager®

Welcome DOE-BBC: [Account Settings](#) | [Contacts](#) | [Help](#) | [Sign Out](#)

Manage Bills (Meter Entries) for [Challenge Heights Apartments](#)

You may select one of your meters to get started. Or, if you are coming here from your meter list, a meter may already be selected.

Electric Grid Meter Display Year(s): 2014 x

	Start Date	End Date	Usage kWh (thousand Watt-hours)	Cost (\$)	Estimation	Green Power	Last Updated
<input type="checkbox"/>	1/1/2014	1/31/2014	12,274.93		<input checked="" type="checkbox"/>	<input type="checkbox"/>	1/30/2015 Daniel Bowman
<input type="checkbox"/>	2/1/2014	2/28/2014	11,234.21		<input checked="" type="checkbox"/>	<input type="checkbox"/>	1/30/2015 Daniel Bowman
<input type="checkbox"/>	3/1/2014	3/31/2014	12,787.63		<input checked="" type="checkbox"/>	<input type="checkbox"/>	1/30/2015 Daniel Bowman