



Pay for Performance - EB Technical Tip

Modeling Anticipated Changes in Occupancy as a Baseline Adjustment in an ERP *Rev1*

Executive Summary

This Tech Tip provides clarification on how to prepare an Energy Reduction Plan for a project where a building(s) is not 100% occupied in the existing case, and building occupancy is anticipated to increase after construction is complete.

- Occupied tenant spaces and common area spaces are treated as a typical P4P Existing Buildings project and shall be modeled using existing conditions and calibrated using the Model Calibration Tool.
- Unoccupied tenant spaces with anticipated future occupancy are treated as a baseline adjustment meeting ASHRAE 90.1-2013 mandatory and prescriptive requirements.
- Improvements to unoccupied spaces shall be modeled separately from occupied spaces and common area spaces using separate parametric runs (eQuest) or alternatives (TRACE).
- Post-retrofit period shall begin when the building reaches the occupancy level approved for use in the ERP (exceptions apply if the building does not reach this occupancy level within 1 year of the post-installation inspection).
- Monthly occupancy data shall be provided in the existing and post-retrofit cases.

Definitions

Occupied Space – Tenant spaces that are occupied during the baseline period that will be treated as a typical P4P Existing Buildings project.

Unoccupied Space – Tenant spaces that are unoccupied during the baseline period that may be occupied after project completion. These spaces are treated as a baseline adjustment only if there is anticipated change in occupancy.

Common Area Space – Non-tenant spaces such as corridors, lobbies, and stairwells that will be treated as a typical P4P Existing Buildings project. These spaces have no anticipated operational or occupancy changes in the existing and proposed cases.

Anticipated Future Occupancy Consumption – Baseline consumption of the unoccupied space determined using ASHRAE 90.1-2013, occupied space characteristics (e.g. schedules), and anticipated future occupancy of the building.

Modeling Approach

1. **Baseline Model** - Create a baseline model that consists of occupied, common area, and unoccupied spaces as they are during the baseline period. All existing loads that contribute to the project's baseline utility bills must be modeled, including loads in occupied and common area spaces that were conditioned during the pre-retrofit period, and any loads in unoccupied spaces that correspond to pre-retrofit utility bills. These may include but are not limited to:
 - a. Heating, cooling, ventilation, and pump energy consumption of the entire building.
 - b. Plug loads and lighting in the occupied and common area spaces.
 - c. Lighting or plug loads in unoccupied spaces (if any).
2. **Model Calibration** - calibrate the baseline model to pre-retrofit bills as required by the program.
3. **Adjusted Baseline** - Create an adjusted baseline model as follows using a parametric run (eQuest), alternative (TRACE), or a saved-as second model (if necessary).

For unoccupied tenant spaces ***with anticipated future occupancy****:

- a. Plug loads, DHW loads, DHW schedule, lighting schedule, and plug load schedule used to calibrate existing consumption in occupied spaces shall be applied to the unoccupied spaces. Where applicable, schedules such as lighting shall not exceed Program Guidelines requirements.
- b. Baseline lighting systems shall be modeled per ASHRAE 90.1-2013, and include mandatory and prescriptive requirements with particular attention to Section 9.4. In the 'Lighting' tab of the ERP, no existing fixtures should be listed for spaces that are unoccupied.
- c. All other systems and controls dedicated to the unoccupied space, including but not limited to air-handlers, equipment and lighting controls, etc. must be modeled as meeting mandatory and prescriptive requirements of 90.1 2013.
- d. HVAC systems that are shared and serve both occupied and unoccupied spaces can be modeled reflecting the existing equipment *if the existing HVAC systems do not have to be replaced to accommodate the increase in occupancy (i.e. larger capacity equipment)*. Otherwise, the occupied space shall be modeled using the existing HVAC systems, and the unoccupied space shall be modeled using an HVAC system that meets mandatory and prescriptive requirements of 90.1-2013.

***Notes:**

- Baseline adjustments shall not be modeled for unoccupied tenant spaces that do not have anticipated future occupancy. For example, if lease records show that 75% of the unoccupied spaces will be leased following construction, baseline adjustments shall not be applied to 25% of the unoccupied spaces.
- The future occupancy assumed using this approach shall be justified and submitted to the Program Manager for approval. Assuming 100% future occupancy in the model is not acceptable without supporting documentation. For example, if lease records show that 75% of the unoccupied spaces will be leased following construction, 75% occupancy shall be used to determine the baseline adjustment.

The difference in monthly energy consumption between the Baseline Model and Adjusted Baseline Model must be added to the ERP 'Utility' tabs in order to accurately measure savings from the adjusted baseline usage.

4. **Efficiency Measures** - Improvements to systems in occupied / common spaces must be modeled separately from improvements to systems in unoccupied spaces. Consider the example below for a project that includes boiler replacement serving the entire building, lighting fixture replacement, and lighting controls.
 - a. *Parametric Run/Alternative 1 (PR/A 1):* Boiler replacement, based on the Adjusted Baseline.
 - b. *Parametric Run/Alternative 2 (PR/A 2):* Lighting retrofit to replace fixtures in occupied and common spaces, based on PR/A 1.
 - c. *Parametric Run/Alternative 3 (PR/A 3):* Lighting controls in occupied and common spaces, based on PR/A 2.
 - d. *Parametric Run/Alternative 4 (PR/A 4):* Lighting fixtures in unoccupied spaces with future anticipated occupancy (improvement over 90.1-2013 requirements) based on PR/A 3.
 - e. *Parametric Run/Alternative 5 (PR/A 5):* Lighting controls in previously unoccupied spaces with future anticipated occupancy (improvement over 90.1-2013 requirements) based on PR/A 4.
 - f. ***Parametric runs or alternatives shall not be modeled for unoccupied spaces with no anticipated changes in occupancy.***

Post-Retrofit Period Requirements

The P4P post-retrofit period should start once all systems are installed and the building meets the occupancy level approved for use in the ERP. Standard P4P post-retrofit period starts after the approval of the Installation Report and is submitted within 15 months, although extensions are available if the building has delayed occupancy.

If it is determined that the building occupancy levels will never reach the approved occupancy levels used in the ERP within the allowed time frame, an appropriate post-retrofit occupancy fraction shall be used to adjust the baseline consumption for the purpose of calculating Incentive #3. Percent occupancy should be calculated as a function of square footage rather than number of tenant spaces. For example, if the post-retrofit occupancy is less than the 75% used in the examples in this Technical Topic, the baseline unoccupied consumption used in the ERP must be adjusted to reflect actual occupancy.

Note that the baseline generated to account for reduced occupancy will not be a function of adjusting the post-retrofit bills proportionally. Please discuss with the Program Manager prior to submitting Incentive #3 documentation to confirm the approach.

Documentation Requirements

1. An explanation regarding how existing occupancy was determined shall be provided in the ERP 'Modeling Approach' tab. Monthly occupancy records for pre-retrofit period used in the Energy Reduction Plan shall be provided.
2. An explanation regarding how anticipated future occupancy was determined shall be provided in the ERP 'Modeling Approach' tab.
3. The entire modeling approach used to establish the 'anticipated future occupancy' baseline shall be clearly documented in the 'Baseline Facility Variables' table of the ERP 'Modeling Approach' tab. This tab should include discussions of the occupied space variables and schedules that were applied to the unoccupied spaces with anticipated future occupancy in the baseline model.
4. Partners shall track occupancy monthly during post-retrofit period, and include both sets of occupancy records in the Incentive #3 submittal. For example, lease records and/or monthly records on the number of employees occupying the building may be used. It is unlikely that building goes from partially occupied to 100% (or 75%, etc.) occupied immediately after retrofit is installed. Instead, occupancy may increase over time as spaces are rented out. These characteristics must be accounted for in the final baseline adjustment in the Savings Verification Tool.