Establishing Baseline for Industrial Process Efficiency Projects

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Effective and appropriate baselines are critical for accurate and defensible estimates of program savings. Energy efficiency program designers, operators, and evaluators often use pre-existing conditions as the benchmark against which they measure energy savings for retrofit projects. For new construction (or replacements on failure), energy codes are typically used to define the baseline. The savings are then projected for the duration of the measure life. These approaches for baseline development are often irrelevant for industrial process projects where no code exists and where measures affect productivity. Key principles are as follows:

Definition

The baseline is the least efficient, code or regulation-compliant option specific to a particular facility and application that the customer technically, functionally and economically could have alternatively considered to deliver the post-retrofit level of production or service. In California, the baseline also cannot be less efficient than the condition prior to measure implementation.

Baseline in the Context of Changing Production Levels

Some energy efficiency measures facilitate increased production rates. The baseline for measures that increase production must account for alternative actions that could have been taken to otherwise increase production. For process measures:

$$\begin{array}{lcl} \textit{Annual Energy} & & \textit{Post-Retrofit} \\ \textit{Impact} & = & \textit{Production Level} \\ \textit{(Energy/Yr)} & & \textit{(Units/Yr)} \end{array} \quad x \quad \left[\begin{array}{lcl} \textit{Baseline} & & \textit{Post-Retrofit} \\ \textit{EUI} & - & \textit{EUI} \\ \textit{(Energy/Unit)} & & \textit{(Energy/Unit)} \end{array} \right]$$

Baseline and Free Ridership

Baseline definition should determine the least efficient approach that a participant reasonably *could* have taken. Free ridership research separately determines the difference between what could have happened and *would* have happened in the absence of the program. To the extent that any of this interpretation is discretionary, the difference can be assessed as part of free ridership rather than elevating the baseline.

Changes in Baseline Definition During the Measure Life

Savings can vary for many reasons over time. The biggest reason savings vary is due to the concept of "dual baselines." The dual baseline concept addresses natural turnover by only using the *in situ* condition as the baseline for the theoretical portion of the remaining useful life of the pre-existing equipment and then uses the new construction efficiency to define baseline for the remainder of the installed equipment life. Such an approach adds complexity to program tracking, evaluation, and

benefit-cost calculations, and requires judgment in determining the remaining useful life as compared to using a single baseline approach. The trade-off for accepting the additional complexity is that the savings profile is more realistic and the dynamic is not otherwise captured in program or typical evaluation estimates.

Baseline is Defined as Minimum Commonly Used Efficiency

Minimum commonly used efficiency is the minimum efficiency that one could choose to install for a particular application and should be used to determine baseline. Most often, minimum commonly used efficiency and industry standard practice are synonymous. However, there can be circumstances in which they can differ.

Minimum commonly used efficiency is never better than industry standard practice. It can be worse, if there are a measurable number of market actors that install less than the predominant/standard practice level of efficiency. Conversely, baseline, while never worse than minimum technically available efficiency, sometimes must be better, if there are minimum efficiency solutions that theoretically are possible, but as a practical matter an entity would not use for the particular application. For unique projects there should be evidence that it is an approach currently used in industry for the type of application under consideration.

Decision-Making Flowchart

Entities in both New York and California have developed logical flowcharts to help program administrators and evaluation professionals determine the appropriate basis for estimating baseline efficiency, particularly for industrial process projects. The poster that accompanies this summary presents the New York version.