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## M&V Guidelines for Constant Load Motor Measures in New Construction

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### 3.1 Overview

This chapter presents the simplified M&V approach for projects involving the installation of constant load motors with efficiency ratings higher than those required by the applicable energy efficiency standard. Examples of qualifying equipment include:

- Constant load chilled water, hot water, or condenser water pumps
- Constant speed exhaust, return, and supply fans without dampers or pressure controls
- Single-speed cooling tower fans
- Constant load industrial processes
- Similar capacity, constant speed, energy efficiency motors

Project Sponsors *should not* use this approach if factors utilized to derive savings vary throughout the year. Examples may include schedule changes and load changes.

If the project does not meet the above requirements, please refer to Chapter 5 for the appropriate M&V approach.

Demand and energy savings for motor installations are based on post-construction peak demand (kW), the motor operating hours, and the difference in efficiency between baseline and higher-efficiency motors.

The peak demand period is defined as weekdays, between the hours of 1 PM and 7 PM, from May 1 through September 30 (excluding holidays). The operating hours are assumed to be the same for both baseline and higher-efficiency motors.

Baseline motor efficiencies are listed in the Standard Motor Table in Appendix B of this document, which is based on ASHRAE Standard 90.1m-1995. The Standard Motor Table is categorized by motor size and rotation speed. No incentive payments are made for new motors with efficiencies equal to or less than the respective baseline efficiencies. In addition, all new motors should meet minimum equipment standards as defined by state and federal law.

### 3.2 Pre-Construction Activities

#### 3.2.1 Equipment Survey

Project Sponsors should use the Motor and VSD Inventory form to record the following information for each specified high-efficiency motor:

- Motor name
- Load served
- Motor location
- Operating schedule
- Equipment manufacturer
- Nameplate data including model, horsepower, and speed

#### 3.2.2 Site Inspection

A pre-construction site inspection is generally not required, but in some cases – such as projects involving additions to existing facilities – this inspection may be requested at CenterPoint Energy's discretion.

### 3.3 Post-Construction Activities

#### 3.3.1 Equipment Survey

The Project Sponsor provides a post-construction equipment survey, similar to the pre-construction equipment survey, to CenterPoint Energy as part of the Installation Report. The updated Motor and VSD Inventory Form reflects the actual, as-built conditions of the project.

#### 3.3.2 Motor Demand Measurement

The Project Sponsor performs spot measurements of the power draw (one-hour average values) of all the high-efficiency motors installed, and includes these measurements in the Installation Report.

#### 3.3.3 Calculation of Baseline Motor Demand

Equation 3.1 is used to determine what the demand would have been had a lower efficiency motor been specified for installation.

<b>Equation 3.1 Baseline Motor Demand</b>	
Baseline demand [kW]	$= \frac{\text{Specified motor efficiency}}{\text{Baseline motor efficiency}} * \text{Spot-measured motor demand}$

In Equation 3.1, the specified motor efficiency is obtained from manufacturer’s specifications. The baseline motor efficiency should be obtained from the Standard Motor Efficiency Table, in Appendix B of this document.

**3.3.4 Site Inspection**

After CenterPoint Energy receives an Installation Report, either CenterPoint Energy or its contractor conducts a post-construction site inspection to verify that the equipment specifications have been correctly reported by the Project Sponsor in the Installation Report. CenterPoint Energy will require the Project Sponsor to make any necessary corrections to the Installation Report based on the results of the inspection.

**3.4 Calculation of Motor Operating Hours**

After CenterPoint Energy approves the Installation Report, the Project Sponsor begins short-term metering of motor operating hours. The metering must be conducted for a minimum period of one week, or an amount of time sufficient to capture the full range of operation. Equation 3.2 is used to calculate the annual operating hours using the metered data.

<b>Equation 3.2 Motor Operating Hours</b>			
Annual operating hours [hrs/yr]	=	$\frac{\text{Motor on-time during metering period (hrs)}}{\text{Length of metering period (hrs)}}$	* 8760 hrs/yr

For projects in which a large number of equal-sized motors have the same application and operating schedule, metering may be conducted for a sample of motors and the results extrapolated to the applicable population. If such an approach is adopted, CenterPoint Energy will assist the Project Sponsor in selecting the sample motors.

The Project Sponsor should include electronic copies of the unprocessed data files as part of the Savings Report.

**3.5 Calculation of Peak Demand and Energy Savings**

Project Sponsors can claim demand savings only for equipment that operates on weekdays between the hours of 1 PM and 7 PM, Monday through Friday, from May 1 through September 30 (excluding holidays).

Peak demand and energy savings are calculated according to Equation 3.3 and Equation 3.4, respectively.

<b>Equation 3.3 Peak Demand Savings</b>			
Peak demand savings [kW]	=	Baseline motor demand [kW]	- Spot-measured motor demand [kW]

<b>Equation 3.4 Energy Savings</b>			
Energy savings [kWh]	=	Peak demand savings [kW]	* Annual operating hours [hrs]

The Project Sponsor reports the peak demand and energy savings to CenterPoint Energy in the Savings Report.

<b>Example</b>	
<p>For a new agricultural processing plant, a high-efficiency, constant-speed motor is specified for installation. As indicated in the mechanical plans, the motor is a 200 hp, 4-pole, enclosed motor with a nominal efficiency of 0.96.</p>	
<p>The Standard Motor Efficiency Table lists the minimum efficiency for the baseline motor as 0.945.</p>	
<p>Post-construction spot measurements indicate an average, one-hour, power draw of 117.9 kW.</p>	
<p>Using Equation 3.1, the baseline demand is calculated as follows:</p>	
$\text{Baseline motor demand} = 117.9 * (0.96/0.945) = 119.7 \text{ kW}$	
<p>Post-construction metering of operating hours for a one-week period show that the motor operates for 81 hours out of the 168 hours in the metering period. Using Equation 3.2, the annual operating hours of the motor is calculated as follows:</p>	
$\text{Annual operating hours} = (81/168)*8760 = 4,224 \text{ hrs}$	
<p>Peak demand savings and energy savings are calculated using Equations 3.3 and 3.4, respectively, as follows:</p>	
$\text{Peak demand savings} = 119.7 \text{ kW} - 117.9 \text{ kW} = \mathbf{1.8 \text{ kW}}$	
$\text{Annual energy savings} = 1.8 \text{ kW} * 4224 \text{ hrs} = \mathbf{7,603 \text{ kWh}}$	