

**saveONenergy Retrofit Program
Project Measurement and Verification Plan**

Facility Overview	Large Office and warehouse facility in Kingston
Objective of Project	Replace two existing chillers used for process cooling with new rotary screw chillers
saveONenergy M&V Type	Equipment Replacement Enhanced (ER-E) - estimated participant incentive over \$25,000
Existing System Description	<p>Central Chiller Plant for Space Cooling, Consists of two (2) chillers for combined operation 9 months of year, summer cooling utilizing both chillers for operation.</p> <p>Chiller # 1 - York model HTA4, Serial # OMJ12346, Vintage: 1974. Electrical 575/3/60, Capacity = 125 Tons cooling</p> <p>Chiller # 2 - Trane Model PCV-1JD2D3, Serial # 01123, Vintage Year: 1968, Electrical: 575/3/60, Capacity = 190 Tons cooling.</p> <p>The operation of the chillers are as follows: • Small chiller (York) runs from May to September, inclusive. • Large chiller (Trane) runs from June to August, inclusive.</p>
Proposed System Description	<p>The project case includes two Trane rotary screw chillers, one with 190 tons of cooling capacity (Trane RTWD180 and the other with 140 tons of cooling capacity (Trane RTWD 130).</p> <p>The cooling capacity of the chillers has been increased to 330 tons. Assuming that the cooling requirements have not changed, the design load has correspondingly decreased to 85.9%.</p>
Measurement Boundary	The replacement is only concerned with the two chillers. None of the other components (such as cooling tower, condenser water pumps, etc.) will be replaced.
Interactive Effects	Interactive effect is negligible.
Variables Affecting Energy and Demand Savings	<p>Variables that will affect energy savings:</p> <ul style="list-style-type: none"> • Weather (heating and cooling degree days)
Measurement Details	<p>As per the OPA's RETROFIT Program M&V Procedure, the Enhanced M&V (ER-E) requires that, the baseline and post-retrofit performance be measured at the current peak design load. To determine the peak design load, a hot day in August is selected for measurement. Three spot measurements are recorded where each record includes voltage, amperage, power factor on each of the three-phases, to calculate the wattage draw.</p> <p>As per the OPA's RETROFIT Program M&V Procedure, the Enhanced M&V (ER-E) requires that baseline and post retrofit performance will be taken at representative distributed load levels spanning total design loads, multiplied by stipulated operating hours at each point. Spot measurements has been taken at six different times of the day, (including afternoon and evening), where the cooling load varies. The measurements are then converted to wattages, and matched against the performance curve of the chiller to determine the cooling load provided. The hours of operation at the various load % (from 0% to 100%) are determined by the operation log.</p>

Based on the operation log kept on site, the cooling load provided by the chillers are detailed as follows:

Load %	Tons of Cooling Provided	Hours of Operation
0 (Off)	0	0
20	63	920
40	126	1265
60%	189	780
80%	252	372
100%	315	15
Total		3,352

For verification, spot measurements will be taken on a summer day after the retrofit to determine accurately the demand drawn approximately same load for the new equipment.

Analysis Procedure

Measurements taken include voltage, amperage, power factor on each of the three phase. These measurements are converted to a wattage using the following calculations:

$$Power \text{ (demand in kW)} = Average \text{ amperage} \times voltage \times Power \text{ Factor} \times \sqrt{3} / 1000$$

To determine the total energy consumption, the measurements are first converted to wattage at the various loads, then multiplied by the hours of operations detailed in the table above. The consumption at each load % is then summed to determined the annual energy consumption (in kWh).

Energy and Demand Savings Estimates

Based on the average of the three spot measurements , the corresponding demand draw has been estimated as:

Base case Demand 212.5 kW , corresponding to a load of 280 ton cooling. This is approximately 88.9% of the full load capacity of the two chillers combined.

Base case Consumption: 279,374 kWh , based on 3,352 hours of operation.

The energy and demand savings calculations is attached separately in a spreadsheet (attached in the application). The estimated demand savings is 35.6 kW and the estimated energy savings is 65,200 kWh