

CRYOGENX4 Energy Efficiency Report

Large Manufacturing Plant

Tri-S Technologies CRYOGENX4 Energy Conservation Method (ECM)

The Industry's Most Advanced, Effective & Proven HVAC Performance Solution

PILOT PARTICULARS

Pilot Dates:

10 July – 14 Aug 2025

Location:

Chardon, OH

Tri-S Technologies:

Jeffrey McGaughey
Senior Test Engineer

Motus Power:

Ben Huddock
National Accounts Manager

Alex Fusco

National Account Executive

Tom Alderson

Project Manager



Pilot Overview

On 15 July 2025, Motus Power (Motus) and Tri-S Technologies (Tri-S), with oversight and logistical support from the Customer Operations Manager, began an HVAC performance improvement demonstration at the their manufacturing plant located in Chardon, OH. Detailed baseline and post measurements were taken of the 80-ton air cooled chiller serving the assembly lines in Building 2 as shown below. The primary purpose of this exercise was to demonstrate the energy savings, increased efficiency, and carbon footprint reductions achieved by implementing the energy control measure (ECM) **CRYOGENX4**.

The positive pilot results show an average energy savings of 17.8% and an increase of 7.6 operating tons equating to a 19.6% increase in capacity after being treated with the CRYOGENX4 technology. Together these improvements will save our customer \$7,375 in energy costs each year which translates to a project payback of just 20.8 months while producing a 10-year long-term Return-on-Investment (ROI) of 476%



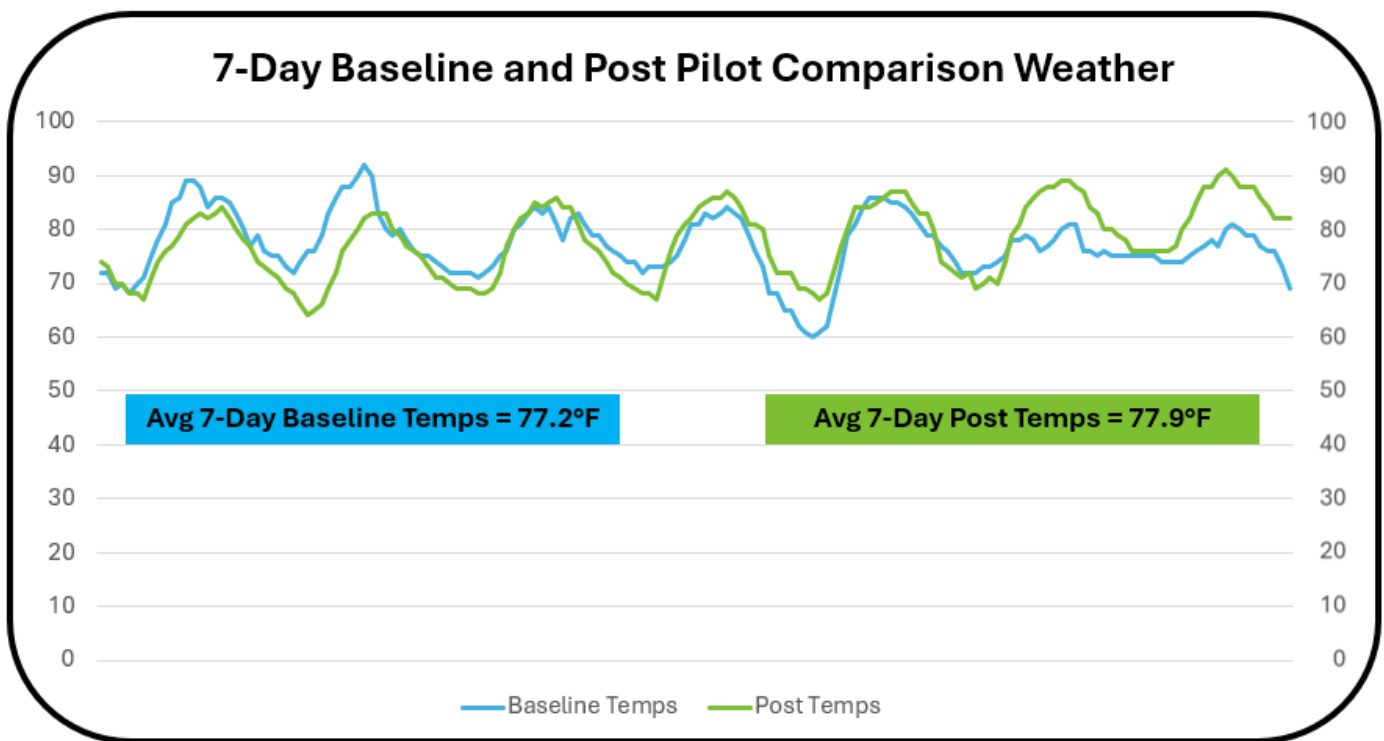
Two different testing methodologies were utilized during this successful pilot to illustrate the improvements brought on by CRYOGENX4. Each is described below and expanded upon in subsequent sections of this report.

1. IPMVP (international performance measurement and verification protocols) measurements of both RTUs in the baseline and post periods.
2. Continuous power meter monitoring of the chiller before and after the introduction of the CRYOGENX4 ECM.

Pilot Operating Conditions

Performance testing in the field first requires the minimization of external variables that may affect the results, positively or negatively. In this demo, the IPMVP readings in both the baseline and post were taken directly at the equipment when the outside air temperatures were identical (85°F) and when the return process water temps coming back to the chiller were the same (69.4°F).

When comparing the energy logger data, the team captured and compared seven (7) full days of data (10,080 data points in each period recorded at 1-minute intervals) in both the baseline and post periods where the weather was very similar and there was little to no precipitation. The seven consecutive days measured in both periods included a full work week and weekends. This similarity in weather (see chart below) and operational conditions means no adjustments were needed to the resulting IPMVP or power logger data.

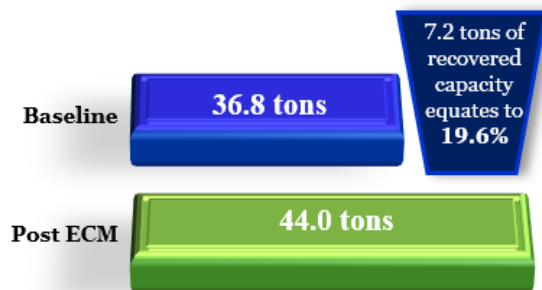


Performance Results from the Demo

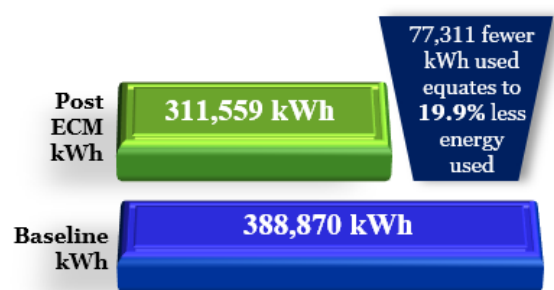
The average key performance indicators (KPI's) measured across the chiller were captured using the International Performance & Measurement Verification Protocols (IPMVP) and are very consistent with our historical improvements for 15-year-old units, as well as the performance losses predicted by the American Society of Heating, Refrigeration & Air-Conditioning Engineers (ASHRAE). See the table and associated charts on the next page and the historical performance improvement chart on page 5.

MEASUREMENT	BASELINE	POST
Volts	441.0	442.4
Amps	86.5	82.6
Entering CHW (from process)	69.4	69.4
Leaving CHW (to process)	60.2	58.4
Evap Refrig Temp Entering	56.8	56.4
Evap Refrig Temp Leaving	67.2	68.3
Flow Rate Thru Evap in GPM	96	96
Chiller Load % at Testing	50	50
Temp at Time of IPMVP Testing	85	85
Estimated Annual Runtime Hours	5,800	5,800

Cooling Capacity Increase



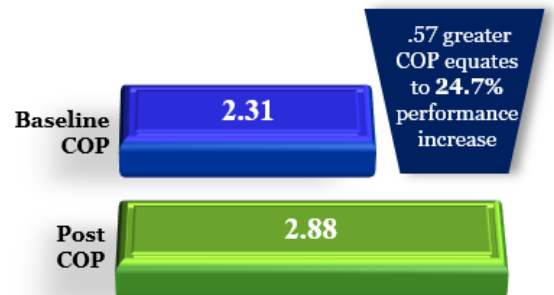
Annual kWh Reduction



Efficiency Improvement



COP Improvement



Chilled Water Delta Increase

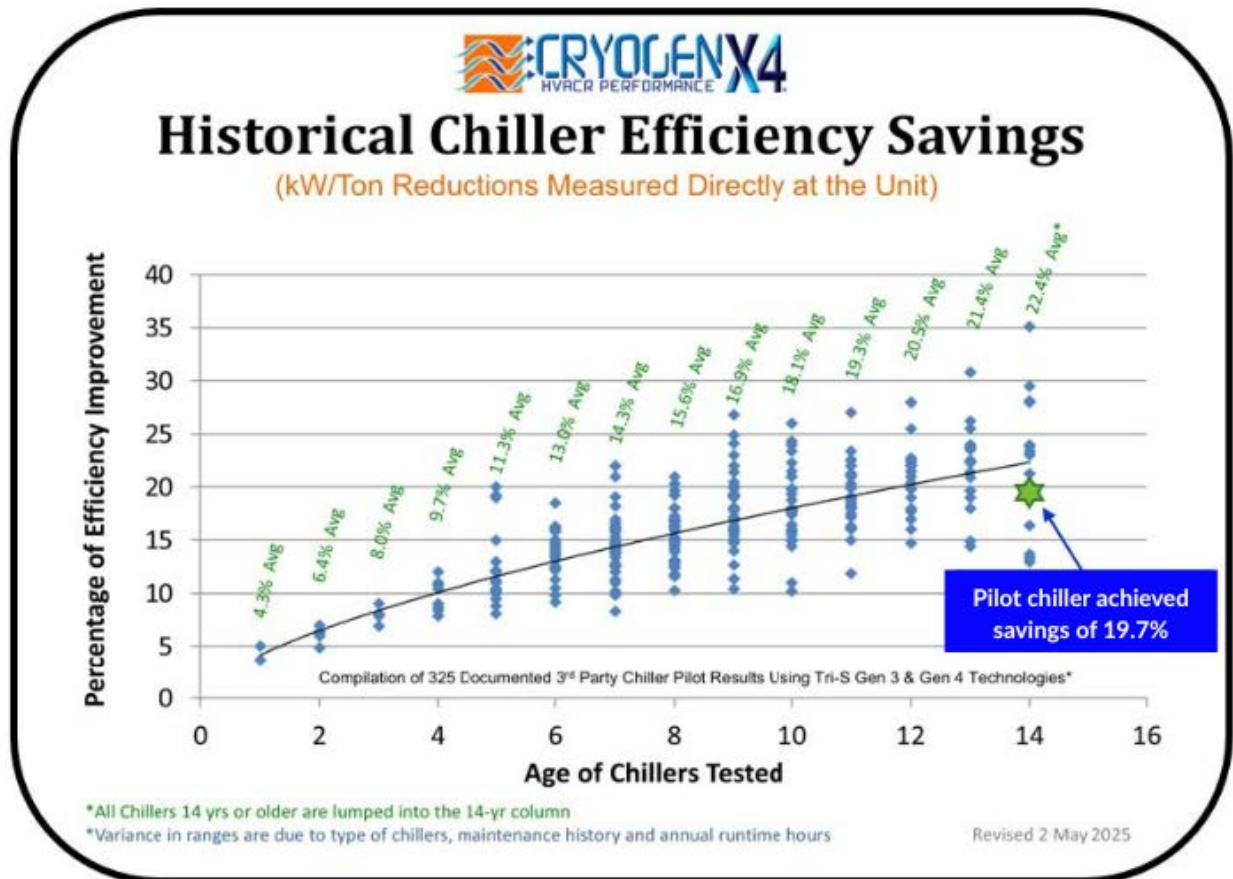


Refrig Approach Improvement

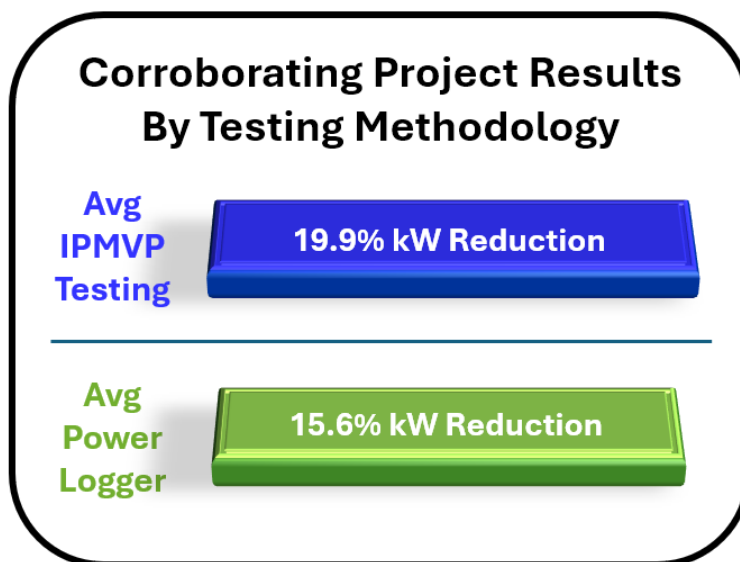


Pilot Results Track with Historical Data

The chart below (Chiller Performance History) shows how close the results of this pilot are to the historical averages achieved for equipment of the same age and type.



The average energy use reductions measured directly at the chiller control panel (the condenser power was not measured) using data loggers are also very consistent with both our historical averages and the IPMVP results, thus corroborating both sets of data. See results shown below.



The improvement of the pilot chiller at the Chardon location was accomplished without requiring any downtime of the cooling systems or interruption to manufacturing plant operations. When combined with a regular preventative maintenance routine and continued proper mechanical operation, CRYOGENX4 will manifest itself by:

- **Delivering extra cooling capacity to satisfy fluctuating assembly line loads better**
- **Improving cooling efficiency, lowering the cost to produce each ton of cooling required**
- **Restoring thermal efficiency, allowing raising of set points 1°F with no process impact**
- **Reducing unscheduled maintenance calls and extending equipment life by 15% or more**

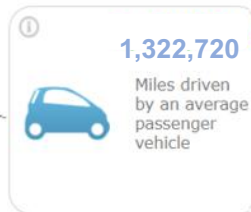
The full IPMVP details, along with photographic evidence, and the chiller’s respective power usage graph can be found in **Appendix A**.

Environmental Impact of CRYOGENX4

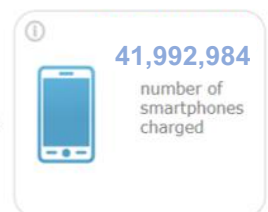
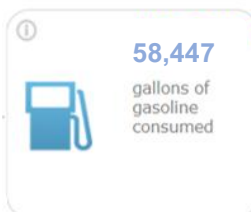


According to the [EPA.Gov](https://www.epa.gov/calculator) calculator, based just on the results produced on the pilot chiller, the Chardon plant will produce **519** fewer metric tons of Greenhouse gases over the next 10 years. This reduction in Greenhouse gases is equivalent to the reductions below. Imagine the impact when all the customer's properties have been treated across the United States and the world.

Greenhouse Gas Emissions from



CO₂ Emissions from



Cooling Equipment Involved

Temptek model TI-80A (2010), 80-ton nominal design capacity with four 20-ton scroll compressors. Tri-S, Motus and Pentair personnel all examined the pilot chiller prior to starting any formal measurements and found it to be functioning (see photos on the next page) within original equipment manufacturers (OEM) operating specifications.



TempTek
Model TI-80A
R407C

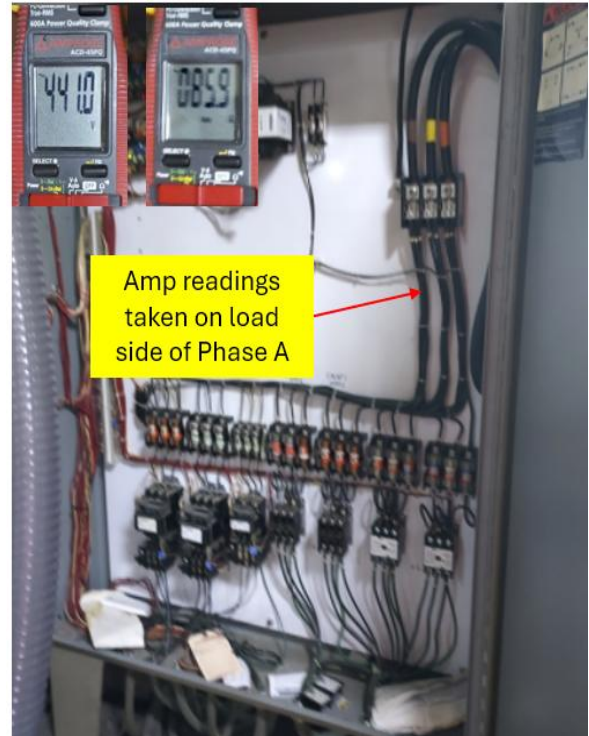


Air-Cooled Chiller Operational Components



IPMVP Testing Methodology

After approving the chiller for testing, Tri-S opened the power control section to take instantaneous Amp and Voltage readings as part of the IPMVP measurements, approved by U.S. Department of Energy and the worldwide scientific community as the gold standard for testing cooling performance improvement in the field. The team then immediately moved to the backside of the chiller to take chilled water (CHW) temperatures entering and leaving the circuit 1 evaporator. This evaporator was the one associated with the only two operating compressors at the time of testing. After capturing the CHW temperatures, the team quickly positioned itself to also capture the refrigerant temperatures entering and leaving the same circuit 1 evaporator. All the readings were taken in the exact same locations in the baseline and post periods and then used to help



calculate the tonnage, approach (i.e., the difference between how cold the refrigerant is compared to how cold the leaving CHW is), and efficiency readings such as kW/ton. The measurements were also taken when the outdoor air temperatures were matched identically in the baseline and post periods. This ensured the external load on each unit was the same in both periods.

The circulating pump associated with the pilot chiller is a constant flow model providing 96 gallons per minute (GPM) of water through each of the two evaporators on the chiller. The same GPM reading was used in both the baseline and post calculations since the load was identical.

Once all IPMVP measurements were taken, the pilot chiller was treated with the appropriate amount of CRYOGENX4. During the testing period, no other work was performed on the pilot chiller, so all improvements are the result of CRYOGENX4.

Twenty days after treating the pilot chiller with CRYOGENX4, the team returned to take post IPMVP measurements at identical outdoor air conditions to those in the baseline. The Pentair Operations Manager was coordinated with prior to every step of the testing.

Power Logging Testing Methodology

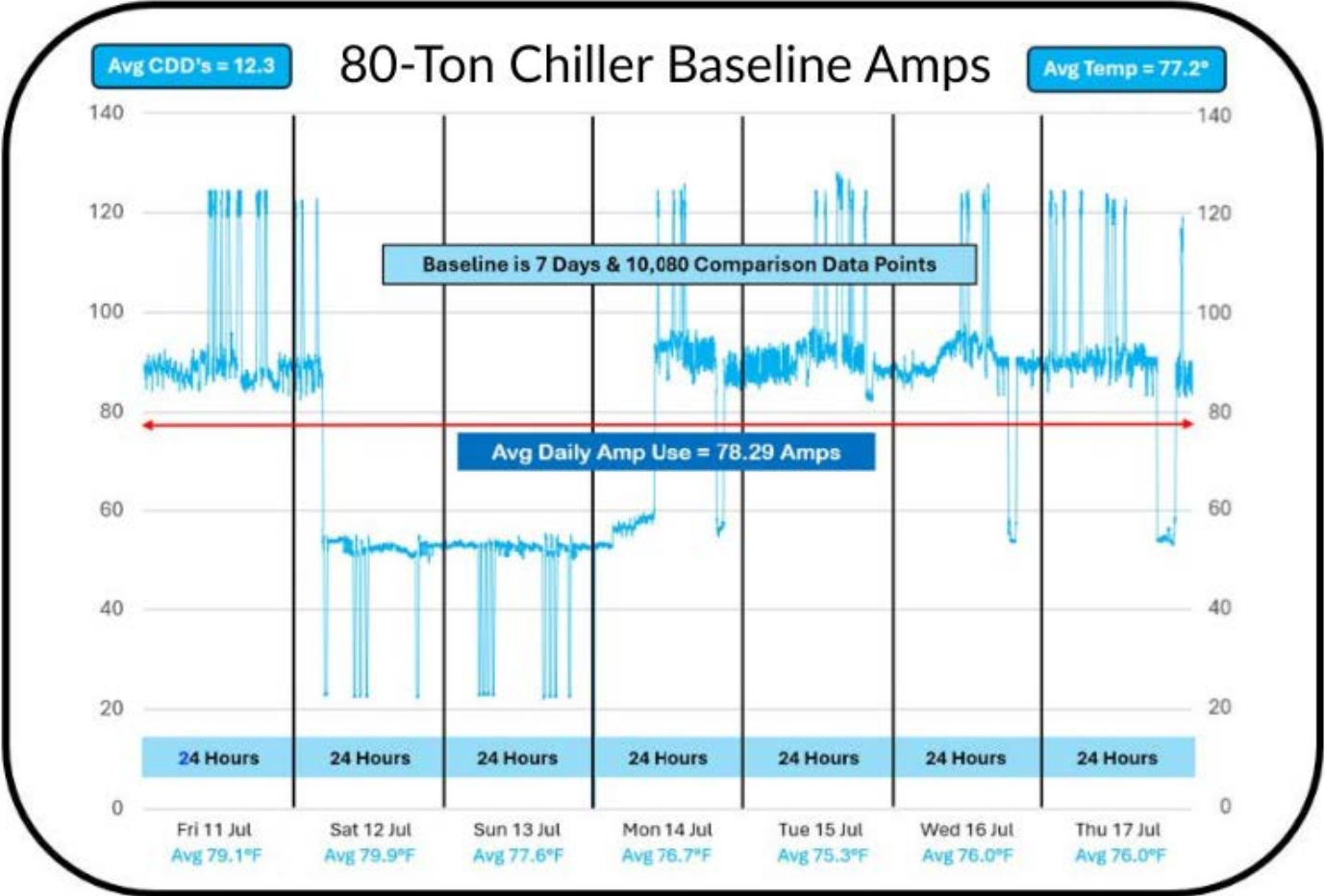
As a secondary collection methodology, the Tri-S and Motus team logged power usage for the pilot Chiller on Phase A of the main load side feed. Looking at the weather in detail, a full week of baseline and post days with similar weather were chosen to compare energy use. With 10,080 baseline and post comparison data points taken at 1-minute intervals, the results are very clear cut as you can see in the charts on the next page.

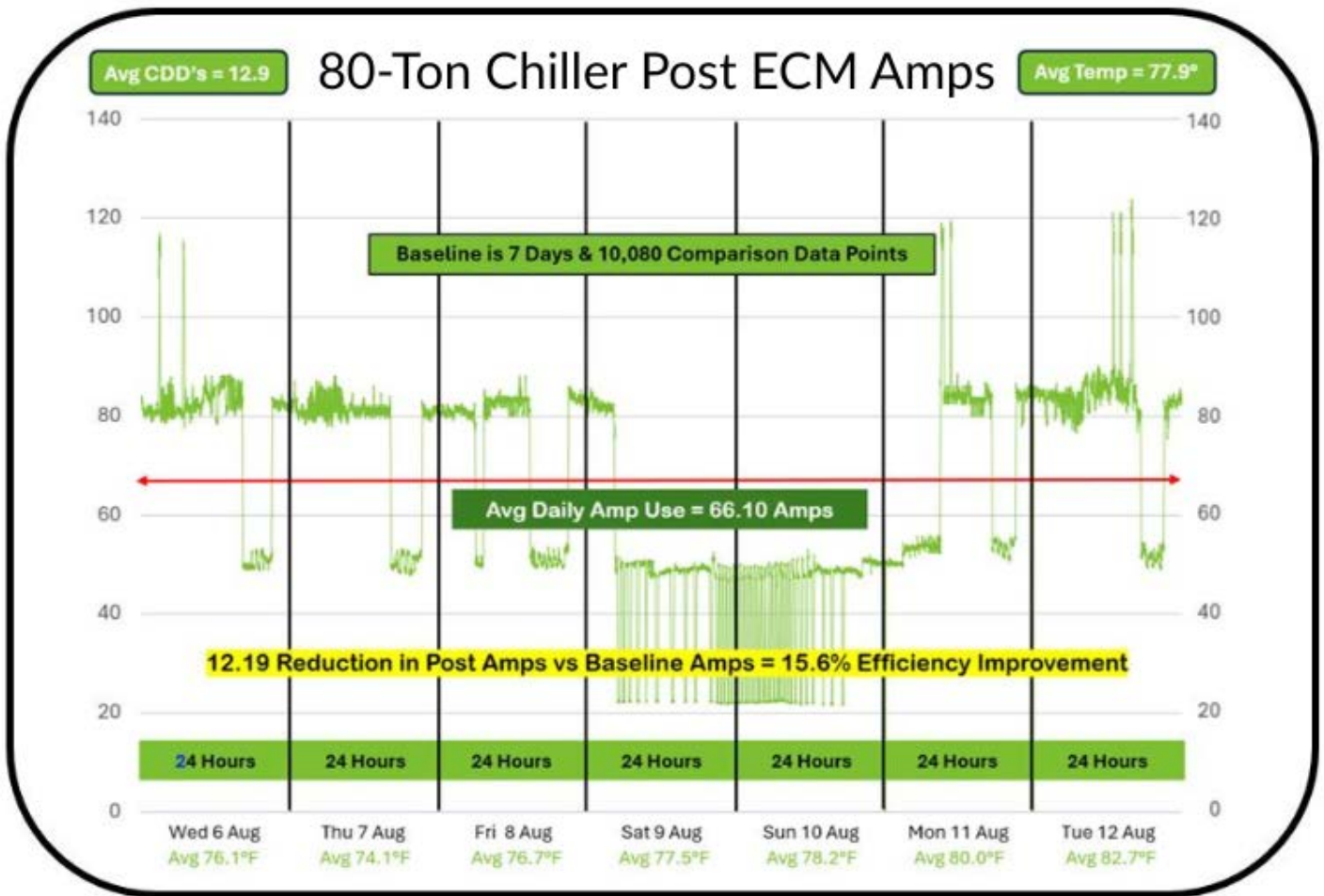
Total energy use dropped by 15.6% in the post period, after being treated with the CRYOGENX4 versus the baseline. This longer-term, 7-day average post amps drop is more related to the increased capacity and improved heat transfer ability of the evaporator and condensing coils. This improvement allows the chiller to reach leaving CHW set points faster and shut off one or both compressors for slightly longer periods of time. It also reduces the overall amount of energy being consumed and ultimately presents itself in the form of lower future power bills. You can see this effect when looking at how much less the third compressor runs in the post versus the baseline. The same can be said for the second compressor.

The drop in top-end amp use for each stage of additional compressor usage is mainly due to improvements in compressor operation. CRYOGENX4 produces better lubrication and less friction inside the compressors which allows them to produce colder refrigerant for less energy. For example, with two compressors and the pump operating during the baseline, the amps averaged nearly 89. In the same scenario in the post, the amps averaged 83.5.

One other point of observation is that the chiller never really shuts down at any time. The evaporator pump is always circulating water as is the process pump.

Appendix A shows the measurement photos of all the IPMVP measurements taken and how these charts fit into the complete logger readings, including the obvious CRYOGENX4 “seating” period.



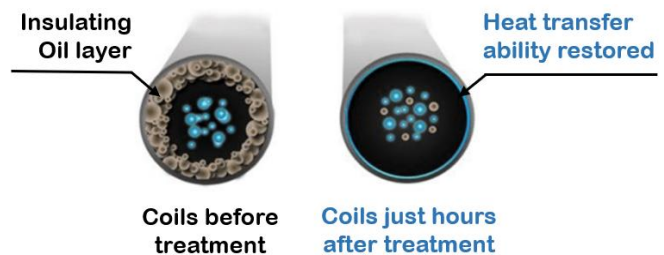


ECM Product Brief

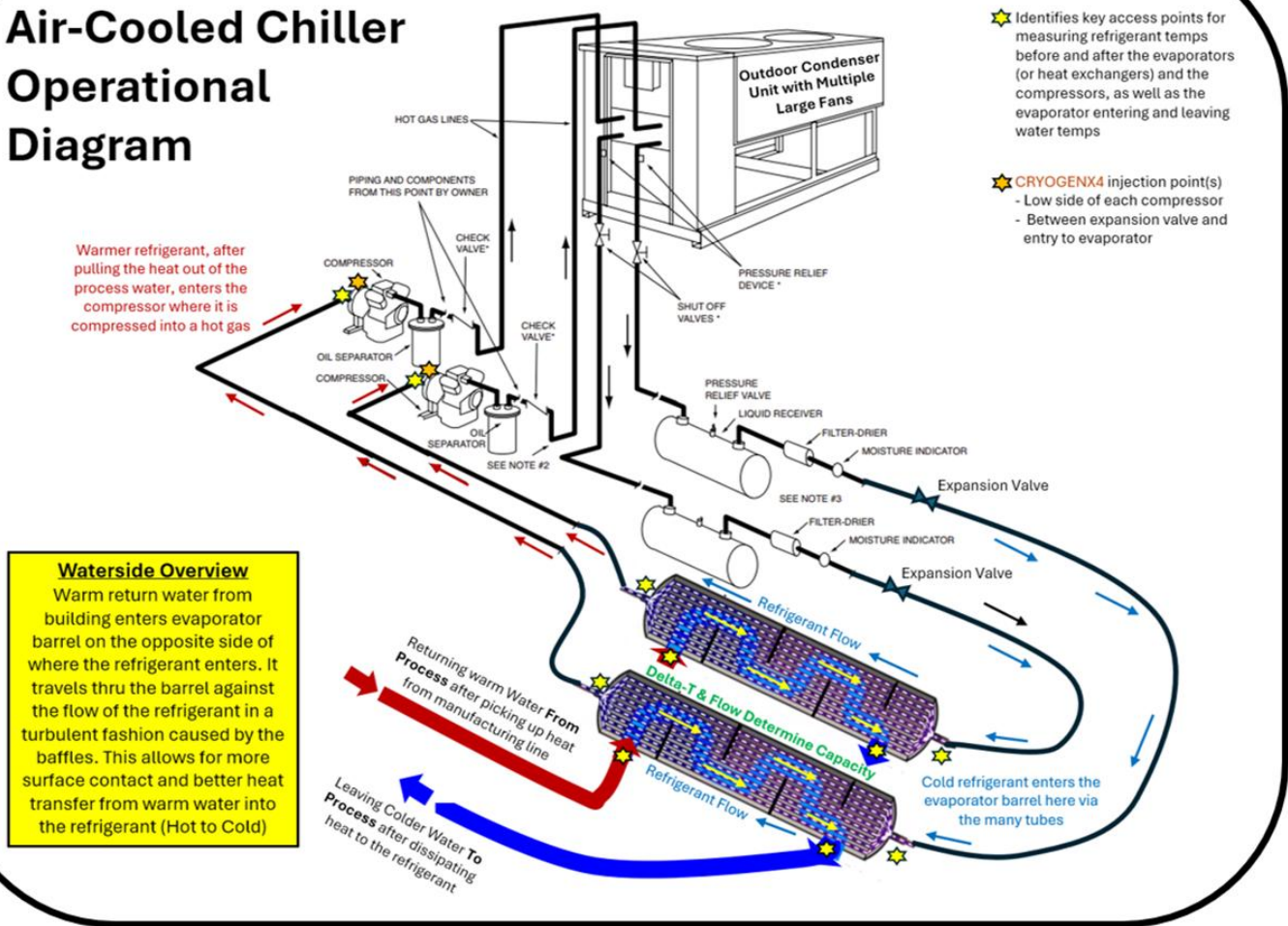
CRYOGENX4 is an advanced, multi-patented, state-of-the-art nanotechnology in liquid form designed and manufactured to boost the cooling performance and improve the overall efficiency of any HVAC-R system. It is sustainable, green and environmentally safe.

CRYOGENX4 is installed into any HVAC-R system while it is running and thereby requires no downtime, modification or alterations to the system for installation. It is the latest, most effective engineering solution derived from nearly 30 years of advanced Tri-S Technologies research.

Installed just once, CRYOGENX4 works to improve the performance of any type of HVAC or refrigeration equipment. The result is a metal surface free of efficiency and capacity-robbing stagnant oil and contaminants that is then enhanced and stabilized to improve its heat transfer ability.



Air-Cooled Chiller Operational Diagram



Additional Notes

Nearly every type of HVAC-R equipment, including chillers, loses capacity and efficiency over time. These losses can add up to 25% or more in older equipment as documented by the American Society of Heating and Air Conditioning Engineers (ASHRAE). This is mainly the result of oil-fouling and thermal degradation of the internal heat exchange surfaces. CRYOGENX4 has been proven to reverse these losses in seasoned equipment or prevent these losses from occurring at all in new equipment.

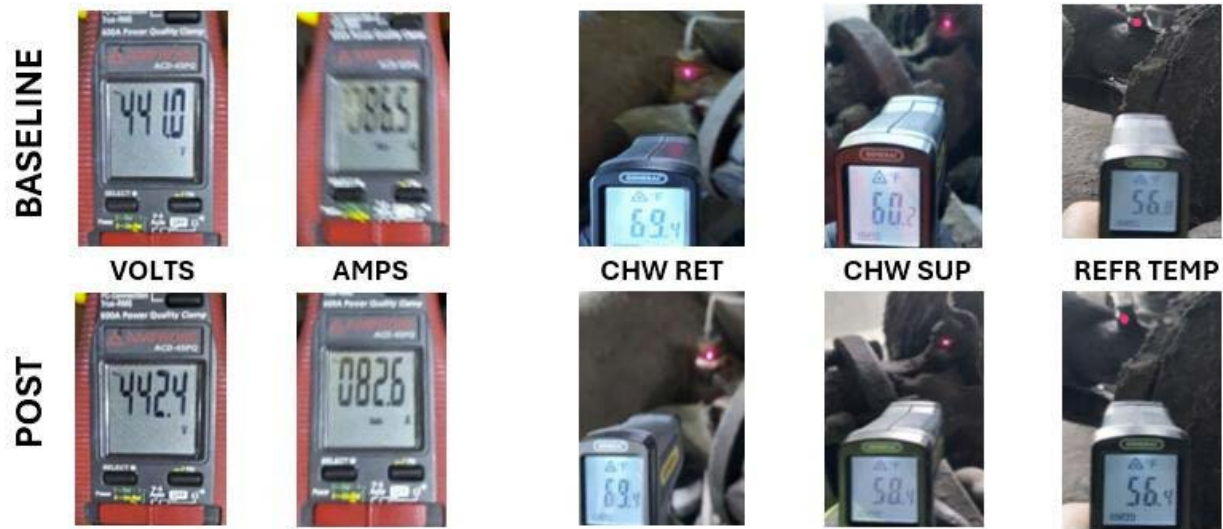
ASHRAE and the U.S. Department of Energy (DOE) issued updated HVAC and Refrigeration efficiency guidance under 90.1-2013 that lists kW/ton as the primary method to compare equipment performance by determining and tracking the cost to produce each ton of cooling produced. To best determine kW/ton improvement, in 2003 the DOE approved the IPMVP methodology as the gold standard for determining performance improvement in the field.

Tri-S has been using the IPMVP methodology for more than 12 years, often in conjunction with other mechanical or empirical methodologies, to evaluate and verify the performance improvements produced by CRYOGENX4 with extreme accuracy.

APPENDIX "A"

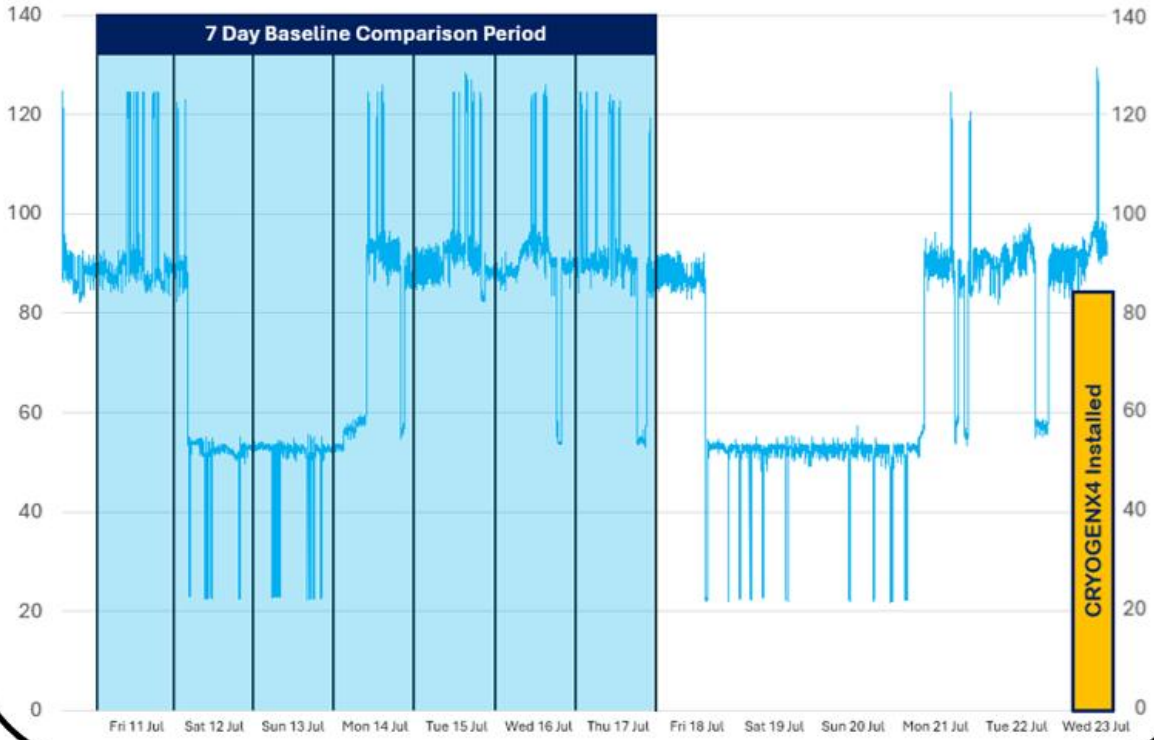
Chardon Plant 80-Ton Chiller - 2010

(Chiller tested using IPMVP methodology at 50% capacity with 2 of the 4 compressors running)



MEASUREMENT	BASELINE	POST	
Volts	441.0	442.4	
Amps	86.5	82.6	
Entering CHW (from process)	69.4	69.4	
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Evap Refrig Temp Entering	56.8	56.4	
Evap Refrig Temp Leaving	67.2	68.3	
Flow Rate Thru Evap in GPM	96	96	
Chiller Load % at Testing	50	50	
Temp at Time of IPMVP Testing	85	85	
Estimated Annual Runtime Hours	5,800	5,800	
			IMPROVEMENTS
kW (following regression analysis)	67.0	53.7	19.9%
kWh (following regression analysis)	388,870	311,559	19.9%
Cost to Operate	\$37,098	\$29,723	\$7,375
Capacity in Tons of Cooling	36.8	44.0	19.6%
kW/ton	1.52	1.22	19.7%
CHW Delta	9.20	11.00	19.6%
Coefficient of Performance	2.31	2.88	24.7%

80-Ton Chiller Full Baseline Amps



80-Ton Chiller Post ECM Amps

