



Thermal Energy Corporation

Optimization helps sustain system reliability during growth—with a payback

Overview

Thermal Energy Corporation, which operates the largest district cooling system in North America, has seen its peak chilled water demand increase by 9,000 tons over the past four years with an additional increase of 9,000 tons forecasted over the next three years. TECO found that increasing efficiency is the most cost-effective way to manage district growth while meeting its mission to provide reliable, economical thermal services to the Texas Medical Center campus in Houston.

TECO partnered with Optimum Energy to determine opportunities for optimization of an already very efficient chilled water system. The goals were to:

1. Lower peak demand by 2 MW, allowing the entire plant to stay within load capacity of the existing combined heat and power (CHP) plant;
2. Avoid spot purchasing of power from the utility;
3. Assure reliable grid power;
4. Provide kWh savings every day of year with a simple payback of under two years;
5. Avoid thousands of dollars of demand charges associated with coincident peak days.

Continuing to have the ability to produce 100% of its power with its combined heat and power systems was a priority for TECO. Reducing peak demand by 2 MW gave TECO time to develop a new master plan for the site and determine the exact timing and path forward for adding power production capacity. It also satisfied TECO's persistent mission to continually improve operational excellence while maintaining its historical reliability and resiliency.

The team, made up of engineers from TECO, Optimum Energy, and Toshiba, deployed the OptimumLOOP® optimization solution safely during the COVID-19 pandemic in less than eight months so TECO could achieve the needed efficiency gains prior to summer. The Texas electric grid operator (Electric Reliability Council of Texas, or ERCOT) records each user's peak usage from June through September to set the next year's demand charge. The solution focused on condenser-side optimization algorithms as well as a new optimized chiller-staging methodology.



"Part of my interest in this project was to reduce electrical consumption. That's money that can be applied to other uses," said Jason Berrio, TECO's vice president of plant operations. "This solution helps us be smart, be energy conscious, and run the right equipment at the right set points."

Over the first seven months of optimization (June to December 2020), the project saved nearly 10.5 million kWh, reducing energy consumption by 6%, an estimated cost savings of \$356,000. In addition to saving kilowatts every day regardless of the season, TECO can keep the entire plant within its existing CHP capacity.

The Challenge: Further optimize an already well-optimized, highly reliable system

The system's two interconnected plants house 27 chillers and seven boilers that pipe chilled water and steam to 23.7 million square feet—much of it for highly controlled environments—in 50 buildings composing 17 institutions. With 120,000 tons of firm capacity, 350 million-plus ton-hours per year of annual load, and a 2020 peak load of 78,600 tons, TECO's power demand had grown enough to push the plant over the existing CHP's capacity.

TECO has logged 100% reliability—with no unplanned outages—since 1992, so the optimization project was aimed at cost-effectively maintaining that reliability while meeting load growth. With a cancer center, a children’s hospital, two Level I trauma centers, and research facilities as customers, the reliability of TECO’s cooling supply is of the utmost importance.

“It is critical to our customers that we maintain reliable thermal services. One key aspect of that is for TECO to be able to produce 100% of the plant electrical load to continually cool the medical campus in case of loss of utility power,” said Mike Manoucheri, TECO’s vice president of engineering and maintenance. “We had to look at ways to improve efficiency to buy time before adding capacity—and do it as cost-effectively and reliably as possible.”

The Solution: Optimization plus business continuity services

Optimum Energy calculated that the optimization project would free up 2.1 MW of peak power, save 14.7 million kWh per year of energy, and have a 1.9-year simple payback.

As part of the optimization project, TECO also integrated the Optimum Energy Plant Diagnostics tool into its work processes, which helps maintain business continuity. While TECO engineers have always collected vast amounts of monitoring data, Optimum’s data rationalization and diagnostics enable the team to dive deeply into their vast assets and identify otherwise unseen opportunities to increase reliability and efficiencies. They can also better prioritize maintenance efforts and tackle less obvious, high-impact actions to take in ongoing efforts to optimize all the equipment.

“The monthly analytics reports are very valuable. They give us insights into potential problems with our machines—starting with overall efficiencies and then diving deeper into the details with things like approach temperature degradation on the chillers. We are also looking at how all that information trends over time—combined with Optimum’s experience from other sites, we get a different set of eyes and experience to help drill down into what the machines are telling us,” said Manoucheri.

Results

With the additional capacity, efficiencies, and insights the Optimum Energy solution provides, TECO is on track to save more than \$500,000 in the first year, and it can delay multimillion-dollar capital expenditures to expand electrical generation capacity for at least several years. The system is performing with more consistent operating procedures over all shifts, which is also key to improving long-term reliability.

“The collaboration between Optimum Energy and TECO has allowed us to accommodate load growth without adding capital equipment,” said TECO CEO Steve Swinson. “This is always the first choice, and the efficiency gains provide savings every day of the year. This is a win-win for Optimum Energy, TECO, and TECO’s customers.”

ABOUT OPTIMUM ENERGY

Since 2005, Optimum Energy has helped customers in district energy, higher education, healthcare, life sciences, and high-tech manufacturing reduce energy use, delivering cost-effective projects, improved operating resiliency, and reduced carbon emissions. To-date, Optimum Energy has helped their customers save over 1.8 billion kilowatt-hours of electricity, reduce carbon emissions by over 1 million metric tons and save over 385 million gallons of water.

DETAILS

TECO

Thermal Energy Corporation (TECO) is the largest district cooling system in North America. Its combined heat and power-based systems provide chilled water and steam to one of the largest medical campuses in the U.S. The chilled water system consists of 27 chillers and an 8.8-million-gallon thermal energy storage tank. The equipment is controlled by a Toshiba Distributed Control System.

Cooling capacity: 120,170 tons

Annual chilled water production (2019): 345.1 million ton-hours

Customers

23.7 million square feet of conditioned space in 50 buildings across 17 institutions on the campus of the Texas Medical Center

Benefits

- Improved business continuity
- Enhanced maintenance prioritization
- Energy savings
- Electrical demand reduction
- Cost savings
- CO₂ emissions reduction

Plant efficiency improvement: 6%

Utility savings

Electrical energy savings: 14.6 million kWh/year

Electrical demand reduction: 2,112 kW

CO₂ emissions reductions: 21.1 million pounds/year

Financial savings

Annual operations costs: \$509,000

Simple payback: 1.9 years

