System Name
Thermal Energy Corporation (TECO)

Location
Texas Medical Center campus in Houston, Texas

Ownership Type
501(c)(3)

Contact
Jason Berrio
Vice President, Operations
Thermal Energy Corporation
1615 Braeswood Blvd.
Houston, TX 77030-3903
Email: jberrio@tecothermalenergy.com
Phone: 713.791.6702
Web: tecothermalenergy.com
THE ENERGY BEHIND WHAT’S NEXT AT THE TEXAS MEDICAL CENTER

Long before there was record-setting Hurricane Harvey, the district energy system serving the Texas Medical Center was born. It has weathered the test of time, has continued to grow and this year – 2019 – marks its 50th anniversary.

The system is owned and operated by Thermal Energy Corporation (TECO), a not-for-profit corporation located on the Texas Medical Center (TMC) campus just south of downtown Houston, Texas. TECO traces its history with the system to 1978 and has been on the job ever since, honored to play a role in the success of the largest medical complex in the world.

Institutions on the Texas Medical Center campus offer high-quality patient care, provide unparalleled educational opportunities and conduct groundbreaking life-science research. They need the most reliable and efficient chilled-water and steam service possible – and TECO is committed to providing it.

TECO and the Texas Medical Center have always been partners in growth, with TECO serving as the energy behind what’s next on campus. Representatives from nine customer institutions comprise TECO’s board of directors. Campus institutions now have $3 billion in construction projects underway. The newest is a 1.5 million sq ft collaborative research complex.

Campus growth helped drive TECO’s Master Plan Implementation Project, a $377 million energy-saving system expansion, completed in 2011, that included the addition of

- 8.8 million-gallon chilled water thermal energy storage (TES) tank, the tallest thermal energy tank in the U.S.
- New chiller building with 32,000 tons installed capacity, expandable to 80,000 tons
- 48 MW combined heat and power plant, which can meet 100% of TECO’s electricity needs
- 138-kV electric substation upgrade
- Operations support facility with state-of-the-art control room
- Distribution system expansion that included a new utility bridge over Brays Bayou

With 120,170 tons chilled-water capacity and 980,000 lb/hr steam capacity, TECO currently serves 50 buildings in 16 different institutions totaling 22.7 million sq ft of space. The system has two interconnected sites with a total of 27 chillers and nine boilers. The distribution system has 35+ miles (7.7 trench miles) of piping ranging in size from 6 to 60 inches in diameter.

**TECO’s 100% reliability over the past 26 years** and its resiliency during Hurricane Harvey pair with its commitment to on-the-job safety. TECO intends for employees to go home just as healthy as they arrived. The system began operation under Houston Natural Gas Co. in 1969 and was purchased by TECO in 1978.

As it celebrates the system’s 50th anniversary, Thermal Energy Corporation is pleased to present a summary of its accomplishments and asks to be considered for IDEA’s 2019 System of the Year Award.
Since energy efficiency translates into environmentally responsible and cost-effective operation, it was a driving force as TECO planned its 2007-2011 expansion. (See System Description.) Upon startup of the new equipment, TECO’s efficiencies rose quickly, reducing TECO’s operating costs and bringing customers considerable cost savings.

CHILLED WATER
Located in Houston, Texas, TECO operates in extremely hot and humid conditions with an average 3,590 cooling degree-days. As a result, on a Btu basis, TECO produces 80% chilled water and 20% steam, placing a high value on chilled-water system efficiency.

TECO operates 27 chillers in two plants, with 35% of its capacity using variable-speed drives. TECO baseloads using constant-speed drives since the baseload is often so high.

TECO’s goal is to produce chilled water using the least amount of energy – the fewest kilowatts per ton and the highest COP – possible. From 2015-2018, TECO averaged an impressive 0.69 kW/ton and 5.10 COP.
As shown below, TECO has steadily reduced kilowatts used per ton with few exceptions, such as when Tropical Storm Allison posed a challenge in 2001-2002. The most notable improvement is between 2011 and 2018 when TECO started operating its new variable-speed chillers, pumps and cooling tower fans and initiated an energy optimization system.

TECO charges its thermal energy storage tank at night when electricity rates are lower and discharges the tank during the day to save on electricity costs. TECO saves an average of 6% annually on energy consumption compared to running the equivalent chillers during the day.

TECO charges its thermal energy storage tank at night when electricity rates are lower and discharges the tank during the day, saving an average of 6% annually on energy consumption.*

*compared to running the equivalent chillers during the day
COMBINED HEAT AND POWER

TECO calculates the simple cycle heat rate as fuel to the gas turbine divided by the power generated in kWh. The combined cycle heat rate is the same fuel input minus the steam heat out of the HRSG. The percent comparison is an expression of the efficiency of the CHP operation.

TECO operates its CHP system to stabilize its offsite power supply and ensure system reliability. It monitors the ERCOT electricity market in real time. When market conditions start to show stress on the grid’s electricity supply, TECO starts its CHP unit to mitigate the risk of a power interruption.

CHP PLANT EFFICIENCY
AVERAGE: 2015 - 2018

<table>
<thead>
<tr>
<th></th>
<th>Simple Cycle Heat Rate Btu/kWh</th>
<th>Combined Cycle Heat Rate Btu/kWh</th>
<th>Unit Efficiency</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>9,136</td>
<td>6,883</td>
<td>72%</td>
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</tbody>
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STEAM

Houston logged 1,230 heating degree-days in FY2018.

STEAM PRODUCTION AND EFFICIENCY TOTAL: 2015 - 2018

<table>
<thead>
<tr>
<th></th>
<th>*Fuel Input (MMBtu)</th>
<th>Energy Output (MMBtu)</th>
<th>Boiler Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package Boilers</td>
<td>5,054,247</td>
<td>3,851,987</td>
<td>76%</td>
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<tr>
<td>HRSG</td>
<td>116,976</td>
<td>866,972</td>
<td></td>
</tr>
<tr>
<td>Total Production</td>
<td>5,171,223</td>
<td>4,718,959</td>
<td>91%</td>
</tr>
</tbody>
</table>

SYSTEM OPERATION

Fuel purchase. In 2006, TECO enacted a board-approved energy policy that allows it to purchase electricity and gas up to 10 years in advance. The policy builds in fuel-price certainty and avoids exposure to real-time power pricing in Texas’ deregulated market.

Visual MESA™. Installed in 2010, TECO uses Visual MESA, a real-time energy optimization model that runs every 5 minutes. It is tied to instrumentation data and models all of the plant’s energy systems. They can also access the model and make adjustments.

Control room. TECO built a new control room during its 2007-2011 expansion and updated it in 2018 to support enhanced plant efficiency. It allows operators to view internal and external data affecting operations, including real-time delta T, loads, electricity market data, and weather data.

CUSTOMER REFUNDS AND CONSERVATION

Since 2011, TECO has logged significant efficiencies allowing it to rebate customers a total of $33.4 million over the past seven years and reduce rates by 14% over the past four. TECO also uses demand response, which holds down costs 4% annually. See the Demonstrated Sustainability section regarding TECO’s conservation efforts. Customers have reduced their energy use per square foot by 30% over the past 10 years.

$33.4 million customer rebates over past seven years

Over the past four years, TECO’S efficiencies have reduced rates by 14%

Customers have reduced energy use per sq ft 30%
With world-famous hospitals and integral research centers among its customers, TECO understands that reliable cooling and heating service is imperative. TECO embraces a “failure is not an option” culture, with a commitment to reliability requiring a concerted effort throughout the organization.

TECO has demonstrated reliability over the decades. **TECO has logged 100% system reliability – no unplanned outages – for 26 years, from 1992-2018** (calculations for past four years shown in IDEA’s separate spreadsheet). TECO’s reliability is made possible by extensive planning and investment in redundancy, quality control, innovative processes and employee diligence.

- **Equipment redundancy** – Maintains 13%-15% redundant equipment above peak capacity available at all times. (Right now TECO has 120,000 tons of chilled-water capacity and 80,000 tons of load.)

- **Looped, interconnected distribution system** – Chilled-water distribution systems from TECO’s Central Plant and South Main Plant have been interconnected since 2003, allowing chilled water to flow to customers from either plant. This is in addition to looped distribution system design that allows customers to be served from more than one direction.

- **48 MW combined heat and power unit** – Can produce enough electricity, in conjunction with thermal storage, Cooper Bessemer engine and steam-driven equipment, to power TECO’s entire plant, keeping chillers, boilers and ancillary equipment running even if the electric grid goes down.

- **Significant emergency generator capacity with blackstart capability** – 16,330 kW emergency generator capacity using natural gas and/or diesel. Blackstart capability tested and can synchronize with the grid.

- **Robust electrical system standards** – Achieved by installing alternate power paths in the event of a sudden failure of the primary path (see “Ring bus system”). TECO also uses main-tie-main. TECO requires the highest voltage service available, which means higher initial, engineering, equipment, and maintenance costs but provides highest reliability.

- **Ring bus system** – Adopted in early 1993 to provide operational flexibility and high reliability. The fast-acting protection relays isolate a faulted portion of the electrical system, and since another electrical system is already connected, service continues while safely isolating the faulty portion. Electrical ring bus breakers have protective relaying that isolate faults in ~6 cycles. TECO is fed from two local electric utility 138 kV substations; the main breakers from the electric transmission lines have an automatic reclosing feature that isolate and reclose automatically upon fault detection and clearing. Switchyard uses gas-insulated circuit breakers. All TECO high-voltage transformers have been upgraded with a transformer protection system.

- **8.8 million-gal chilled-water storage tank** – Can be brought into service quickly and only uses about 10% of the equivalent power it would take to operate a chiller.

- **Floodwall and floodgates** – Installed in 2003, designed to withstand a 500-year flood plus 3 ft at Central Plant.

- **Distribution system construction quality control** – Dedicated, experienced TECO personnel are on-site full-time inspecting all construction daily. Third party inspects and x-rays every weld. Geotech engineers are on-site full time during backfilling to ensure compaction specs are met. Concrete in all new vaults is tested by third party using core samples.
Load shed plan – Designed to establish which customer loads are in absolute critical need of service and which ones could be temporarily dropped from service in an emergency to serve critical loads. Closely coordinated with customers and automated through customers’ energy controls. Refined and tested annually before peak cooling season.

8,000-sq-ft on-site warehouse – More than 13,000 spare and critical parts in inventory, including motors for condenser water pumps, chilled-water pumps, cooling tower fans, boiler feedwater pumps, raw water pumps and water well pumps. TECO stocks entire variable-frequency drives for quick replacement when needed.

Testing and commissioning – Each piece of plant equipment regularly and thoroughly tested and re-commissioned to ensure it works exactly as specified under trying conditions. TECO also examines all manhole seals within its plants, verifying they can still remain watertight under 15 ft of water.

Major Equipment Replacement Program (MERP) – Established a schedule to detail TECO’s longer-term maintenance needs. Guarantees funding is available for large repairs and overhauls on an annual basis for next 30 years. Eliminates surprises and ensures reliability will not be compromised due to cost. MERP allocates an annual capital replacement budget of $2.8 million.

Predictive and preventive maintenance program – Predictive maintenance includes one employee fully dedicated to vibration and oil analysis monitoring. Computerized preventive maintenance program lists each piece of equipment and details maintenance protocols. TECO has two full-time coating specialists keeping materials and piping free of external corrosion.

Distribution system maintenance – Crews conduct system blowdowns and flushes, check cathodic protection monthly, check valve fit and exercise valves. Also perform quarterly customer meter checks.

Strict steam condensate requirements – Proper chemical balance is vital to reliable system operation so TECO has conductivity meter in each customer building that monitors if customers are meeting the limit of 25 micromho conductivity and less than 0.3 ppm hardness.

Redundant air supplies for diesel generator – One diesel compressor, one electric compressor and the ability to cross connect between starting air and plant air.

True distributed control system – Loss of control room does not mean loss of plant. There are redundant operator stations in the plant, so if the control room needs to be evacuated, TECO can operate all plant equipment locally.

Detailed emergency preparedness plan – Ready for both natural and manmade disasters (see Resiliency section).

Portable pumps – Portable pumps increase TECO’s dewatering capability to 43,000 gpm.

Strategic server location – Computer servers located in interior space off the ground floor and connected to multiple electrical circuits.

Cybersecurity – Multiple layers of network security that include intrusion prevention systems on two redundant external connections. Air gaps are incorporated for the operations network, which is fully in-house and separate from on-site information network. The information network has above-industry-standard cybersecurity protection and is regularly audited.

Robust water supply – Three water wells (two supplied from two separate aquifers) plus three municipal water feeds.
TECO is no stranger to natural disasters. It endured Hurricane Alicia in 1983; Tropical Storm Allison in 2001; Hurricane Rita in 2005; Hurricane Ike in 2011; and then Hurricane Harvey, a Category 4 storm, in 2017. In every instance, because of careful planning, engineering and investment, TECO maintained chilled-water and steam service to its customers.

**LEARNING FROM EXPERIENCE**

After disaster hits, the events inform TECO’s emergency planning efforts. TECO conducts debriefing sessions after each major event to fortify the company’s plans and procedures.

In 1983, TECO added an on-site water well as a secondary water source after city water supply pressure dropped during Hurricane Alicia.

2001’s Tropical Storm Allison was one of the worst disasters to ever hit Houston, dropping 36 inches of rain. More than $2 billion of campus research projects were destroyed. Only a trickle of water seeped in at TECO, but it was too close for comfort. In 2003, TECO followed up by installing a $5.5 million floodwall and floodgates designed to withstand a 500-year flood plus 3 ft. Allison also helped drive plans for a 48 MW CHP unit that produces enough electricity to power TECO’s entire system and an 8.8 million-gallon chilled-water storage tank, both enhancing reliability. (See Reliability section for details.) The Allison experience also changed TECO’s chilled-water connection requirements. Prior to Allison, TECO’s chilled water flowed through customer buildings. Fouling occurred during Allison, so now TECO requires all new customers to install plate-and-frame heat exchangers and 60% of customer buildings have them installed.

**PLANNING FOR THE WORST**

TECO has an emergency preparedness plan that addresses natural and manmade disasters. The company conducts monthly, quarterly and annual training and emergency drills and participates in preparedness drills with the Texas Medical Center, state of Texas, Harris County and City of Houston.

It also contracts with a nationally recognized weather service.

TECO’s plan details individual responsibilities plus the size, composition and care of TECO’s ride-out team. It is committed to sheltering 35 employees in place for seven days. The plan includes recipes and shopping lists for healthy meals and procedures to ensure that the proper plant and personal protection equipment, nonperishable food, and bedding and hygiene items are on-site.

Shown completed in 2003, TECO’s floodwall has 254 one-foot-thick reinforced concrete piers that are 30 feet deep.

**DEMONSTRATED RESILIENCY**

Thermal Energy Corporation: IDEA 2019 System of the Year Entry

8
BEATING HURRICANE HARVEY

With a solid plan and a well-designed system in place, TECO’s dedicated storm ride-out team kept chilled water and steam running during record-setting Hurricane Harvey. Harvey dropped nearly 60 inches of rain on Houston over a five-day period, Aug. 25-30, 2017. Without its floodwall, portions of TECO’s plant would have been under water.

TECO put its preparedness plan into action Aug. 23, asking ride-out team members to report to work for an extended stay starting Aug. 25. These employees spent the next 132 hours – 5-1/2 days – working nonstop to maintain service.

When Harvey hit Aug. 27, TECO was ready. The on-site operators maintained standard 12-hour shifts, and maintenance and distribution crews worked around the clock as needed. Support staff made sure fresh food was delivered before the storm and stayed on-site to cook.

Although rain covered much of the system’s underground piping in 100 vaults, trap boxes and manholes and posed a challenge for TECO’s steam lines, there were no service interruptions. TECO reached sites via a vintage high-water vehicle, allowing TECO’s distribution crews to work 24/7 to lower rainwater levels around the pipes.

The true measure of TECO’s resilience comes from its customers.

“Thermal Energy Corporation is a treasure, cooling and heating our campus buildings to help us sustain life. It is a cornerstone of how the Texas Medical Center operates. It is truly that important. The company goes out of its way to provide uninterrupted service. It stood strong throughout Harvey, and that’s a real marvel of engineering, planning and investment.”

William F. McKeon
President and Chief Executive Officer
Texas Medical Center

TECO’s Central Plant is sited on Brays Bayou, shown here under normal conditions (top) and in the middle of Hurricane Harvey, bottom. Flood waters peaked just under the bayou’s bridges.
TECO understands that every kilowatt-hour of electric power or every cubic foot of natural gas saved through its robust energy conservation and efficiency programs reduces the environmental impact of not only its own operation, but the entire Texas Medical Center campus. Its own and its customers efforts to conserve have real benefit.

TECO’s major expansion from 2007-2011 added a 48 MW combined heat and power unit and an 8.8 million-gallon chilled-water storage tank to its system, building on a long history as an environmental steward. It has never had an enforcement action taken against it, and it is committed to sustainable growth.

TECO operates in Houston, which has improved from severe nonattainment status for ozone in 2008 to marginal nonattainment for 8-hour ozone in 2018, with an attainment deadline of 2021. TECO benefits the area by keeping approximately 42,000 tons of greenhouse gases (based on EPA’s CHP Emissions Calculator) out of the air annually.

ENVIRONMENTAL BENEFITS

- TECO’s startup of a combined heat and power unit in 2010 doubled its annual operating efficiency and cut fossil fuel consumption by more than 60% compared to conventional electric generation and heat-only systems.
- Using actual data in EPA’s CHP Emissions Calculator, TECO
  - cuts annual tons of NOx by more than 90% and
  - reduces CO2 and total greenhouse gas emissions by 48%.

EMISSION CONTROLS

- TECO primarily uses natural gas with low-NOx burners and selective catalytic reduction technology to minimize emissions. Three boilers run on natural gas exclusively, and three additional boilers run on natural gas and/or diesel fuel oil.
- Only ultra-low sulfur diesel fuel is used to test diesel-fired boilers and the Cummins emergency engines. The Cooper Bessemer is a dual-fuel engine, which operates on a mixture of 94% natural gas and 6% ultra-low sulfur diesel under normal conditions. It is also capable of running on 100% diesel in an emergency. TECO installed an exhaust catalyst and crankcase emission control system on the dual fuel engine in 2013. In addition, TECO’s chillers are equipped with refrigerant leak detection systems.

REFRIGERANT STEWARDSHIP

- TECO monitors, manages, recycles and reuses its own refrigerants.

ASBESTOS MANAGEMENT

- TECO eliminated all asbestos in the 1980s.

CHEMICAL MANAGEMENT AND RECYCLING

- TECO has a tightly managed chemical water treatment program that helps minimize the use, management, and disposal of hazardous chemicals within the community:
  - Closely monitors chemical tank levels and checks secondary containment to ensure that chemicals are not leaking from the tanks and totes.
  - Keeps personal protective equipment, safety showers and eyewashes in chemical storage areas.
  - Checks chemical labels frequently to ensure compliance with Globally Harmonized System standards.
  - Stores diesel fuel in fiberglass underground storage tanks (USTs) equipped with leak detection and monitoring wells. UST spill containers and drain valves are tested and inspected at least monthly.
  - Manages refrigerant in accordance with rules set forth by EPA in 40 CFR Part 42.
  - Inspects, maintains and monitors chillers to minimize leaks of refrigerant.
  - Screens all chemicals used in TECO’s boilers and cooling towers for toxicity and compatibility with the wastewater outfall permit.
  - Uses containment, visual observation, and personnel training to minimize leaks and spills of hazardous chemicals.
  - Makes a concerted effort to keep any chemical or fuel spill from reaching Brays Bayou.

The greenhouse gas reduction is estimated to be the same as taking nearly 8,000 passenger vehicles annually off the road.

Due to highly efficient cooling tower and chiller operation, TECO also has a lower gallon/ton-hour rate of water usage than smaller dedicated facilities.

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SUSTAINABILITY

TECO is a true energy partner with its customers and the local community.

WATERWISE PROGRAM/HARRIS COUNTY GALVESTON SUBSIDENCE DISTRICT

TECO supports WaterWise, an award-winning educational program dedicated to teaching children in third through sixth grades how to protect and conserve precious freshwater resources. Local school districts teach the program in a classroom setting, and businesses like TECO provide support by funding “Water Detective” kits for children to take home. The kits include a high-efficiency showerhead, faucet aerators, digital thermometer, rain/drip gauge, shower timer, flush saver, flow diverter and toilet leak detector tablets. TECO funds approximately 2,600 student kits a year. In exchange, TECO receives water credits worth 84,000 gallons of groundwater to be withdrawn in excess of its normal permitted allowance and up to 50% of its total water usage. This reduces TECO’s city water consumption and provides an overall cost savings to its customers.

TECO funds approximately 2,600 student kits/yr

BRAYS BAYOU DISCHARGE OPTIMIZATION

TECO is permitted to discharge treated wastewater – cooling tower water and boiler blowdown – into a Brays Bayou outfall, reducing costs. Chemical oxygen demand, total suspended solids, and oil and grease loads are monitored and are typically less than 10% of permitted limits. TECO has installed oil and grease and pH analyzers in its effluent stream, which discharges to the outfall on a periodic basis using a ball float. If pH or oil and grease readings exceed permit parameters, TECO can reroute this water to the City of Houston’s wastewater collection system for treatment. Stormwater on the facility’s east side discharges to Brays Bayou via the City of Houston stormwater collection system. Grate inlet skimmer boxes ensure that the stormwater does not degrade Brays Bayou.

SUSTAINABILITY-TRAINED TEAM MEMBERS

TECO’s Energy Director Ram Goonie received AEE’s Legend in Energy Award in 2007. Including Ram, TECO has four employees who are certified energy managers (CEMs), one who is a business energy professional (BEP) and one who holds a LEED AP (Leadership in Energy and Environmental Design). These employees help TECO better communicate energy management with its customers and optimize its own system efficiency. TECO supports their certification and funds continuing education.

EFFICIENCY INCENTIVE

Since TECO charges chilled-water customers by the gallon, there is financial incentive to reduce return water delta T. TECO’s service agreement requires customers maintain a 12°F to 14°F delta T, but the average return is higher than 12°F, with some hitting 18°F to 20°F.
CUSTOMER ENERGY CONSERVATION SUPPORT

Through its Facility Advisory Committee (see Customer section), TECO provides ongoing energy conservation support for customers. From 1992 to 2005, TECO and its customers tracked overall savings through a special Energy Conservation Program. During that period alone, TECO and its customers reduced chilled-water consumption by 20% and steam by 4%, a total of more than 6 billion Btu saved, cutting energy costs by more than $50 million.

TECO’s 2014 annual report, “Putting Efficiency to Work,” was dedicated to customers’ and TECO’s energy efficiency. The report profiled customers and highlighted their efforts to reduce greenhouse gas emissions, increase chilled-water delta T, commission and recommission buildings and more. By sharing best practices and results (one building saved $2 million in energy costs in 2012 vs. 2008 baseline), TECO hoped to encourage other customers to adopt best practices and reduce energy use.

A number of TECO’s high-profile customers have engaged with ENERGY STAR, LEED and Energy to Care programs to help optimize their energy performance. TECO has fully supported their efforts, providing guidance and data.

Energy to Care Award Recipients - American Society for Healthcare Engineering. One of TECO’s largest customers, Memorial Hermann (a Level I trauma center), has received four Energy to Care awards for three different TECO-served buildings in the past six years. Energy to Care award winners are recognized for reducing energy consumption by 10% or more over their baseline energy consumption. The program’s goal is to empower healthcare institutions to put resources back into patient care.

ENERGY STAR®. Five TECO customer institutions – including TECO’s largest customer, MD Anderson Cancer Center – have received ENERGY STAR certification for multiple buildings since 2003. One customer institution, Level I trauma center Ben Taub General Hospital, just received its second ENERGY STAR rating in two years. The facility is the only public hospital in Texas and one of only three hospitals in Houston to have earned this certification.

LEED®. Several TECO customers have embraced LEED certification: University of Texas Health Science Center at Houston – School of Nursing received LEED Gold, and Houston Community College Coleman Health Sciences Building is pursuing LEED Silver. Although MD Anderson Cancer Center does not intend to seek LEED certification, it requires compliance with LEED v4 Silver for new building construction, building additions, and major renovation projects.

From 1992 to 2005, TECO and its customers reduced chilled-water consumption by 20% and steam by 4%, a total of more than 6 billion Btu saved, cutting energy costs by more than $50 million.

Customer quoted in TECO’s 2014 annual report

“By continuing to reduce its energy use, Shriners Hospitals for Children is serving as a responsible financial steward. Rather than directing our funding toward energy use, we’re instead able to focus monies on our mission: providing the highest quality care to children with neuromusculoskeletal conditions, burn injuries and certain other special health care needs within a compassionate, family centered and collaborative care environment.”

Cathy Moniaci, RN, MS
Hospital Administrator
Shriners Hospitals for Children - Houston
Safety is a top priority at TECO, with employees saying they “eat, drink and breathe safety.” TECO embraces a safety culture, rewarding safe behavior and encouraging safety suggestions. Its safety record reflects its success.

On Jan. 27, 2019, TECO set a new safety record: It marked **four years – 718,116 hours – worked without a lost-time incident.** (And it has extended that record to today.) The company celebrated the milestone with a cookout. All 100-plus employees received beanie hats with the TECO logo. At the one-year mark, each employee received a Yeti cooler.

The accomplishment means that TECO’s .47 rating is better than the 0.7 similar-industry average. TECO had zero OSHA-recordable incidents in 2014, one in 2015, one in 2016, zero in 2017 and one in 2018.

**Monthly employee safety meetings and safety committee meetings.** The safety committee is comprised of a representative from each department, TECO’s full-time EHS Engineer and the president/CEO. The committee discusses incidents and near misses; screens and assigns responsibility for investigating and implementing Safety Action Suggestions (SASs) submitted by employees that month; and discusses progress made on previous SASs and other issues. The CEO has a dedicated SAS-project budget.

**Safety Action Suggestions.** TECO encourages employees to suggest safety improvements year-round. Employees vote on the suggestions monthly, with the top three vote-getters receiving a cash award. The winners are grouped quarterly, and the EHS engineer selects the quarter’s top three winners, who receive a cash award. The annual winner is recognized at the annual safety and award banquet and receives a larger cash bonus.

**Standard industrial safety programs.** TECO holds safety training for PPE, LOTO, Confined Space, Hot Work, Respiratory Protection, Excavation Safety (Distribution Group), Rigging and Lifting, Aerial Lift Safety and certification, Fire Protection, Hearing Conservation, Hazardous Materials, NFPA 70E Electrical Safety Training for Operators, and Electrical Safety for Qualified Workers. It also conducts forklift training and sends employees to smoke school so they learn how to determine property stack opacity.

**Work site safety zones.** TECO uses work site safety zones including cones, barricades, vehicle placement, high visibility clothing, etc.

**Emergency coordination.** Local firefighters make their rounds at TECO and are familiar with the facility and key lock boxes for access. TECO also has a close relationship with Harris County’s emergency management personnel, meeting with them twice a year plus holding drills. They have placed TECO on a top priority list. In addition, Texas Medical Center has its own police force that is familiar with TECO’s service and knows the importance of plant security.
TRAINING
Training has always been important at TECO, but when it added more than 700 pieces of new equipment during its 2007-2011 expansion, training became paramount to system reliability and efficiency. In early 2009 the company began developing an extensive new Operator Training and Certification Program (OTCP) and rolled it out in late-2009.

From late 2009 to mid-2011, multiple levels of personnel completed 14,280 hours of training on new equipment during normal and extended hours. The 22 operators each averaged 325 hours during the same period. TECO allocated nearly $1.2 million in direct and administrative expenses for the continued OTCP from 2011-2015, not including OTCP startup.

TECO aims for continuous improvement by investing in employee training and reimbursing education costs, on- and off-site. It shows employees they are valued, instills confidence, improves performance and makes advancement and mobility possible within the company. TECO now has a full-time training manager to oversee and provide on-site training and has converted office space into an on-site training center.

Current licensed/titled positions
- 16 licensed first grade City of Houston stationary engineers
- 3 licensed second grade City of Houston stationary engineers
- 1 licensed third grade City of Houston stationary engineers
- 10 licensed professional engineers
- 1 engineer in training
- 1 TCEQ certified A/B operator for petroleum storage tanks
- 1 OSHA 40-hour HAZWOPER
- 4 certified energy managers (CEM)
- 1 business energy professional (BEP)
- 1 LEED AP
- 3 CPAs
- 1 Six Sigma Green Belt
- 1 Cisco certified entry level technician
- 1 Certified Payroll Professional
- 1 Microsoft Certified Solutions Associate

WORK ENVIRONMENT
TECO’s management maintains an open door policy, which sets a positive tone for company culture.

Employee survey. TECO has conducted an annual employee survey since 2013. Employees rate issues on a scale. TECO’s 2013 average was just short of “really good.” The 2013 results put changes in motion, including holding smaller and more regular employee meetings directly with the president/CEO. Progress has been made, as TECO’s 2018 rating (with 85% employee participation) was at the top end of “really good.”

Celebrations. TECO celebrates two months’ of birthdays every other month with an afternoon cupcake break and gives each person celebrating a cake to take home. The company also marks retirements with special posters, presentations, and a going-away party and gift tailored to the individual. Plus, it holds periodic company BBQs, with the president/CEO smoking the meat and manning the grill.

Employee support. TECO brings in experts in various topics to talk with employees. It offers free access to a financial planner who provides one-on-one, on-site consultation for employees to discuss 401ks, retirement planning, etc. Recently TECO also had someone share insights on personal internet security.

Healthcare. TECO offers a healthcare program where individuals can reduce their medical premiums if they follow through with a wellness program. The company also has an on-site workout room with free weights, treadmill and other equipment.

Reputation. TECO is known for being a great place to work. Many employees stay with the company for decades. In 2018 employees with more than 235 years’ worth of experience announced their retirements. The board and management agreed to hire replacements to overlap employment with retirees by often more than a month so knowledge could be fully transferred.

Internships. TECO’s internship program started more than 26 years ago by offering paid summer internships to employees’ children who were at least 18 years old. The program has grown, with positions now open to students outside TECO. Most internships last May to August; some interns return. All receive job safety training. TECO’s current IT manager rose through the internship program.
CUSTOMERS AND COMMUNICATION

TECO provides chilled water and steam service to 50 buildings at 16 customer institutions on the Texas Medical Center campus. Totaling 22.7 million sq ft of space, the customers include the largest cancer center and the largest children’s hospital in the U.S., two Level I trauma centers, CHI St. Luke’s Texas Heart Institute, and multiple high-level life science research labs.

These customers are TECO’s core. They have a stake in TECO’s success and a share in decision-making, with nine of the 16 represented on TECO’s board of directors. TECO stays in close contact with customers, from the board level to the operating engineer. Customers sign long-term service agreements, so much of TECO’s focus is providing high-level customer service to ensure satisfaction.

“As chair of TECO’s board of directors, I frequently interact with the other customer board members and TECO management. Together we make quite a team. TECO’s management operates with real transparency, listening to our needs and charting a path forward. The board has utmost confidence in the guidance we receive from the management team to help us make solid, insightful decisions for the future. We are committed to fully supporting the operation and growth of Texas Medical Center institutions while providing the most reliable and cost-effective chilled-water and steam service possible.”

Bradley N. Howell
Chairman, TECO Board of Directors
Representative, Texas Medical Center Corp.
Chairman & CEO, Lodestar Logistics
TECO REACHES OUT TO CUSTOMERS:

Facility Advisory Committee. TECO started a Facility Advisory Committee for operating engineer-level customers in the early 1990s and continues to hold committee meetings three times a year. From 20-25 people representing 16 institutions attend the meetings. TECO shares information from board-level presentations and discusses energy management, load shedding, environmental, water treatment, engineering, operation and maintenance, and evolving technologies.

One-on-one meetings. TECO isn’t just a utility, it’s an energy partner, so it meets personally with each customer twice a year at the customer’s location or welcomes customers to the plant for a customized tour.

Technical guidance. Although TECO doesn’t provide “consulting” services, it does provide customers with guidance. TECO has given support related to sterilizers, welding and fabrication in emergencies, water testing for determining source of leaks, troubleshooting hydraulic problems with chilled water in building, piping corrosion, and material data safety sheets for supplied chilled water and steam. It has even provided emergency diesel fuel during natural disasters.

New billing system and online customer portal. TECO is now rolling out a new billing system that includes usage graphs for both chilled water and steam. It already has an online customer portal where customers can log in and view real-time energy consumption that helps them manage their utilities and conservation efforts.

Annual online customer satisfaction survey. TECO has surveyed customers every fall since 2007. In 2018, 100% of TECO customers who responded to the 27-question survey stated that TECO met their expectations “very well” (the highest rating) in terms of providing chilled-water and/or steam service to their facilities.

Annual report. Published regularly since 2006, TECO’s award-winning annual report shares stories about TECO’s customers and employees and highlights the year’s accomplishments, metrics and financials. The goal is to give customers confidence in TECO and connect TECO to the achievements of its member institutions.

40th and 50th anniversaries. 2018 marked the 40th anniversary of TECO’s system ownership. (TECO purchased it from Houston Natural Gas in 1978). 2019 marks the 50th anniversary of the system itself, which started operation in 1969. For each anniversary, TECO produced standing and hanging banners and interior and exterior flags for the Central Plant and printed stationery noting the anniversary. For the 40th, TECO USPS-mailed customers specially designed thank-you cards personally signed by President and CEO Steve Swinson and emailed a special thank-you note on the actual anniversary of the purchase agreement signing date. For the 50th, TECO is rolling out a new website (noted above) and a system history timeline wall (8 ft x 40 ft) – including a list of all customer buildings and their connection years – to be displayed across from the boardroom. A customer thank-you event may be held in the fall near the exact anniversary of the plant’s dedication.

“...for the past 27 years, my association with TECO hasn’t been just to supply my chilled water and steam at Texas Woman’s University. They’ve supplied me with confidence that my needs will always be met and at the highest quality. To watch and participate in TECO’s Facilities Advisory Committee has been an extraordinary experience. Seeing first-hand an operation truly focused on providing for the needs of its customers has defined real professionalism for me.”

Bill Bussman
Manager, Facilities Operations - Houston
Texas Woman’s University
COMMUNITY INVOLVEMENT

The Texas Medical Center is the eighth-largest business district in the United States and is unlike any other. Institutions located on the Texas Medical Center campus— including district energy provider TECO—are members of the Texas Medical Center. TECO is the only member on campus that collaborates with the majority of institutions as a service provider. It is critical to the medical center’s mission.

The TMC board of directors recently asked TECO President and CEO Steve Swinson to represent TECO on its newly established TMC advisory committee. Participating in quarterly meetings, Swinson helps strategize campus growth and share an infrastructure perspective.

ASSOCIATION INVOLVEMENT


TECO is a longtime IDEA member and numerous employees have been and continue to be active in the association. For example, Steve Swinson is a past IDEA president and chairman, a past board member, a Norman R. Taylor Award winner, a MADE founder, a John Gray Scholarship Fund founder, and is currently chair of IDEA’s audit committee.

AWARDS AND RECOGNITION RECEIVED

- Turbine Inlet Cooling Association Excellence Award – Turbine inlet cooling – 2018
- EPA ENERGY STAR CHP Award – Combined heat and power plant – 2015
- ASHRAE Technology Award/Second Place – East Chiller Building – 2013
- Mayor’s Proud Partner Award/Certificate of Recognition – Richard E. Wainerdi Flag Plaza – 2012
- American Council of Engineering Companies Honor Award – Burns & McDonnell – 2012
- American Council of Engineering Companies Texas Excellence Award – Burns & McDonnell – 2012
- ASHRAE First Place in New Industrial Facilities or Process at Chapter – Thermal storage tank – 2011
- Steel Tank Institute/Steel Plate Fabricators Association Tank of the Year Award – Thermal storage tank – 2009
- Industrial Technologies Program Recovery Act Funding, U.S. Department of Energy – $10 million stimulus funding for combined heat and power plant
- U.S. Environmental Protection Agency Combined Heat and Power Partnership

TOURS AND DISPLAYS

TECO welcomes tour groups from around the world, averaging about 20 per year. Most recently, TECO hosted local up-and-coming construction industry leaders from Associated General Contractors of Houston. Nearly 20 members and leaders toured the plant and discussed TECO’s role in Texas Medical Center infrastructure. TECO has information display boards and framed customer profiles, which are helpful for tours. Ring photo frames were made from portions of various sizes of chilled-water piping leftover from construction. The pipes were cut into thin rings, coated with chrome and used to frame TECO photos. TECO also installed a display featuring the company’s successful rideout of Hurricane Harvey.

TECO IN THE NEWS

Numerous print and online articles have been published about or mention TECO over the past decade, including District Energy magazine, SmartCitiesDIVE, Microgrid Knowledge, Sustainable Business magazine, ASHRAE Journal, Texas Medical Center News, Houston Business Journal and Cogeneration & On-Site Power Production.
TECO REACHES OUT

2018 marked TECO’s fourth annual holiday toy drive. Each year the company selects one customer hospital and donates toys and gifts for the babies, children and teens during the holidays. Employees coordinate the drive, encourage participation, and load and deliver the donations. To make giving easy, TECO places large gift-wrapped boxes in the lobby so employees and contractors can easily drop off their donations according to age groups.

MILITARY SERVICE LAUDED

TECO currently has 12 employees who have served in the military, comprising more than 10% of its total work force. Twenty-six past employees were also veterans. To honor its veterans’ patriotic service, TECO produced a plaque placed in the lobby that features each current and past veteran’s military branch and years of service.

EMPLOYEES IN THE COMMUNITY

TECO’s employees are active volunteers throughout the area. Here are a few examples:

**Church:** administrators, Hurricane Harvey Demolition Team, holiday care packages, Hurricane Harvey Food Relief Volunteer, maintenance, youth and children’s ministry team, Bible study teacher

**Community:** outreach organizer, Houston Ensemble Theater patron, Houston Livestock Show and Rodeo, Houston Police Foundation, Houston Zoo, Hurricane Katrina Astrodome Relief, National Museum of African-American History and Culture, Pasadena Livestock Show & Rodeo, St. Anthony’s Charitable Foundation, Texas Campgrounds Club Galveston board member, United Way Day of Caring, Arms of Hope homelessness efforts

**Education:** elementary school reading mentor, Rise School of Houston, Notes for Education, Marsha Hill Scholarship Foundation for Rice University Students fundraiser

**Environment:** Keep Pearland Beautiful, Audubon Society’s Annual Bird Count, Boy Scouts beach clean-up

**Food:** St. Paul’s Necessities Pantry, Houston Food Bank, Interfaith Caring Ministries “Ani-meals” on Wheels, Meals on Wheels

**Health:** American Heart Association, American Red Cross 26-gallon blood donor, March of Dimes, Relay for Life Cancer fundraiser, Texas Children’s Hospital Ambassador Program, Head for a Cure, Texas Adaptive Aquatics water sports training for disabled people, treasurer for local chapter drug and alcohol prevention program

**Youth:** Little Brother Mentor for Big Brothers and Sisters of America, SEARCH Homeless Services, Girl Scout cookie manager, patrol leader for Trail Life USA Troop, school annual coat drive, team rep for little league baseball, neighborhood back-to-school drive, youth martial arts Instructor