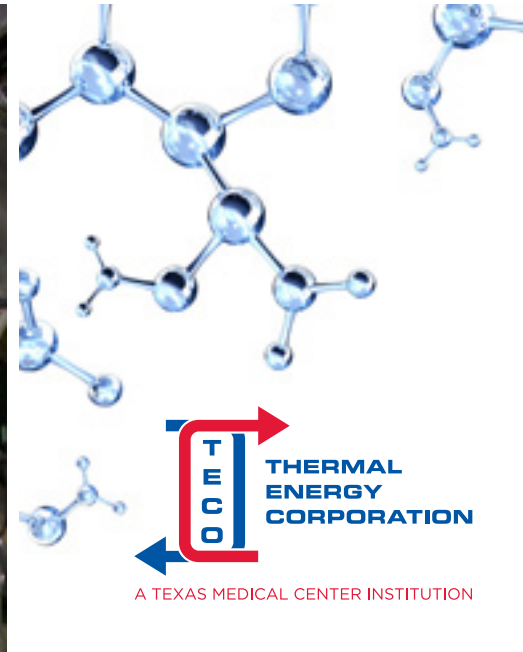


50  
YEARS

1969-2019  
COMMEMORATIVE ISSUE

2019 ANNUAL REPORT

# The Energy Behind What's Next: The legacy continues



A TEXAS MEDICAL CENTER INSTITUTION

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TECO Board of Directors  
Representative  
Texas Medical Center  
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The University of Texas  
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\* Through October 2019

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A TEXAS MEDICAL CENTER INSTITUTION

## THE ENERGY BEHIND WHAT'S NEXT

Mission: Provide reliable and economical thermal services to the institutions of the Texas Medical Center.



# Contents



“

Someone is sitting  
in the shade today  
because someone  
planted a tree a  
long time ago.”

Warren Buffett, *investor and philanthropist*



TECO has the simple but daunting task to be perfect 100% of the time, providing chilled water and steam every minute of every day to mission-critical facilities. Lives and invaluable research are at stake. It's a zero-fail mission."

Bradley N. Howell, June 2019, IDEA2019: The Energy for More Resilient Cities

### To our customers and friends in the Texas Medical Center and our energy industry colleagues

As we write these words, the Texas Medical Center, Houston and the rest of the world are feeling the effects of a COVID-19 pandemic. Thermal Energy Corporation is following the lead of community leaders and medical professionals and taking actions to protect our workers while maintaining reliable chilled-water and steam service.

It is our collective strength and resolve that will see us all through such an unprecedented time. We have met and conquered major challenges before. We are ready.

While 2020's story continues to be written, Thermal Energy Corporation's 2019 annual report, "The energy behind what's next: The legacy continues," looks back and at what lies ahead.

2019 was a year of celebration: TECO marked the 50th anniversary of its district energy system. In tribute, our 2019 report is a commemorative edition, one wider in scope that features each of our customer institutions and the TECO departments that serve them. You'll see common threads - new technology, innovative solutions, and eyes trained fully on the future. They are leaders in their fields.

2019 also brought accolades: TECO was selected district energy System of the Year by the International District Energy Association. We were on hand for the ceremonies as TECO was recognized by our industry peers. It was an honor.

TECO's success drew the attention of then Energy Secretary Rick Perry, who visited our Central Plant in July. We gave him a tour and shared system highlights, noting TECO is the largest district cooling system in North America and that it serves the largest medical center in the world.

TECO's growth has been intentional. We have always looked ahead to what's next while ensuring our

reliability - our legacy - is never compromised. We've paralleled the growth of the Texas Medical Center and its member institutions throughout the system's 50 years of operation.

While we applaud the past, the Texas Medical Center of the future is more important than ever. With the upcoming addition of the research collaborative TMC<sup>3</sup>, there will be more researchers and inventors on campus, potentially discovering a vaccine for the next life-threatening virus, designing new ventilators, or modeling new manufacturing techniques. The possibilities are endless.

Indeed there has been no other moment in our lifetimes that demonstrates the absolutely critical role health care and health care professionals play in our lives. On behalf of TECO's Board of Directors and our employees, we extend our heartfelt gratitude to our health care customers. It is an honor to serve you.

Stephen K. Swinson, PE  
President and Chief Executive Officer

Bradley N. Howell  
Chairman



# Building a legacy

## 1960s

1966

Texas Medical Center commissions Brown & Root to conduct a study to determine the need for and feasibility of a Central Heating and Cooling plant.

1967-1968

Texas Medical Center contracts Houston Natural Gas Corporation (HNG) to construct \$4.5 million Central Plant to produce chilled water and steam.

(summer) 1969

HNG completes construction of central cooling and heating plant and begins to serve buildings on the Texas Medical Center campus.

## 1970s

1975

Texas Medical Center Central Heating and Cooling Services Association (Thermal Energy Cooperative) forms to explore acquisition of chilled-water and steam system from HNG.

1978

Thermal Energy Cooperative acquires chilled-water and steam system from HNG and enters into membership and service agreements with Texas Medical Center customers.

## 1980s

1980

TECO begins major energy-efficiency and reliability improvements, including conversion to a combination of natural gas, utility electric power and emergency power production.

## 1990s

1991

Adds **South Main Plant**, a satellite with additional chilled-water and steam capacity.

“

[The site] requirements [for a central plant] were that it had to be on the central campus, it had to be near the bayou...and it had to be near some good electrical service. The present site was chosen and made available by the Medical Center.” - Paul G. Bell, Jr.

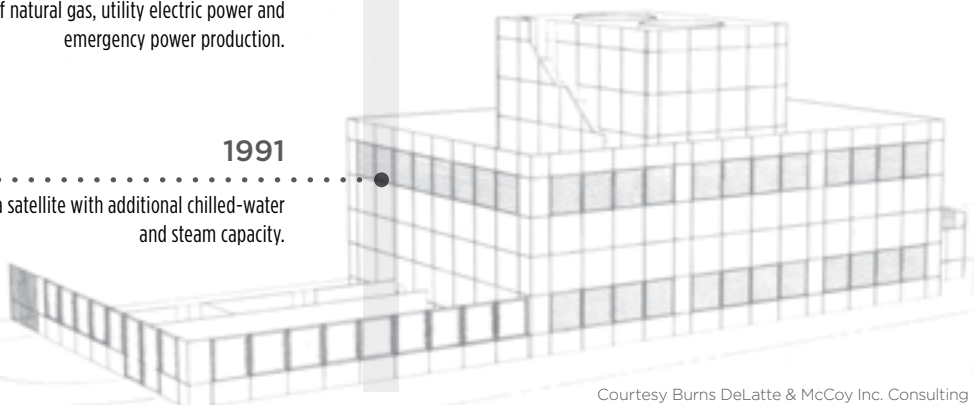
# 1969

November 25

Officials inaugurate the Central Plant.

10,000 tons chilled-water capacity  
250,000 lb/hr steam capacity  
2 chillers  
2 boilers

1969



Courtesy Burns DeLatte & McCoy Inc. Consulting Engineer

# 2000s

2002

Changes name to Thermal Energy Corporation.

2003

Shifts from cooperative to a 501(c)(3) not-for-profit corporation.

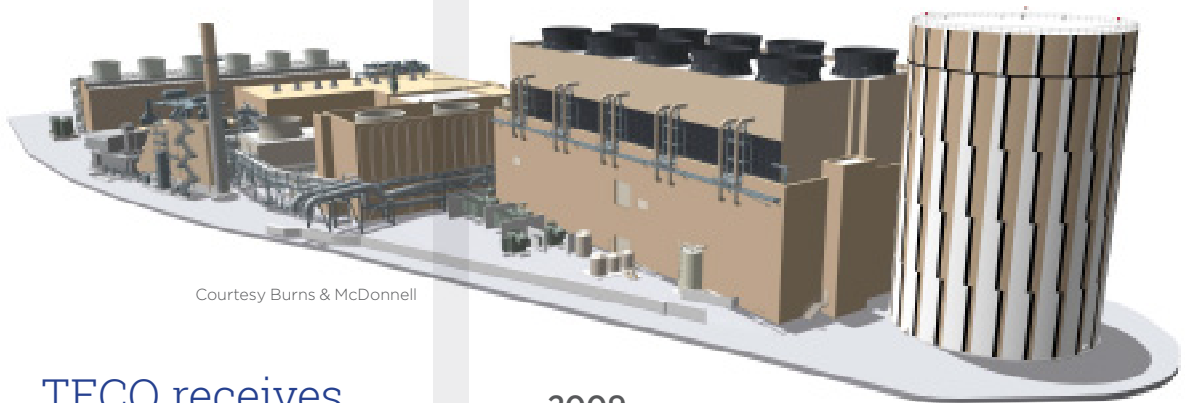
2003-2004

Interconnects Central Plant and South Main Plant distribution systems to allow for expansion, even greater efficiency and reliability.

Completes construction of floodwall and other major infrastructure upgrades to protect against future flood damage and disaster impact.

2006

Undertakes master planning and expansion construction project to support growth of Texas Medical Center.



Courtesy Burns & McDonnell

2009

Completes 8.8 million-gallon chilled-water storage tank, then tallest in the world.

2010

Finishes 48 MW combined heat and power (CHP) unit, designed to produce enough electricity to power Central Plant, keeping chillers and boilers running even if electricity grid goes down.

2011

Celebrates completion of expansion construction, including East Chiller Building.

2018

Recognizes 40 years since system acquisition.



**120,170** tons chilled-water capacity  
**980,000** lb/hr steam capacity  
**27** chillers + **thermal storage**  
**9** boilers

2019

TECO receives International District Energy Association's System-of-the-Year award for 2019 and recognized as "a world-class organization with world-class people in charge."

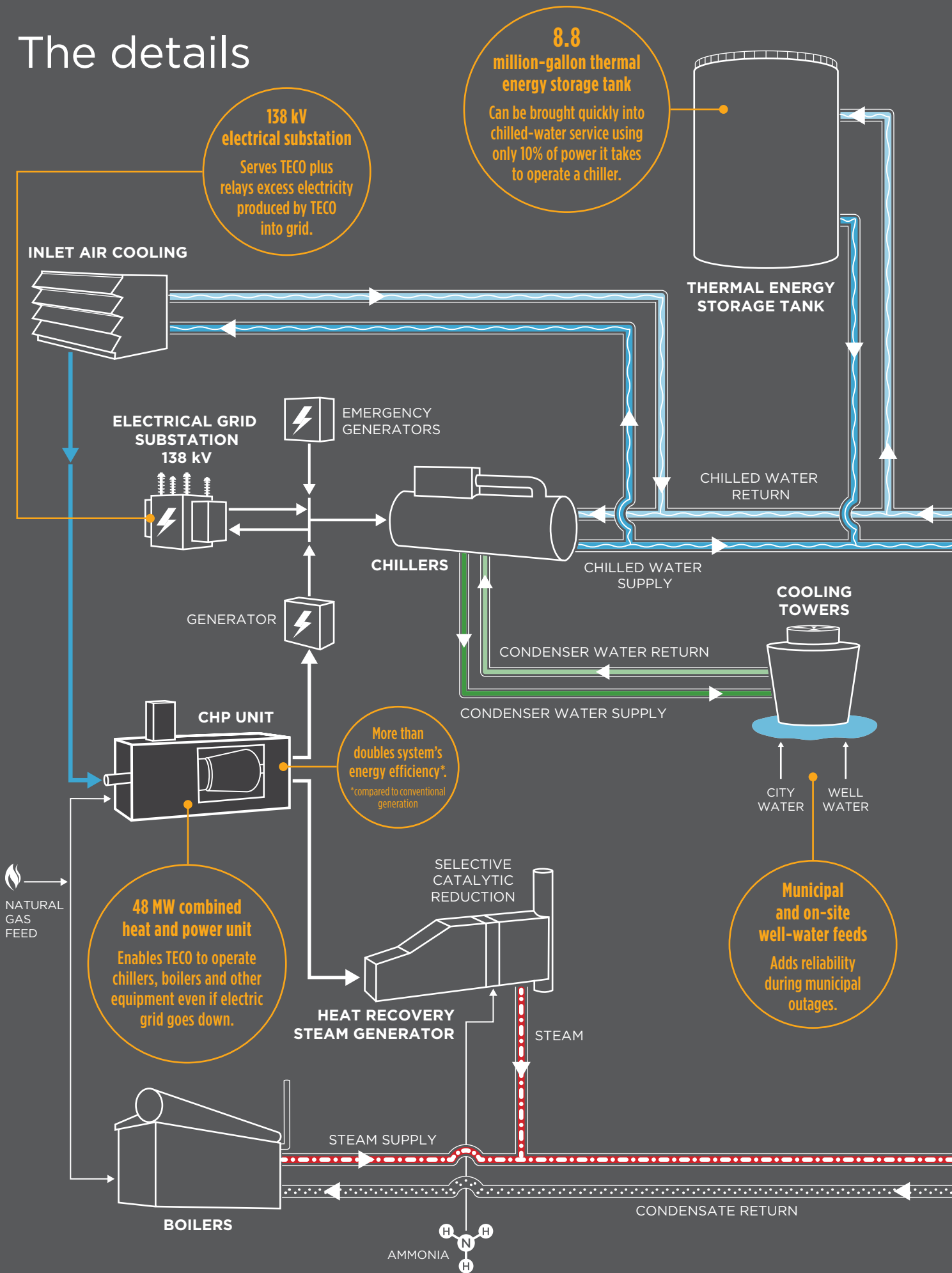
# 2019

Marks district energy system's 50 years of chilled-water and steam service to Texas Medical Center campus.

## Celebrating 50 Years

1969-2019

# The details

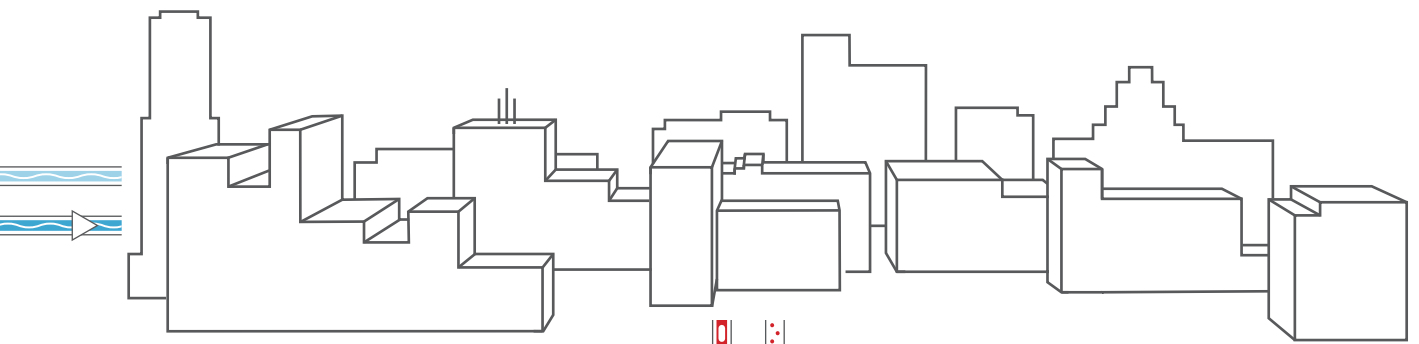


(Central Plant conceptual diagram / not to scale)



Doctors performing innovative surgeries. Researchers developing life-saving drug therapies. Students learning the latest on modern medicine. All while just blocks away, TECO reliably and efficiently keeps chilled water and steam flowing, serving their operatories, laboratories and classrooms—doing its important work so customers can keep doing theirs.

# How it works



## EXCEPTIONALLY RELIABLE

Automated and monitored around the clock, TECO has maintained 100% reliability for its customers with no unplanned outages in 27 years.

TECO's efficiencies helped reduce customer rates 14% from 2015 to 2019.

## The basics

TECO's combined heat and power-based district energy system uses chillers and boilers to produce chilled water and steam at two interconnected plants – the Central Plant (Paul G. Bell, Jr. Energy Plant) and South Main Plant. TECO then pipes the chilled water and steam underground to customer buildings on the Texas Medical Center campus.

Customers use the chilled water for space cooling, cold rooms and refrigeration and the steam to meet space heating, dehumidification, humidification, sterilization, kitchen, sanitary and research requirements. Customers do not need their own chillers or boilers since TECO's chilled-water and steam system does that work for them.

“

Legacy is not  
leaving something  
for people. It's  
leaving something  
in people.”

Peter Strople, *speaker and mentor*

**We are**

engineers

accountants

operators

supervisors

analysts

assistants

mechanics

coordinators

IT specialists

leaders

procurers

planners

technicians

providers

**We are TECO.**  
Here is what we do.



# ADMINISTRATION





# Empowering and inspiring

An interview with Steve Swinson, President and Chief Executive Officer

**DURING THE PAST TWO YEARS, TECO HAS TAKEN A SPECIAL LOOK BACK AT ITS HISTORY. WHAT HAS STOOD OUT TO YOU ABOUT THE SYSTEM AND THE ORGANIZATION OVER THE YEARS?**

First, of course, there has always been a commitment to service reliability. There's no question about that. But it has also been interesting to look at the leadership through the decades and what was accomplished during each leader's era - at both the board and management levels. It's clear that the right leaders were in place at the right time to make the right things happen. Everyone brings different strengths to the table - and TECO has benefitted from that.

**YOU ARE THE PRIMARY LIAISON TO TECO'S BOARD OF DIRECTORS. WHAT ROLE DOES THE BOARD PLAY IN TECO'S OPERATIONS?**

TECO bought its district energy system from Houston Natural Gas Company in 1978 - and from the beginning, we've had a strong Board of Directors. TECO started as a cooperative. Today we have a not-for-profit business structure, but our bylaws still govern us as a cooperative. The board is active, not just at the board level, but also on our long-range planning, compensation and benefits, and

finance and audit committees. The board acts as owners and has been consistently forward-thinking. TECO has always been ready to serve the growth of the Texas Medical Center because of the board's visionary and strategic thinking.

**TECO HAS FIVE MAJOR DEPARTMENTS, INCLUDING YOUR OWN. HOW DO YOU BRING YOUR TEAM TOGETHER, WORKING TOWARD A COMMON GOAL?**

I look at leadership as an upside-down pyramid. I'm at the bottom. My role is to empower the people above me so they can empower the people above them, and so on. The edges of the pyramid are our boundaries that set the company's values, our mission and our commitment to our customers. For instance, we're never going to compromise reliability, we're going to maximize economic value, we're going to schedule maintenance so maintenance doesn't schedule us, we're going to be precise and accurate. You get the idea. If you have those boundaries, and you've empowered the people above you, and they've empowered the people above them, you're all going to head in the same direction. I don't think it's possible - and it shouldn't be necessary - for me to be involved in every decision. Every person at TECO has 100% of my trust and confidence. That's why they're here.

**YOU REPRESENT TECO IN SEVERAL ORGANIZATIONS. PLEASE SELECT TWO AND TELL US MORE.**

I'm honored to be a member of TMC's Advisory Board of Directors. There we learn details about TMC campus growth, such as TMC<sup>3</sup>. It's vital information for me to bring back to TECO, plus I like to think we can provide insight to TMC as well. TECO is also a long-time member of the International District Energy Association. I've been actively involved for decades, serving on the board and as board president. Now I head up the John Gray Scholarship Award committee, which is near and dear to my heart. The late John Gray was a revered mentor who was committed to bringing new people into the district energy industry and providing them with knowledge and insight to make them the leaders of tomorrow. I am proud to have taken up that mantle. ○

# ..... HUMAN RESOURCES



Hiring  
Salary and wage administration  
Benefits administration  
Employee retention  
Employee performance evaluation  
Payroll processing  
Health and financial wellness programs  
Tuition assistance



# Reimagining what's next

An interview with Clarissa Brewster, Vice President,  
Human Resources

## **WHAT IS THE GREATEST VALUE THE HUMAN RESOURCES DEPARTMENT BRINGS TO TECO'S EMPLOYEES AND CUSTOMERS?**

For employees, I think it's that we are on-site. We're always here. We're accessible and transparent. Employees can pop in any time. For our customers, I think that our recruiting, employee retention and succession planning matter because they show our commitment to our customers. Customers can feel confident they will get good service from us – whether from a long-time employee or someone new.

## **TELL US MORE ABOUT YOUR RETENTION AND RECRUITING EFFORTS.**

A solid benefits package is important for both recruiting and retention. We've maintained the same level of benefits since 2014, sometimes changing providers, but never cutting offerings. That's appealing when trying to attract new employees. We actually do about 90% of our recruiting in-house. We outsource for some positions, but for most jobs we ask employees to provide leads through an incentive-based referral program. If employees are willing to refer their friends and family, it means they trust TECO as an employer. And when an employee recommends someone, we feel the prospect is likely to be a good fit for our team.

## **DOES TECO OFFER OTHER PROGRAMS BEYOND ITS STANDARD BENEFITS PACKAGE?**

Yes! We're always looking for ways to support and engage employees. One of our newest efforts is a wellness program that rewards employees for making healthy choices and following healthcare recommendations. It's not only good for our team members, but for our customers as well. Healthy employees perform at peak levels! We also have a financial advisor visit quarterly to present tips so employees can make smart decisions about their money. Twice a year we provide more advanced 401k educational sessions. We also offer lunch-and-learn sessions on retirement planning, personal finance, smart internet use and other hot topics.

## **WHAT WERE HR'S MOST SIGNIFICANT ACCOMPLISHMENTS IN 2019?**

We restructured so we now have three people supporting our employees. Plus, we revamped TECO's tuition assistance program. Employees used to pay 100% of their own tuition costs upfront. After passing the course, TECO would reimburse 90% of the cost. Now TECO will pay the 90% upfront, plus 90% of incidental course-related expenses upon proof of passing the course. Lessening the financial burden upfront has boosted participation. We also implemented new HR payroll software that has more functionality, including an incredibly useful training and certification tracking module.

## **WHAT DO YOU SEE AHEAD FOR TECO'S HR DEPARTMENT?**

Our department was largely paper-based, so we're making a concerted effort to go digital. We've scanned and archived paperwork, and we'll be leveraging the features in our new HR payroll software to further streamline processes. Overall, I look forward to continuing the great collaboration I have with our CEO Steve Swinson and the three other vice presidents. The VPs meet for lunch once a week and toss around ideas, keeping each other up to speed on what's happening and how we might help. In fact, I think of TECO as one big brainstorm. The company now uses the tagline, "The energy behind what's next," but I think we could change it to, "Reimagining what's next." It's what we do every day! ○

# FINANCE





Financial reporting and analysis  
 Internal controls  
 Treasury management  
 Accounting  
 Procurement  
 Rating agency interface  
 Equity calculation  
 Budget  
 Audit  
 Risk management



# Integrity and accuracy

An interview with Carolyn Luomala, Vice President, Finance

## WHAT ARE THE FINANCE DEPARTMENT'S STRENGTHS?

It boils down to integrity, accountability, transparency, professionalism and accuracy. I started at TECO in early 2019 and quickly observed that the members of the finance department were stellar performers. In fact, I learned that TECO has had a clean annual audit for as long as anyone can remember, and that goes back 28 years! I've been extremely impressed with the team's accuracy. I rarely see things coded incorrectly or missed at TECO.

## TELL US MORE ABOUT YOUR TEAM.

There are four people on the accounting team and two on the procurement team, plus me. Regardless of whom they report to, I meet with each person at least once a week, and we do a download of what's going on. I want everyone to have a clear sense of purpose and direction and know they're an important part of the department. We also meet in groups to exchange ideas. Sometimes that's in the hallway, sometimes it's a sit-down meeting, sometimes it's even over breakfast. We are definitely a team.

## LOOKING BACK ON 2019, WHAT WERE THE DEPARTMENT'S GREATEST ACHIEVEMENTS?

We had another clean audit. We moved to ACH payments, changed insurance brokers, shifted to an online environment for financial reporting, and now use Microsoft Teams to

coordinate our work with other departments. We also set up a sweep account with our bank. I credit our controller, Kevin Giblin, for identifying that opportunity. It's really paying off! We also received notice that TECO will continue to hold a AA S&P global rating. We're pleased, as that accomplishment reflects well on our organization's financial stability under even stricter S&P conditions than previous years.

## HOW IS THE FINANCE DEPARTMENT EVOLVING TO MEET THE NEEDS OF TECO'S CUSTOMERS?

To be as efficient and accurate as possible, TECO's finance department has changed through the decades to keep pace with technological advances in business software and related processes. That will certainly continue! We're moving paperless (we could be totally paperless in five years), upgrading our accounting software, adopting new accounting standards and evaluating future financing sources related to growth. We'll be ready so TECO can be ready as new buildings go up on the Texas Medical Center campus.

## HOW DOES THE FINANCE DEPARTMENT INTERACT WITH OTHER TECO DEPARTMENTS?

We prepare monthly financial statements and hold monthly in-person reviews with people in each department. We also compile overall revenue and expenses to date. Expenses are almost always under budget, which is quite an achievement. We also talk through the timing of projects in every department so we know what expenses are likely to be incurred when. We also stay in touch weekly, if not daily. We don't want to miss anything!

## WHAT WAS ONE OF TECO'S MOST SIGNIFICANT FINANCIAL ACCOMPLISHMENTS IN 2019?

Everyone at TECO does a great job of staying on top of revenue and expenses. When we closed out 2019, we were able to provide customers with a rebate plus obtain board permission to fund two major capital projects. TECO's strict attention to production efficiency and cost control is enabling us to make investments that further enhance system reliability. ○

# ENGINEERING AND MAINTENANCE



Plant and distribution system engineering  
Project engineering and management  
Plant and distribution system maintenance  
Equipment health and reliability  
Inventory management  
Environmental health and safety  
Information technology



# Continuous improvement, always

An interview with Mike Manoucheri,  
Vice President, Engineering and Maintenance

## **ENGINEERING AND MAINTENANCE ARE TWO MAJOR FUNCTIONS WITHIN THE COMPANY. HOW DO THEY INTEGRATE THEIR WORK?**

Engineering and maintenance employs 54 people, so we're more than half of TECO's work force. We often think of ourselves as the "reliability department." We design system components for reliability and resiliency upfront, and then we maintain all facets of the system to make sure they stay that way. So it makes sense that the two teams work so closely together. We learn from each other. Sometimes the maintenance guys point out how we could change future designs to reduce issues on their end, so that drives continuous improvement. In both areas TECO has always taken a "belt and suspenders" approach for reliability, which has proved successful.

## **WHAT MAJOR PROJECTS ARE BEHIND YOU, AND WHICH ONES WILL SOON GET UNDERWAY?**

We wrapped up two major distribution system projects in 2019 – the extensions and connections to Memorial Hermann and Ben Taub. Those were each multi-year projects, so it was gratifying to complete them and begin service. Looking down the road, we have two big projects: a new gas compressor at the Central Plant and one distribution project. We'll be replacing the 50-year-old Bertner-Holcombe steam line with a pre-insulated steam pipe that's inside an exterior-

grouted steel casing. We'll seal the ends with steel and weld bellows to the pipe. The approach is impermeable and has proved effective in other areas of the system.

## **WHAT ROLE DOES DIGITAL TECHNOLOGY PLAY IN THE DEPARTMENT'S DAY-TO-DAY ACTIVITIES?**

As with most companies, digital technology is playing a greater and greater role in our business. We're ramping up its use for scheduling predictive and preventive maintenance projects, and we're tapping it to help us archive older plans and documents. We've contracted a third party to streamline document retrieval, which will help us improve productivity.

## **WHAT EXTERNAL FACTORS MOST AFFECT YOUR DEPARTMENT?**

The primary factor relates to our workforce. It's absolutely critical that we hire well-qualified people who will be as committed as we are to delivering excellent service. It's not always easy, as there is a lot of competition from gas and oil companies that have higher pay scales than we do. We pay fairly, provide stability, have excellent benefits and offer a positive – and safe – work environment. That ultimately helps many to choose TECO. There are some folks who are enticed by higher pay and leave, but sometimes they contact us later and want to come back. We feel we offer a great work-life balance, benefits beyond a paycheck.

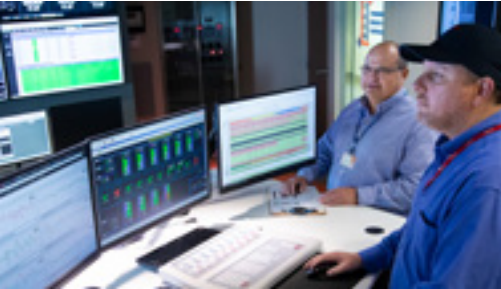
## **WHAT DO YOU ENVISION FOR TECO FIVE – OR EVEN 10 – YEARS DOWN THE ROAD?**

I can sum that up in one word: expansion. The Texas Medical Center and a number of its member institutions have major projects on the drawing board, and we'd be happy to serve them. We have space to expand within our East Chiller Building, with room for six additional 8,000-ton chillers. We're now updating our master plan and looking at that existing space and all of our options from a variety of angles. Everything is on the table. We brainstormed the future internally, and now we're meeting with a range of experts to see what's possible. Whatever approach we choose, we'll be ready to serve. ○

# OPERATIONS



Plant and equipment operations  
Chemistry monitoring and control  
Environmental monitoring and control  
Fuel procurement  
Water management  
NERC compliance  
Customer billing and invoicing  
Customer/facility relations  
Training



# Vision, best practices lead

An interview with Jason Berrio, Vice President, Plant Operations

## THE OPERATIONS DEPARTMENT IS VITAL TO TECO'S EXISTENCE. TELL US MORE.

Without the operations team, the chilled water and steam wouldn't flow! We have operators on-site 24 hours a day, seven days a week to maintain service to our customers, even during major storms such as Hurricane Harvey. We're proud of our track record. We have reliably provided 100% of our demand for the past 27 years. In addition, our team members purchase fuel, analyze energy efficiency, and manage billing. They get to know customer buildings and their energy requirements well. The team even forecasts customers' future chilled-water and steam needs so customers can integrate our information into their budgets.

## WHAT ARE THE OPERATIONS DEPARTMENT'S GREATEST STRENGTHS?

I'd say experience and our commitment to mentoring. We have a broad range of experience in our operations group. We have people who have been here close to 30 years, some who have been here 10 to 15, and then about 25% who have worked here fewer than three years. It's a great mix. We have a lot of knowledge to share with new employees, and we do that through mentoring and even storytelling. Storytelling is a great way to reinforce real-life examples of what's happened in the past and what has worked and what didn't.

## WHAT WERE YOUR IMPRESSIONS OF THE OPERATIONS DEPARTMENT WHEN YOU STEPPED IN AS VP IN 2017?

I was impressed. It was a blessing to come in and see the level of documentation the team had put together over the years. There were all kinds of "breadcrumbs" to follow, which has been invaluable. Specifically, the department has established many best practices that have proved to work time after time. We don't want to lose sight of those! So we're going to be integrating that information into new technologies for quick and easy access.

## WHAT WERE THE DEPARTMENT'S BIGGEST ACCOMPLISHMENTS IN 2019?

2019 was busy! With board approval, we purchased a 10-year block of power. We got an excellent price that allows us to maintain stable energy pricing for the next decade. We also were pleased to maintain a near net-zero demand during ERCOT's 2019 demand assessment period, which means we will not incur excessive demand charges for 2020's electric use, saving us money. Plus, we became a supporter of Water Wise, an award-winning education program that teaches children about protecting and conserving precious freshwater resources. TECO funds about 2,600 student "Water Detective" kits a year and, in exchange, we receive water credits worth 84,000 gallons of groundwater to be withdrawn in excess of our normal permitted allowance, up to 50% of our total water usage. This reduces TECO's city water consumption and reduces costs.

## IN 2019, TECO RECEIVED INTERNATIONAL RECOGNITION. WHAT ROLE DID YOUR DEPARTMENT PLAY?

TECO is a longstanding member of the International District Energy Association (IDEA). IDEA holds a district energy System-of-the-Year competition, and in 2019 chose TECO as the top district energy system in the world. Our department facilitated and submitted TECO's award entry. TECO also received IDEA awards for contracting or renewing the most number of customer buildings and the most square footage in the U.S. in 2019. It was an honor for our department to accept the awards on behalf of TECO. It was a great year. ○



## The TECO Team

Haley Ackman  
 Marsha Ackman  
 Craig Acree  
 Rosalie Arellano  
 James Arnett  
 Priscilla Avila  
 Henry Barrios  
 Rohnald Benfield  
 Rohn Benfield  
 Christopher Beroo  
 Jason Berrio  
 Clarissa Brewster

Julian Brewster  
 Fabian Charry  
 Callen Clark  
 Brian Connell  
 Corey Contreras  
 Lori Cook  
 Milton Cowan  
 Charles Darden  
 Shawn Dennis  
 Ryan Doucet  
 Jackson Fay  
 Kerry Fischer

Kyle Fridley  
 Manuel Gamez  
 Joey Garcia  
 Jose Garcia  
 Kevin Giblin  
 Ross Goedeke  
 Phillip Gonzales  
 Vincent Gonzales  
 Ram Goonie  
 Manny Guerra  
 Dakota Hall  
 Travis Hampton

Mike Handorf  
 Jess Harper  
 Troy Hollin  
 Cory Hubbell  
 Mycah Jewell  
 Juan Jimenez  
 Brandon Johnson  
 Barbara Johnston  
 Brady Jones  
 Austin Kelly  
 Nolan Lambert  
 Antonio Lopez



Carolyn Luomala  
 Joshua Lybarger  
 Anthony Manning  
 Mike Manoucheri  
 Jared Marish  
 Eddie Martinez  
 Joel McCormick  
 Lamont McInnis  
 John McNeil  
 Dan Mitten  
 Frederick Musil  
 Philip Muzar, Jr.

Stephen Nagy  
 Christopher Olson  
 Fidel Orizaba  
 Walter Pascua  
 Thomas Penzi, III  
 Shelly Pesak  
 Kim Pettis  
 Kelly Powell  
 Sean Price  
 Faustino Quiroz  
 Tim Reardon, IV  
 Jenice Ricks

Melissa Ripple  
 Joey Rodriguez  
 Juan Rodriguez  
 Brad Rogers  
 Carlos Romero  
 Jake Ruttle  
 Tong Sahnnon  
 Marty Sarch  
 Jason Savoie  
 Jared Schneider  
 Jeffrey Snover  
 Phyllis Sousley

Don Stowe  
 Steve Swinson  
 Ramon Tapia  
 Mike Thamm  
 Karen Thomas  
 Steve Toro  
 Justin Underwood  
 Salomon Vega  
 Scotty Walker  
 Linsey Whalen  
 Shane Williams

### Key Business Partners

Burns & McDonnell  
 CenterPoint Energy  
 ChemTreat  
 Cool Solutions  
 DaCott Energy Services  
 EDF Energy Services  
 Frost Bank  
 GE Gas Power  
 HALO Branded Solutions Inc.  
 Jackson & Ryan Architects  
 Johnson Controls, Inc.  
 Stanley Consultants  
 Tellepsen  
 Toshiba International Corporation  
 Westerlund Communications Inc.  
 Willis Tower Watson

“

The best way to  
predict the future  
is to create it.”

Abraham Lincoln, *U.S. president*



They are

patients

scientists

caregivers

inventors

physicians

surgeons

custodians

entrepreneurs

therapists

cooks

executives

professors

technicians

visionaries

They are our customers.

Here are their stories.





Courtesy Texas Medical Center

## TMC<sup>3</sup> IN PROFILE

Research labs, conference center,  
office space, lodging, dining

\$1.5 billion project

30-plus acres

1.5 million sq ft  
of built environment

Scheduled for  
completion in 2022

# Texas Medical Center

---

## Capitalizing on collaboration and innovation

### TMC IN PROFILE

Largest medical city  
in the world

60+ member institutions

50 buildings

Nearly 23 million sq ft  
of built environment

Two Level 1 trauma centers

Multiple world-class life  
science research laboratories

\$2 billion of annual  
life science research

Founded 1945





By uniting its unrivaled resources and expertise, the Texas Medical Center can more readily drive the commercialization of breakthrough ideas, expand its reach as a global medical leader and ultimately transform human health.”

From TMC<sup>3</sup> Vision Statement

**A**s the Texas Medical Center (TMC) celebrates its 75th anniversary in 2020, it is well on its way to transforming its already remarkable legacy into a future of unrivaled knowledge and accelerated life science advancement and investment.

The Texas Medical Center’s potential has never looked brighter as it rolls out the clear vision set forth by member institutions in 2014 in its first-ever collaborative strategic plan. One of the plan’s many shining stars is TMC<sup>3</sup>, a planned new complex of collaborative translational research facilities that epitomizes “what’s next” in health care.

### VISUALIZATION

Preliminary designs for TMC<sup>3</sup> were announced in 2018 by its founders: TMC, Baylor College of Medicine, Texas A&M University Health Science Center, The University of Texas Health Science Center at Houston, and The University of Texas MD Anderson Cancer Center.

The complex is being designed to foster what the project’s architects call problem-solving “collisions” among clinicians, researchers and entrepreneurs working within the TMC ecosystem.

Scheduled for completion in 2022, TMC<sup>3</sup>’s centerpiece will be a “necklace” of outdoor plazas and green spaces designed to evoke DNA’s elegant double-helix form and support an eat, work and play environment. The initiative is expected to bring more than 30,000 new jobs and an estimated \$5.3 billion in economic impact to TMC and the Houston region.

### INCUBATION

As part of TMC’s strategic plan, TMC institutions established six collaborative institutes, including the Innovation Institute, which was founded in 2014. The Innovation Institute serves as an early example of the exponential possibilities the collaborative TMC<sup>3</sup> campus will hold.

More than 100 companies have operated or currently operate at the institute, taking advantage of opportunities

to co-create with scientists and clinicians from TMC member institutions.

Robotics, artificial intelligence, Internet-of-Things prosthetics and match-making software (to match nurses with jobs in remote locations) are being researched, incubated and guided to market at the institute. In 2017 the institute’s first “graduate,” a surgical adhesives start-up, was acquired by a global pharmaceutical company.

### CAPITALIZATION

Statistics helped drive the push for TMC<sup>3</sup> and Innovation Institute development. Texas currently lags other key U.S. states in the ratio of research funding to venture capital financing attracted by its companies and institutions. That ratio is a key measure of a region’s ability to translate research discoveries into thriving businesses – serving customers, generating jobs and creating economic impact.

Currently 22-to-1 for Texas, the ratio is 6-to-1 in California and 8-to-1 in Massachusetts, two health care

powerhouses at opposite ends of the nation.

With more than \$240 million in venture funding already having flowed to start-ups being fostered by TMC’s Innovation Institute, Houston is well on its way to achieving a key goal in its strategic plan: become the nation’s “third coast” for life sciences. ○



TMC<sup>3</sup> is one of the most transformational things that will ever happen to the Texas Medical Center. This will really set the cornerstone of how we do things in the future.”

William McKeon, President and CEO, Texas Medical Center

Baylor College of Medicine – ranked the No. 1 medical school in Texas – is “a health sciences university that creates knowledge.”

It may sound ambitious, but the forward-leaning research inspired by those words is nothing short of interplanetary in scope.

Baylor’s Center for Space Medicine overlooks Rice University Stadium, where in 1962 President John F. Kennedy delivered his historic “we choose to go the moon” speech. Here researchers create knowledge that will enable humans to maintain good health and performance as we continue to explore – even eventually colonize – outer space.



Humanity is driven to explore the unknown and challenge the boundaries of what is possible.”

Jeffrey P. Sutton, M.D., Ph.D.  
Director of the Center for Space Medicine

Through a cooperative agreement with NASA, the center’s Translational Research Institute for Space Health (TRISH) seeks to connect medical research and funding to convert leading-edge discoveries into useful strategies and technologies that will mitigate the health challenges posed by deep space.

Current TRISH projects include developing systems that will operate in deep space to

**MONITOR** anxiety and stress,

**IMPROVE** sleep,

**PROVIDE** ‘just-in-time’ medications using a plant-based platform,

**MANUFACTURE** pharmaceuticals,

**USE** retinal imaging to detect risk of stroke, and

**LEVERAGE** video gaming as a training tool to simulate how human physiology and medical diagnosis change in space.

It is because of such futuristic work that for 20 years Baylor College of Medicine has ranked No. 1 among academic institutions for NASA-funded life science research and development. [O](#)

# Baylor College of Medicine

Exploring a galaxy  
of health care possibilities



Courtesy NASA



This is an exciting time in neuroscience and neurotechnology, and I feel that within my lifetime we can restore functional sight to the blind.”

Daniel Yoshor, M.D., Chief of Neurosurgery  
Baylor St. Luke's Medical Center

## Baylor St. Luke's Medical Center

Giving patients a second chance  
at sight



As chief of neurosurgery at Baylor St. Luke's Medical Center, Dr. Daniel Yoshor would be the first to admit he's no miracle worker. Yet Yoshor is co-leading a feasibility study that holds the promise of a rather miraculous-sounding outcome: allowing people who've become blind to regain useful vision.

Yoshor is one of two principal investigators evaluating the Orion® Visual Cortical Prosthesis System. Developed by Second Sight Medical Products Inc., the device is designed to create an artificial form of useful vision for people who have acquired blindness through causes that include glaucoma, diabetic retinopathy, optic nerve disease or traumatic eye injury.

Using a tiny video camera mounted on eyeglasses, Orion converts captured images into electrical impulses that are transmitted wirelessly to electrodes implanted on the brain's visual cortex. The study's 12-month results were positive, including a husband who reported he was able to see and navigate curbs and sidewalks on evening walks with his wife.

That Yoshor's visionary research is ongoing at Baylor St. Luke's is no surprise. A joint venture between Baylor College of Medicine and CHI St. Luke's Health, Baylor St. Luke's is legendary for its pioneering "firsts." It is home to the Texas Heart Institute, which performed the first successful heart transplant in the United States, as well as the world's first implantation of an artificial human heart.

The Orion study is the latest advance in more than a decade of forward-looking research by Yoshor and colleagues into potential treatments for acquired blindness.

"When people think of sight, they tend to think of the eyes, but in reality, the brain plays a significant role," Dr. Yoshor says. "Using this device, we now have the ability to activate the part of the brain that handles sight. This is an exciting breakthrough in neuroscience and neurotechnology and brings us one step closer to restoring functional sight in the blind." ○



# Children's Nutrition Research Center

## Feeding a more healthful future

For any society, children are the ultimate legacy. A gift handed down by each preceding generation.

But in the United States, childhood obesity threatens a future populated by healthy, long-lived adults. According to the Centers for Disease Control, nearly 20% of youngsters ages six to 19 are obese.

From genetics and metabolism to nutrition and lifestyle, scientists and medical professionals know many of obesity's causes and contributing factors. Finding corrective measures and remedies has proved more elusive. That is why obesity and related health risks – including diabetes, stroke, even cancer – are a major focus for the Children's Nutrition Research Center.

The center's research is expansive and its impact is global, from investigating obesity at the molecular and brain circuitry level, to exploring ways to excite teenagers about eating vegetables. **Recent studies found:**

**Fresh insights** into the barriers and motivators to children getting enough daily physical activity – and that learning can help promote healthful habits among not only kids, but also their parents.

**Infants born prematurely**, at low birth weights, are more likely to experience long-term health and development benefits when fed via tube intermittently versus continuously.

**Adding milk powder** to meals provided to schools in Ghana by the United Nations' World Food Program improved kids' lean muscle growth and problem-solving ability.

Houston-area residents are invited to participate in nutrition research projects designed to help CNRC scientists learn more about the nutritional needs of children. Curious? Contact 713-798-7002. [o](#)



Children are our most precious natural resource and the key to this planet's future."

Dennis M. Bier, M.D.  
Director, Children's Nutrition Research Center

Founded in 1978.

One of six U.S. Department of Agriculture (USDA) human nutrition research centers.

Operated by Baylor College of Medicine, in cooperation with Texas Children's Hospital and the USDA's Agricultural Research Service.

200-plus staff, including nearly 50 faculty researchers.

Nearly 2,000 studies and reports that advance understanding and improvement of childhood nutrition and health.

“

It always  
seems impossible  
until it's done.”

Nelson Mandela, *social rights activist and politician*

# Harris County Institute of Forensic Sciences

## Using innovative program to bring closure for loved ones

You've lost an important email. You've misplaced your favorite coffee mug. Your car tag is no longer on your desk. You may feel confused and frustrated, but it is nothing compared to losing a child, spouse, close relative or friend – one who has literally gone missing. The flood of emotions would be anything but mild.

At the end of 2018, more than 8,300 missing persons cases stood open in Texas. For staff at the Harris County Institute of Forensic Sciences (HCIFS), missing persons are a daily concern. HCIFS is home to the medical examiner's office, crime lab and morgue in the state's most populous county – the third most populous county in the United States.

During 2019, 279 deceased individuals received at HCIFS were initially classified as "unidentified". Because the identification process can stretch over hours, even weeks or months, HCIFS is a critical medical and information resource for helping to resolve missing persons cases.

To reduce the number of cases, HCIFS staff in 2015 helped launch an annual Missing in Harris County Day,

an innovative public outreach effort modeled after a similar initiative in another state. During the highly publicized day, family members are encouraged to meet with specialists from HCIFS, local law enforcement and social service agencies to file missing person reports; provide photos, descriptions and medical or dental records of the missing; and have DNA samples taken via cheek swab.

The information collected helps HCIFS as it checks its records and funnels data into state and national missing persons databases. It sets the stage for possible matches with unidentified remains at HCIFS or another morgue or cemetery. Since the county's first "missing day" in 2015, more than a dozen missing persons cases have been solved.

Moving forward, HCIFS, Texas Center for the Missing and other cooperating agencies continue to promote and stage the annual awareness-raising, evidence-gathering event – a day designed to bring closure for those who face the unrelenting grief of a loved one gone missing. ○





Mention Ben Taub Hospital and most Houstonians will think of the renown acute and specialty care provided in its Level 1 trauma center on the Texas Medical Center campus.

What might not come to mind is the remarkable health care it delivers *outside* Ben Taub's walls through its House Call program, largely carried out in the cozy confines of patients' homes. Harris Health System spotlighted the program at its annual Innovation Summit in 2019 by bestowing Transformation awards to Anita Major, M.D., House Call medical director at Ben Taub, and Jessica Lee, M.D., House Call medical director at Ben Taub's sister facility, Lyndon B. Johnson Hospital.

Working in close collaboration, Drs. Major and Lee are piloting efforts to reduce health care costs while dramatically improving patient experience. How? By delivering expanded in-home primary and palliative care during patients' final months and years.

The House Call services are provided by a team of dedicated physicians, nurses, nurse practitioners and social workers who are enabling vulnerable patients to receive best-in-class care at home. There - surrounded by familiar, comfortable spaces and faces - patients avoid what can become a financial, physical and emotional spiral of hospital stays and emergency room visits.

Thanks to pioneering leadership by Drs. Major and Lee, Ben Taub's and Lyndon B. Johnson's recently became the only house call programs in Texas to achieve Patient-Centered Medical Home recognition from the National Committee for Quality Assurance, an independent accreditation body focused on measuring and improving health care quality. ○



The physicians recognized apply innovation to their everyday practice, resulting in a positive financial impact and a better patient experience. They are instrumental in leading innovation within Harris Health toward a brighter, more sustainable future."

Harris Health System, 2019 Innovation Summit Program Notes

## Harris Health System - Ben Taub Hospital

Delivering best-in-class care at home



By some estimates, as much as 25% of the costs paid by Medicare are for care provided to roughly 5% of recipients who die each year. According to a 2016 analysis of the health care expenses for more than 2,300 patients during their final year of life, care costs up to seven times more for those who died in a hospital compared with those who died in their homes.



Source: Shutterstock

# Houston Independent School District Michael E. DeBakey High School for Health Professions

## Educating health care's next generation

“

I wouldn't want to teach anywhere else. These kids are absolutely amazing. It's just been a wonderful experience to see what they can offer, and it's kind of renewed my hope in the future.”

Marie Bielamowicz, D.C.,  
Health Science Teacher and Chiropractor  
Michael E. DeBakey High School for  
Health Professions

In 1972 a television doctor still made house calls, a nod to the past, while Houston Independent School District and Baylor College of Medicine were moving forward and not looking back: They joined forces to create the first U.S. high school devoted to preparing students for careers in medicine, science and health professions. The

founders could never have imagined how powerfully their vision would come to life.

From a first-year class of 45 students, the four-year school today serves a richly diverse student body of more than 900, attending classes and conducting research inside a five-story, 194,000-sq-ft facility in the heart of the Texas Medical Center. Known for academic rigor and demanding admission standards, the school, with its synergistic location, enables students to interact with health care professionals at several nearby TMC institutions, making job shadowing a central element of the student experience.

**With a 100% graduation rate, its graduates go on to colleges and universities – and, ultimately, to hospitals, clinics, corporations and research labs – around the world.**

Yet the school's contributions to fostering the workforce of tomorrow also are felt much closer to home. These grads, among others, currently work on the TMC campus:

**Ronald Timothy Cotton, M.D.**, class of 1998 valedictorian, is an assistant professor in the division of abdominal transplantation in the Michael E. DeBakey Department of Surgery at Baylor College of Medicine.

**Judith Campbell, M.D.**, class of 1977, is medical director of infection control and prevention at Texas Children's Hospital and a professor at Baylor College of Medicine.

**Amelia Quizon, RN**, class of 1996, is a registered nurse at MD Anderson.

**Paul Quizon**, class of 1997, is Amelia's husband and a senior financial analyst at MD Anderson. ○



They are at the front line of modern medicine, yet they are often health care's unsung heroes. They take x-rays and blood samples. They carefully code and process insurance claims. They respond to patients' emergency call alerts, no matter the time of day. And many of them get their start at Houston Community College's Health Sciences Center of Excellence-Coleman College.

They are the next generation of healthcare specialists who are hard at work earning their associate degrees and certificates in more than 20 of the fastest-growing, fastest-changing careers in medicine. Each will be uniquely positioned to instill greater care into health care by melding high tech and high touch to ensure the highest quality experience for patients.

With health care accounting for one in every 10 jobs in the Houston region, Coleman College graduates are poised to find difference-making careers not only within neighboring institutions on the Texas Medical Center campus, but at hospitals and clinics throughout Texas and the United States.

"Coleman College offers students a state-of-the-art academic environment that mirrors the real-life situations they will encounter in their future medical and dental careers," says Houston Community College Chancellor Dr. Cesar Maldonado. "HCC is the leader in Houston when it comes to training the medical professionals of tomorrow." ○



# Houston Community College

Powering  
the workforce of tomorrow



Photos courtesy Houston Community College, Coleman College for Health Sciences

- • • Certified nurse aide
- • • Dental assistant
- • • Dental hygienist
- • • EKG technician
- • • Endoscopy technician
- • • Histotech
- • • Licensed vocational nurse
- • • Medical assistant
- • • Medical business office professional
- • • Medical coder
- • • Medical laboratory technician
- • • Nuclear medicine technologist
- • • Occupational therapy assistant
- • • Patient care technician
- • • Pharmacy technician
- • • Phlebotomist
- • • Physical therapist assistant
- • • Psychiatric technician
- • • Radiologic technologist
- • • Registered health information technician
- • • Registered nurse
- • • Respiratory therapist
- • • Sonographer
- • • Surgical technologist
- • • Telemetry technician

In September 2019, media company Innovation Leader named Houston Methodist one of its annual Impact Award winners for the plethora of possibilities being explored by its Center for Innovation.

**C**enter for Innovation. The name alone positions Houston Methodist exactly where it wants to be and where it wants to go. Houston Methodist’s leadership established the center in 2018 to build on their organization’s world-renowned achievements in medical research and explore innovations to treat what ails the health care delivery system.

Consistent with Houston Methodist’s “Leading Medicine” tagline, the center initiated multiple projects that employ digital technologies to improve health care processes and patient experience. Ground Zero for many initiatives is Houston Methodist Hospital, the organization’s flagship at the Texas Medical Center. Examples include:

**Mia - HR’s AI:** When nurses apply for a job at Houston Methodist, their early interactions are with Mia. Only Mia isn’t a human resources person. She’s a chatbot. Powered by “assistive intelligence” and natural-language processing, the

Methodist Interactive Assistant (Mia) makes applicant screening more efficient and helps ensure that hiring managers focus their time and energy on the most qualified candidates.

**Way to go:** With more than a half dozen Houston-area facilities, including its hospital at TMC, Houston Methodist spans more than 12 million sq ft of built environment, including more than 200 patient-accessible areas. To help keep blood pressures from spiking as consumers navigate the immense network, the Center for Innovation developed a wayfinding application that provides turn-by-turn directions.

**Communicating with care:** Using text messages to communicate appointment reminders has led to fewer missed appointments. That means more patients are getting care they need while staff maintain a more productive and profitable schedule. Providing pre- and post-surgery instructions via patients’ preferred communications channel has led to improved health outcomes while cutting down on panicky calls to doctors’ offices.

**Virtual by design:** Houston Methodist was the region’s first health care system – through its MyMethodist mobile app – to offer consumers 24/7 access to virtual urgent care visits. ○

# Houston Methodist

## Navigating health care’s digital frontier



There is no roadmap for where we’re going as an industry and where this hospital is going to go down the road of innovation, but we’re putting one foot in front of the other and not being scared to continue to move forward.”

Roberta Schwartz, Chief Innovation Officer  
Houston Methodist Hospital





Courtesy Texas Medical Center

# Memorial Hermann - Texas Medical Center

## Innovating health care trials and technology

**F**irsts are nothing new for Memorial Hermann-Texas Medical Center.

Founded in 1925, it was the first hospital to open on the Texas Medical Center campus. Now it is one of Houston's two certified Level 1 trauma centers and serves as the primary teaching hospital for McGovern Medical School at UTHealth.

From neuroscience to orthopedics to women's health and organ transplantation, Memorial Hermann is dedicated to early exploration and advances. Inside the hospital's surgical suites and physical therapy rooms, it is common to find a diverse array of cutting-edge treatments undergoing trial or being fine-tuned into new standards of care:

### An eight-year clinical trial of the Amplatzer PFO Occluder,

a tiny metal-mesh device surgeons implant via catheter to correct patent foramen ovale (PFO), a heart defect common in newborns. Left untreated, PFO creates risk for future, recurring strokes.

Recent follow-up with trial patients found the device reduced stroke risk as much as 62%.



Amplatzer PFO Occluder courtesy St. Jude's Medical



Courtesy Parker Hannifin

**A trial of the Indego<sup>®</sup>, a 26-pound powered exoskeleton** that helps restore the all-important ability to stand and move in patients undergoing physical therapy for spinal cord injuries.

**Augmented reality technology** that enhanced surgical-field navigation and visualization during minimally invasive sinus surgery – the first use in the nation.

### Use of deep brain stimulation to treat tremors and other debilitating symptoms

caused by certain neurological disorders, such as Parkinson's disease. In one recent dramatic case, clinicians were treated to a brief concert by a symphonic flutist who regained the ability to play her instrument while lying on an operating table as electrodes stimulated her brain.

Memorial Hermann's dedication to Innovation on all fronts helps its medical professionals live out its vision:

**To create healthier communities, now and for generations to come. ○**

“

Discovery consists  
of looking at the same  
thing as everyone  
else and thinking  
something different.”

Albert Szent-Györgyi, *biochemist*



“

You just can't give up. I think that's what I always told myself, you just have to keep pushing. Because, although you're going to have bad days, you're going to have good days too, that's what you have to do.”

Jonica

# Shriners Hospitals for Children-Houston

## Graduating kids to higher degrees of health

In May 2019, when 18-year-old Jonica donned cap and gown to receive her high school diploma in front of a throng of admirers, both her achievement and the ceremony's venue were remarkable.

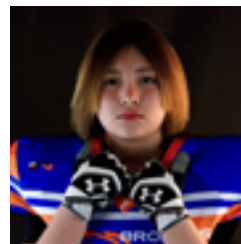
Jonica had spent the prior three months as an inpatient at Shriners Hospitals for Children-Houston undergoing intensive rehabilitation for a severe spinal injury. Her cap-and-gown celebration marked the first time the hospital's lobby had hosted a patient's high school graduation ceremony.

The journey began within a few days of her hospital admission when Jonica was enrolled in a charter school the hospital operates in concert with The University of Texas. School staff worked closely with Jonica's high school to ensure she stayed on track to graduate and was prepared to enroll at Texas Tech University.

Every day Shriners Hospital-Houston and 21 other Shriners hospitals across the United States treat patients like Jonica and thousands of other children with a variety of diseases, disorders and traumatic injuries. At Shriners, children up to age 18 receive services regardless of their families' ability to pay. The organization's multidisciplinary, family-centric approach to care helps young people reach their maximum potential.

Inspirational stories resembling Jonica's abound, signaling a brighter future for children, no matter their physical or financial circumstances. ○

Photos courtesy Shriners Hospital for Children-Houston



**Adison**

Since having a leg amputated after suffering a gunshot wound, Adison is back playing defensive end for his youth football team, owing in part to the extensive physical, occupational and recreational therapy he's received at Shriners Hospital-Houston.



**Kaitlyn**

When a rare birth defect caused abnormal development of her lower spine, Kaitlyn as a child underwent multiple surgeries and rounds of rehabilitation at Shriners Hospital-Houston. Today she's a world-class wheelchair basketball athlete, preparing to compete at the next summer Paralympics.



**Reese**

Born with a cleft lip and palette, Reese had more than dozen ear, nose, throat and palette surgeries before he and his family came to Shriners Hospital-Houston. There, additional surgeries improved his ability to smell and breathe through his nose. Salutatorian of his high school class, and winner of a Horatio Alger Scholarship, Reese plans to earn a degree in mechanical engineering from Oklahoma State University.

The bad news: According to the American Heart Association, someone in the United States suffers a heart attack every 40 seconds. The good news: Approximately 86% of victims survive their attack.

The bad news: Heart attacks often are accompanied by life-threatening complications, including arrhythmias and aneurysms that can be exacerbated by excessive inflammation.

What if medical science could allow the body to do its healing work without the extreme inflammation that puts patients' longer-term health and survival at risk? It's one of many "what if" questions researchers at Texas A&M's Institute of Biosciences & Technology (IBT) are asking.

In fact, "Making What If Possible" is a galvanizing theme for IBT's work, which is organized around centers of research excellence in cancer, genomics and disease, developmental biology and

birth defects, and infectious diseases. Their broad research scope ensures there is no shortage of diverse, daring, can-we-create-a-better-future questions being asked - and determinedly answered - each day inside the labs and offices at Texas A&M Health Science Center.

Researchers recently answered the question about heart attacks and



inflammation, announcing some good news for the future: The absence or deficiency of a bodily protein called RhoE provides clues to which patients could be at greatest risk and identifies possible pathways to targeted drug therapies that could fine-tune the body's immune response post-heart attack. [O](#)



At Texas A&M Health Science Center, we find solutions to the seemingly impossible questions facing health care. We ask 'what if' and then we make it possible."

Texas A&M Health Science Center (website)

# Texas A&M University Health Science Center

Making "what if"  
possible







Courtesy Texas Children's Hospital

## Texas Children's Hospital

### Animating educates parents, children for better outcome

When it comes to congenital heart disease, Ruby, a Texas armadillo, and Beau, a bison, are popular "experts" at Texas Children's Hospital – and at children's hospitals around the world.

Ruby and Beau star in animated videos co-created by Daniel J. Penny, M.D., Ph.D., chief of cardiology at Texas Children's Hospital, and Australian Michael Liddy. Their goal is to present congenital heart disease information to children and their parents in a non-threatening and non-technical way.

With the help of a racetrack and race cars, Ruby and Beau explain how the body's heart and circulation system work and what happens if there are clogs or blockages. Buzzing robotic blings demonstrate how the conditions can be treated or fixed. Forty videos use the fun and friendly format to cover topics from a cardiopulmonary bypass to a catheter balloon septostomy for tricuspid atresia.



Courtesy Texas Children's Hospital

Ruby's and Beau's voices are soft and soothing, as is the background music, providing a calm and welcoming experience for children and their families. Penny and Liddy are cognizant of the stress such conditions place on families and have also created videos that help parents understand the social and emotional challenges they are facing.

Penny says he previously used diagrams of the heart to

explain the situation to the young patients and their parents, but the one-of-a-kind animated videos have opened up a whole new world.

Check out the free videos: [www.texaschildrens.org/departments/cardiology/educational-animation-videos](http://www.texaschildrens.org/departments/cardiology/educational-animation-videos). Penny and Liddy plan to produce more videos and translate them into other languages for even greater accessibility. [o](#)



The aim of our [animated video] project is to improve health literacy for the children who come to us with heart disease and for their parents. We know that despite our best efforts, children really don't understand a lot about their conditions, and we know that if we can empower them through information their likely outcomes and their quality of life and treatments will be better."

Daniel J. Penny, M.D., Ph.D., Chief of Cardiology  
Texas Children's Hospital



## Texas Woman's University

### Exercising care for caregivers

Estimates are that more than 90 million U.S. adults are caregivers for an ill or vulnerable friend, neighbor or family member, and that at least two-thirds of family caregivers are women.

So it is appropriate that a first-ever study of the ancient practice of Qigong is underway at the nation's largest public university primarily for women, Texas Woman's University (TWU). Researchers at TWU's College of Nursing on the Texas Medical Center campus will determine whether Qigong can help sustain – even enhance – the physical and emotional well-being of caregivers.

TWU Professor Pinky Budhrani-Shani, Ph.D., recently received a grant from the National Institutes of Health to conduct a study on "Caring for Caregivers with Mind-Body Exercise." The \$534,000 funding is the college's first from NIH in more than 10 years.

During years of working with cancer patients as they underwent painful, exhausting chemotherapy and radiation treatments, Budhrani-Shani noticed many caregivers experiencing their own physical and emotional suffering. "Being a caregiver is a full-time job and that can be extremely stressful," she says. "Seeing how much these caregivers give every day is what made me decide to focus on this unique and often-overlooked population."

The study will compare a control group that does not practice Qigong to two groups of caregivers who practice Qigong movement, breathing and meditation – one doing so at home using videos, the other taking classes in a studio. At the

study's conclusion, Texas Woman University researchers will evaluate participant outcomes ranging from grip strength and balance to sleep quality and levels of depression. ○



... I'm looking forward to seeing the outcomes. Hopefully, I can make a difference in caregivers' lives and thus in the lives of cancer patients."

Pinky Budhrani-Shani, Ph.D.  
Texas Woman's University



Whether you're a graying Baby Boomer or a member of the sandwich generation, "aging in place" is a term you'll be hearing – perhaps even experiencing – as the number of people age 65 and older continues to grow.

**Research by the American Association of Retired Persons finds that 90% of older adults wish to live at home as long as possible. The U.S. Centers for Disease Control and Prevention defines aging in place as “the ability to live in one’s own home and community safely, independently, and comfortably, regardless of age, income, or ability level.”**

The aspiration poses a major challenge to the health care industry: How best to provide high-quality care for people who, whether robust or fragile, have their hearts and minds set on staying home.

Founded in 1972, The University of Texas Health Science Center at Houston (UTHealth) is seeing the challenge as an opportunity. Researchers have built a one-bedroom “smart apartment” inside UTHealth’s Cizik School of Nursing. It’s a living laboratory established to test and develop aging-in-place technologies and personalized, mobile diagnosis and treatment methods.

Technology is a major focus of the lab’s ongoing exploration (see sidebar). But researchers at the well-respected university also are looking at such issues as fall prevention, data privacy issues, and dealing with the potential for malnourishment and dehydration when an elderly patient is not under the watchful care of an in-patient medical team. Can aging-in-place be made healthy and safe?

Constance Johnson, Ph.D., RN, and director of UTHealth’s smart apartment program, is confident solutions can be found. “We have an aging population and a shortage of health care providers,” she says. “We’re going to have to provide more services in the homes of seniors and make it easier for them to stay there.” ○

# The University of Texas Health Science Center at Houston

Advancing health care  
on the home front



Among the technologies being explored at UTHealth’s aging-in-place “smart apartment”:

**Lack-of-motion sensors** to detect when a patient has become immobilized and needs direct attention.

**Employing virtual reality** to combat loneliness.

**Voice-activated** light and TV switches.

**Two-way** caregiver-patient video conferencing.

**Robots, artificial intelligence** and wearable technologies.



Rendering courtesy Stantec

# The University of Texas MD Anderson Cancer Center

## Keeping cancer on the run

**T**he team of passionate researchers and clinicians at The University of Texas MD Anderson Cancer Center are driven toward a single goal: ending cancer.

Through the focused effort of more than 20,000 employees and 3,000 volunteers, MD Anderson is committed to improving the lives of patients with cancer. In fiscal year 2018, MD Anderson invested more than \$860 million in research across the spectrum of cancer care, including prevention, early detection, treatment and survivorship. In the same year, MD Anderson treated more than 140,000 patients and conducted more than 1,200 innovative clinical trials.

Among the most advanced tools MD Anderson uses in its mission? Proton therapy. In 2019 it announced plans to more than double the size of its Proton Therapy Center on the Texas Medical Center campus. The expanded facility—nearly as large as three football fields, at more than 160,000 sq ft—will host eight proton therapy machines. Each rotates

360 degrees around a patient while delivering a precisely targeted proton beam to areas needing treatment.

This is not standard radiation treatment. It is intensity-modulated proton therapy (IMPT), the most precise form of image-guided radiation: Picture a narrow beam of positively charged subatomic particles passing through healthy human tissue at a low radiation dose. As it reaches a tumor, with pinpoint accuracy, the beam scales up its cancer-fighting energy and even expands to match the tumor's size.

Modulating intensity lets the beam pack maximum radiation wallop directly against the tumor, while sparing surrounding healthy tissue as well as tissue passed through to reach the treatment site.

Unlike less-advanced types of X-ray radiation, IMPT helps ensure that collateral damage to a patient's tissues and organs is markedly reduced, even avoided. It is proving effective at treating a range of adult and pediatric cancers,

including prostate, lung, head and neck, liver, esophagus, brain and lymphoma.

Today's 73,500-sq-ft Proton Center operates at capacity, treating patients 20 hours per day, five days per week. "Doubling our size," says Steven J. Frank, M.D., the Proton Center's medical director, "will mean not only that we can treat more patients, but that we can do so using the very latest technology while achieving remarkable efficiency." [o](#)

**In the future, whenever a cancer meets its medical match, don't be surprised if it happens inside a building at MD Anderson Cancer Center. Scheduled for completion 2023: a \$159 million expansion of its Photon Therapy Center (rendering shown).**

**Baylor College of Medicine**

Center for Comparative Medicine  
Lee and Jo Jamail Special Care Center - McNair Campus

**CHI St. Luke's Health**

Baylor St. Luke's Medical Center  
Texas Heart Institute at Baylor St. Luke's Medical Center - Denton A. Cooley Building

**Children's Nutrition Research Center**

**Harris County Institute of Forensic Sciences**

**Harris Health System - Ben Taub Hospital**

# Customer Institutions and Buildings Served

**Houston Community College**

Coleman College for Health Sciences  
Coleman College for Health Sciences Tower

**Houston Independent School District**

DeBaKey High School for Health Professions

**Houston Methodist Hospital**

Mary Gibbs Jones Building  
Walter Tower

**Memorial Hermann**

Heart & Vascular Institute  
Medical Center  
Susan & Fayex Sarofim Pavilion  
The Institute for Rehabilitation and Research - Edna B. Dunn Tower

**Shriners Hospitals for Children-Houston**

**Texas A&M University**

Albert B. Alkek Institute of Biosciences and Technology

**Texas Children's Hospital**

Abercrombie Building  
Feigin Center  
Jan and Dan Duncan Neurological Research Institute  
Pavilion for Women  
Wallace Tower  
West Tower

**Texas Medical Center**

Garage 8  
John P. McGovern Texas Medical Center Commons

**Texas Woman's University-Houston**

**The University of Texas Health Science Center at Houston**

Cizik School of Nursing and Community Center Building  
Cyclotron Building  
Institute of Molecular Medicine - Fayez S. Sarofim Research Building  
McGovern Medical School  
McGovern Medical School - Expansion  
Professional Building  
School of Public Health - Reuel Stallones Building  
The TMC Library Health Sciences Resource Center  
University Center Tower

**The University of Texas MD Anderson Cancer Center**

Albert B. and Margaret M. Alkek Hospital  
Charles A. LeMaistre Clinic/Margaret and Ben Love Clinic/R. Lee Clark Clinic  
Dan L. Duncan Building  
John Mendelsohn Faculty Center  
Lowry and Peggy Mays Clinic  
Lutheran Hospital Pavilion - M.G. and Lillie A. Johnson Building  
Main Building (Anderson Central, East and West)  
Mid-Campus Building 1  
Percy and Ruth Legett Jones Research Building  
Rotary House Hotel  
Sheikh Zayed bin Sultan Al Nahyan Building for Personalized Cancer Care  
T. Boone Pickens Academic Tower  
The George and Cynthia Mitchell Basic Sciences Research Building

**University of Houston**



- TECO customers
- TECO plants
- TECO-operated, customer-owned plant
- Parking

“

I was taught that  
the way of progress  
was neither swift  
nor easy.”

*Marie Curie, Nobel Prize winner in both physics and chemistry*

# Achieved

## FY2019 ACCOMPLISHMENTS

### FINANCE AND ADMINISTRATION

- Exceeded budget expectations for FY2019\* and presented FY2020\* budget that was approved by Board of Directors.
- **Issued \$6.2 million in customer rebates for FY2019.**
- Completed FY2019 financial audit. There were no notable comments regarding FY2019 financial results, accounting methods, process or internal controls.
- Maintained TECO's financial closing on third business day of the month.
- Met on a regular basis with Board members outside of regularly scheduled meetings and met with senior executives for many customer institutions.
- Prepared accurate forward-year rate forecasts for institutions that need them for early-in-the-year budgeting.
- Conducted employee survey for 2019.
- Produced and distributed TECO's 2018 Annual Report, "Inspired to Lead."
- Hired three former interns as full-time employees.
- Installed district energy system history timeline wall.
- **Marked district energy system's 50th anniversary (1969-2019).**
- Prepared and sealed company time capsule to be opened in 2044.

### OPERATIONS

- Provided 100% chilled-water and steam reliability to customers.

- Generated 100% of own power during peak power demand periods recorded by Electricity Reliability Council of Texas (ERCOT), so TECO had zero power demand during these periods. TECO's CHP system eliminated the risk that chilled-water and steam customers could be negatively affected by power grid failure.
- **Named International District Energy Association's System of the Year for 2019.**
- Successfully followed Energy Policy initiated by Board of Directors in 2006, which helps TECO lock in fuel purchases at the lowest-possible cost.
- Continued Operator Training and Certification Program as scheduled. Three operators received or upgraded their City of Houston stationary engineer license in 2019: two received their First Grade Engineers License and one received his Third Grade Engineers License.
- **Completed FY2019 with a perfect safety record. There were no recordable accidents. At fiscal year-end, TECO had gone more than 1,676 days without a lost time accident – a company record.**
- Achieved Workers Compensation Experience Modifier of 0.73, which continues to be below the industry average.
- Successfully completed, on schedule and budget, capital projects to enhance performance, efficiency and reliability.
- Continued Major Equipment Replacement Program (MERP) and

the insurance reserve fund. MERP ensures funding will be available for future equipment replacement as needed assuming normal equipment life cycles. By regularly allocating money to insurance reserve fund, TECO can raise deductibles and reduce insurance premiums.

- Continued to operate and maintain The University of Texas Health Science Center's Research Park Energy Plant, South Campus. TECO remotely monitors plant operations 24 hours a day, and operators visit the plant daily, bringing UTHealth significant economic savings and improved operational benefits.
- Continued to serve as point of contact for monitoring Metro Stray Current issues and their effect on institutions in Texas Medical Center.
- Had no citations relating to environmental, safety or regulatory requirements.

### CUSTOMERS

- Completed distribution projects and began service to Memorial Hermann's Susan and Faye Sarofim Pavilion and Harris Health's Ben Taub Hospital.
- **Conducted 2019 customer satisfaction survey, with 100% of respondents replying that TECO's chilled-water and/or steam service met their expectations very well (highest rating) over the past year.**

\* Fiscal year September 1 - August 31

## Joining the team

Thermal Energy Corporation’s internship program continues to produce future impact players for the organization, with TECO hiring three former interns as full-time employees in 2019. Recent interns (left to right) Linsey Whalen (human resources), Haley Ackman (finance) and Callen Clark (engineering) follow in the footsteps of another former intern, Austin Kelly, who came on board full-time in 2011. Today Austin is TECO’s electrical engineer/information technology manager.

TECO launched its internship program in the early 1990s, initially offering positions to employees’ children but later expanding to include applicants outside the TECO family. Placements are open to applicants 18 and older who are enrolled in college.



## Time for reflection

Whether leaning in or standing back to take it all in, TECO employees and visitors saw the system’s 50-year history brought to life in late 2019 – thanks to the installation of a museum-quality timeline displayed on two walls inside TECO’s Central Plant.

Incorporating photographs, artifacts, quotations and informative graphics, the timeline charts the growth and evolution of the system’s chilled-water and steam service. Running in parallel are notations of historic medical breakthroughs accomplished by the Texas Medical Center institutions TECO serves.

Like the system itself, the timeline is the product of intensive collaboration. TECO recognizes William H. Kellar and the McGovern Historical Center at the Texas Medical Center Library for their support.



## Named best of the best

The International District Energy Association named TECO its district energy system of the year for 2019 at ceremonies June 26. The annual award is IDEA's highest system honor. TECO Vice President of Operations Jason Berrio and Board Chairman Bradley Howell accepted the award on TECO's behalf.

The award recognizes the system that demonstrates exemplary efficiency; outstanding performance in reliability, safety and environmental stewardship; and overall commitment to customer service excellence and industry engagement. IDEA noted that TECO excelled in all of its evaluation categories.

IDEA represents more than 2,400 members from more than 30 countries.



Courtesy International District Energy Association

## Looking ahead to history

What will today and yesterday look like from a distant tomorrow? Twenty-five years from now, future generations of employees—and potentially some current ones—will find out, thanks to the company's first-ever time capsule created by TECO employees in November 2019. The event wrapped up the 50th anniversary year of TECO's district energy system.

The 400-pound steel capsule, at left, contains an eclectic collection of more than 55 items, ranging from TECO annual reports and an ASHRAE handbook to company-branded merchandise and a *District Energy* industry magazine.

The literature and memorabilia reflect history, while projecting an enduring culture and team spirit. Mark your calendar for 2044!



## Extending to serve

When Harris Health System's Ben Taub Hospital began a \$70 million expansion and Level I trauma center upgrade, it turned to TECO to provide chilled-water and steam service. To minimize traffic disruption, TECO's contractor Tellepsen tunneled from a parking lot at Memorial Hermann's TIRR, bringing TECO's pipes to the mezzanine level at Ben Taub's existing energy plant.

Once inside the plant, the pipes were well-supported by structures designed to withstand hurricane force winds. TECO activated steam service first, then chilled-water service six months later once existing equipment was removed to make room for the chilled-water heat exchangers.

The project came in on time and on budget in 2019.



Courtesy Tellepsen

# Measured

## FY2019 METRICS

### Chilled Water

### Steam

#### CUSTOMERS

Number of customers .....	17	.....	15
Number of buildings served .....	50	.....	37
Square feet served .....	23.7 million	.....	18.1 million
Energy sales .....	327,929,000 ton-hr	.....	1,025,172 Mlb

#### ENERGY SOURCES

##### Paul G. Bell, Jr. Energy Plant - Central Plant

Number of boilers, chillers/fuels .....	14 chillers	.....	7 boilers
	electricity & natural gas		natural gas & diesel
Thermal storage tank .....	8.8 million-gallon	.....	n/a
	chilled-water storage tank		

##### South Main Plant

Number of boilers, chillers/fuels .....	13 chillers	.....	2 boilers
	electricity		natural gas & diesel

#### OPERATIONS / DISTRIBUTION

Capacity .....	120,170 tons	.....	980,000 lb/hr
	(including thermal storage)		(with heat-recovery steam generator & duct firing)
Supply temperature .....	40° - 43°F	.....	450°F
Supply pressure .....	55 - 75 psi	.....	400 psi plant
			250 psi distribution
Return temperature .....	52° - 55°F	.....	150°F
Water volume in system .....	12.4 million gallons	.....	n/a
Steam pressure .....	n/a	.....	400 psi
Piping type .....	Welded steel coated with coal/tar epoxy	.....	Welded steel, Schedule 40 with insulation
Piping diameter .....	6 to 60 inches	.....	2 to 16 inches
Piping distribution trench length .....	7.7 miles	.....	7.7 miles
			(portions of the line have three pipes)

### Power

##### Paul G. Bell, Jr. Energy Plant - Central Plant

Combined heat and power system .....	48 MW
Standby generation .....	14 MW

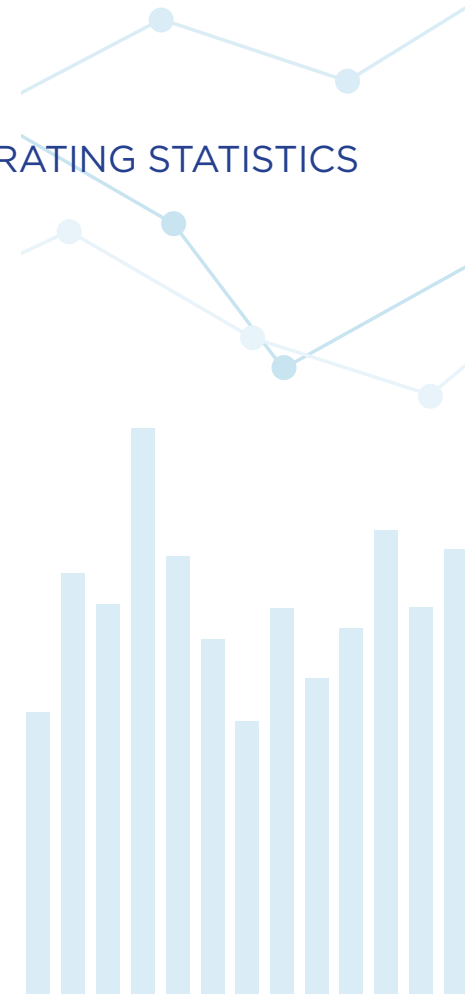
##### South Main Plant

Standby generation .....	2 MW
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# Counted

## FY2019 FINANCIAL AND OPERATING STATISTICS



### Rates and Units

Fiscal year September 1 - August 31

	FY2019	FY2018
<b>CHILLED WATER</b>		
Rate (\$/ton-hr).....	\$ 0.1893	\$ 0.1863
Rate (\$/MMBtu).....	\$ 15.77	\$ 15.52
Peak Demand (tons).....	77,042	74,279
Average Demand (tons).....	39,399	38,070
Load Factor .....	51%	51%
Peak (sq ft/ton) .....	308	292
Production (sq ft/ton-hr).....	0.069	0.065
Production (ton-hr).....	345,138,138	333,496,080
Cooling Degree-Days (3,510 normal) .....	3,694	3,590
Fuel Consumption MWh..... (natural gas and electricity)	280,900	276,888

### STEAM

Rate (\$/Mlb).....	\$ 15.95	\$ 15.04
Rate (\$/MMBtu).....	\$ 13.28	\$ 13.64
Peak Demand (lb/hr).....	321,057	378,854
Average Demand (lb/hr).....	141,435	130,185
Load Factor .....	44%	34%
Peak (sq ft/lb).....	56	40
Production (sq ft/Mlb).....	15	13
Production (Mlb) .....	1,238,967	1,140,421
Heating Degree-Days (1,081 normal) .....	1,290	1,230
Fuel Consumption MMBtu (natural gas) .....	1,604,776	1,532,167

### Revenue and Expenses

Fiscal year September 1 - August 31

	FY2019	FY2018
<b>OPERATING REVENUE</b>		
Chilled Water.....	\$ 66,978,064	\$ 67,580,397
Steam.....	\$ 17,654,382	\$ 15,764,479
Other.....	\$ 4,794,993	\$ 3,638,677
<b>Total Operating Revenue .....</b>	<b>\$89,427,439</b>	<b>\$ 86,983,553</b>

### OPERATING EXPENSES

#### Fuel

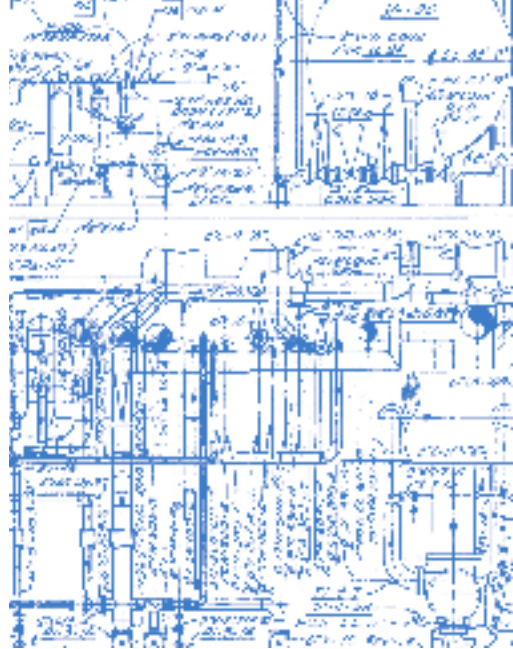
Electric.....	\$ 2,516,195	\$ 5,966,056
Gas .....	\$ 7,694,146	\$ 6,875,985
Fuel Oil .....	\$ 70,072	\$ 104,951
Other Operating Expenses.....	\$ 56,756,320	\$ 58,993,159
<b>Total Operating Expenses.....</b>	<b>\$ 67,036,735</b>	<b>\$ 71,940,152</b>

Customer Rate Reduction .....	\$ (6,200,000)	\$ (9,993,524)
Net from Operations.....	\$ 16,190,704	\$ 5,049,877
Non-Operating Revenue/(Expense).....	\$ 1,176,778	\$ (12,916,238)
<b>(Deficiency)/Excess of Revenues Over Expenses.....</b>	<b>\$ 17,367,482</b>	<b>\$ (7,866,361)</b>

TECO completed fiscal year 2019 with operating revenues 10.3% over budget and operating expenses 15.9% under budget. Operating revenues were over primarily due to unbudgeted demand revenue from new customer buildings. Most of the favorable operating expense variance was achieved because (1) fuel and water costs were 36.1% below budget due to operating efficiencies and (2) personnel costs were 15.0% below budget due to a combination of favorable health insurance costs and capitalized costs. These favorable variances along with additional unbudgeted operating revenues allowed for a customer rebate of \$6.2 million (7.5% of budgeted operating revenues) in August 2019. TECO's income from operations in fiscal year 2019 was \$16.2 million.

TECO achieved its below-budget fuel cost without deviating from its energy policy, which provides fuel price stability so that rapid increases in fuel costs do not affect TECO's rates during a budget year.

The company met all of its planned cash, internally set financial, and debt covenant requirements for fiscal year 2019.



A TEXAS MEDICAL CENTER INSTITUTION

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