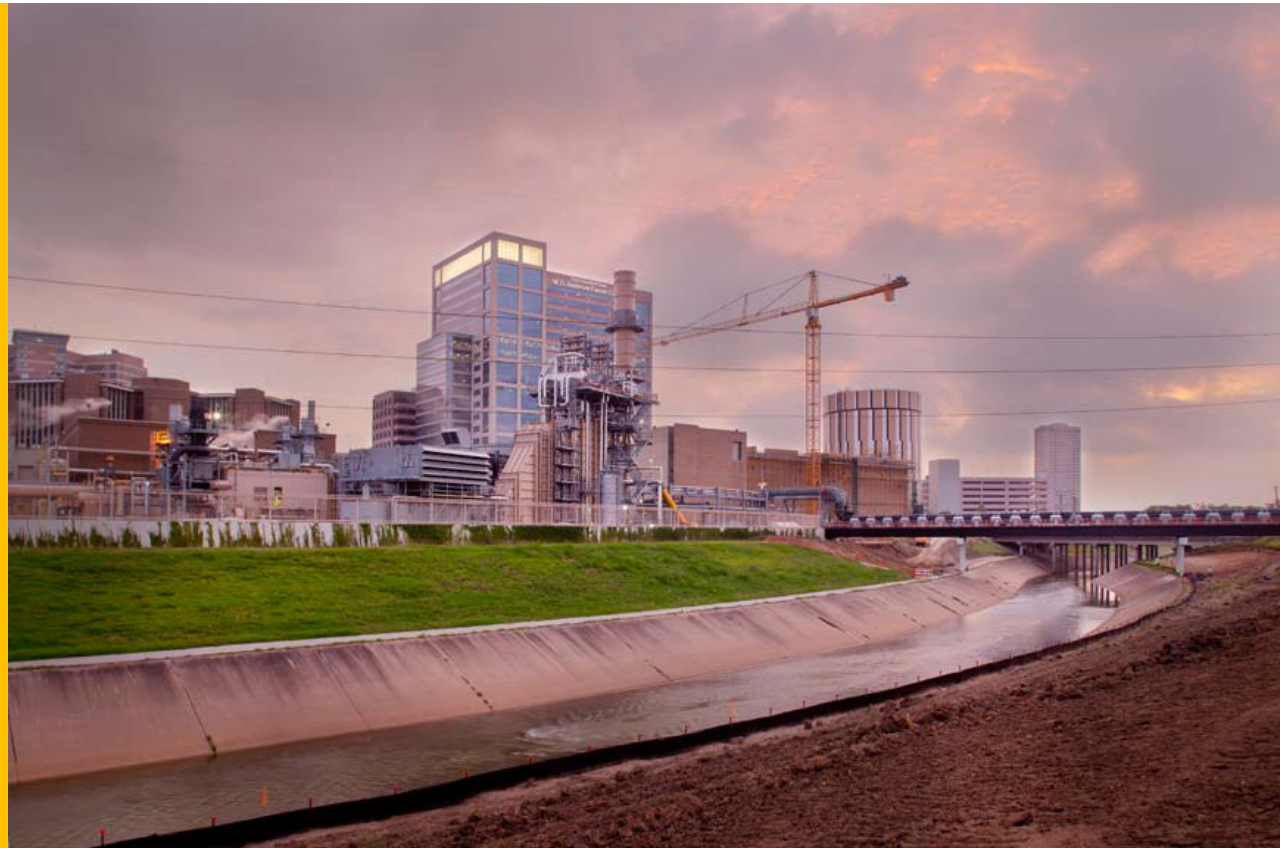


# Case Studies: Thermal Energy Corporation at Texas Medical Center, Houston, TX

Steve Swinson, PE  
President & CEO  
Thermal Energy  
Corporation



November 1, 2010



# CHP Case Study: Thermal Energy Corporation

## Pre-CHP Project

- Serves Texas Medical Center – 18 institutions
- 18.3 million ft<sup>2</sup> of space
- 80,000 tons of chilled water
- 762,000 pph of steam
- 16 MW generation
- 35 miles of distribution piping

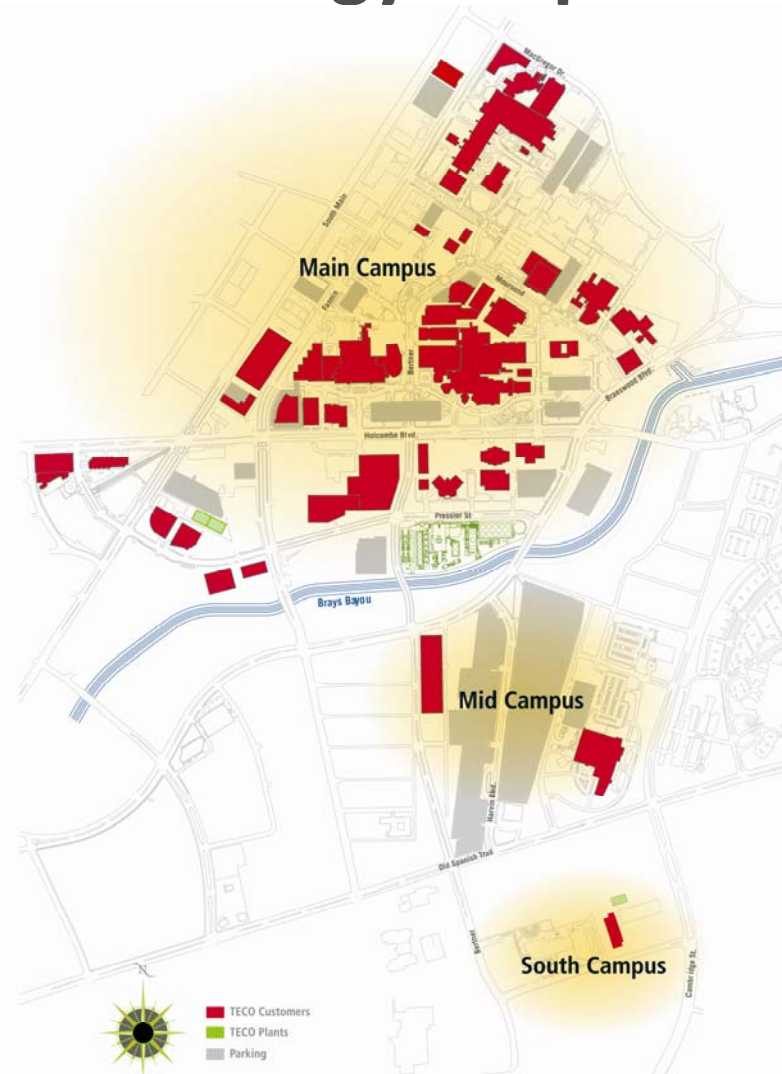
**TECO Mission: *Providing Reliable, Cost Effective Thermal Services***



# CHP Case Study: Thermal Energy Corporation

## Planned Growth

- Expand to 160,000 tons of chilled water
- Add 152,000 ton-hrs CHW TES
  - 2 at 8.8 million gals
- Add 100 MW CHP on-site generation
- Add 540,000 pph heat recovery



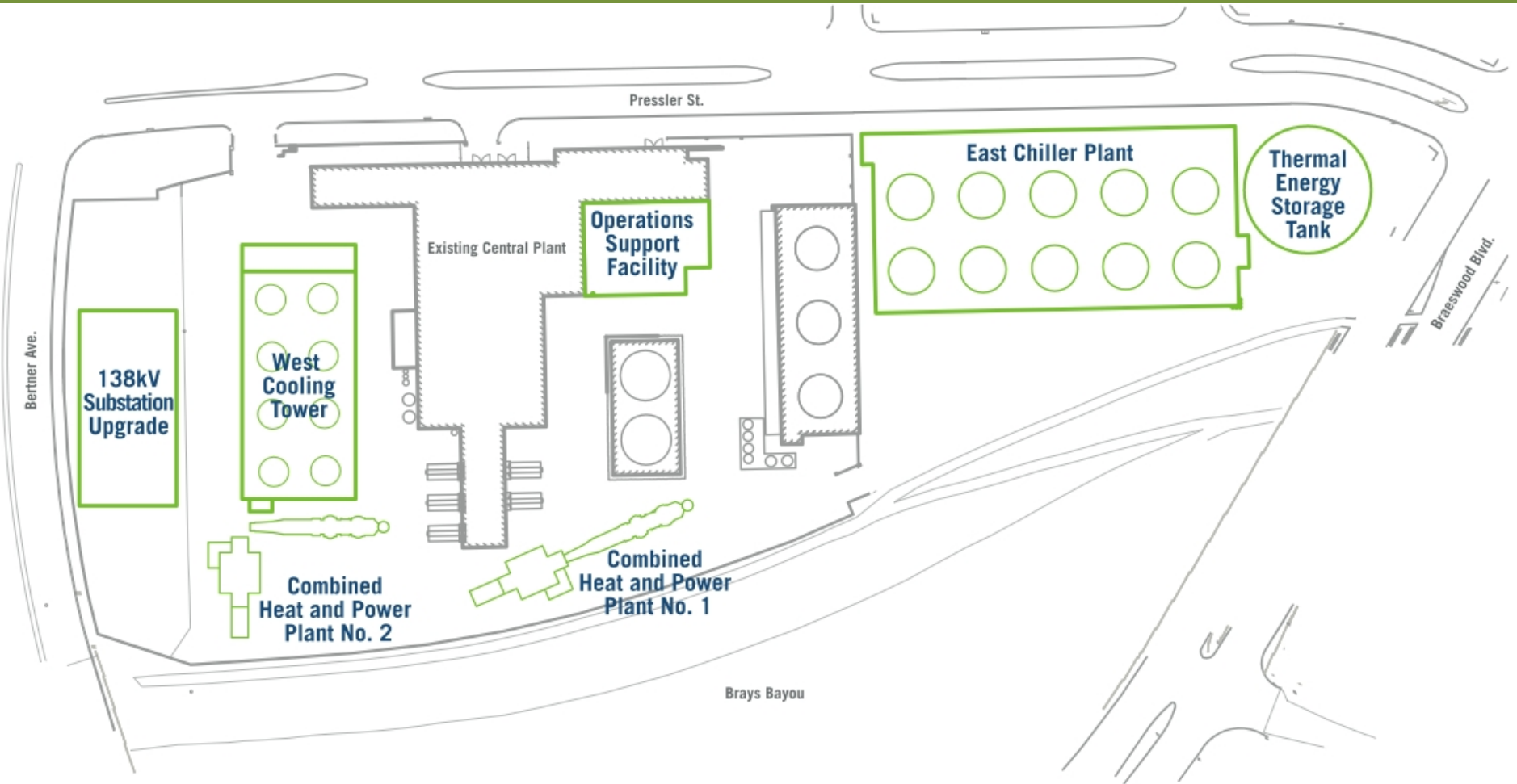
# CHP Case Study: Thermal Energy Corporation

## Master Plan Implementation

- \$372 MM Expansion
  - 4 miles of thermal distribution
  - 32,000 tons chilled water plant addition
  - 8.8 MG thermal energy storage tank
  - 45 MW / 330,000 lb/hr CHP / HRSG system
  - Electric substation upgrades



# CHP Case Study: Thermal Energy Corporation



# CHP Case Study: Thermal Energy Corporation

## New CHP System

- 45 MW Combustion Turbine Generator – GE LM-6000 Sprint
- 330,000 lbs/hr HRSG
- ERCOT average heat rate 8,500 Btu/kW (low) to 10,700 Btu/kW (high)
- TECO CHP System 5,800 Btu/kW (low) to 7,200 Btu/kW (high)



# CHP Case Study: Thermal Energy Corporation

## New Chiller Plant

- 4 – 8,000 ton Chillers
- Roof mounted cooling towers
- Chiller water distribution pumps
- Expandable to 80,000 tons
- 8.8 million gallon stratified chilled water tank



# CHP Case Study: Thermal Energy Corporation

## Electric Infrastructure Upgrades

- 138 kV Substation Expansion
- 138kV Feeders for Chiller Plant
- Ability to export 45 MW



# CHP Case Study: Thermal Energy Corporation

## Mission Critical Control Room

- Toshiba Distributed Control System
  - Redundant networks
  - 2,900 hardwired points – 9,500 soft points
- Integrated optimization – *Visual Mesa*

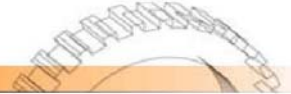


# CHP Case Study: Thermal Energy Corporation

## Environmental

- Reduced Carbon Dioxide (CO<sub>2</sub>) by 305,455 tons per year
- Equal to 75,527 metric tons of carbon equivalent per year
- Equal to carbon emissions of 50,452 cars

### CHP Results



The results generated by the CHP Emissions Calculator are intended for educational and outreach purposes only; it is not designed for use in developing emission inventories or preparing air permit applications.

#### Annual Emissions Analysis

	CHP System	Displaced Electricity Production	Displaced Thermal Production	Emissions/Fuel Reduction	Percent Reduction
NOx (tons/year)	8.06	132.14	228.02	352.11	98%
SO <sub>2</sub> (tons/year)	0.80	481.94	1.34	482.48	100%
CO <sub>2</sub> (tons/year)	161,042	199,709	266,788	305,455	65%
Carbon (metric tons/year)	39,819	49,380	65,966	75,527	65%
Fuel Consumption (MMBtu/year)	2,706,593	2,416,446	4,560,474	4,270,327	61%
Acres of Forest Equivalent				62,939	
Number of Cars Removed				50,452	

This CHP project will reduce emissions of Carbon Dioxide (CO<sub>2</sub>) by 305,455 tons per year

This is equal to 75,527 metric tons of carbon equivalent (MTCE) per year

This reduction is equal to removing the carbon that would be absorbed by 62,939 acres of forest



OR

This reduction is equal to removing the carbon emissions of 50,452 cars



# CHP Case Study: Thermal Energy Corporation

## Results

- \$10 million DOE ARRA funding
- Savings of \$200 MM NPV over the next 15 years
- Emissions reduced by 75,527 metric tons carbon equivalent
- Largest, most efficient and reliable medical central plant in the U.S.



# Case Studies: Thermal Energy Corporation at Texas Medical Center, Houston, TX

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November 2, 2010

