

CHP in District Energy Application

TECO Master Plan Expansion Texas Medical Center



TECO Project Objectives

- Meet Forecasted Chilled Water and Steam Demand, 2009 - 2021
- Flexibility to Manage Energy Costs
- Maintain High Reliability
- Optimize Facility's Energy Efficiency
- Significant Reduction in Emissions
- Emergency Operation Capacity

Existing Systems

TECO Serves Texas Medical Center

Customers

- 16.6 Million Square Feet Served
- 18 Customer Owned Institutions
- 42 Buildings Chilled Water Service
- 36 Buildings Steam Service

Two Thermal Energy Plants

- 23 Chillers, 5 Boilers
- 3.6 Million Gallons Chilled Water System
- 80,000 Tons Chilled Water Capacity
- 762,000 PPH of Steam Capacity
- 16 MW Emergency Generation



Project Implementation

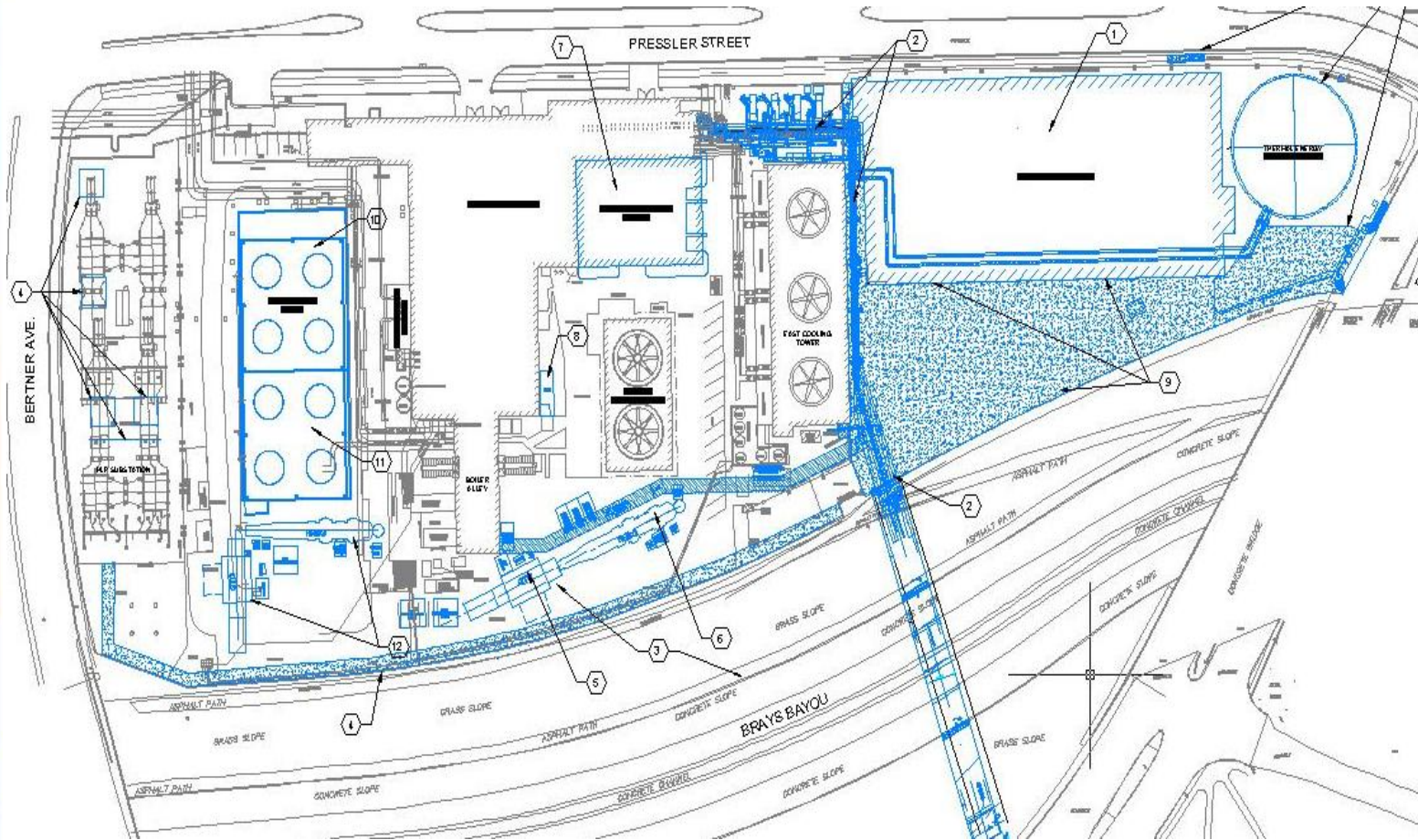
- Evaluated Several Different Plant Configurations
- Each Scenario Evaluated with Numerous Sensitivity Analysis
- *CHP was the Best Economical Choice Every Time !*

Major Program Results Include

- 80,000 Tons Chilled Water
- 152,000 ton-hrs chilled water storage (16,000 tons)
- 100 Megawatts Power
- 540,000 PPH Steam
- Support Facilities and Electrical Improvements

GOAL: *Thermally base-loaded plant that significantly improves efficiency, reliability and reduce environmental emissions* 5

Project Implementation



Project Details

Client: Thermal Energy Corporation

EPC Contractor: Burns & McDonnell

- Thermal Energy Storage Tank

Chicago Bridge & Iron

- Chillers

8000 Tons, York

- Gas Turbine

GE LM6000PD Sprint (45MW) with Inlet Cooling

- Heat Recovery Steam Generator

Express Integrated Technologies (EIT)

Efficiency Comparisons

- Existing TECO plant efficiency = **40%**
 - 80,000 tons chilled water (*2 - 5,000 ton steam turbine drive*)
 - 16 MW on-site generation
 - 750,000 PPH steam packaged boilers
- TECO plant efficiency after installation of CHP system = **80%**
 - 80,000 tons chilled water
 - 152,000 ton-hrs chilled water storage (*16,000 tons*)
 - 100 MW CHP on-site generation
 - 540,000 PPH heat recovery steam generator

Energy Efficiency

Chasing the BTU's

- National average heat rate natural gas fired
 - Simple cycle combustion turbine = 11,664 Btu/kW
 - Combined cycle combustion turbine = 7,502 Btu/kW
- ERCOT average central generation heat rate
 - 8,500 Btu/kW (low) to 10,700 Btu/kW (high)
- TECO CHP System (*calculated*)
 - 5,000 Btu/kW (low) to 8,500 Btu/kW (high)

RESULT: *TECO CHP system will provide a competitive heat rate when compared to the National and ERCOT generation.*

Environmental Efficiency

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%
SO2 (tons/year)	0.80	481.94	1.34	482.48	100%
CO2 (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 (CO2) 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

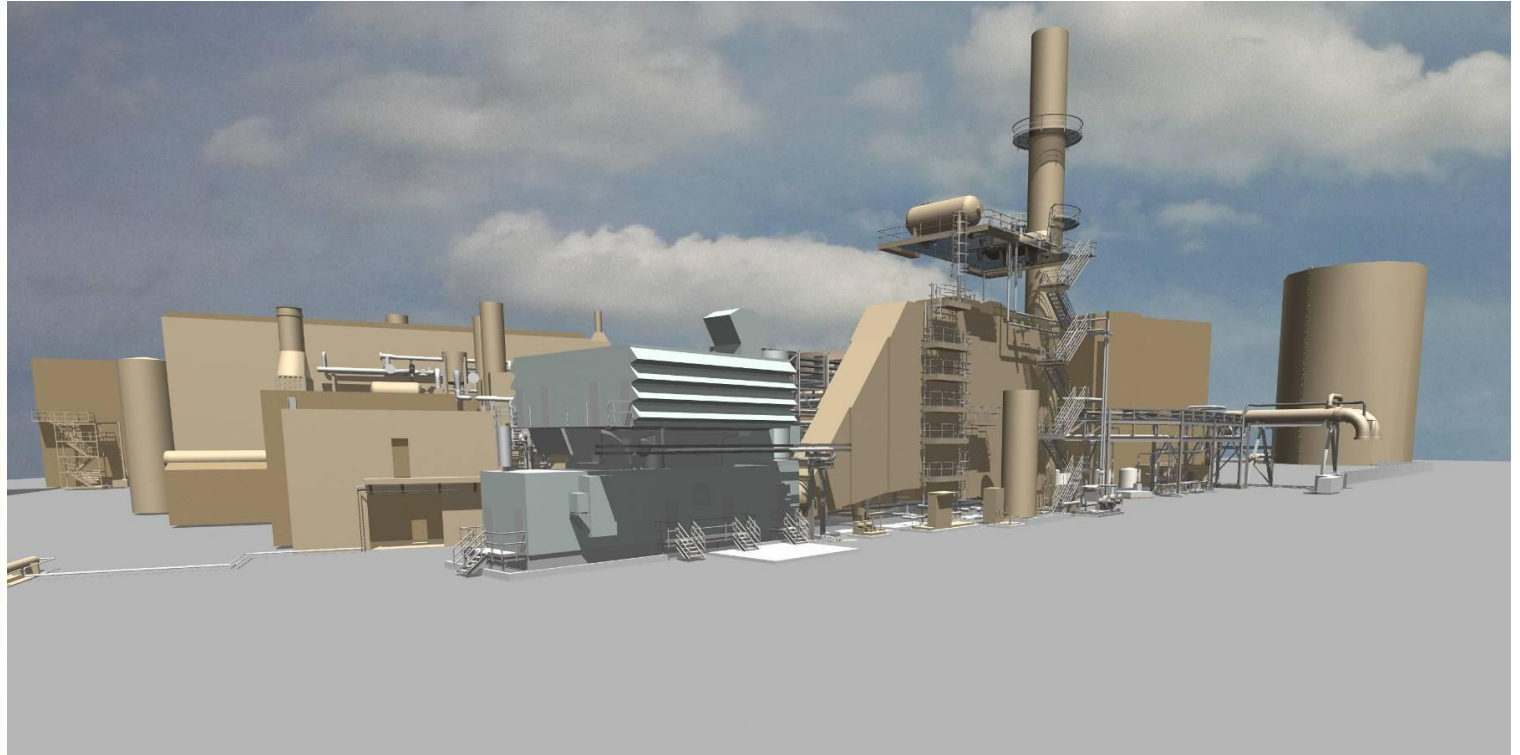
This reduction is equal to removing the carbon emissions of 50,452 cars



DOE FOA 44 Update

- \$9 Billion, 400 applications, submitted
- \$3 Billion found technically feasible
- \$155 Million for 41 projects approved
 - \$149.5 Million for 9 industrial CHP projects approved
 - \$4.5 Million for IETP throughout US
- \$10 Million awarded to TECO for CHP
 - Burns & McDonnell successfully prepared submittal with \$71 Million cost identified

TECO CHP Plant



THANK YOU for your attention!



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