

**FINAL
ENVIRONMENTAL ASSESSMENT
FOR THE
THERMAL ENERGY CORPORATION
COMBINED HEAT AND POWER PROJECT,
HOUSTON, TEXAS**

**U.S. Department of Energy
National Energy Technology Laboratory**



July 2010

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ACRONYMS AND ABBREVIATIONS

| | |
|--------------|---|
| Recovery Act | American Recovery and Reinvestment Act of 2009 (Recovery Act) |
| Btu | British thermal units |
| CFR | Code of Federal Regulations |
| CHP | combined heat and power |
| DOE | U.S. Department of Energy (also called the Department) |
| EA | environmental assessment |
| EPA | U.S. Environmental Protection Agency |
| HRSG | heat recovery steam generator |
| NEPA | National Environmental Policy Act, as amended |
| NSR | new source review |
| PSD | prevention of significant deterioration |
| SHPO | State Historic Preservation Officer |
| TAC | Texas Administrative Code |
| TECO | Thermal Energy Corporation |
| TCEQ | Texas Commission on Environmental Quality |

Note: Numbers in this EA generally have been rounded to two or three significant figures. Therefore, some total values might not equal the actual sums of the values.

COVER SHEET

Responsible Agency: U.S. Department of Energy (DOE)

Title: *Final Environmental Assessment for Thermal Energy Corporation Combined Heat and Power Project, Houston, Texas* (DOE/EA-1740)

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Abstract: DOE prepared this EA to evaluate the potential environmental consequences of providing a financial assistance grant under the *American Recovery and Reinvestment Act of 2009* (Recovery Act; Public Law 111-5, 123 Stat. 115) to the Thermal Energy Corporation to facilitate installation of a combined heat and power system (CHP), water chillers, and cooling tower at a district power plant that supplies the energy, heating, and cooling needs of the Texas Medical Center campus in Houston, Harris County, Texas. This EA analyzes the potential environmental consequences of DOE's Proposed Action to provide the Recovery Act grant, Thermal Energy Corporation's proposed project of installing and operating a CHP system, and the No-Action Alternative.

In this EA, DOE evaluated in detail potential impacts to air quality, sound levels, water resources, health and safety, and socioeconomics. After performing a screening analysis of other environmental resource areas, DOE concluded that impacts to other aspects of the environment would not be likely to occur or would not be detectable. The proposed project would be designed and operated in compliance with federal and Texas air quality regulations, reduce greenhouse gas emissions, and have a net beneficial impact on air quality in the region. Operation of the CHP system would cause a small increase in noise outdoors near the adjacent medical facilities. Installation of the CHP system in a floodplain would not adversely impact natural and beneficial floodplain values or increase risks to lives or property. The project would have no or only small impacts to surface water quality and future availability of potable water in the Houston area, and would not cause significant hazards to workers or the public at the Central Plant. Manufacturing and installation of the equipment would result in a minor to moderate, temporary beneficial impact to the economy. Incremental increase in cumulative impacts from the proposed project, relative to impacts from other activities in the surrounding area, would be negligible to small.

Availability: DOE encourages public participation in the NEPA process. A Notice of Availability was placed in the *Houston Chronicle* on May 22, 23, and 24, 2010. The Draft EA was made available for public review on DOE's National Energy Technology Laboratory (NETL) web site and at the Harris County Library, West University Branch, 6108 Auden, Houston, Texas, from May 22 through June 5, 2010. This Final EA is available on DOE's NETL web site at <http://www.netl.doe.gov/publications/others/nepa/ea.html>.

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SUMMARY

The U.S. Department of Energy (DOE or the Department) proposes to award a financial assistance grant under the *American Recovery and Reinvestment Act of 2009* to the Thermal Energy Corporation to facilitate the purchase and installation of a new combined heat and power system at an existing district power plant. The plant supplies the energy, heating, and cooling needs of the Texas Medical Center campus in Houston, Harris County, Texas. The Department's Proposed Action would provide Thermal Energy Corporation with \$10 million in financial assistance in a cost-sharing arrangement to facilitate installation of the combined heat and power system, four water chillers, a cooling tower, and balance of plant equipment. The system would have the capacity to produce about 45 megawatts of onsite electricity generation and 270,000 pounds per hour of steam, which would be used to meet the heating, cooling, and other thermal needs of the Texas Medical Center.

The combined heat and power system would be installed on an existing foundation outside at the Thermal Energy Corporation Central Plant. The water chillers and cooling tower would be installed inside a building currently under construction at the site. Electricity from the system would be produced using a natural gas-powered combustion turbine. The exhaust gas from the turbine would be routed to a heat recovery steam generator, which would be equipped with natural gas-fired duct burners to increase steam production. A selective catalytic reduction system would be installed to reduce emissions of oxides of nitrogen.

The combined heat and power system would have an overall energy efficiency of more than 78 percent. Operation of this system would result in an annual energy savings for the Thermal Energy Corporation of about 1.5 trillion British thermal units compared with the current system of individual natural gas-fired boilers, chillers, and grid-supplied electrical power.

Installation and operation of the combined heat and power system and other equipment would not have any meaningful or detectable impacts on land use; geology and soils; visual, biological, and cultural resources; transportation and traffic; utilities, energy, and materials; hazardous and nonhazardous waste; and environmental justice.

The combined heat and power system would be operated in an area that is classified under the *Clean Air Act* as in nonattainment for the 8-hour ozone criterion. More than 40 tons of nitrogen oxides, 200 tons of carbon monoxide, and 50 tons of particulate matter would be emitted per year during operation of the system. The Texas Commission on Environmental Quality conducted a new source review and a prevention of significant deterioration review for operation of the combined heat and power system and other equipment to be operated at the Central Plant, and issued a revised operating permit. The Department of Energy concludes that operation of the system would conform to the State's implementation plan and would be in compliance with federal and Texas air quality regulations. The refrigerant to be used in the new water chillers, R-22, is a greenhouse gas that contains ozone-destroying chlorine. These compounds could be released into the atmosphere if the refrigerant leaked during installation, operation, or repair of

the water chillers. Operation of the new system would allow Thermal Energy Corporation to reduce its consumption of electricity from the regional grid, and would require less natural gas to produce steam than under current operations. The resulting decrease in emissions of pollutants from regional power plants and from burning less natural gas at the Central Plant would be greater than emissions from the new system. In addition, the Department estimates that this proposed project would result in a net decrease of about 115,000 tons of carbon equivalents per year. Thus, the project would have a net beneficial impact on air quality in the region.

Sound levels at the boundary of the Central Plant during operation of the combined heat and power system and other equipment at that facility would range from about 60 to 75 decibels. Sound levels outside of medical facilities immediately north of the Central Plant currently are relatively high and would increase by about 5 decibels during operation of the equipment. However, sound levels indoors at these facilities would remain at acceptable levels. Sound levels at the nearest residential areas would increase by about 3 to 5 decibels, resulting in a small, possibly imperceptible change in noise.

The existing Central Plant is located in the 100-year floodplain of Brays Bayou. The Department conducted a floodplain assessment as required by regulations for “Compliance with Floodplain and Wetland Environmental Review Requirements” (10 CFR Part 1022). All equipment would be installed behind an existing floodwall, and the project would not cause an increase in storm water runoff or raise the elevation of the floodplain. The Department concludes that this project would have no adverse impacts on the natural and beneficial floodplain values associated with Brays Bayou, and would not affect lives or property in the area.

Installation and operation of the combined heat and power system would have no or negligible adverse impacts on surface water quality. Discharges of storm water and wastewater from the cooling tower would meet the effluent limitation and monitoring requirements of discharge permits. The municipal water system has the capacity to meet the increase in demand for water to operate the new cooling tower, water chillers, and other equipment.

Operation of the combined heat and power system would not cause significant hazards to workers or the public at the Central Plant. Ammonia, which would be used during operation of the selective catalytic reduction system, would be the only new hazardous material used in large quantities at the facility. The ammonia would be stored in an outdoor tank in an area with secondary containment, and workers would be trained to handle this hazardous material.

Manufacturing of the combined heat and power equipment would result in a minor to moderate and temporary, beneficial impact to the economy in the areas where the equipment would be manufactured and in the Houston area during installation.

The Texas Medical Center and local government agencies have plans for a large number of other construction projects and infrastructure upgrades in the area surrounding the Central Plant. Relative to the cumulative changes in the environment that would be caused by these projects, installation and operation of the combined heat and power system would cause small, adverse

incremental changes in air quality and noise in that area, as well as a small incremental increase in the demand for water in the City of Houston.

Under the No-Action Alternative, the Department of Energy would not provide funding to Thermal Energy Corporation for its proposed project. DOE assumes for purposes of this analysis that the combined heat and power system would not be installed and operated. No impacts to the existing environment would occur, and beneficial impacts of the proposed project would not be realized.

On the basis of the evaluations in this environmental assessment, the Department of Energy determined that its Proposed Action, providing financial assistance to the Thermal Energy Corporation to facilitate installation of a combined heat and power system, and Thermal Energy's proposed project would have no significant impact on the human environment.

1. INTRODUCTION

As part of the *American Recovery and Reinvestment Act of 2009* (Recovery Act) (the Recovery Act; Public Law 111-5, 123 Stat. 115), the U.S. Department of Energy's (DOE's or the Department's) National Energy Technology Laboratory (NETL), on behalf of the Office of Energy Efficiency and Renewable Energy's Industrial Technologies Program, is providing up to \$156 million in federal funding for competitively awarded grants for the deployment of projects for district energy systems, combined heat and power (CHP) systems, waste energy recovery systems, and energy-efficient industrial equipment and processes at single installations or multiple installations at multiple sites. The funding of these projects requires compliance with the *National Environmental Policy Act of 1969* (NEPA), as amended (NEPA; 42 U.S.C. 4321 et seq.), Council on Environmental Quality regulations (40 CFR Parts 1500 to 1508), and DOE NEPA implementing procedures (10 CFR Part 1021).

Thermal Energy Corporation (TECO) proposes to install a new high-efficiency CHP system at an existing district power plant (that is, the Central Plant) that supplies the energy, heating, and cooling needs of the Texas Medical Center (TMC) in Houston, Harris County, Texas. DOE is considering providing TECO with a grant under Funding Opportunity Announcement DE-FOA-0000044, *Recovery Act: Deployment of Combined Heat and Power (CHP) Systems, District Energy Systems, Waste Energy Recovery Systems, and Efficient Industrial Equipment*, to facilitate the purchase and installation of the CHP system. Specifically, TECO would use DOE funding to facilitate the purchase and installation of a natural gas-powered turbine, heat recovery steam generator (HRSG), a natural gas compressor, four electric chillers to be powered by the CHP system, a cooling tower, an exhaust stack, and required balance of plant equipment at an existing facility.

DOE prepared this environmental assessment (EA) to evaluate the potential environmental consequences of providing a grant under DOE's initiative. In compliance with NEPA and its implementing procedures, this EA examines the potential environmental consequences of DOE's Proposed Action (that is, providing a financial assistance grant), TECO's proposed project, and the No-Action Alternative (under which it is assumed that, as a consequence of DOE's denial of financial assistance, TECO would not proceed with the project). The EA's purpose is to inform DOE and the public of the potential environmental consequences of the proposed project and alternatives.

This section explains NEPA and the related procedures (Section 1.1), the background of this project (Section 1.2), the purpose and need for DOE action (Section 1.3), and the environmental considerations DOE did not carry forward to detailed analysis (Section 1.4). Chapter 2 discusses DOE's Proposed Action; TECO's proposed project, the No-Action Alternative, and action alternatives. Chapter 3 details the affected environment and potential environmental consequences of the Proposed Action, proposed project, and No-Action Alternative. Chapter 4 addresses cumulative impacts, and Chapter 5 provides DOE's conclusions from the analysis. Chapter 6 lists the references for this document. Appendix A contains the distribution list for

this document, and Appendix B contains copies of DOE's consultation letters with other agencies.

1.1 National Environmental Policy Act and Related Procedures

In accordance with the DOE NEPA implementing procedures, DOE must evaluate the potential environmental impacts of its proposed actions, including funding decisions, which may have a significant impact on human health and the environment. In compliance with these regulations and DOE's procedures, this EA:

- Examines the potential environmental impacts of the Proposed Action and the No-Action Alternative;
- Identifies unavoidable adverse environmental impacts of the Proposed Action;
- Describes the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- Characterizes any irreversible and irretrievable commitments of resources that would be involved should DOE decide to implement its Proposed Action.

DOE must meet these requirements before it can make a final decision to proceed with any proposed federal action that could cause adverse impacts to human health or the environment. This EA fulfills DOE's obligations under NEPA and provides DOE with the information needed to make an informed decision about helping finance the installation of the CHP system at the TECO district energy facility in Houston, Texas.

This EA evaluates the potential individual and cumulative impacts of TECO's proposed project. No other action alternatives are analyzed. For purposes of comparison, this EA also evaluates the impacts that could occur if DOE did not provide funding (the No-Action Alternative), under which DOE assumes that TECO would not proceed with the project. This assumption might be incorrect—that is, TECO might proceed without federal assistance. However, this assumption allows DOE to compare the impacts of an alternative in which the project occurs with one in which it does not.

1.2 Background

DOE's National Energy Technology Laboratory manages the research and development portfolio of the Industrial Technologies Program for the Office of Energy Efficiency and Renewable Energy. The mission of the Industrial Technologies Program is to establish U.S. industry as a world leader in energy efficiency and productivity. The Program leads the national effort to reduce industrial energy intensity and carbon emissions, and strives to transform the way U.S. industry uses energy by supporting cost-shared research and development that addresses the top energy challenges facing industry. In addition, the Industrial Technologies Program fosters the

adoption of advanced technologies and energy management best practices to produce meaningful progress in reducing industrial energy intensity.

Congress appropriated significant funding for the Industrial Technologies Program in the Recovery Act to stimulate the economy and reduce unemployment in addition to furthering the objectives of the existing Program. DOE solicited applications for this funding by issuing a competitive Funding Opportunity Announcement (DE-FOA-0000044), *Recovery Act: Deployment of Combined Heat and Power (CHP) Systems, District Energy Systems, Waste Energy Recovery Systems, and Efficient Industrial Equipment*, on July 7, 2009. The announcement invited applications in four areas of interest:

- Area of Interest 1 – Combined Heat and Power; the generation of electric energy and heat in a single, integrated system, with an overall thermal efficiency of 60 percent or greater on a higher-heating-value basis.
- Area of Interest 2 – District Energy Systems; systems providing thermal energy from a renewable energy source, thermal energy source, or highly efficient technology to more than one building or fixed energy-consuming use from one or more thermal energy production facilities through pipes or other means to provide space heating, space conditioning, hot water, steam, compression, process energy, or other end uses.
- Area of Interest 3 – Industrial Waste Energy Recovery; the collection and reuse of energy from sources such as exhaust heat or flared gas from any industrial process; waste gas or industrial tail gas that would otherwise be flared, incinerated, or vented; a pressure drop in any gas, excluding any pressure drop to a condenser that subsequently vents the resulting heat.
- Area of Interest 4 – Efficient Industrial Equipment; any proven commercially available technology that can provide a minimum 25 percent efficiency improvement into the industrial sector.

DOE announced its selections on November 3, 2009, with multiple awards in three of the four areas of interest. DOE selected nine projects based on the evaluation criteria in the funding opportunity announcement and gave special consideration to projects that promoted the objectives of the Recovery Act—job preservation or creation and economic recovery—in an expeditious manner.

The proposed project, installation of a CHP system in Houston, Texas, was one of the nine projects DOE selected for funding. DOE's Proposed Action is to provide a \$10 million financial assistance grant under a cost-sharing arrangement with TECO. The estimated cost of the proposed project is \$83 million.

1.3 Purpose and Need

The purpose of the Proposed Action is to support the mission of DOE's Industrial Technologies Program and the goals of the Recovery Act. The mission of the Industrial Technologies Program is to have U.S. industry lead the world in energy efficiency and productivity. The Program leads the national effort to reduce industrial energy intensity and carbon emissions, and strives to transform the way U.S. industry uses energy by supporting cost-shared research and development that addresses the top energy challenges facing industry. In addition, the Program fosters the adoption of today's advanced technologies and energy management best practices to produce meaningful progress in reducing industrial energy intensity.

The Industrial Technologies Program's three-part strategy pursues this mission by:

- Sponsoring research, development, and demonstration of industry-specific and crosscutting technologies to reduce energy and carbon intensity;
- Conducting technology delivery activities to help plants access today's technology and management practices; and
- Promoting a corporate culture of energy efficiency and carbon management within industry.

To align with its mission, the program established a goal of achieving a 25-percent reduction in industrial energy intensity by 2017, guided by the *Energy Policy Act of 2005*. The strategy also calls for an 18-percent reduction in U.S. carbon intensity by 2012. The Department seeks to identify projects and technologies that it can fund to meet this goal.

In June 2009, DOE initiated a process to identify suitable projects by issuing Funding Opportunity Announcement DE-FOA-00000044, *Recovery Act: Deployment of Combined Heat and Power (CHP) Systems, District Energy Systems, Waste Energy Recovery Systems, and Efficient Industrial Equipment*. This Funding Opportunity Announcement is funded by the Recovery Act.

The Recovery Act seeks to create jobs, restore economic growth, and strengthen America's middle class through measures that modernize the nation's infrastructure, enhance America's energy independence, expand educational opportunities, preserve and improve affordable health care, provide tax relief, and protect those in greatest need. Provision of funds under this Funding Opportunity Announcement would achieve these objectives.

The capital cost of new equipment is often a roadblock for use of more efficient equipment and processes. Although the newer technologies would provide lower energy requirements and operating costs, the payback period for some technologies does not meet internal business goals. DOE's provision of financial assistance allows companies to reduce the payback period, making these new technologies an acceptable option for them..

1.4 Environmental Resources Not Carried Forward

Chapter 3 of this EA examines the potential environmental impacts of the proposed project and the No-Action Alternative for the following resource areas:

- Air quality
- Noise
- Water resources
- Socioeconomics
- Occupational health and safety.

DOE EAs commonly address the following resource and subject areas. In an effort to streamline the NEPA process and enable a timely award to the selected project, this assessment did not examine these areas at the same level of detail as the resource areas listed above. The focus for the more detailed analysis was on those activities or actions that would require new or revised permits, have the potential for significant adverse environmental impacts, or have the potential for controversy. For the reasons discussed below, DOE concludes that the TECO proposed project would result in very minor or no impacts to the following resource areas, and the detailed description and analyses of these resources are not carried forward into Chapter 3.

- Land use. The CHP system would be installed at the existing TECO Central Plant. TECO owns the Central Plant, which has been used to provide heating and cooling services for the TMC for more than 40 years. Installation of the new CHP system would improve the efficiency of the TECO district energy system and would not disrupt the primary land use, which is an industrial facility operated to generate steam and chilled water for the TMC. Because all installation activities associated with the proposed project would occur at the Central Plant site, there would be no adverse impacts to surrounding land uses.
- Aesthetics and visual resources. The CHP system would be similar in appearance to the existing equipment and facilities at the TECO Central Plant (such as boilers, cooling towers, and an electrical substation; see Section 2.2). The new 110-foot-tall exhaust stack for the CHP system and the new cooling tower would be similar in height to the recently constructed thermal energy storage tank cooling tower and would not change the general appearance of the Central Plant as an industrial, power-generating facility.
- Geology and soils. All equipment would be installed on an existing foundation outdoors, or inside a building that is currently under construction. No additional information on geology and soil conditions is required for installation of the system, and the installation would not impact geological or soil resources.
- Biological resources. Installation of the CHP system at a fully developed industrial facility in an urban setting would not result in loss of habitat or harm to any protected plant or animal species. In addition, indirect impacts, such as impacts to air quality

(Section 3.1) and water resources (Section 3.3), would be minimal. DOE obtained a list of species protected under the *Endangered Species Act* that might occur in Harris County, Texas, from the U.S. Fish and Wildlife Service Southwest Region web site, as required by the Clear Lake Texas Field Office (see the letter from the U.S. Fish and Wildlife Service in Appendix B). The only protected species known to occur in Harris County is the Texas prairie dawn-flower (*Hymenoxys texana*) (FWS 2010). However, critical habitat has not been identified for this protected plant. Because the CHP system would be installed on an existing foundation outside or inside a building that is currently under construction in an existing industrial facility, DOE concluded that the proposed project would have no adverse impacts on federally listed threatened, endangered, proposed, or candidate species. For the same reasons, the proposed project also would not adversely affect any rare, threatened, or endangered plant or animal species protected by Texas laws and regulations (Texas Parks and Wildlife 2010).

- Cultural resources. Installation of the CHP system at the TECO Central Plant would not directly impact cultural resources or historic properties. There are no sites listed on the National Register of Historic Places within 0.5 mile of the project site (Texas Historical Commission 2010). Any cultural resources or historic properties near the project site, including those that might be eligible for the National Register, would not be indirectly affected because the increase in noise from operation of the CHP would be minimal (Section 3.2) and there would be no substantial change in the appearance of the TECO Central Plant. DOE has submitted documentation to the Texas State Historic Preservation Officer explaining DOE's conclusion that no historic properties would be affected, as required by 36 CFR Part 800, the implementing regulations for the *National Historic Preservation Act*. That submittal letter is included in Appendix B of this EA.
- Transportation and traffic. Installation and operation of the CHP would not require modification of the surrounding streets. There is sufficient parking on and around the TECO Central Plant for construction workers during installation of the CHP system, and this project would not otherwise disrupt traffic in and around the TMC campus.
- Utilities, energy, and materials. Production of 45 megawatts of electricity by the CHP system and steam from the HRSG would result in a very small reduction in the use of electricity and natural gas relative to the amounts consumed in the Houston area. There are no unique materials required to manufacture, install, or operate the CHP system, water chillers, cooling tower, or other equipment required for this project. Section 3.3 of this EA analyzes the use of water from the Houston municipal water system for operation of the water tower and CHP system.
- Hazardous and nonhazardous waste. Operation of the CHP system would not result in new hazardous waste streams and would cause a negligible increase in nonhazardous, solid waste production at the TECO Central Plant.

- Environmental justice. Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs federal agencies to address environmental and human health conditions in minority and low-income communities. The evaluation of impacts to environmental justice is dependent on demonstrating that significant, adverse impacts from the proposed project are not disproportionately borne by any low-income or minority groups in the affected community. As illustrated in this EA, no significant, adverse impacts would occur to any members of the community; therefore, there would be no adverse and disproportional impacts to minority or low-income populations. Section 3.4 presents information on the percentage of low income and minority individuals living in and near the area where this project would occur.

1.5 Consultations and Public Comment Response Process

1.5.1 CONSULTATIONS

As required by the implementing regulations of the *National Historic Preservation Act* (36 CFR Part 800), DOE initiated consultation with the Texas State Historic Preservation Officer (SHPO) of the Texas Historic Commission on March 16, 2010. On that date, DOE sent a letter and supporting application to the Texas SHPO stating that DOE had determined the TECO project would not affect historic properties. A letter dated April 1, 2010, from the Texas SHPO supported DOE's determination. A copy of the DOE letter with SHPO concurrence is included in Appendix B of this EA. DOE determined that there are no American Indian tribes with historic ties to the project site and/or surrounding area and, therefore, did not consult with any tribes about the TECO project.

DOE initiated informal consultation with the Clear Lake, Texas, Field Office of the U.S. Fish and Wildlife Service in February 2010. In accordance with a form letter DOE received from that office (see Appendix B), DOE obtained a list of species classified as threatened or endangered under the *Endangered Species Act* that might occur in Harris County, Texas (FWS 2010). As described in Section 1.4 above, DOE concluded that installation and operation of the CHP system would not affect species protected under the Act and, therefore, did not consult further with the Fish and Wildlife Service.

In accordance with DOE regulations for conducting a floodplain analysis (10 CFR Part 1022), DOE sent a notice of floodplain involvement and copy of the Draft EA to the Federal Emergency Management Agency and to the Harris County Flood Control District.

1.5.2 COMMENT-RESPONSE PROCESS

DOE issued the Draft EA for comment on May 22, 2010, and advertised its release in the *Houston Chronicle* on May 22, 23, and 24, 2010. The Department sent copies for public review to the Harris County Library in Houston, Texas, to the people and agencies listed in Appendix A of this EA, and made the EA available on the National Energy Technology Laboratory web site.

The Department established a 15-day public comment period that began May 22 and ended June 5, 2010. The Department announced it would accept comments by mail, email, or fax.

DOE received comments from the Federal Emergency Management Agency and the U.S. Environmental Protection Agency (EPA). The Federal Emergency Management Agency recommended that the county floodplain administrator be contacted for review and possible permit requirements for this project. DOE sent a copy of the Draft EA to the Harris County Flood Control District and TECO has obtained all necessary permits and certifications from that agency for construction of the proposed project.

The EPA identified the following four areas of concern that should be addressed in the EA.

- The project might require “no rise” certification, which states that the project would not increase the base elevation within the 100-year floodplain. DOE modified Section 3.3.2.1 to include a discussion about the preparation of Federal Emergency Management Agency flood proofing and elevation certificates for this project. Those certificates are included in Appendix C of this EA.
- Include clarification of whether the existing foundation is capable of handling the dynamic load of the proposed equipment and whether a foundation exists for the stack and cooling tower. DOE modified Section 2.2.1 to include a discussion of the subsurface supports and foundations that were designed and prepared to meet the requirements of all proposed upgrades and expansions at the Central Plant, including the CHP system, water chillers, and cooling tower.
- The sound level at night in neighborhoods is close to exceeding the City of Houston noise ordinance. Section 3.2.3 states the project would result in a small, possibly imperceptible, change in sound levels at nearby residential properties. DOE modified this section to clarify that the predicted sound levels are equal to or less than the maximum sound levels specified in the City of Houston noise ordinance.
- The EA should state that water quality standards for the designated uses of Brays Bayou, which is classified as impaired, would be maintained. DOE modified Section 3.3.2.1 to clarify that discharges from the Central Plant would not increase pollutant loadings that would contribute to the impairment of Brays Bayou.

2. DOE PROPOSED ACTION AND ALTERNATIVES

This chapter describes DOE's Proposed Action (Section 2.1), TECO's proposed project (Section 2.2), the No-Action Alternative (Section 2.3), and the bases for not considering other alternatives (Section 2.4).

2.1 DOE's Proposed Action

DOE's Proposed Action would award TECO a financial assistance grant through the Recovery Act to facilitate the purchase and installation of a new CHP system. Specifically, TECO would use DOE funding to facilitate the purchase and installation of a natural gas-powered turbine, HRSG, a natural gas compressor, four electric chillers to be powered by the CHP system, a cooling tower, an exhaust stack, and required balance of plant equipment at an existing facility. DOE would provide \$10 million in financial assistance in a cost-sharing arrangement with TECO. The estimated cost of the proposed project is \$83 million.

2.2 TECO's Proposed Project

TECO's proposed project would install a new CHP system, including an industrial natural gas-powered turbine, heat recovery steam generator (HRSG), a natural gas compressor, four water chillers, a cooling tower, an exhaust stack, and required balance of plant equipment within the existing Central Plant at the Texas Medical Center in Houston, Texas. The proposed project would improve the plant's energy efficiency and help meet TMC's expanding need for thermal energy. TECO is a nonprofit corporation that operates a district energy service to provide thermal services in the form of steam and chilled water to multiple users in the TMC.

TECO currently operates two thermal utility plants (the Central and South plants), with a combined capacity of 80,000 tons of chilled water and 762,000 pounds per hour of steam production. The Central Plant is located just south of Midtown in Houston, near the intersection of Braeswood Boulevard and Pressler Drive, in the southeastern portion of the TMC campus (Figure 2-1). Prior to recent upgrades at the plant, the Central Plant used six boilers to produce steam and eight electric centrifugal chillers and two steam centrifugal chillers to produce chilled water. The TMC uses steam from the plant to heat buildings and for other hospital and research facility needs. A portion of the produced steam also is used to operate steam-driven equipment such as chillers, water feed pumps, chilled water distribution pumps, and other ancillary equipment at the plant. A thermal energy distribution system consisting of 35 miles of piping provides steam and chilled water to over 16 million square feet of space for offices, laboratories, and patient services in 43 buildings on the TMC campus. The local grid currently supplies all electrical power for operations at the plant.

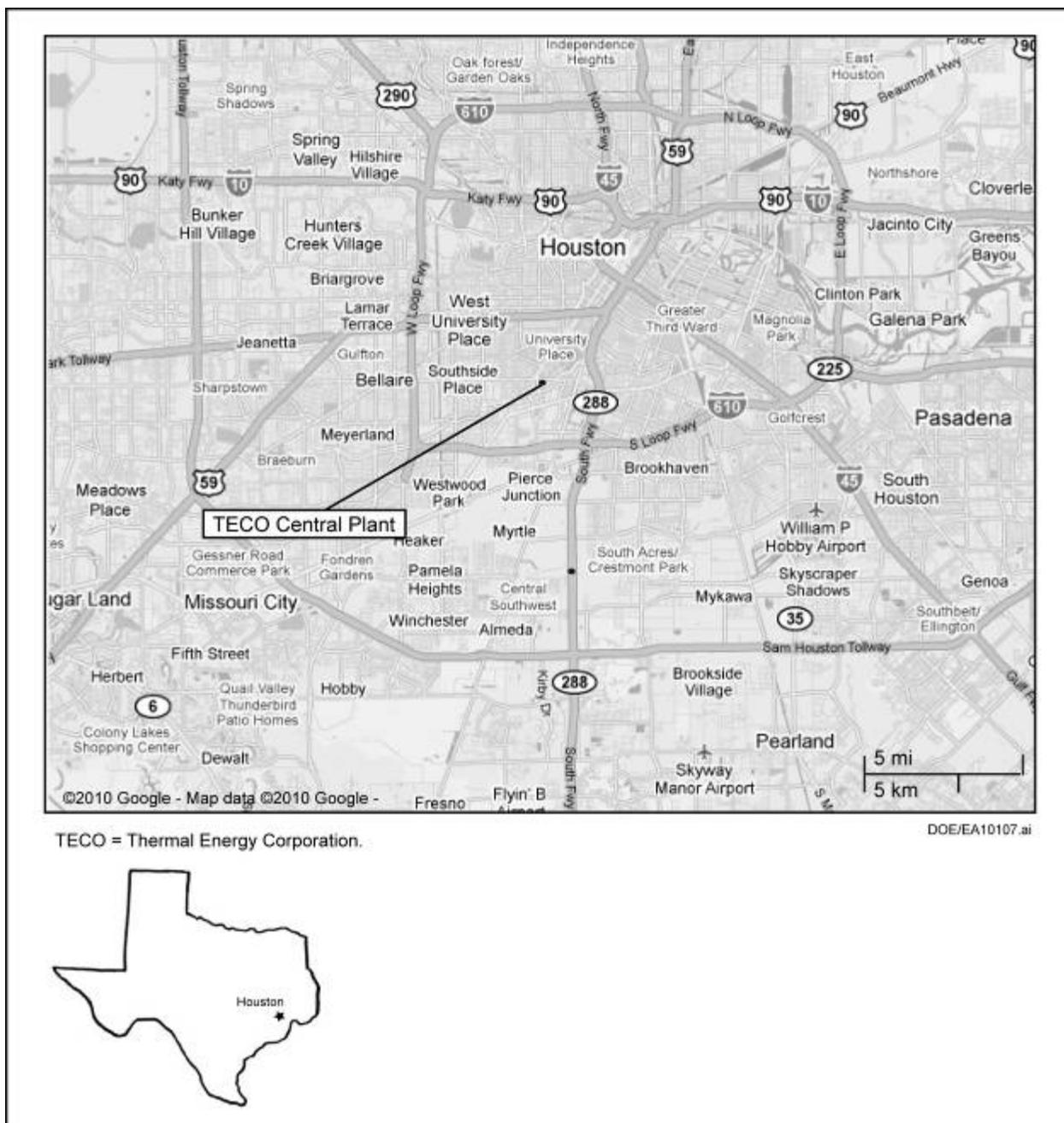


Figure 2-1. Location of the Thermal Energy Corporation Central Plant in Houston, Texas.

TECO is undertaking a major expansion and upgrade of its energy system at the Central Plant that will substantially change operations, add capacity, improve efficiency, reduce emissions, and improve reliability and emergency operating capacity. Installation of a new CHP system, including upgraded chilled water capacity, would be an integral part of this expansion. In addition, TECO plans to implement the following other changes and additions to the Central Plant (Figures 2-2 and 2-3), which are not being funded under this Proposed Action.

- Demolition and removal of the TMC laundry facility that was located on the eastern portion of the facility (Figure 2-2) to make room for the thermal energy storage tank and chiller building;
- Relocation of the natural gas service to support new CHP systems;
- Construction of an 8.8-million-gallon thermal energy storage tank;



Figure 2-2. The TECO Central Plant prior to expansion and upgrades (view to north). TECO would install the CHP system near the southern boundary of the facility (A) and the four new water chillers in a building being constructed where the laundry facility (B) is shown in this photograph.

- Construction of a chiller building to house additional chilled water production equipment;
- Replacing part of the west cooling tower;
- Construction of a 30,000-square-foot operations support facility;
- Possible additional chilled water production (up to 16,000 tons) depending on cooling load demand;
- Upgrading the existing 138-kilovolt substation;

- Upgrading the water supply system and adding another backup water well;
- Installation of additional chilled-water loops to serve new loads on the TMC to the west and south; and
- Installation of a second CHP power plant.

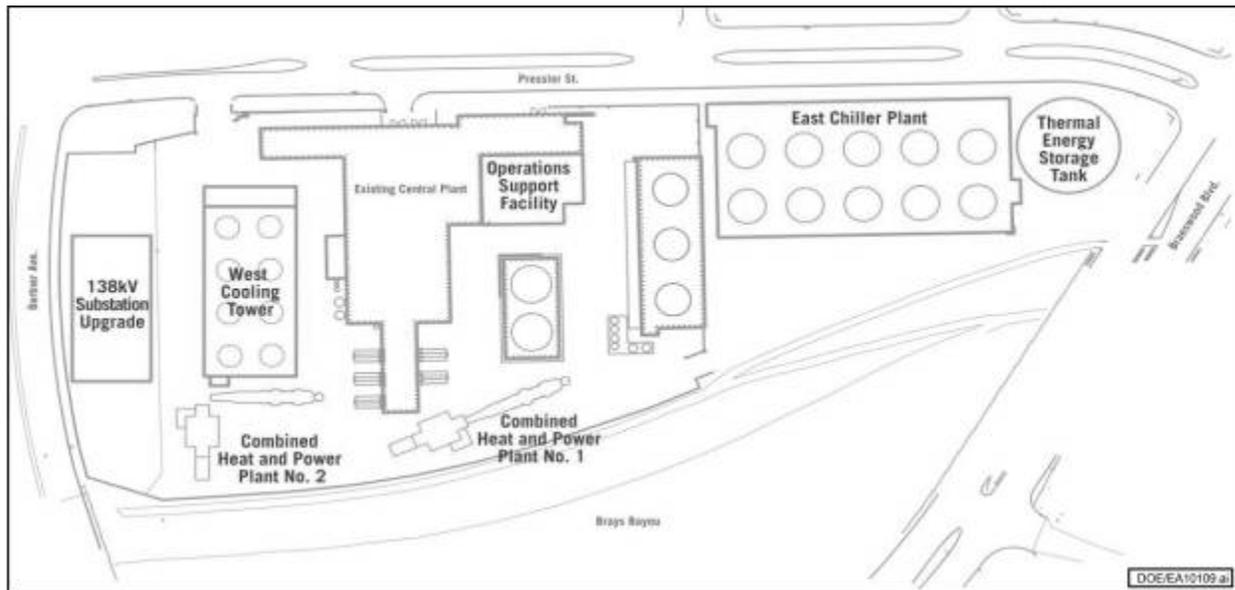


Figure 2-3. Location of new and upgraded facilities and equipment at the TECO Central Plant.

Some of these expansions and upgrades are ongoing or have been completed. For example, as of March 2010, the laundry facility had been removed, the thermal energy storage tank and operations support facility had been constructed, and construction of the new east chiller plant had begun. Other upgrades, such as installation of a second CHP power plant and additional chilled-water capacity, might not occur until 2014 or later.

DOE's Proposed Action of providing TECO with \$10 million in financial assistance in a cost-sharing arrangement applies to the purchase and installation of part of the expansion and upgrades planned for the Central Plant. Specifically, DOE funding would be used to facilitate the purchase and installation of a natural gas-powered turbine, HRSG, natural gas compressor, four electric chillers to be powered by the CHP system, a cooling tower required for operation of the chillers, an exhaust stack, and balance of plant equipment at an existing facility. The equipment to be funded as part of DOE's Proposed Action is referred to collectively in this EA as the TECO proposed CHP system or CHP system. Other construction, modification, and installation activities at the TECO Central Plant that are ongoing or had not been started as of March 2010, including installation of a second CHP power plant, are evaluated as cumulative impacts in Chapter 4 of this EA.

The major components of the TECO proposed CHP system are described in the following paragraphs. All activities required for installation of the system would occur within the

boundaries of the TECO Central Plant. Some of the infrastructure and equipment for the CHP system have been developed or installed, such as the foundation for the combustion turbine generator and HRSG. TECO estimates that installation of the remaining equipment for the CHP system, water chillers, and cooling tower would take 14 months. A peak of about 300 workers would be required for this installation process, and TECO would expand its workforce by two workers to maintain and operate the CHP system.

2.2.1 CHP SYSTEM COMPONENTS

The CHP system would be capable of producing about 45 megawatts of onsite electricity generation and 270,000 pounds per hour of steam. The system would operate as a base-load system to serve 50 percent of the TECO plant peak electrical load and 100 percent of the TMC peak process and space heating loads. The major components of this system would be installed on existing subsurface supports and foundations near the southern boundary of the Central Plant (Figures 2-2 and 2-3) that were designed and prepared specifically to meet the requirements of all proposed expansions and upgrades at the Central Plant, including the CHP system, water chillers, and cooling tower.

The prime component of the CHP system would be a General Electric LM6000 gas-powered combustion turbine generator. This generator consists of an air compressor, combustors, and a turbine. Inlet air enters the compressor where its pressure is increased. The compressed air then combines with pipeline-quality natural gas and feeds to the combustor. The combustion products and excess air are expanded through the turbine to produce shaft horsepower, which is used to compress the inlet combustion air and drive an electric power generator. The exhaust gas is routed to the HRSG for steam production. This equipment would be installed in a thermally and acoustically insulated module that provides thermal and acoustic dampening as well as a self-contained fire protection system. The turbine and associated equipment would cover an area of about 15 by 60 feet.

The exhaust gas from the combustion turbine generator, which exits at a temperature of about 850°F, would be routed through a heat transfer module in the HRSG to create steam. The HRSG would be equipped with natural gas-fired duct burners to increase steam production. The steam generated in the HRSG would be used to power steam-driven equipment at the Central Plant and meet the TMC needs for heat and steam.

A selective catalytic reduction system would be installed on the HRSG to reduce emissions of nitrogen oxides. In this system, ammonia would be injected into the exhaust gas, where it would react with the nitrogen oxides to form nitrogen and water vapor. The selective catalytic reduction system would consist of a pressurized 10,000-gallon tank to store aqueous ammonia, an ammonia vaporization system, an injection grid, and a catalyst.

The unit containing the HRSG and catalytic reduction system would be located adjacent to the turbine, cover an area of about 30 by 110 feet, and have a maximum height of about 75 feet. The exhaust stack for the CHP system would be 110 feet tall.

The CHP system would also require the installation of a natural gas compressor to pressurize the utility-line gas to a sufficient pressure for use in the turbine. The balance of plant equipment, such as the electricity control and distribution system, piping, instrumentation and controls, pumps, and valves, would also be installed on and in the vicinity of the turbine and HRSG.

TECO estimates that this CHP system would have an overall energy efficiency of more than 78 percent (that is, the production of useful energy in the form of electricity and steam per unit of fuel consumed to produce the energy). Most commercial power production systems in the United States have an efficiency of less than 30 percent, and an additional 5 percent or more of power is lost during transmission of electricity from central generating systems to points of use.

Operation of this system would result in an annual energy savings for TECO of 1.5 trillion British thermal units (Btu) compared with the current system of individual natural gas-fired boilers, chillers, and grid-supplied electrical power. This system also would:

- Reduce the quantity of grid power purchased by TECO by more than 300,000 megawatt hours per year;
- Reduce natural gas fuel consumption for steam production by more than 60 percent;
- Reduce the total annual consumption of fossil fuel by TECO by more than 60 percent; and
- Result in \$11.4 million of energy cost savings in the first year of operation and will accrue about \$150 million of energy costs savings over a 30-year life cycle.

2.2.2 WATER CHILLERS AND COOLING TOWER

TECO would install four electric centrifugal water chillers on the third level of the new east chiller building (Figure 2-3) currently under construction. Each chiller would have a capacity of producing 8,000 tons of chilled water and would be powered by the electrical output from the gas turbine generator. Heat rejection for the chillers would be provided by a new cooling tower to be located on the top of the chiller building. This cooling tower would have a maximum height of 120 feet and be similar in appearance to three existing cooling towers at the Central Plant.

The cooling tower would be equipped with high-efficiency mist eliminators to reduce emissions of particulate matter. Electricity produced by the gas turbine generator would power this equipment. The east chiller building would be equipped with a vessel for storage of 37,100 pounds of R-22 refrigerant, or 1.5 times the volume required for a single chiller.

Operation of the water chillers and cooling tower would require 41.5 million gallons of water per year. Most of this water would be used as makeup water for the chillers and process water for the cooling tower. The water would evaporate in the tower or discharge to Brays Bayou (located directly south of the Central Plant) via an outfall permitted by the Texas Commission on

Environmental Quality (TCEQ). The water would arrive at the chiller building via an existing eight-inch water main that previously served the laundry building. The water could also arrive via one of two permitted wells that serve as a backup source of water sources for the Central Plant.

2.3 No-Action Alternative

Under the No-Action Alternative, DOE would not provide funding to TECO for the proposed CHP system. As a result, installation of the CHP system would be delayed while TECO looked for other funding sources, or abandoned if other funding sources could not be obtained.

Furthermore, demonstration and adoption of advanced technologies and energy best management practices would not occur or would be delayed and DOE's ability to achieve its objectives under the Industrial Technologies Program and the Recovery Act would be impaired.

Although TECO's proposed project might proceed if DOE decided not to provide any form of financial assistance, DOE assumes for purposes of this EA the project would not proceed without this assistance. If the project did proceed without DOE's financial assistance, the potential impacts would be essentially identical to those under DOE's Proposed Action (that is, providing assistance that allows the project to proceed). In order to allow a comparison between the potential impacts of a project as implemented and the impacts of not proceeding with a project, DOE assumes that if it decided to withhold assistance from this project, construction and operation of the TECO proposed CHP system would not proceed.

2.4 Alternatives

DOE's alternatives to its Proposed Action for the Industrial Technologies Program consist of the other technically acceptable applications received in response to the Funding Opportunity Announcement DE-FOA-0000044, *Recovery Act: Deployment of Combined Heat and Power (CHP) Systems, District Energy Systems, Waste Energy Recovery Systems, and Efficient Industrial Equipment*. Prior to selection, DOE made preliminary determinations regarding the level of review required by NEPA based on potentially significant impacts identified during reviews of the technically acceptable applications. DOE conducted these preliminary environmental reviews pursuant to 10 CFR 1021.216 and a variance to certain requirements in the regulation granted by the Department's General Counsel (74 FR 41693, August 18, 2009). These preliminary NEPA determinations and environmental reviews were provided to the selecting official, who considered them during the selection process.

Because DOE's Proposed Action under the Industrial Technologies Program is limited to providing financial assistance in cost-sharing arrangements to projects submitted by applicants in response to a competitive funding opportunity, DOE's decision is limited to either accepting or rejecting the project as proposed by the proponent, including its proposed technology and selected sites. DOE's consideration of reasonable alternatives is therefore limited to the technically acceptable applications and a No-Action Alternative for each selected project.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

In this chapter, DOE assesses the following resources: air quality, noise, water resources, socioeconomics, and environmental health and safety. The “environmental baseline” for each of these resource areas is described first, followed by an assessment of the potential consequences of the proposed project and of the No-Action Alternative.

3.1 Air Quality

This section describes wind and ambient air quality conditions in the Houston area; discusses the air quality conformity requirements that apply to this EA; and describes the potential environmental impacts resulting from emissions of regulated pollutants, odor-causing compounds, and greenhouse gases associated with TECO’s proposed project.

3.1.1 AFFECTED ENVIRONMENT

3.1.1.1 Wind and Ambient Air Quality Conditions

The prevailing wind direction in the Houston area is to the south or southeast (about 40 percent of the time) or to the north (about 15 percent of the time). The average annual wind speed is about 7.5 miles per hour, with higher wind speeds in the spring (average monthly speed of about 9 miles per hour) and lower wind speeds in the summer (6 miles per hour) (NCDC n.d.; TCEQ n.d.).

The ambient air quality in an area can be characterized in terms of whether it complies with the primary and secondary National Ambient Air Quality Standards. The *Clean Air Act* (42 U.S.C. 7401 et seq.) requires the EPA to set national standards for pollutants considered harmful to public health and the environment. National Ambient Air Quality Standards have been established for six criteria pollutants: carbon monoxide; lead; nitrogen dioxide; ozone; particulate matter (including particulate matter with both an aerodynamic size less than or equal to 10 microns and less than or equal to 2.5 microns); and sulfur dioxide. Primary standards define levels of air quality the EPA has determined as necessary to provide an adequate margin of safety to protect public health, including the health of “sensitive” populations such as children and the elderly. Secondary standards define levels of air quality deemed necessary to protect the public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

Table 3-1 lists the primary National Ambient Air Quality Standards for each of the criteria pollutants. Regions that are not in compliance with these standards are designated as nonattainment areas. Harris County is classified as a nonattainment area for 8-hour ozone (EPA 2010) and is in attainment for the other criteria pollutants. The county has been classified as a nonattainment area for 8-hour ozone since the EPA first classified areas for ozone in 2004. The Texas State Implementation Plan for the Houston-Galveston-Brazoria area, which includes

Harris County, addresses the measures required to achieve attainment for this criteria by June 2019 (TCEQ 2010). Measures required to address emissions attributable to point source emissions include an 80-percent reduction of nitrogen oxides from existing industrial sources and utility power plants, an emission mass cap and trade program for nitrogen oxides, and regulations for controlling emissions of volatile organic compounds (TCEQ 2008a).

Table 3-1. National ambient air quality primary standards and air quality data for Harris County, Texas, in 2008.

| Pollutant | Averaging period | Primary standard | Harris County 2008 |
|-------------------|------------------|------------------------|-------------------------|
| Carbon monoxide | 8 hours | 9 ppm | 5.2 ppm |
| | 1 hour | 35 ppm | 8.1 ppm |
| Lead | Quarterly | 1.5 µg/m ³ | 0.01 ppm |
| Nitrogen dioxide | Annual | 0.053 ppm | 0.015 ppm |
| Ozone | 8 hours | 0.075 ppm | 0.083 ppm |
| PM ₁₀ | 24 hours | 150 µg/m ³ | 127 µg/m ³ |
| PM _{2.5} | Annual | 15.0 µg/m ³ | 14.26 µg/m ³ |
| | 24 hour | 35 µg/m ³ | 32.4 µg/m ³ |
| Sulfur dioxide | Annual | 0.03 ppm | 0.002 ppm |
| | 24 hours | 0.14 ppm | 0.015 ppm |

Sources: 40 CFR 50.4 through 50.13, EPA 2009.

µg/m³ = micrograms per cubic meter.

ppm = parts per million.

3.1.1.2 Air Quality Conformity

Section 176(c) (1) of the *Clean Air Act* requires federal agencies to ensure that their actions conform to applicable implementation plans for the achievement and maintenance of the National Ambient Air Quality Standards for criteria pollutants (DOE 2000). To achieve conformity, a federal action must not contribute to new violations of standards for ambient air quality, increase the frequency or severity of existing violations, or delay timely attainment of standards in the area of concern. The EPA general conformity regulations (40 CFR 93, Subpart B) contain guidance for determining whether a proposed federal action would cause emissions to be above specified levels in nonattainment or maintenance areas.

TECO’s proposed project would occur in an area that is in nonattainment for ozone, and emissions of nitrogen oxides (a precursor of ozone) from the project could exceed the specific level that triggers a conformity determination. However, in accordance with 40 CFR 93.153(d) (1), the conformity determination requirements do not apply to installation of the TECO proposed CHP system that is evaluated in this EA. The regulation states that a conformity determination is not required for federal actions if “the portion of an action includes major new or modified stationary sources that require a permit under the new source review program (Section 173 of the [Clean Air] Act) or the prevention of significant deterioration program (title I, part C of the Act).” All actions associated with the proposed project evaluated in this EA that would result in emissions of ozone precursors (that is, nitrogen oxide and volatile organic compounds), such as operation of the gas-powered turbine and the HRSG, require a permit under

the new source review (NSR) program and the prevention of significant deterioration (PSD) program. Therefore, DOE did not conduct a conformity determination for the installation of the TECO proposed CHP system.

3.1.1.3 Greenhouse Gas Emissions

The burning of fossil fuels, such as diesel and gasoline, emits carbon dioxide, which is a greenhouse gas. Greenhouse gases can trap heat in the atmosphere and have been associated with global climate change. The Intergovernmental Panel on Climate Change, in its Fourth Assessment Report issued in 2007, stated that warming of the earth's climate system is unequivocal, and that most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in concentrations of greenhouse gases from human activities (IPCC 2007). Greenhouse gases are well mixed throughout the lower atmosphere, such that any emissions would add to cumulative regional and global concentrations of carbon dioxide. The effects from any individual source of greenhouse gases therefore cannot be determined.

3.1.2 ENVIRONMENTAL CONSEQUENCES

3.1.2.1 Proposed Project

Impacts on air quality during installation of the CHP system would be short term and negligible. The primary source of air pollutants during installation would be vehicle exhaust from the operation of heavy equipment such as trucks, forklifts, and cranes. These activities would be temporary, would occur in a localized area, and would be very small compared with the emissions from vehicles and other sources in the Houston area.

The nearest receptors that could be affected by emissions from the proposed project would be TMC workers and visitors directly north of the Central Plant. Additional receptors would be individuals at the motel about 600 feet to the southwest, the apartment complex about 1,300 feet to the southwest, and the single-family residences about 1,500 to 1,600 feet to the east and southeast.

Operation of the CHP system and water chillers would result in the following emissions:

- Nitrogen oxides, carbon monoxide, particulate matter, volatile organic compounds, and other pollutants from the use and combustion of natural gas in the turbine and HRSG;
- Particulate matter from operation of the cooling tower;
- Ammonia from operation of the catalytic reduction system; and
- Release of the hydrochlorofluorocarbon R-22 from leaks in the refrigerant system.

TECO submitted an application to the TCEQ in 2007 for an amendment to the air quality operating permit for the Central Plant to cover these new emissions (TECO 2007). The

application was for authorization to install and operate all sources (equipment) of regulated pollutants during the expansion and upgrades at the Central Plant. The equipment listed in the application included two combustion turbine generators with duct fired HRSGs; all cooling towers, chillers, and chilled water pumps at the facility; thermal energy storage tank; and associated ancillary equipment. As Chapter 2 of this EA describes, TECO’s proposed CHP system includes only one CHP and HRSG, four water chillers, and one cooling tower to be located on the new chiller building. Table 3-2 lists the planned emissions from these sources and sums the total emissions for the CHP system and associated equipment that are part of the proposed project.

The fossil fuel-fired boilers at the Central Plant have a combined heat input capacity of more than 250 million Btu per hour; therefore, the site is classified as a PSD source. Currently, the site has the potential to emit more than 100 tons per year of nitrogen oxides, carbon monoxide, and particulate matter, and is therefore classified as a major source for those pollutants, as defined in 40 CFR Part 70 and Texas Administrative Code (TAC) Title 30, Chapter 116. The projected increase in emissions of nitrogen oxides, carbon monoxide, and particulate matter (Table 3-2) are greater than 40, 100, and 15 tons per year, respectively; therefore, in accordance with 40 CFR 581.166, a PSD review was required for these pollutants as part of the air quality permitting process. In addition, because the Central Plant is located in an area of nonattainment for ozone and because the increase in emissions of nitrogen oxides would exceed 40 tons per year, an NSR was required for that pollutant. However, the project would not be a major source of volatile organic compounds, and the increase in emissions did not require an NSR of these compounds.

Table 3-2. Emissions of air pollutants from all sources to be installed as part of the upgrade and expansion of the TECO Central Plant.

| Emissions Source | Emissions (tons per year) | | | | | | |
|---|---------------------------|-----------------|--------|-------|-----------------|-----------------|--------------------------------|
| | PM ₁₀ | NO _x | CO | VOC | NH ₃ | SO ₂ | H ₂ SO ₄ |
| CHP Unit–2010 ^{a,b} | 56.94 | 40.22 | 204.02 | 18.65 | 34.68 | 10.19 | 1.56 |
| CHP Unit–2014 ^b | 56.94 | 40.22 | 204.02 | 18.65 | 34.68 | 10.19 | 1.56 |
| Chiller Building Cooling Tower ^a | 17.53 | | | | | | |
| West Cooling Tower | 8.77 | | | | | | |
| Ammonia Fugitives ^a | | | | | 5.50 | | |
| Natural Gas Fugitives ^a | | | | 0.64 | | | |
| Total: | | | | | | | |
| Proposed Project | 74.47 | 40.22 | 204.02 | 18.97 | 37.43 | 10.19 | 1.56 |
| All upgrades | 140.18 | 80.44 | 408.03 | 37.94 | 74.87 | 20.39 | 3.12 |

Source: TECO 2007.

a. Equipment or emission source to be partially funded by DOE under the Proposed Action.

b. CHP Unit–2010 refers to a 50 megawatt (nominal) gas-fired turbine and duct-fired heat recovery steam generator to be installed in 2010. CHP Unit–2014 has the same equipment that might be installed in 2014.

CO = carbon monoxide.

PM₁₀ = particulate matter less than 10 microns.

H₂SO₄ = sulfuric acid.

SO₂ = sulfur dioxide.

NO_x = nitrogen oxides.

VOC = volatile organic compound.

NH₃ = ammonia.

The Texas nonattainment NSR requirements (30 TAC 116.150) stipulate that any major new or modified facility located in a nonattainment area must use emission controls capable of achieving lowest achievable emission rates for pollutants subject to review. The lowest achievable emission rate is defined as the most stringent emission limitation contained in any state implementation plan or achieved by practice by the same source type. The federal PSD regulations (40 CFR 52.21) require that best available control technology be used to minimize emissions of pollutants subject to PSD review. In addition, the TCEQ NSR policy requires best available control technology for all regulated pollutants. To meet these requirements, TECO identified the following control technologies to achieve lowest achievable emission rates for nitrogen oxides and best available control technologies for all regulated pollutants (TECO 2007).

- Nitrogen oxides – Meet a lowest achievable emission rate of 3 parts per million by using low nitrogen oxides turbine combustors and low nitrogen oxides dust burners or water injection, combined with selective catalytic reduction control technology.
- Carbon monoxide – Meet a 25 parts per million emission rate using efficient and complete combustion technology on turbines and duct burners.
- Sulfur dioxide and sulfuric acid – Use low-sulfur, pipeline-quality natural gas.
- Particulate matter – Use pipeline-quality natural gas and 0.0005 percent mist eliminators on cooling towers.
- Volatile organic compounds – Use efficient and complete combustion technology on turbines and duct burners.
- Ammonia – Use proper selective catalytic reduction design and operation.

The TCEQ issued TECO a modified air quality operating permit and permits for PSD and nonattainment NSR in July 2008 (TCEQ 2008b). These permits specified maximum allowable emissions of regulated air pollutants that are equivalent to the emission rates listed in Table 3-2. The requirements in the permits incorporate the best available control technologies listed above and also include stipulations for stack monitoring and testing, monitoring systems, reporting, and participation in an emission mass cap and trade program to offset nitrogen oxides emissions.

Based on the TCEQ review of the TECO permit application and issuance of a modified air quality permit, PSD permit, and NSR permit, DOE concludes that operation of the TECO proposed CHP system would conform to the applicable State Implementation Plan for achieving and maintaining air quality standards, and would be in compliance with federal and Texas air quality regulations.

The average hourly concentration of ammonia predicted to be emitted from the selective catalytic reduction and CHP systems is approximately 220 micrograms per cubic meter (TECO 2008). This is far below the odor threshold concentration of about 5 parts per million, or 3,700 micrograms per cubic meter for ammonia (DHHS n.d.); therefore, operation of the selective

catalytic reduction and CHP systems will not result in a detectable odor of ammonia. In addition, the selective catalytic reduction system would be equipped with an ammonia leak detection system so that any malfunction resulting in a leak of ammonia could be quickly detected and repaired.

The hydrochlorofluorocarbon refrigerant that would be used in the new water chillers, R-22, is a greenhouse gas that contains ozone-destroying chlorine, which could be released into the atmosphere if the refrigerant leaked during installation, operation, or repair of the water chillers. Small amounts of R-22 refrigerant could be released into the atmosphere during operation of the water chillers.

TECO would follow the requirements under Section 608 of the *Clean Air Act* and the associated implementing regulations (40 CFR 82, Subpart F) to minimize any release of R-22. These requirements include:

- Specified service practices to maximize the recovery and recycling of R-22;
- Use of certified technicians for servicing and disposal of equipment; and
- Repair of substantial leaks within 30 days.

Use of the R-22 refrigerant is being phased out in the United States and may no longer be produced after 2020. Until the product is completely phased out and its use at the Central Plant is replaced with a different refrigerant, operation of the new water chillers could cause the release of greenhouse gases and ozone-depleting substances.

Use of the energy-efficient CHP system to produce electricity would allow TECO to reduce its consumption of electricity from the regional grid, which would result in a reduction in emissions of air pollutants from regional power plants. Use of the CHP system would also result in a more efficient production of steam, reducing the amount of natural gas required to produce the steam and reducing emissions at the Central Plant from combusting this gas.

DOE used the EPA CHP Emissions Calculator (EPA 2009a) to estimate the decrease in energy consumption and emissions from operation of the TECO proposed CHP system. EPA's spreadsheet-based calculator uses information on the characteristics and efficiency of a CHP system, characteristics of the steam-producing units being replaced, type of fuel used, and average emission rates for electricity in the local North American Energy Reliability Corporation region (in this case the Texas Regional Entity) to estimate reductions in fuel consumption and emissions of nitrogen oxides, sulfur dioxide, and carbon equivalents.

The CHP Emissions Calculator predicts that use of the CHP system would allow TECO to reduce electricity consumption by 2,416,000 million Btu (equivalent to about 700,000 megawatt hours) and natural gas consumption by 4,560,000 million Btu (Table 3-3). The total offset in emissions of nitrogen oxides and sulfur dioxide from the reduction in energy consumption would be about 360 and 480 tons per year, respective, which is greater than the emissions of these

pollutants that would be emitted by the CHP system (Table 3-2). Reductions in volatile organic compounds and particulate matter from the decrease in energy consumption would also occur.

Table 3-3. Predicted annual reductions in consumption of fuel and emissions of pollutants resulting from operation of the CHP system.

| | Displaced electricity production | Displaced thermal production | Total reduction |
|--------------------------------------|--|---------------------------------|-----------------|
| Fuel consumption (million Btu/year) | 2,416,000 | 4,560,000 | 6,976,000 |
| NO _x (tons/year) | 132 | 228 | 360 |
| SO ₂ (tons/year) | 481 | 1 | 483 |
| CO ₂ (tons/year) | 199,709 | 266,788 | 466,497 |
| Carbon equivalent (metric tons/year) | 49,380 | 65,966 | 115,346 |

Source: CHP Emissions Calculator (EPA 2009a).

Btu = British thermal units.

CO₂ = carbon dioxide.

NO_x = nitrogen oxides.

SO₂ = sulfur dioxide

Operating the energy-efficient CHP system would also result in a decrease in emissions of carbon dioxide by about 467,000 tons per year (Tables 3-2 and 3-3), or about 115,000 metric tons of carbon equivalents per year. This would have a beneficial impact on the environment, as greenhouse gases can trap heat in the atmosphere and have been associated with global climate change.

In summary, the CHP system and cooling tower would emit air pollutants regulated under the *Clean Air Act* and Texas regulations in an area that is in nonattainment for ozone. TCEQ issued an air quality permit for the CHP system in 2008, and operation of that system would conform to the State Implementation Plan and be in compliance with federal and Texas air quality regulations. The refrigerant to be used in the new water chillers, R-22, is a greenhouse gas that contains ozone-destroying chlorine. These compounds could be released into the atmosphere if the refrigerant leaked during installation, operation, or repair of the water chillers. Use of the energy-efficient CHP system would allow TECO to reduce its consumption of natural gas and electricity from the regional grid, which would reduce emissions of greenhouse gases, ozone precursors such as nitrogen oxides, and other pollutants, and have a net beneficial impact on air quality in the region.

3.1.2.2 No-Action Alternative

Under the No-Action Alternative, DOE would not provide funding to TECO for the proposed CHP system, and DOE assumes, for purposes of this EA, that the project would not proceed without this assistance. TECO would continue to obtain all electricity from the regional grid and use existing boilers to produce steam. There would be no increase in emissions of pollutants from the TECO plant; however, there would be no beneficial decrease in regional emissions of pollutants from the use of the energy-efficient CHP system.

3.2 Noise

This section describes current sound levels in commercial and residential areas surrounding the Central Plant, predicted sound levels associated with TECO's proposed project, and possible impacts of the noise on individuals at nearby facilities and residences.

3.2.1 AFFECTED ENVIRONMENT

TECO commissioned a noise assessment study (Burns and McDonnell 2009) to determine ambient noise levels in the area surrounding the proposed project, estimate operational sound levels from the planned expansion and upgrades, and evaluate compliance with the City of Houston noise ordinance (Section 2 of Ordinance 01-945; City of Houston n.d.). Per this ordinance, the maximum sound levels (reported in this EA as A-weighted decibels, or dBA) allowed to be emitted by a source (as measured at the boundary of a property where the sound is being received) is 68 dBA during the day and 58 dBA at night at residential properties, and 68 dBA at all times at nonresidential properties.

As part of the noise assessment study, ambient sound levels were measured in accordance with Houston noise ordinances during four, two-hour periods at the following locations: on the TMC campus along Pressler Street just north of the Central Plant, at two of the closest residences east and southeast of the facility, and at a motel and apartment complex to the southwest (Burns and McDonnell 2009) (white boxes in Figure 3-1). Sound levels ranged from 60 to 72 dBA at the three TMC locations, 53 to 59 dBA at the residences, and 56 to 62 dBA at the motel and apartments (Table 3-4). Activities that contributed to the noise at these locations included traffic, construction at the Central Plant and other nearby construction sites, operating equipment, sirens, trains, and airplanes. For comparison, sound levels of 70 to 80 dBA are considered loud, 60 to 70 dBA moderate, 50 to 60 dBA quiet, and typical sound levels in a very quiet residential neighborhood are 30 to 40 dBA (Burns and McDonnell 2009). Thus, sound levels on the TMC campus and neighborhoods surrounding the Central Plant are relatively high.

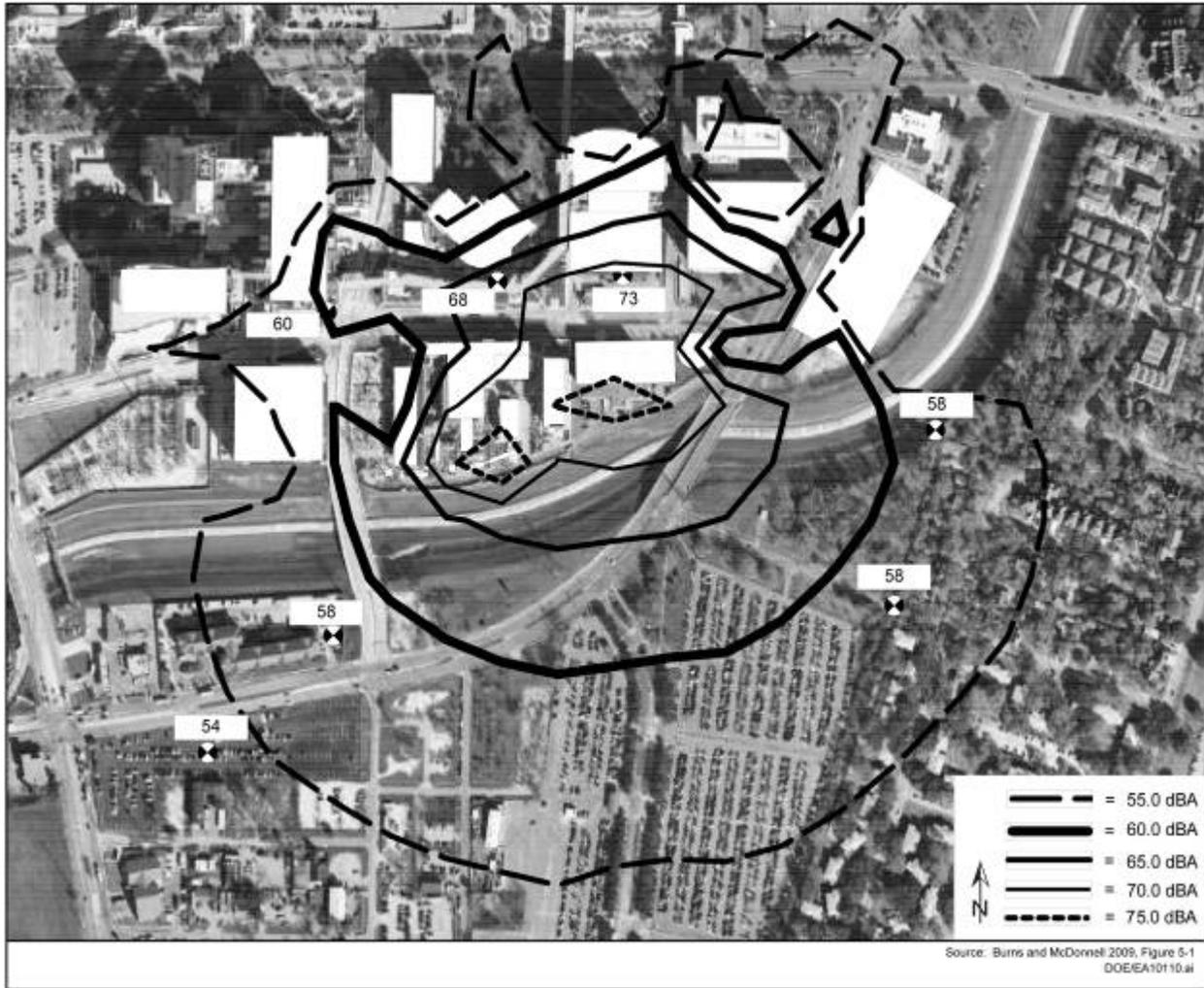


Figure 3-1. Predicted sound level contours (dBA) resulting from the operation of all new equipment at the TECO Central Plant. Values in boxes are predicted sound levels at seven locations near the Central Plant.

Table 3-4. Measured and predicted sound levels (dBA) outdoors at facilities and neighborhoods surrounding the TECO Central Plant.

| Location ^a | Distance ^b (feet) | Measured levels | | Predicted levels |
|--|---------------------------------|-----------------|---------|---------------------|
| | | Day | Night | |
| TMC facilities (MP 1, 2, and 3) | 100 – 200 | 64 – 72 | 60 – 64 | 60 – 73 |
| Residential areas (MP 4 and 5) | 400 – 800 | 56 – 59 | 53 – 57 | 58 |
| Motel and apartment complex (MP 6 and 7) | 1,000 – 1,400 | 56 – 61 | 58 – 62 | 54 – 58 |

Source: Burns and McDonnell 2009.

a. Locations are shown in Figure 3-1.

b. Distance from boundary of Central Plant to measurement locations.

3.2.2 ENVIRONMENTAL CONSEQUENCES

3.2.3 PROPOSED PROJECT

Installation and operation of the proposed CHP system could increase the level of noise experienced at TMC facilities adjacent to the TECO Central Plant and at residences and businesses near the Central Plant. The nearest noise-sensitive receptors to the facility are the M.D. Anderson Cancer Center and University of Texas School of Public Health. Both of these TMC facilities are located directly north of the Central Plant on Pressler Drive. The closest business not associated with the TMC is a motel about 600 feet to the southwest. The nearest residences are an apartment complex about 1,300 feet to the southwest and single-family residences about 1,500 to 1,600 feet to the east and southeast.

Noise during installation of the CHP system and water chillers would be periodic and temporary. Construction and installation activities that typically produce the highest sound levels, such as site preparation and pile driving; have already been completed at the site. Future noise from installation of the CHP system would result primarily from operation of cranes and other large equipment and would occur periodically over 14 months.

Sound levels that might result from operation of all new equipment to be installed as part of the expansion and upgrade of the TECO Central Plant were modeled as part of the noise assessment study commissioned by TECO (Burns and McDonnell 2009). That model considered the combined levels from all noise-emitting equipment, including two LM6000 turbines, two HRGSs, and the water cooling tower. The following description of the model is from the noise assessment study report (Burns and McDonnell 2009, p. 11).

“The program used to model the Project was the Computer Aided Design for Noise Abatement (CadnaA), Version 3.7, published by DataKustik, Ltd., Munich, Germany. The CadnaA program is a scaled, three-dimensional program that takes into account each piece of noise-emitting equipment on the Project site and predicts sound levels in circular contours of equal sound pressure. Appropriate sound generation sources are applied for all sound radiating surfaces and points. Attenuation was included for sound propagation over vegetation, barriers, and shielding. The model calculates sound propagation based on ISO 9613-2:1996, General Method of Calculation. ISO 9613 and CadnaA assess the sound levels based on the Octave Band Center Frequency range from 31.5 to 8,000 Hz. The atmospheric conditions were assumed to be calm and the temperature and relative humidity were set to 50°F and 70 percent respectively (based on program defaults). Since temperature and humidity can vary significantly during the course of year in the vicinity of this site, the program defaults were used as an ‘average’ for weather in this area.”

The equipment that would emit the loudest noises from the Central Plant (and the total sound power level predicted for each) are the cooling tower (117 dBA), two CHP system emission

stacks (110 dBA), two HRSGs (106 dBA), the cooling tower fan (106 dBA), two turbines (98 dBA), and numerous blowers and pumps (95 dBA).

The predicted sound contour levels for future operations at the Central Plant are shown in Figure 3-1 and listed in Table 3-4. Sound levels would be 75 to 80 dBA near the HRSG units and would range from about 60 to 75 dBA at the boundary of the project site. The predicted sound levels at the nearest residences, motel, and apartment complex range from 54 to 58 dBA. These levels are within 2 to 5 dBA of the ambient sound levels measured at all four locations (Table 3-4); increases in sound levels of that magnitude are barely perceptible to the human ear. Thus, the expansions and upgrades at the Central Plant would cause a small, possibly imperceptible change in sound levels at nearby residential properties. The predicted sound levels are equal to or less than the maximum sound levels (68 dBA during the day and 58 dBA at night at residential properties, and 68 dBA at all times at nonresidential properties) specified in the City of Houston noise ordinance (City of Houston n.d.), and the project would be compliant with that ordinance.

Predicted sound levels outdoors at TMC facilities immediately north of the Central Plant would range from 60 to 73 dBA (Figure 3-1). These predicted levels are very similar to the ambient levels measured there (Table 3-4); thus, the expected change in the sound levels from operation of new equipment at the Central Plant would be minimal. The predicted level of 73 dBA at the location immediately north of the Central Plant, near the entrance to the M.D. Anderson Cancer Center, is greater than the 68-dBA sound level specified in the Houston noise ordinance for nonresidential facilities. However, because this location is on TMC property, it is not subject to the limits specified in the ordinance (that is, it is within the property boundary of the emitting source). Changes in sound levels on each floor of the Cancer Center were modeled to further evaluate impacts on occupants of the facility. Sound levels in rooms facing the Central Plant are predicted to be within the range recommended by the American Society of Heating, Refrigerating, and Air-Conditions Engineers for private offices and meeting rooms, which should also be compatible for occupants of the Cancer Center (Burns and McDonnell 2009, pp. 17 and 18).

The increase in sound levels from operation of the proposed CHP system would be less than that described above, as the noise assessment considered all new equipment to be installed as part of the planned expansion and upgrades at the Central Plant.

3.2.3.1 No-Action Alternative

Under the No-Action Alternative, DOE would not provide funding to TECO for the proposed CHP system, and DOE assumes for purposes of this EA that the project would not proceed without this assistance. There would be no change in sound levels at the Central Plant or at the surrounding residences and facilities.

3.3 Water Resources

This section includes an evaluation of the potential impacts of the proposed project on surface waters and effects that may occur from the use of water by the project. Because the TECO Central Plant is located within a 100-year floodplain, this section includes a floodplain analysis as required by DOE regulations for “Compliance with Floodplain and Wetland Environmental Review Requirements” (10 CFR Part 1022).

3.3.1 AFFECTED ENVIRONMENT

The nearest surface water to the Central Plant is Brays Bayou, which is less than 100 feet south of the TECO property boundary. The existing Central Plant is within the 100-year floodplain of that stream (Figure 3-2).

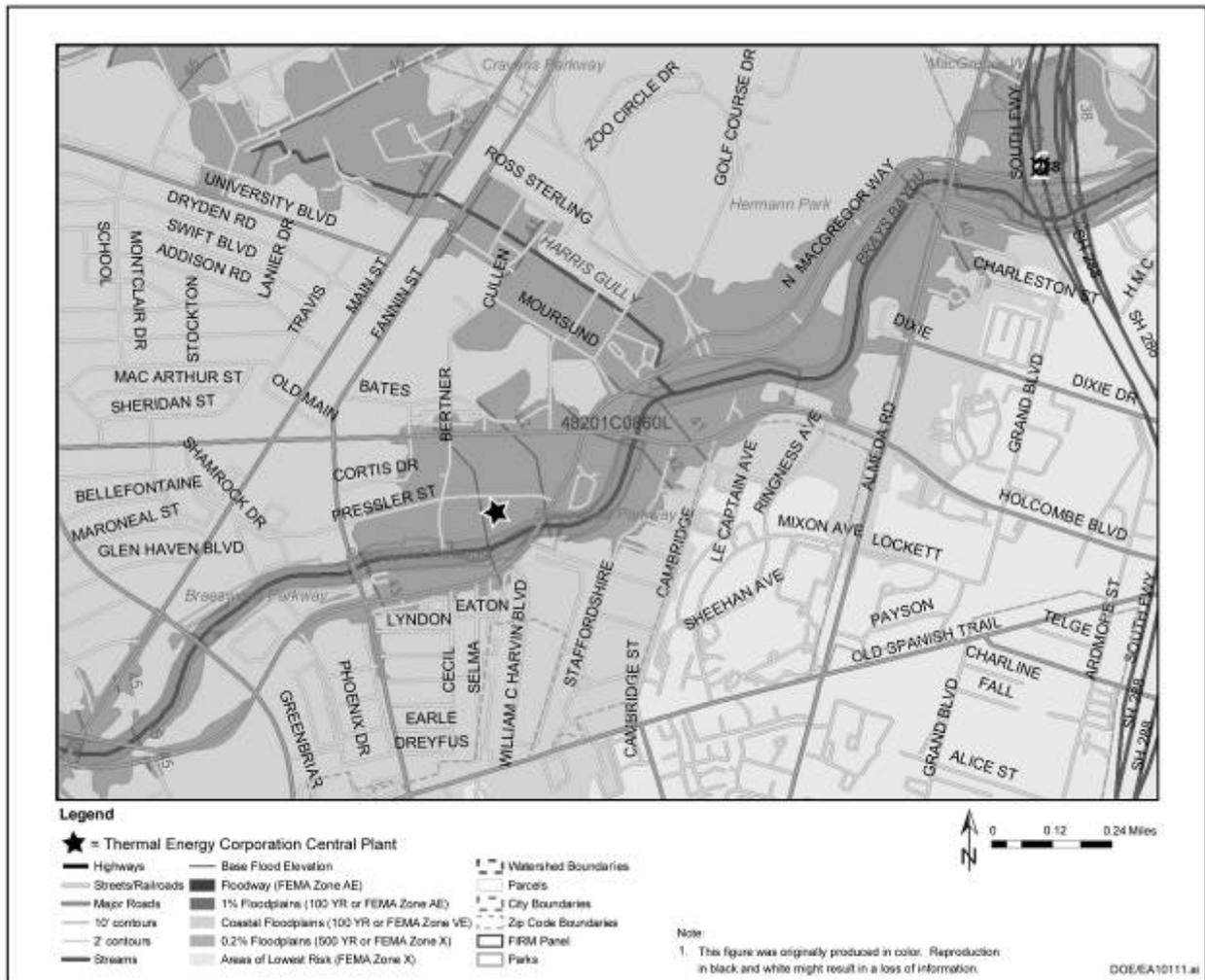


Figure 3-2. Federal Emergency Management Agency floodplain map for the area around the TECO Central Plant.

Brays Bayou flows east into the Houston Ship Channel and drains an approximately 130-square-mile watershed (HCFCFCD 2007). Brays Bayou has a history of flooding, which has caused substantial damage and financial losses to the TMC (SOM 2006). The Harris County Flood Control District and the U.S. Army Corps of Engineers have an ongoing program to reduce flooding in this watershed. Storm water runoff from the Central Plant discharges directly into Brays Bayou. In addition, TECO discharges treated cooling water into Brays Bayou under a discharge permit issued by the TCEQ. All facilities at the Central Plant are located behind a floodwall, which was constructed in 2004 and has not been breached during high flows in Brays Bayou.

The City of Houston public water system supplies water for process and potable use at the Central Plant. The water comes from an 8-inch tap off a 12-inch city water main that crosses the site. That system is capable of delivering 3,500 gallons per minute (5 million gallons per day). TECO has permits from the Harris-Galveston Subsidence District for two existing and one planned water wells, for a combined annual withdrawal of 117.9 million gallons. The wells are used primarily to provide a backup source for city water. From 8 to 22 percent of the water used at the Central Plant during 2004 through 2007 was from the two existing wells. One of these wells is located at the Central Plant and has the capacity to deliver 1,000 gallons per minute; the other is at the TECO South Plant. The planned well would be installed near the new chiller building, and it is anticipated to have a rated capacity of 1,500 gallons per minute.

From 2004 to 2007, about 420 to 480 million gallons of water per year (1.1 to 1.3 million gallons of water per day) were withdrawn from the public water system for operations at the Central Plant, and 30 to 117 million gallons (0.01 to 0.3 million gallons per day) were obtained from wells. Water use at the facility has decreased since then because the laundry facility was decommissioned and removed. Over 90 percent of the water used at the facility is for cooling tower makeup. Most of the remaining 10 percent is used to operate the boilers (8 percent) and to produce chilled water (1.5 percent).

3.3.2 ENVIRONMENTAL CONSEQUENCES

3.3.2.1 Proposed Project

The new CHP system would be constructed on an existing foundation outside and would not increase the amount of impervious surfaces or otherwise increase storm water runoff from the facility. The project would not cause a change to the elevation of any facilities within the 100-year floodplain of Brays Bayou because the CHP system would be installed behind an existing floodwall, and the water chillers and tower would be installed in an existing building. Federal Emergency Management Agency flood proofing and elevation certificates have been prepared for this project to certify that the project would not alter the floodplain management elevation requirements or affect associated insurance ratings (see Appendix C of this EA), and TECO has obtained all necessary permits and certifications from that agency for construction of the proposed project. Thus, DOE concludes that the proposed project would have no adverse impacts on the natural and beneficial floodplain values associated with Brays Bayou, which is primarily

for conveyance of floodwaters in this area. Furthermore, no impacts on lives or property in the area are anticipated because the proposed project would not alter the depth of flood waters or otherwise modify inputs to, or flow of, water in the floodplain.

Treated cooling-tower water would discharge into dedicated drainage pipes that flow into Brays Bayou, which TCEQ has classified as impaired under Sections 303(d) and 304(a) of the *Clean Water Act* because effluent limitations are not stringent enough to implement water quality standards (TCEQ 2008c). Process water discharges from cooling towers, and all other discharges by TECO from the Central Plant, would meet the effluent limitation and monitoring requirements of TECO's existing discharge permit (TCEQ 2007) and would not increase pollutant loading or contribute to the impairment of Brays Bayou. As part of TECO's existing spill prevention plan, pavement surrounding the CHP system is sloped to contain spills, and storm water inlets are closed or covered prior to unloading fuels and filling storage tanks. Thus, installation and operation of the CHP system would have no or negligible adverse impacts on surface water quality.

Operation of all proposed new equipment at the Central Plant in 2011, including the water tower, four new water chillers, and HRSG, would require a water supply of 1,250 gallons per minute (1.8 million gallons per day) (Brents 2008). The water would be supplied primarily from a connection to the city water supply that would be installed for the new chiller building. Back-up water would come from TECO's permitted groundwater wells. The municipal water main and TECO supply lines at the Central Plant have sufficient capacity to support this new water demand. This additional demand for water is a small proportion of total capacity of 1.37 billion gallons of water per day from the City of Houston municipal water supply (City of Houston 2010).

3.3.2.2 No-Action Alternative

Under the No-Action Alternative, DOE would not provide funding to TECO for the proposed CHP system, and DOE assumes for purposes of this EA that the project would not proceed without this assistance. Discharges of water into Brays Bayou and use of water for operations at the Central Plant would be unchanged.

3.4 Socioeconomics

This section reports characteristics of the population in the area and region surrounding the TMC, including the percentage of minorities and individuals with an income below the poverty level, and describes the beneficial economic impacts of DOE's Proposed Action and TECO's proposed project.

3.4.1 AFFECTED ENVIRONMENT

The estimated population of Harris County, Texas, in 2008 was 3.9 million. This was an increase of 12 percent from 2000 (USCB 2002, 2009). The total number of persons in the labor force in that county in 2008 was 2.0 million.

Table 3-5 presents the most recent information on the percentage of people with an income below the poverty level and percentage of people classified as minorities in the United States, Texas, Harris County, Houston, and Census Tract 3131—the census tract where the Central Plant

Table 3-5. Characteristics of the population in the region surrounding the TECO Central Plant, and in Texas and the United States.

| | United States | | Texas | | Harris County | | City of Houston | | Tract 3131 |
|--|---------------|------|-------|------|---------------|------|-----------------|------|------------|
| | 1999 | 2008 | 1999 | 2008 | 1999 | 2008 | 1999 | 2008 | 1999 |
| Percent of individuals Below poverty level | 12.4 | 13.2 | 15.4 | 16.3 | 15.0 | 16.0 | 16.7 | 20.5 | 17.5 |
| Minorities | 24.9 | 25.6 | 29.0 | 28.7 | 41.3 | 40.3 | 50.7 | 46.2 | 31.0 |

Sources: USCB 2002, 2009.

is located. The percentage of individuals with an income below the poverty level in Census Tract 3131 (17.5 percent) in 1999 (the last year data at the census-tract level are available) was similar to that in all of the City of Houston and slightly higher than in Harris County, Texas, and the United States.

The percentage minority population in Houston in 2008 (46 percent) was higher than that in Harris County, Texas, or the United States. The percentage minority population in Census Tract 3131 (31 percent) in 1999 was lower than that in Houston and Harris County (Table 3-5). The unemployment rate in the Houston metropolitan area in December 2009 was 8.3 percent, similar to the rate of 8.2 percent for Texas (BLS 2010).

3.4.2 ENVIRONMENTAL CONSEQUENCES

3.4.2.1 Proposed Project

Based on U.S. Department of Commerce data on rates of indirect and direct jobs created within the engineering, manufacturing, and construction industry, TECO estimated that manufacturing and installation of the CHP system would result in the creation or support of 411 direct and indirect jobs in the first year of manufacturing and installation and 658 jobs in the second year (TECO 2009). This increase in spending on jobs would have a minor to moderate and temporary beneficial impact in the areas where the CHP system components were manufactured and in the Houston area during installation. Permanent employment of two additional workers to operate and maintain the CHP system would have a negligible impact on the economy of the Houston area.

A peak of 300 workers would be employed during installation of the CHP system. This is a very small portion of the labor pool in the Houston metropolitan area. Thus, DOE does not anticipate any in-migration of workers to support this project or any temporary impact on housing prices or public services.

3.4.2.2 No-Action Alternative

Under the No-Action Alternative, DOE would not provide funding to TECO for the proposed CHP system, and DOE assumes for purposes of this EA that the project would not proceed without this assistance. There would be no beneficial increase in employment resulting from the manufacturing and installation of the CHP system.

3.5 Occupational Health and Safety

This section describes the accident rate for TECO's facilities and similar operations and discusses the potential health and safety risks of installation and operation of the proposed CHP system.

3.5.1 AFFECTED ENVIRONMENT

TECO maintains a comprehensive health and safety management program for its operations at the Central Plant. The Occupational Safety and Health Administration recordable incident rate for TECO operations during 2009 was 0.74 per 200,000 hours worked; there were no days away from work or days of work restrictions (TECO 2010b), which is below the industry average of 1.9 per 200,000 hours worked (BLS 2009). Engineering controls are in place to prevent injuries and to control employee exposure to electrical hazards, steam, and chemicals in the workplace.

3.5.2 ENVIRONMENTAL CONSEQUENCES

3.5.2.1 Proposed Project

3.5.2.1.1 Installation

DOE estimated health and safety impacts to workers from industrial hazards by using 2007/2008 incidence rates for both nonfatal occupational injuries and occupational fatalities from the U.S. Department of Labor, Bureau of Labor Statistics data. The Bureau reports information for two categories of nonfatal occupational injury information: (1) total recordable cases and (2) days away from work, or days of restricted work activity or job transfer.

For installation activities, DOE used the Bureau of Labor Statistics incidence rates from the category "non-residential building construction." The incidence rate in 2008 for total recordable cases was 4.4 injuries per 100 full-time employees, and the incidence rate for days away from work, or days of restricted work activity or job transfer was 2.2 injuries per 100 full-time employees (BLS 2009). A peak of 300 workers would be required for a few months during initial construction, with fewer workers during the remainder of installation. For this analysis,

DOE assumed that an average of 200 workers would be required for 14 months to install the CHP system. Using this information, DOE estimates that about 10 total recordable cases and about 5 days away from work would occur during installation. TECO would implement standard best management practices for the construction industry to reduce risks to workers. This includes, but is not limited to, complying with Occupational Safety and Health Administration “Safety and Health Regulations for Construction” (29 CFR Part 1926).

The fatality incidence rate for construction activities in 2007 (2008 data were not available) was 10.5 fatalities per 100,000 full-time employees (BLS 2007). To estimate the number of worker fatalities from industrial hazards during installation of the CHP system, DOE multiplied the above rate by the number of full-time workers during construction (200) and the number of years required for installation (1.2), and divided the results by 100,000. The result is an estimate of about 0.03 fatality occurring installation. Based on these results, DOE concludes that a fatality during installation activities would be unlikely.

3.5.2.1.2 Operations

With the exceptions of onsite generation of electricity and storage and use of aqueous ammonia, risks to workers and the public at the Central Plant during operation of the CHP system would be similar to ongoing operations at the site. For example, risks from operating the HRSG would be similar to current risks from production of steam at the Central Plant. In addition, the refrigerant to be used for the new water chillers is currently stored onsite and used for existing chillers. TECO has an effective industrial safety and health program, including requirements for hearing protection and handling and storage of hazardous materials, as well as plans for training employees on the hazards and safe operating procedures for all new equipment and processes.

The gas-fired turbine to be used to generate electricity would be installed and operated in an enclosed container to reduce risks to workers, and TECO workers are currently trained to work in areas with high-voltage electricity. The incident rate in the utility industry for steam and air conditioning supply (1.9 recordable cases per 100 full-time equivalent workers per year), which is representative of ongoing activities at the Central Plant, is similar to the rate for electric power generation (2.6 recordable cases) (BLS 2009). Thus, onsite generation of electricity would not be a new or substantially different type of hazard at the Central Plant and would not cause a significant increase in risk to workers.

The only additional chemical to be stored onsite in large quantities for operation of the CHP system would be aqueous ammonia, which would be stored outside in a pressurized 10,000-gallon tank adjacent to the HRSG and used in the selective catalytic reduction system. Ammonia is flammable as a gas; corrosive to skin, eyes, and lungs; and is toxic by inhalation. It is also highly toxic to most aquatic organisms. Storage and use of aqueous ammonia outside in an unconfined space would reduce the risk of inhalation exposure to workers. The site of the CHP system is curbed and sloped, and the storm water drains have valves to close or isolate them from the storm water system to prevent the release of spilled chemicals into adjacent surface waters.

The ammonia storage tank would be located near the southern boundary of the Central Plant, which is over 500 feet from the nearest TMC facilities and residential properties. The selective catalytic reduction system would be equipped with an ammonia leak detection system. TECO employees would be trained on the proper safety precautions for conveying equipment, material handling, and required personal protective equipment. Storage and use of aqueous ammonia in catalytic reduction systems is common in the electricity utility industry and DOE concludes that use of aqueous ammonia at the TECO Central Plant would not pose a significant hazard to workers or the public.

3.5.2.2 No-Action Alternative

Under the No-Action Alternative, DOE would not provide funding to TECO for the proposed CHP system, and DOE assumes for purposes of this EA that the project would not proceed without this assistance. Risks to workers and the public from operation of the TECO Central Plant would be unchanged.

3.6 The Relationship between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Council on Environmental Quality regulations that implement the procedural requirements of NEPA requires consideration of the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). Installation and operation of the proposed CHP system would require short-term use of land and other resources. Short-term use of the environment, as used here, is that used during the life of the CHP system, whereas long-term productivity refers to the period of time after the equipment has been decommissioned and removed. The short-term use of the project site and other resources for the TECO proposed CHP system would not impact the long-term productivity of the area. When it is time to decommission and remove the CHP system, the land and facilities occupied by that system could be used for other industrial purposes, or the land could be reclaimed and revegetated to resemble pre-disturbance conditions.

3.7 Irreversible and Irretrievable Commitments of Resources

There would be an irretrievable commitment of the land and facilities where the TECO proposed CHP system would be located. This area currently is dedicated to the production of thermal power for the TMC, and the proposed project would support this mission. There would also be a commitment of materials used to manufacture and install the CHP system.

3.8 Unavoidable Adverse Impacts

Operation of the CHP system would cause unavoidable emissions of air pollutants at the Central Plant. These emissions would be offset by a reduction in emissions at electrical generating plants in the region. This project also would cause an unavoidable increase in noise on the TMC

campus and in surrounding areas. This increase would be small compared with the existing sound levels in areas surrounding the Central Plant.

4. CUMULATIVE IMPACTS

Council on Environmental Quality regulations stipulate that the cumulative impacts analysis in an EA consider the potential environmental impacts resulting from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such actions (40 CFR 1508.7). Because the impacts of the proposed project generally would be minor and localized (see Section 3), DOE focused this evaluation of cumulative impacts on activities at the TECO Central Plant and other past, present, and reasonably foreseeable future actions on and around the TMC campus.

Conditions resulting from past and ongoing activities are included in the descriptions of the affected environment in Chapter 3 of this EA. The following sections describe reasonably foreseeable future actions (Section 4.1) and the incremental cumulative impacts of installation and operation of the proposed CHP system (Section 4.2).

4.1 Reasonably Foreseeable Actions

To identify reasonably foreseeable actions in and around the TECO Central Plant, DOE primarily considered information from TECO on its completed and planned expansion and upgrades, the TMC Master Plan (SOM 2006), the City of Houston Master Plan (City of Houston 2000) and Strategic Plan (Main Street Coalition 2001) for the Main Street Corridor of Houston, and plans from the Harris County Flood Control District for improvements along Brays Bayou (HCFCD 2010). Other City of Houston and Harris County planning documents were also examined.

Section 2.2 and Figure 2-3 describes the ongoing and planned expansion and upgrades of the TECO Central Plant. TECO has completed the upgrade of its 138-kilovolt substation, construction of a new operations support facility, and installation of an 8.8-million-gallon thermal energy storage tank. Construction of a new east chiller plant and other infrastructure required for the CHP system is underway. Future planned upgrades include upgrading the west cooling tower, adding a second CHP system, and installing additional water chillers and cooling towers.

The TMC Master Plan (SOM 2006) describes regional and local initiatives necessary to support the continued growth of the TMC. The Center expanded from 21 million square feet of facilities in 1999 to 26 million square feet in 2005 and is expected to continue growing at a similar or faster rate over the next 10 years or more. Most of this growth will occur to the south and southwest of the Central Plant. The expansion and upgrades at the TECO Central Plant and other utilities are identified as important initiatives required supporting growth of the TMC. Other applicable initiatives listed in the Master Plan include:

- Improving access, transportation alternatives, and parking;
- Increasing connectivity among TMC campuses and facilities;

- Supporting denser land use patterns surrounding the TMC campus;
- Improving and increasing open space adjacent to the TMC campus;
- Implementing storm water management strategies;
- Promoting sustainability for the region, campus, open spaces, and buildings; and
- Developing mixed-use centers on and surrounding the TMC campus.

The Master Plan and Strategic Plan of the City of Houston Main Street Corridor describe the framework for integrating land use, transportation, and development planning along Main Street, including the TMC campus. These plans describe the integration of a light rail system and other transportation improvements, improving pedestrian access and movement, flood control measures, utility upgrades, and other infrastructure improvements. These plans also address landscape and historic preservation considerations for the area (City of Houston 2000; Main Street Coalition 2001).

The Harris County Flood Control District and U.S. Army Corps of Engineers have an ongoing program to reduce the risk of flooding along Brays Bayou. Current and planned projects that will occur near the TECO plant include deepening the Brays Bayou channel near the Central Plant to increase flow capacity and replacing the bridge along South Braeswood Boulevard that crosses this channel (HCFCD 2010).

In summary, in addition to the expansion and upgrades at the TECO Central Plant, there is a substantial amount of construction, ongoing and planned, on the TMC campus and elsewhere in the area surrounding the Central Plant. In addition, there are plans to modify streets and bridges and improve flood control systems and other infrastructure in the surrounding area.

4.2 Summary of Cumulative Impacts

In this analysis of cumulative impacts, DOE evaluated potential impacts to the resources and subject areas analyzed in detail in Section 3 of this EA. Impacts to other resources would be negligible or would not occur (Section 1.4). Therefore, it is unlikely that installation and operation of the CHP, in combination with other past, present, or reasonably foreseeable actions, would have more than a negligible incremental impact on those aspects of the environment, and they are not further discussed here.

4.2.1 AIR QUALITY

Ongoing and planned construction activities would cause emissions of particulate matter and other pollutants in the Houston area. Although emissions from each construction project individually would be temporary, the cumulative emissions from all projects would have a longer-term adverse impact on air quality in the area. Installation of the CHP system would have a very small incremental adverse impact for the few weeks or months that cranes and other heavy equipment would be required.

Operation of the two CHP systems and other equipment planned for the Central Plant would cause emissions of nitrogen oxides and other pollutants (Table 3-2), which would contribute to the cumulative adverse impacts on air quality from construction and other activities in the area around the TMC campus. The TCEQ reviewed plans for operation of these systems and determined that the systems would conform to the applicable state implementation plan for achieving and maintaining air quality standards and would be in compliance with federal and Texas air quality regulations. In addition, emissions from the CHP system would be offset by a reduction in use of natural gas at the TECO plant and reductions in emissions from electricity-generating plants in the region (Section 3.1.2). DOE therefore concludes that ongoing and planned activities at the TECO Central Plant, including operation of the CHP system would not cause significant cumulative adverse impacts on air quality in the Houston and Harris County area.

4.2.2 NOISE

Sound levels in the area surrounding the Central Plant are relatively high, ranging from 64 to 72 dBA during the day on the TMC campus and 56 to 61 dBA at a nearby motel and apartment complex (Section 3.2.1). Operation of the Central Plant, construction of new facilities on the TMC, road and bridge construction, traffic, and other ongoing and planned activities in the area will increase the amount of noise in that area. Sound levels from operation of the TECO proposed CHP system are predicted to be within 2 to 5 dBA of current sound levels in the area, and would have a small incremental impact on the cumulative increase in noise in the area.

4.2.3 WATER RESOURCES

Construction of new buildings on the TMC within the floodplain of Brays Bayou could increase storm water runoff and the elevation of the floodplain, thus increasing the risk of flooding in the area. To offset this risk, the Harris County Flood Control District is increasing the flow capacity of Brays Bayou. Master plans for the TMC and City of Houston emphasize the importance of designing new facilities and infrastructure improvements to reduce storm water runoff and decrease the impacts of flooding. The TECO proposed CHP system would be located behind an existing floodwall on an existing foundation and within a building now under construction. Therefore, this proposed project would not increase the cumulative risks from growth in the area on flooding of Brays Bayou.

Operation of new cooling towers, water chillers, and other equipment by TECO, and the addition of large, new medical facilities on the TMC would increase the demand for water from the Houston municipal water system. TECO estimates that operation of the Central Plant in 2011, including operation of the new CHP system, four water chillers, and a cooling tower, would require 1,250 gallons of water per minute (1.8 million gallons per day). In 2021, after installation of all expansion and upgrades under consideration for the Central Plant, the water demand would be 2,975 gallons per minute (4.3 million gallons per day) (Bretns 2008). The City of Houston estimates that it has sufficient water supplies to support its wholesale and retail customers through approximately year 2035 from a combination of over 1.2 billion gallons per

day of reliable surface water rights and over 150 million gallons per day of available groundwater supplies (City of Houston 2010). Based on this information, DOE concludes that the City of Houston has sufficient water to support growth in the TMC area, and that the increase in demand for operation of the TECO proposed CHP system would be a small incremental increase in the total amount of water available in Houston.

4.2.4 SOCIOECONOMICS

Ongoing and planned expansion activities by the TMC, at the TECO facilities, and elsewhere in the area would expand employment opportunities, increase the tax base for Houston and Harris County, and have other beneficial impacts on the economy of the Houston area. Installation and operation of the TECO proposed CHP system would have a minor contribution to these cumulative economic benefits.

4.2.5 HEALTH AND SAFETY

Construction of new facilities on the TMC campus would cause temporary and possibly long-term traffic congestion, which could increase the rate and severity of traffic accidents. The peak of 300 construction workers required for installation of the CHP system would be negligible relative to the total number of commuters in the central Houston area. Likewise, installation of the system would have a negligible incremental impact on traffic congestion and accident rates. Operation of the Central Plant, including the CHP system, would not impact traffic congestion, traffic accident rates, or other health and safety risks, as all operations would be confined to the Central Plant.

5. CONCLUSIONS

DOE's Proposed Action would provide TECO with \$10 million in financial assistance in a cost-sharing arrangement to facilitate the purchase and installation of a new CHP system. Specifically, TECO would use DOE funding to facilitate the purchase and installation of a natural gas-powered turbine, HRSG, a natural gas compressor, four electric chillers to be powered by the CHP system, a cooling tower, an exhaust stack, and required balance of plant equipment at an existing facility. This system would have the capacity to produce about 45 megawatts of onsite electricity generation and 270,000 pounds per hour of steam, which would be used to meet the heating, cooling, and other thermal needs of the TMC. DOE concludes the following about the potential environmental impacts of its Proposed Action and TECO's proposed project.

- Installation and operation of the CHP system and other equipment would have no or negligible adverse impacts on land use; geology and soils; visual, biological, and cultural resources; transportation and traffic; utilities, energy, and materials; hazardous and nonhazardous waste; and environmental justice.
- Operation of the CHP system would conform to the State Implementation Plan and would be in compliance with federal and Texas air quality regulations.
- The refrigerant to be used in the new water chillers, R-22, is a greenhouse gas that contains ozone-destroying chlorine. These compounds could be released into the atmosphere if the refrigerant leaked during installation, operation, or repair of the water chillers.
- This proposed CHP system would result in a net decrease in emissions of air pollutants, including a decrease of about 115,000 tons of carbon equivalents per year. Thus, the project would have a net beneficial impact on air quality in the region.
- Operation of the CHP system would cause a small adverse increase in sound levels outdoors at medical facilities adjacent to the Central Plant, but sound levels indoors at those facilities would remain within acceptable levels. The project would cause a small, possibly imperceptible change in noise in nearby residential facilities.
- There would be no adverse impacts on the natural and beneficial floodplain values associated with Brays Bayou, and no increase in risk to lives or property in the area from installing the CHP system behind an existing floodwall in the 100-year floodplain.
- Installation and operation of the CHP system would have no or negligible adverse impacts on surface water quality and would cause a small increase in the demand for water in the City of Houston.
- There would be no new or significant hazards to workers or the public.

- There would be a minor to moderate and temporary beneficial impact to the economy in the areas where equipment would be manufactured, as well as in the Houston area during installation.
- Relative to the cumulative changes in the environment that would be caused by ongoing and planned activities surrounding the Central Plant, installation and operation of the CHP system would cause small, adverse incremental changes in air quality and noise in that area, and a small incremental increase in the demand for water in the City of Houston.

Under the No-Action Alternative, DOE would not provide funding to TECO and, for purposes of this EA, assumes that the CHP system would not be installed and operated. No impacts to the existing environment would occur, and beneficial impacts of the proposed project would not be realized.

On the basis of the evaluations in this EA, DOE concludes that its Proposed Action, to provide financial assistance to the TECO to facilitate installation of a CHP system, would have no significant impact on the human environment.

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APPENDIX A
DISTRIBUTION LIST

The Honorable Rick Perry
Governor of Texas
Office of the Governor
PO Box 12428
Austin, TX 78711-2428

Ms. Denise Stines Francis
State Single Point of Contact
Governor's Office of Budget, Planning,
and Policy; State Grants Team
PO Box 12428
Austin, TX 78711

Mr. Toby Baker
Governor's Advisor – Natural Resources
and Agriculture
PO Box 12428
Austin, TX 78711

Mr. Terry Zrubek
Governor's Advisor – Water
PO Box 12428
Austin, TX 78711

Mr. Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
PO Box 12276
Austin, TX 78711

Texas Commission on Environmental
Quality
5425 Polk Ave Suite H
Houston, TX 77023

Mr. Donald Fairley
Regional Environmental Officer
DHS/FEMA Region VI
800 North Loop 288
Denton, TX 76201-3698

Mr. Michael P. Jansky
Regional Environmental Review
Coordinator
Office of Planning and Coordination
U.S. Environmental Protection Agency
1445 Ross Avenue, Mail Code 6EN-XP
Dallas, TX 75202-2733

Mr. Steve Parris
U.S. Fish and Wildlife Service
Clean Lake Ecological Services Field Office
17629 El Camino Real #211
Houston TX 77058

Mr. Kevin Haggerty
U.S. Department of Energy
Freedom of Information Act Reading Room
1000 Independence Avenue, SW, 1G-033
Washington, DC 20585

The Honorable Annise D. Parker
Mayor
City of Houston
P.O. Box 1562
Houston, TX 77251

Mr. Stephen K. Swenson
Thermal Energy Corporation
1615 Braeswood Blvd
Houston, TX 77030

Harris County Flood Control District
9900 Northwest Freeway
Houston, TX 77090

Harris County Library
West University Branch
6108 Auden
Houston, TX 77005

APPENDIX B
CONSULTATIONS

This appendix contains copies of consultation letters sent by the DOE to fulfill its responsibilities under the *Endangered Species Act* and *National Historic Preservation Act*.



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Division of Ecological Services

17629 El Camino Real #211

Houston, Texas 77058-3051



January 2010

Thank you for your request for threatened and endangered species information in the Clear Lake Ecological Services Field Office's area of responsibility. According to Section 7(a)(2) of the Endangered Species Act and the implementing regulations, it is the responsibility of each Federal agency to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any federally listed species.

Please note that while a Federal agency may designate a non-Federal representative to conduct informal consultation or prepare a biological assessment, the Federal agency must notify the U.S. Fish and Wildlife Service (Service) in writing of such designation. The Federal agency shall also independently review and evaluate the scope and contents of a biological assessment prepared by their designated non-Federal representative before that document is submitted to the Service.

A county by county listing of federally listed threatened and endangered species that occur within this office's work area can be found at <http://www.fws.gov/southwest/es/EndangeredSpecies/lists/ListSpecies.cfm>. You should use the county by county listing and other current species information to determine whether suitable habitat for a listed species is present at your project site. If suitable habitat is present, a qualified individual should conduct surveys to determine whether a listed species is present.

After completing a habitat evaluation and/or any necessary surveys, you should evaluate the project for potential effects to listed species and make one of the following determinations:

- **No effect** – the proposed action will not affect federally listed species or critical habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area). No coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.
- **Is not likely to adversely affect** – the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effects. The Federal agency or the designated non-Federal representative should seek written concurrence from the Service that adverse effects have been eliminated. Be sure to include all of the information and documentation used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.



Threatened and Endangered Species Information
January 2010
Page 2

- **Is likely to adversely affect** – adverse effects to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. If the overall effect of the proposed action is beneficial to the listed species but also is likely to cause some adverse effects to individuals of that species, then the proposed action “is likely to adversely affect” the listed species. An “is likely to adversely affect” determination requires the Federal action agency to initiate formal Section 7 consultation with this office.

Regardless of your determination, the Service recommends that you maintain a complete record of the evaluation, including steps leading to the determination of affect, the qualified personnel conducting the evaluation, habitat conditions, site photographs, and any other related articles.

The Service’s Consultation Handbook is available online to assist you with further information on definitions, process, and fulfilling Endangered Species Act requirements for your projects at <http://endangered.fws.gov/consultations/s7hndbk/s7hndbk.htm>.

If we can further assist you in understanding a federal agency’s obligations under the Endangered Species Act, please contact Moni Belton, David Hoth, Charrish Stevens, Arturo Vale or Catherine Yeargan at 281/286-8282.

Sincerely,



Stephen D. Parris
Field Supervisor, Clear Lake Field Office



NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR - Morgantown, WV - Pittsburgh, PA



March 16, 2010

Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
PO Box 12276
Austin, TX 78711

Dear Mr. Wolfe:

SUBJECT: U.S. Department of Energy Request for Consultation on the Thermal Energy Corporation Combined Heat and Power Project, Houston, Texas.

The U.S. Department of Energy (DOE or the Department) proposes to provide a financial assistance grant to Thermal Energy Corporation through the Industrial Energy Efficiency Initiative of the American Reinvestment and Recovery Act (Recovery Act). Funding to that company would be used to install a new high efficiency combined heat and power system to supply the energy, heating, and cooling needs of the Texas Medical Center campus. That system would be installed at the Thermal Energy Corporation's Central Plant located on the Texas Medical Center campus at 1615 S. Braeswood Blvd, Houston, Harris County, Texas.

To comply with Section 106 of the National Historic Preservation Act, DOE has evaluated the potential impacts of this proposed project and determined that no historic properties would be affected. In accordance with the implementing regulations of that Act at 36 CFR 800.4(d) (1), DOE is providing you with documentation of that finding in the form of a completed *Application for Request for SHPO Consultation*. The required figures and maps are included.

Please forward any request for additional information, or objections to the Department's finding, to Mark Lusk of the Department's National Energy Technology Laboratory using the contact information included in the application. Since this is a Recovery Act project, we would appreciate a quick response to DOE's request for consultation. Thank you for your assistance in this matter.

Sincerely,

A handwritten signature in cursive script that reads "Mark W. Lusk".

Mark W. Lusk
NEPA Document Manager

Attachments: Application – Request for SHPO Consultation (10 pages)

3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507

TEXAS HISTORICAL COMMISSION

**REQUEST FOR SHPO CONSULTATION:
Projects Subject to Section 106 of the National Historic Preservation Act
and/or the Antiquities Code of Texas**

Submission of this form only initiates consultation with the Texas Historical Commission, the State Historic Preservation Officer (SHPO) for Texas. The SHPO may require additional information to complete the review for some projects.

FCC projects: this form should not be completed when submitting Form 620 or 621 for communications towers.

Section 106 of the National Historic Preservation Act of 1966, as amended, requires federal agencies to consider the effects of their undertakings on historic properties and to consult with the State Historic Preservation Officer (SHPO) regarding the undertaking. An undertaking is any action by or on behalf of a federal agency that has the potential to affect historic resources and includes funding, permits, or other approvals. Federal agencies are required to identify historic resources that may be affected and to avoid, minimize, or mitigate any adverse effects. The Section 106 regulations are codified in 36 CFR 800 and are available from the Advisory Council on Historic Preservation website at www.achp.gov. Regulations allow 30 days upon receipt for SHPO review.

The Antiquities Code of Texas (Title 9, Chapter 191 of the Texas Natural Resources Code) is intended to protect historic and archeological landmarks and is applicable to public lands owned by the state of Texas or a political subdivision of the state, including state agencies, counties, cities, school districts, and public colleges and universities, as well as other public authorities. Notification of the Texas Historical Commission is required before breaking ground at a project location on state or local public land.

This is a new submission

Complete all pages of this form and include required attachments.

This is additional information relating to original submission made on or about _____

Complete only the first page of this form and add any new information, including attachments.

| 1. Project Information | | |
|---|---|------------------------------|
| PROJECT NAME Thermal Energy Corporation Combined Heat and Power Project, Houston, Texas | | |
| PROJECT ADDRESS 1615 Braeswood Blvd, Houston, TX 77030 | PROJECT CITY Houston | PROJECT ZIP CODE(S) 77030 |
| PROJECT COUNTY OR COUNTIES Harris County | | |
| PROJECT TYPE (Check all that apply) | | |
| <input type="checkbox"/> Road/Highway Construction or Improvement | <input type="checkbox"/> Repair, Rehabilitation or Renovation of Structure(s) | |
| <input type="checkbox"/> Site Excavation | <input type="checkbox"/> Addition to Existing Structure(s) | |
| <input checked="" type="checkbox"/> Utilities & Infrastructure | <input type="checkbox"/> Demolition or Relocation of Existing Structure(s) | |
| <input type="checkbox"/> New Construction | <input type="checkbox"/> None of these | |
| BRIEF PROJECT SUMMARY: Please provide a one or two sentence description to explain the project. More details will be provided separately in Part 5, the Project Work Description Attachment. DOE is considering providing partial funding for the installation of a gas turbine, heat recovery steam generator, chilling units, and balance of plant equipment for improved efficiency at the Thermal Energy Corp. (TECO) Central Plant, to more efficiently provide heating and cooling for the Texas Medical Center. | | |

| 2. Project Contact Information | | | |
|---|---------------------------------|--------------------------------------|-------------------|
| PROJECT CONTACT NAME Mark W. Lusk | TITLE | ORGANIZATION Department of Energy | |
| ADDRESS 3610 Collins Ferry Road, P.O. Box 880 MS B07 | CITY Morgantown | STATE WV | ZIP 26507-0880 |
| PHONE 304-285-4145 | EMAIL mark.lusk@netl.doe.gov | | |

| For SHPO Use Only | Date Stamp Below: |
|---|-------------------|
| Track Review to: | |
| <input type="checkbox"/> Archeology Division: Reviewer: | |
| <input type="checkbox"/> History Programs Division: Reviewer: | |
| <input type="checkbox"/> Architecture Division: Reviewer: | |

| | |
|--|--|
| 3. Federal Involvement | |
| Does this project involve approval, permit, license, or funding from a federal agency? <input checked="" type="checkbox"/> Yes (Please complete this section) <input type="checkbox"/> No (Skip to next box) | |
| FEDERAL AGENCY U.S. Department of Energy | FEDERAL PROGRAM, FUNDING, OR PERMIT TYPE: American Recovery and Reinvestment Act Industrial Energy Efficiency Program |
| FEDERAL AGENCY CONTACT PERSON Mark W. Lusk | PHONE 304-285-4145 |
| ADDRESS USDOE National Energy Technology Laboratory 3610 Collins Ferry Road, P.O. Box 880, MS B07 Morgantown, WV 26507-0880 | EMAIL mark.lusk@netl.doe.gov |
| Has the federal agency (if other than HUD) formally delegated authority to consult with SHPO on the agency's behalf? <input type="checkbox"/> Yes (Please attach delegation letter) <input checked="" type="checkbox"/> No | |

| | |
|---|---|
| 4. State Involvement | |
| Does this project involve approval, permit, license, or funding from a state agency? <input checked="" type="checkbox"/> Yes (Please complete this section) <input type="checkbox"/> No (Skip to next box) | |
| STATE AGENCY Texas Commission on Environmental Quality | STATE PROGRAM, FUNDING, OR PERMIT TYPE: Air Quality Permit |
| STATE AGENCY CONTACT PERSON Richard Hyde, Air Permits Division | PHONE 512-239-1000 |
| ADDRESS P.O. Box 13087 Austin, TX 78711 | EMAIL available at www.tecq.state.tx.us |
| Will this project involve public land owned by the State of Texas or a political subdivision of the state? (State Agency, County, City, School District, Public Authority, Public College or University, etc.) <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | |
| CURRENT OR FUTURE OWNER OF THE PUBLIC LAND | |

| |
|---|
| 5. Project Work Description |
| Attach a detailed written description of the project that fully explains what will be constructed, altered, or demolished. Include architectural or engineering plans, site plans, specifications, or NEPA documents, as necessary, to illustrate the project. |

| |
|--|
| 6. Identification of Project Location and Area of Potential Effect (APE) |
| The APE includes the entire area within which historic properties could be affected by the project. This includes all areas of construction, demolition, and ground disturbance (direct effects) and the broader surrounding area that might experience visual or other effects from the project (indirect effects). |
| 1. Attach map(s) indicating the location and specific boundaries of the project. Road names must be included and legible. Identify the project location, boundaries, and APE on the map(s) as precisely as possible. Suggested maps may include USGS 7.5 minute quadrangle maps (or relevant portions thereof), tax maps, satellite images, etc. The number and types of map(s) will depend on the nature and complexity of the project as well as the extent of the APE. Projects involving ground disturbance must include the appropriate 7.5 minute USGS quadrangle. |
| 2. Attach a brief written description of the APE, including a discussion of the potential for direct and indirect effects that might result from the project and the justification for the boundaries chosen for the APE. |

| |
|--|
| PROJECT NAME Thermal Energy Corporation Combined Heat and Power Project, Houston, Texas |
|--|

VER 0110

7. Identification of Historic Properties within the APE (Attach additional materials as necessary)

A. Archeological Resources

Does this project involve ground-disturbing activity?

- Yes (Please complete this section) No (Skip to Structures section)

Describe the nature, width, length, and depth of the proposed ground-disturbing activity.

Describe previous land use and disturbances.

Describe the current land use and conditions.

B. Structures

Are there any structures, buildings, or designed landscape features (park, cemetery, etc.) 45 years old or older within the project area or APE?

- Yes No

Is the project located within or adjacent to a district that is listed in or eligible for the National Register of Historic Places? Eligible districts may include locally designated districts or areas identified in historic resource surveys.

- Yes, name of district: No Do not know

If the Texas Historic Sites Atlas (<http://atlas.thc.state.tx.us>) has been consulted, were previously identified architectural resources identified within the project area or APE?

- Yes No Did not consult Atlas

If the answer to any of the above questions is yes, use the space below or provide an attachment identifying each structure, building, designed landscape feature, or district within the APE that is 45 years old or older. Include an actual or estimated date of construction and the location of each of the features.

(Operation of the TECO Central Plant began operation in 1969)

Does the project involve the rehabilitation, alteration, removal, or demolition of any structure, building, designed landscape feature, or district that is 45 years old or older?

- Yes No

If yes, include information with the attachments for Part 5: Project Work Description and Part 8: Photographs.

8. Photographs

Attach clear, high-resolution color photographs that illustrate the project area and APE as defined in Section 6. Images from the internet are not acceptable due to low resolution. Photography should document the project area and properties within the APE, including clear views of any buildings or structures. Please number and label all photographs, and include a map or site plan labeled to show the location and direction of each view. Where applicable, include photographs of the surrounding area from the project site and streetscape images. Should your project entail the alteration of existing structures, please also provide photographs of the existing conditions of sites, buildings, and exterior and interior areas to be affected.

9. Consulting Parties/Public Notification (Section 106 only)

Attach a description of the actions taken to notify the public or invite consultation with parties other than SHPO. Provide a summary of any consultation and comments received from consulting parties or the public.

The SHPO is only one consulting party under Section 106. Refer to 36 CFR 800.2 for information about other participants who are entitled to comment on the Section 106 process, including Native American tribes, interested parties, and the public. Consultation with the SHPO is not a substitution for consultation with Native American tribes. When identifying historic resources within the APE and determining the effect of an undertaking, applicants should consider consulting with the county historical commission and the local historic preservation officer, if any.

PROJECT NAME

Thermal Energy Corporation Combined Heat and Power Project, Houston, Texas

VER 0110

| |
|---|
| <p>10. Applicant's Determination of Effect (Section 106 only)</p> <p>An effect occurs when an action alters the characteristics of a property that qualify it for listing in the National Register of Historic Places, including changes to the property's location, design, setting, materials, workmanship, feeling, and association. Effects can be direct or indirect, and can be physical, visual, audible, or economic. They may include a change in ownership or change in use.</p> <p><input checked="" type="checkbox"/> No Historic Properties Affected based on 36 CFR 800.4(d)(1). Please provide the basis for this determination.</p> <p><input type="checkbox"/> No Adverse Effect on historic properties based on 36 CFR 800.5(b). Please explain why the criteria of adverse effect at 36 CFR 800.5(a)(1) were not found to be applicable for your project.</p> <p><input type="checkbox"/> Adverse Effect on historic properties based on 36 CFR 800.5(d)(2). Please explain why the criteria of adverse effect at 36 CFR 800.5(a)(1) were found to be applicable to your project. You may also wish to include an explanation of how these adverse effects might be avoided, minimized, or mitigated.</p> <p>In the space below or as an attachment, please explain the effect of the project on historic properties. See Attached</p> |
|---|

Submit Completed Form and Attachments to:

Via mail:
 Mark Wolfe
 State Historic Preservation Officer
 Texas Historical Commission
 PO Box 12276
 Austin, TX 78711

Via hand delivery or private express delivery:
 Mark Wolfe
 State Historic Preservation Officer
 Texas Historical Commission
 108 West 16th St.
 Austin, TX 78701

Faxes and email are not acceptable.

| | | | |
|--|--|---------------------------------|--------------------------------------|
| For SHPO Use Only | | | |
| | | | |
| PROJECT NAME Thermal Energy Corporation Combined Heat and Power Project, Houston, Texas | | | |
| PROJECT ADDRESS 1615 Braeswood Blvd. Houston, TX 77030 | | PROJECT CITY | PROJECT ZIP CODE(S) |
| PROJECT COUNTY OR COUNTIES Harris County | | | |
| PROJECT CONTACT NAME Mark W. Lusk | | TITLE | ORGANIZATION Department of Energy |
| ADDRESS 3610 Collins Ferry Road, P.O. Box 880 MS B07 | | CITY Morgantown | STATE WV |
| PHONE 304-285-4145 | | ZIP 26507-0880 | |
| | | EMAIL mark.lusk@netl.doe.gov | |

VER 0110

**Attachment to the Request for SHPO Consultation for the
U.S. Department of Energy Partial Funding of the
Thermal Energy Company Combined Heat and Power Project, Houston, Texas**

5. Project Work Description

The U.S. Department of Energy (DOE) is considering providing partial funding to the Thermal Energy Company (TECO) for the installation of a combined heat and power (CHP) system and associated water chillers. TECO provides thermal services, such as heating, cooling, and steam, to the Texas Medical Center (TMC), located in central Houston, Texas.

The project DOE will partially fund includes installation of a gas turbine generator, a heat recovery steam generator, four water chilling units, and associated balance of plant equipment (e.g., natural gas compressor, piping and auxiliaries, electrical equipment, pumps, and valves). All equipment will be installed at the TECO Central Plant, located at 1615 S. Braeswood Blvd, Houston, Texas (Figures 1 and 2). The fully developed plant site currently houses an electrical substation, numerous boilers, water chillers, cooling towers, and other buildings and structures (Figure 3).

The installation of a CHP system is part of a large-scale, ongoing upgrade of the TECO Central Plant. Upgrades include removing the TMC laundry facility and replacing it with a new water chiller building; installing a 8.75-million gallon chilled water storage tank; and upgrading the electrical substation, existing boilers, and other major equipment on the site. Most of this other work has been completed or is under way. DOE is providing partial federal funding only for installation of the CHP system and water chillers.

The CHP gas turbine and heat recovery steam generator will be installed at an open site on an existing concrete foundation near the southern end of the Central Plant boundary (Figure 3). The turbine (which will be fully enclosed to reduce noise and protect workers) and associated equipment will cover an area of about 15 by 60 feet. The adjacent heat recovery steam generator will cover an area of about 30 by 110 feet, and will have a maximum height of about 65 feet. The exhaust stack for the unit will be 110 feet tall. The four water chillers will be installed in the water chiller building, which is currently being completed (Figure 3). Additional electrical lines and equipment, piping, and other required infrastructure will also be installed to support the operation of the CHP system. All work will be conducted within the boundaries of the existing, developed TECO Central Plant.

6. Identification of Project Area and Area of Potential Effects

All work for the DOE-funded project will occur within previously disturbed and developed areas of the TECO Central Plant. If historic properties were to exist near the plant, these properties could be indirectly affected from an increase in noise during operation of the CHP turbine and heat recovery steam generator, as well as from any change in the view of the facility.

DOE has chosen to evaluate an area of potential effects of 2,000 feet in diameter for the following reasons (Figure 2 shows the area of potential effects).

- No activities for this project will occur outside of the TECO Central Plant boundaries.
- Noise from operation of the CHP equipment will approach ambient levels within less than 2,000 feet of the plant boundary.
- The tallest piece of equipment to be installed outside, the stack for the heat recovery steam generator, will be similar in height to other structures at the site. Thus, the new equipment will only be visible from the south and southeast. The view of the facility from those directions will not change substantially, as the plant has numerous similar, large pieces of electrical and mechanical equipment such as a substation and cooling towers (Figure 3). From more than 2,000 feet the new equipment will not be discernable in detail from the existing equipment and structures.

The USGS 7.5-minute map for this site is the Bellaire, Texas quadrangle (1995).

9. Consulting Parties/Public Notification

DOE examined the National Park Service Native American Consultation Database and numerous other sources of information on the history of American Indian tribes in Texas and identified no Indian tribes that might attach religious and cultural significance to historic properties that might exist near the project site, and therefore does not plan to consult with any tribes.

DOE is preparing an environmental assessment to evaluate the impacts of partially funding the TECO CHP project, including impacts on cultural resources. A draft of the assessment will be made available for public review. The availability of the draft assessment will be announced in local newspapers, and copies will be sent to county and city regulatory agencies for their review.

10. Applicant's Determination of Effect

In accordance with 36 CFR 800.4 and 800.5, DOE has determined that no historic properties will be affected for the following reasons:

- All direct impacts of this project will occur within the boundaries of the TECO Central Plant. Installation of the CHP system, chillers, and associated equipment on the site will not directly impact or diminish the character of the property's use or the physical features of the buildings and structures at that site.
- There are no historic properties known to occur within the area of potential effects, or within one-half mile of the project site. In addition, DOE is not aware of any American Indian tribes that might attach religious and cultural significance to historic properties that might exist near the project site. Even if historic properties did exist near the site, they would not be affected because installation of the CHP system and water chillers would not result in a substantial increase in noise, substantially modify the view of the Central Plant, or otherwise result in indirect impacts that would diminish the integrity of any property's historic features.



Figure 1. Location of the Thermal Energy Corporation Combined Heat and Power Project at 1615 S. Braeswood Blvd in the City of Houston, Harris County, Texas



Figure 2. Thermal Energy Corporation Main Plant (outlined in red). The circle represents a 2,000-foot-diameter Area of Potential Effects.



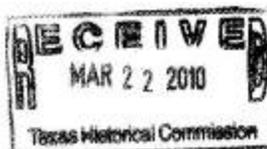
Figure 3. Thermal Energy Corporation Central Plant (outlined in red) (view to northwest). The CHP gas turbine and heat recovery steam generator will be installed near the southern boundary of the property (A). The chillers will be installed in a building currently being constructed on eastern portion of the property (B), where the recently removed Texas Medical Center laundry is shown in this photograph.



NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA



March 16, 2010



Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
PO Box 12276
Austin, TX 78711

Dear Mr. Wolfe:

SUBJECT: U.S. Department of Energy Request for Consultation on the Thermal Energy Corporation Combined Heat and Power Project, Houston, Texas.

The U.S. Department of Energy (DOE or the Department) proposes to provide a financial assistance grant to Thermal Energy Corporation through the Industrial Energy Efficiency Initiative of the American Reinvestment and Recovery Act (Recovery Act). Funding to that company would be used to install a new high efficiency combined heat and power system to supply the energy, heating, and cooling needs of the Texas Medical Center campus. That system would be installed at the Thermal Energy Corporation's Central Plant located on the Texas Medical Center campus at 1615 S. Braeswood Blvd, Houston, Harris County, Texas.

To comply with Section 106 of the National Historic Preservation Act, DOE has evaluated the potential impacts of this proposed project and determined that no historic properties would be affected. In accordance with the implementing regulations of that Act at 36 CFR 800.4(d) (1), DOE is providing you with documentation of that finding in the form of a completed *Application for Request for SHPO Consultation*. The required figures and maps are included.

Please forward any request for additional information, or objections to the Department's finding, to Mark Lusk of the Department's National Energy Technology Laboratory using the contact information included in the application. Since this is a Recovery Act project, we would appreciate a quick response to DOE's request for consultation. Thank you for your assistance in this matter.

Sincerely,

Mark W. Lusk
NEPA Document Manager

**NO HISTORIC
PROPERTIES AFFECTED
PROJECT MAY PROCEED**
by Mark Wolfe
for Mark Wolfe
State Historic Preservation Officer
Date 16 April 2010

Attachments: Application -- Request for SHPO Consultation (10 pages)

3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507

APPENDIX C
FLOODPROOFING AND ELEVATION CERTIFICATES

U.S. DEPARTMENT OF HOMELAND SECURITY
 FEDERAL EMERGENCY MANAGEMENT AGENCY
 National Flood Insurance Program

O.M.B. NO. 1660-0008
 Expires February 28, 2009

FLOODPROOFING CERTIFICATE
 FOR NON-RESIDENTIAL STRUCTURES

The floodproofing of non-residential buildings may be permitted as an alternative to elevating to or above the Base Flood Elevation; however, a floodproofing design certification is required. This form is to be used for that certification. Floodproofing of a residential building does not alter a community's floodplain management elevation requirements or affect the insurance rating unless the community has been issued an exception by FEMA to allow floodproofed residential basements. The permitting of a floodproofed residential basement requires a separate certification specifying that the design complies with the local floodplain management ordinance.

| | | | |
|---|-----------------------|---------------------------|--|
| BUILDING OWNER'S NAME <u>THERMAL ENERGY CORPORATION</u> | | FOR INSURANCE COMPANY USE | |
| STREET ADDRESS (including Apt., Unit, Suite, and/or Bldg. Number) OR P.O. ROUTE AND BOX NUMBER <u>1615 BRAESWOOD</u> | | POLICY NUMBER | |
| OTHER DESCRIPTION (Lot and Block Numbers, etc.) <u>RES A BLK 1</u> | | COMPANY NAIC NUMBER | |
| CITY <u>HOUSTON</u> | STATE <u>TEXAS</u> | ZIP CODE <u>77030</u> | |

SECTION I FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

Provide the following from the proper FIRM:

| COMMUNITY NUMBER | PANEL NUMBER | SUFFIX | DATE OF FIRM INDEX | FIRM ZONE | BASE FLOOD ELEVATION (In AO Zones, Use Depth) |
|------------------|-------------------|----------|----------------------|-----------|--|
| <u>480296</u> | <u>48201C0860</u> | <u>L</u> | <u>JUNE 18, 2007</u> | <u>AE</u> | <u>42.9</u> |

SECTION II FLOODPROOFING INFORMATION (By a Registered Professional Engineer or Architect)

Floodproofing Design Elevation Information:

Building is floodproofed to an elevation of 50.1 feet NGVD. * NAVD 1988, 2001 ADJ
* BASE ON PERIMETER FLOODWALL
 Height of floodproofing on the building above the lowest adjacent grade is 7.59 feet.

(NOTE: for insurance rating purposes, the building's floodproofed design elevation must be at least one foot above the Base Flood Elevation to receive rating credit. If the building is floodproofed only to the Base Flood Elevation, then the building's insurance rating will result in a higher premium.)

SECTION III CERTIFICATION (By Registered Professional Engineer or Architect)

Non-Residential Floodproofed Construction Certification:

I certify that, based upon development and/or review of structural design, specifications, and plans for construction, the design and methods of construction are in accordance with accepted standards of practice for meeting the following provisions:

The structure, together with attendant utilities and sanitary facilities, is watertight to the floodproofed design elevation indicated above, with walls that are substantially impermeable to the passage of water.

All structural components are capable of resisting hydrostatic and hydrodynamic flood forces, including the effects of buoyancy, and anticipated debris impact forces.

I certify that the information on this certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.

| | |
|--|---|
| CERTIFIER'S NAME <u>Douglas L. Lenz</u> | LICENSE NUMBER (or Affix Seal) <u>91873</u> |
| TITLE <u>ASSOCIATE</u> | COMPANY NAME <u>BURNS & McDONNELL</u> |
| ADDRESS <u>7400 WARD PARKWAY</u> | CITY STATE ZIP CODE <u>HANSAAS CITY MO 64114</u> |
| SIGNATURE <u>[Signature]</u> | DATE PHONE <u>4/17/2009 816-822-3926</u> |

Copies should be made of this Certificate for: 1) community official, 2) insurance agent/company, and 3) building owner.

FEMA Form 81-05, Feb 06

Replaces all previous editions

F-056 (2/06)



CERT 7

May 1, 2006

Appendix C

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

ELEVATION CERTIFICATE

OMB No. 1660-0008
Expires February 28, 2009

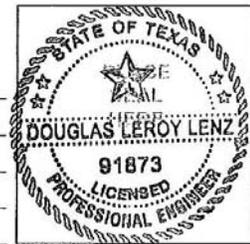
Important: Read the instructions on pages 1-8.

| SECTION A - PROPERTY INFORMATION | | For Insurance Company Use: |
|--|----------------------------|--|
| A1. Building Owner's Name | Thermal Energy Corporation | Policy Number |
| A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. | 1615C Braeswood | Company NAIC Number |
| City Houston State TX ZIP Code 77030 | | |
| A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.) RES A BLK 1 TRS71819A-1 PW ROSE SURVEY | | |
| A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.) Office / Warehouse | | |
| A5. Latitude/Longitude: Lat. 29-42-15.60N Long. 95-23-47.43W | | Horizontal Datum: <input type="checkbox"/> NAD 1927 <input checked="" type="checkbox"/> NAD 1983 |
| A6. Attach at least 2 photographs of the building if the Certificate is being used to obtain flood insurance. | | |
| A7. Building Diagram Number NA | | |
| A8. For a building with a crawl space or enclosure(s), provide | | |
| a) Square footage of crawl space or enclosure(s) | 0 sq ft | A9. For a building with an attached garage, provide: |
| b) No. of permanent flood openings in the crawl space or enclosure(s) walls within 1.0 foot above adjacent grade | 0 | a) Square footage of attached garage |
| c) Total net area of flood openings in A8.b | 0 sq in | b) No. of permanent flood openings in the attached garage walls within 1.0 foot above adjacent grade |
| | | c) Total net area of flood openings in A9.b |

| SECTION B - FLOOD INSURANCE RATE MAP (FIRM) INFORMATION | | | | | |
|--|------------|---------------------|---------------------------------------|-------------------|---|
| B1. NFIP Community Name & Community Number | | B2. County Name | | B3. State | |
| Houston 480296 | | Harris | | TX | |
| B4. Map/Panel Number | B5. Suffix | B6. FIRM Index Date | B7. FIRM Panel Effective/Revised Date | B8. Flood Zone(s) | B9. Base Flood Elevation(s) (Zone AO, use base flood depth) |
| 48201C0860 | L | June 18, 2007 | June 18, 2007 | AE | 42.9 |
| B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in Item B9. | | | | | |
| <input checked="" type="checkbox"/> FIS Profile <input type="checkbox"/> FIRM <input type="checkbox"/> Community Determined <input type="checkbox"/> Other (Describe) _____ | | | | | |
| B11. Indicate elevation datum used for BFE in Item B9: <input type="checkbox"/> NGVD 1929 <input checked="" type="checkbox"/> NAVD 1988 <input checked="" type="checkbox"/> Other (Describe) NAVD 1988, 2001 Adj | | | | | |
| B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | | | |
| Designation Date _____ <input type="checkbox"/> CBRS <input type="checkbox"/> OPA | | | | | |

| SECTION C - BUILDING ELEVATION INFORMATION (SURVEY REQUIRED) | |
|--|---|
| C1. Building elevations are based on: <input checked="" type="checkbox"/> Construction Drawings* <input type="checkbox"/> Building Under Construction* <input type="checkbox"/> Finished Construction | |
| *A new Elevation Certificate will be required when construction of the building is complete. | |
| C2. Elevations - Zones A1-A30, AE, AH, A (with BFE), VE, V1-V30, V (with BFE), AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO. Complete Items C2.a-g below according to the building diagram specified in Item A7. | |
| Benchmark Utilized Texas State Plane - TMC 1 Vertical Datum 44.00 NAVD88 | |
| Conversion/Comments Site is protected by floodwall to elevation 50.1 (NAVD 1988, 2001 Adj) | |
| Check the measurement used. | |
| a) Top of bottom floor (including basement, crawl space, or enclosure floor) | 44.70 <input checked="" type="checkbox"/> feet <input type="checkbox"/> meters (Puerto Rico only) |
| b) Top of the next higher floor | 72.20 <input checked="" type="checkbox"/> feet <input type="checkbox"/> meters (Puerto Rico only) |
| c) Bottom of the lowest horizontal structural member (V Zones only) | 56.60 <input checked="" type="checkbox"/> feet <input type="checkbox"/> meters (Puerto Rico only) |
| d) Attached garage (top of slab) | _____ <input type="checkbox"/> feet <input type="checkbox"/> meters (Puerto Rico only) |
| e) Lowest elevation of machinery or equipment servicing the building (Describe type of equipment in Comments) - water well that is protected within the floodwall to elevation 50.1 NAVD with 2001 Adj | 44.10 <input checked="" type="checkbox"/> feet <input type="checkbox"/> meters (Puerto Rico only) |
| f) Lowest adjacent (finished) grade (LAG) | 43.00 <input checked="" type="checkbox"/> feet <input type="checkbox"/> meters (Puerto Rico only) |
| g) Highest adjacent (finished) grade (HAG) | 44.70 <input checked="" type="checkbox"/> feet <input type="checkbox"/> meters (Puerto Rico only) |

| SECTION D - SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION | |
|---|--|
| This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by law to certify elevation information. I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001. | |
| <input type="checkbox"/> Check here if comments are provided on back of form. | |
| Certifier's Name | Douglas L Lenz License Number 91873 |
| Title | Project Civil Engineer Company Name Burns & McDonnell |
| Address | 9400 Ward Parkway City Kansas City State MO ZIP Code 64114 |
| Signature | Date 1/17/09 Telephone 816-822-3926 |

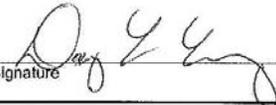


| | |
|--|----------------------------|
| IMPORTANT: In these spaces, copy the corresponding information from Section A. | For Insurance Company Use: |
| Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 1615C Braeswood | Policy Number |
| City Houston State TX ZIP Code 77030 | Company NAIC Number |

SECTION D - SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION (CONTINUED)

Copy both sides of this Elevation Certificate for (1) community official, (2) insurance agent/company, and (3) building owner.

Comments

Signature 

Date 4/17/09

Check here if attachments

SECTION E - BUILDING ELEVATION INFORMATION (SURVEY NOT REQUIRED) FOR ZONE AO AND ZONE A (WITHOUT BFE)

For Zones AO and A (without BFE), complete Items E1-E5. If the Certificate is intended to support a LOMA or LOMR-F request, complete Sections A, B, and C. For Items E1-E4, use natural grade, if available. Check the measurement used. In Puerto Rico only, enter meters.

- E1. Provide elevation information for the following and check the appropriate boxes to show whether the elevation is above or below the highest adjacent grade (HAG) and the lowest adjacent grade (LAG).
- a) Top of bottom floor (including basement, crawl space, or enclosure) is _____ feet meters above or below the HAG.
- b) Top of bottom floor (including basement, crawl space, or enclosure) is _____ feet meters above or below the LAG.
- E2. For Building Diagrams 6-8 with permanent flood openings provided in Section A Items 8 and/or 9 (see page 8 of Instructions), the next higher floor (elevation C2.b in the diagrams) of the building is _____ feet meters above or below the HAG.
- E3. Attached garage (top of slab) is _____ feet meters above or below the HAG.
- E4. Top of platform of machinery and/or equipment servicing the building is _____ feet meters above or below the HAG.
- E5. Zone AO only: If no flood depth number is available, is the top of the bottom floor elevated in accordance with the community's floodplain management ordinance? Yes No Unknown. The local official must certify this information in Section G.

SECTION F - PROPERTY OWNER (OR OWNER'S REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and E for Zone A (without a FEMA-issued or community-issued BFE) or Zone AO must sign here. *The statements in Sections A, B, and E are correct to the best of my knowledge.*

Property Owner's or Owner's Authorized Representative's Name

| | | | |
|-----------|------|-----------|----------|
| Address | City | State | ZIP Code |
| Signature | Date | Telephone | |
| Comments | | | |

Check here if attachments

SECTION G - COMMUNITY INFORMATION (OPTIONAL)

The local official who is authorized by law or ordinance to administer the community's floodplain management ordinance can complete Sections A, B, C (or E), and G of this Elevation Certificate. Complete the applicable item(s) and sign below. Check the measurement used in Items G8, and G9.

- G1. The information in Section C was taken from other documentation that has been signed and sealed by a licensed surveyor, engineer, or architect who is authorized by law to certify elevation information. (Indicate the source and date of the elevation data in the Comments area below.)
- G2. A community official completed Section E for a building located in Zone A (without a FEMA-issued or community-issued BFE) or Zone AO.
- G3. The following information (Items G4.-G9.) is provided for community floodplain management purposes.

| | | |
|-------------------|------------------------|---|
| G4. Permit Number | G5. Date Permit Issued | G6. Date Certificate Of Compliance/Occupancy Issued |
|-------------------|------------------------|---|

- G7. This permit has been issued for: New Construction Substantial Improvement
- G8. Elevation of as-built lowest floor (including basement) of the building: _____ feet meters (PR) Datum _____
- G9. BFE or (in Zone AO) depth of flooding at the building site: _____ feet meters (PR) Datum _____

| | |
|-----------------------|-----------|
| Local Official's Name | Title |
| Community Name | Telephone |
| Signature | Date |
| Comments | |

Check here if attachments