THE UNIVERSITY OF TEXAS AT AUSTIN

WHAT STARTS HERE CHANGES THE WORLD

# First Global District Energy Climate Award

## The Utilities & Energy Management Department

Full-service Campus Utility in Austin, Texas, United States

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## Section 2, *Photos of the Carl J. Eckhardt Heating and Power Plant*

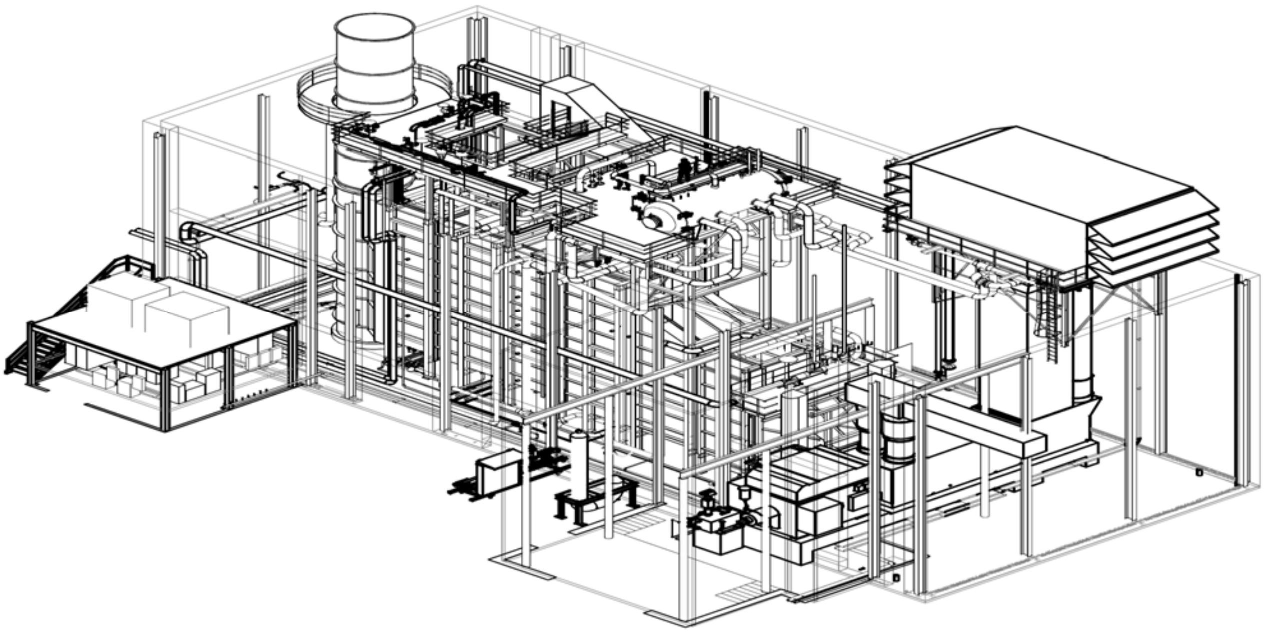
**Aerial View of Plant Facilities – 137 MW**

**Combustion Turbine #8 – 45 MW & 298,000 lb/hr HRSG**

**Steam Turbine #7 – 25 MW**

**Steam Turbine #9 – 25 MW**

**New Combustion Turbine 10 - 34 MW & 200,000 lb/hr HRSG**



**Cooling Tower #1 – 63,000 GPM**

Chilling Station #6 – 15,000 tons

Inlet Air Cooler for CT #8- 3,000 Ton Capacity

**Thermal Storage Tank – 39,000 Ton-hrs**

## Section 3, *System Description*

The University of Texas at Austin main campus is a dense urban campus of over 16 million square feet in 200 buildings serving 70,000 students, faculty, and staff. The buildings are connected through a district energy system with all utilities centrally generated on campus by the Utilities & Energy Management Department. Connections to the surrounding city electrical grid exist only for emergency backup, providing the university independence and flexibility in generating the electricity, chilled water, heating steam and other utilities required on campus.

Eighty percent of the 16 million square feet on campus is research oriented, operating 24 hours a day, 7 days a week, 365 days a year. The research facilities conduct $511 million dollars in contract and research grants annually, demanding a versatile and uninterrupted supply of energy demonstrated by the 99.998% reliability maintained over the last 35 years.

### History

The Combined Heat and Power system was originally started in 1929 with a lignite fired boiler steam system generating 3 MW using two 1.5 MW steam turbines and also heating the campus. The system was converted to use natural gas in the 1930's and has been that way ever since. This system has evolved to a system that produces 350 million kWh electricity, 980 million lbs of steam and 136 million ton-hrs of chilled water annually through six miles of underground distribution tunnels and over 56 miles of underground electrical distribution duct banks. The utility system has been self generating 100% of all energy since 1929 with extremely high reliability, added value to the campus, and ever increasing efficiency that has translated in significant emissions reductions.

### Configuration of Production Units

The installed equipment listed below totals 137 MW of on-site combined heat and power, 1.2 million lbs/hr of steam generation and 48,000 tons of chilled water capacity. A 4 million gallon chilled water thermal energy storage system is scheduled to come on line by September 2010.

<u>Combustion Gas Turbine/Generator #10</u>
<u>With Inlet Air Cooling</u>

Model: General Electric LM-2500+G4
Commissioned: November 2009
Rating: 34,000 KW
Voltage: 12,000 V

<u>Heat Recovery Steam Generator #10</u>

Model: Express Integrated Technologies
Commissioned: November 2009
Rating: 77,000 LBS/HR (unfired)
Rating: 185,000 LBS/HR (fired)
Temperature: 750° F
Steam Pressure Design: 700 PSIG
Steam Pressure Operating: 450 PSIG

<u>Combustion Gas Turbine/Generator #8</u>
<u>With Inlet Air Cooling</u>

Model: Westinghouse CW251B10
Manufactured: 1986
Rating: 36,180 KW
Voltage: 12,000 V
Boiler #8 (HRSG)

<u>Heat Recovery Steam Generator #8</u>

Model: Vogt
Manufactured: 1986
Rating: 157,000 LBS/HR (unfired)
Rating: 289,000 LBS/HR (fired)
Temperature: 750° F
Steam Pressure Design: 700 PSIG
Steam Pressure Operating: 450 PSIG

Steam Turbine/Generator #7

Model: General Electric
Manufactured: 1977
Rating: 25,000 KW
Temperature: 750° F
Steam Pressure: 400 PSIG
Voltage: 12,000 V

Steam Turbine/Generator #9

Model: Siemens ENK 50/90/0
Manufactured: 2003
Rating: 25,000 KW
Temperature: 750° F
Steam Pressure: 410.5 PSIG
Voltage: 12,000 V

Steam Turbine/Generator #**5**

Model: Westinghouse
Manufactured: 1958
Rating: 5,000 KW
Temperature: 750° F
Steam Pressure: 400 PSIG
Voltage: 4160 V

Steam Turbine/Generator #4

Model: Westinghouse
Manufactured: 1949
Rating: 5,000 KW
Temperature: 750° F
Steam Pressure: 400 PSIG
Voltage: 4160 V

Boiler #7

Model: Vogt
Manufactured: 1967
Rating: 500,000 LBS/HR
Temperature: 750° F
Steam Pressure Design: 600 PSIG
Steam Pressure Operating: 425 PSIG

Boiler #3

Model: Babcock & Wilcox
Manufactured: 1959
Rating: 150,000 LBS/HR
Temperature: 750° F
Steam Pressure Design: 600 PSIG
Steam Pressure Operating: 425 PSIG

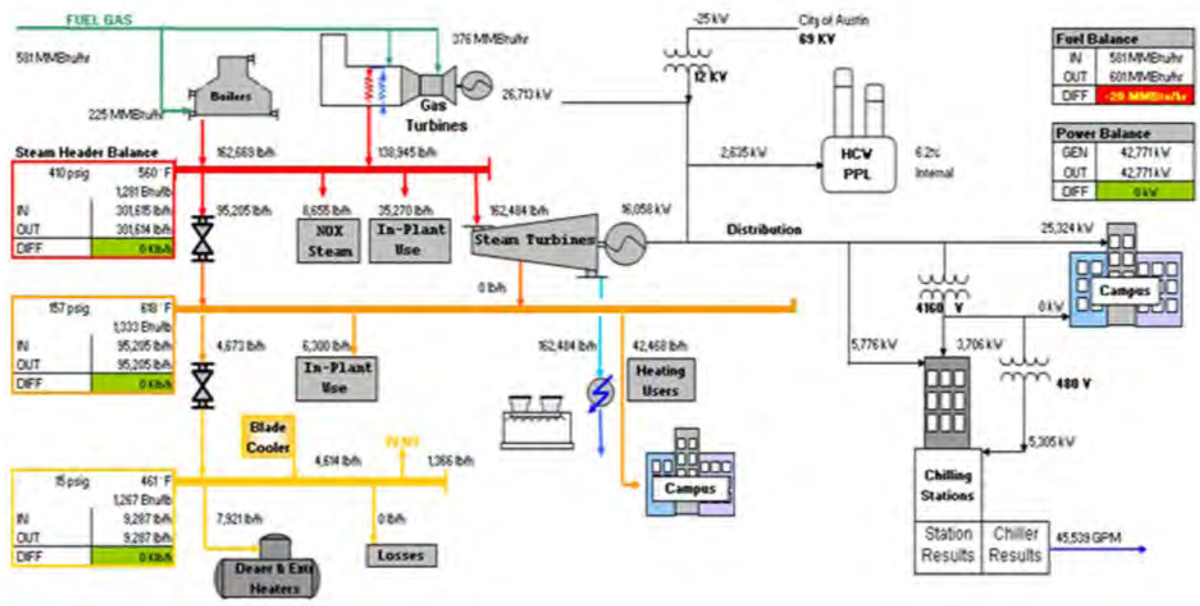
Boiler #2

Model: Vogt
Manufactured: 1948
Rating: 75,000 LBS/HR
Temperature: 750° F
Steam Pressure Design: 600 PSIG
Steam Pressure Operating: 425 PSIG

Boiler #1

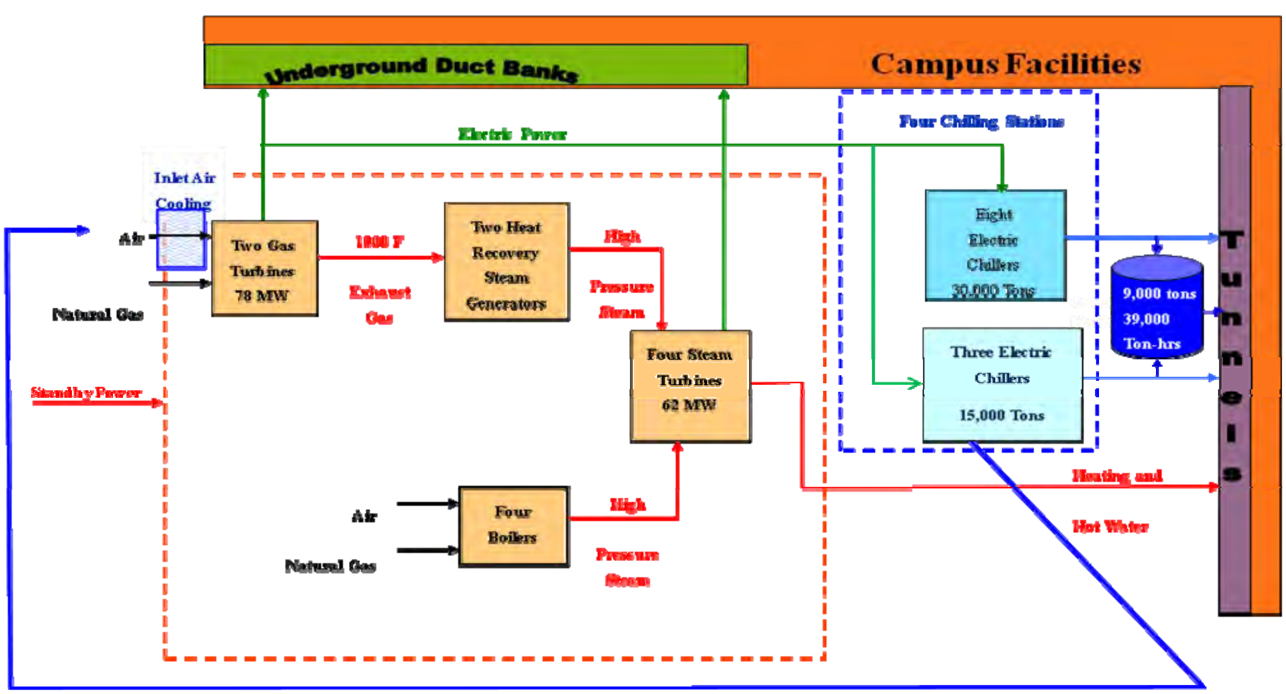
Model: Vogt
Serial No:
Manufactured: 1948
Rating: 75,000 LBS/HR
Temperature: 750° F
Steam Pressure Design: 600 PSIG
Steam Pressure Operating: 425 PSIG

The system is configured as described in this screen shot of the real time plant optimization system diagram below:




A higher level schematic of the system below shows that the campus is connected in parallel with the local electrical utility grid and has available 25 MW of stand-by electricity but the system is operated as an island. In other words the campus self-generates 100 % of all electricity and maintains a net zero import/export of electricity with the grid. The diagram shows that the chilled water distribution system also provides inlet air cooling needed to provide the campus optimum, high efficiency combustion turbine power year-round.

**System Schematic**



The system is operated in a combined cycle mode comprised of a combustion turbine paired with a steam turbine. Maximum electrical generation efficiency is obtained by operating the combustion turbine as high as possible, using the inlet air cooler in hot weather, and matching the HRSG steam output to the steam turbine generator to match the exact campus electrical load requirement.

Steam is extracted from the turbine to supply steam to the campus for heating and hot water generation in the facilities. The boilers are operated to provide peak steam needs above and beyond what can be produced by the HRSG's and they provide a backup steam source in the event of a combustion turbine/HRSG upset.

The system is able to operate at extremely high efficiencies because the boilers have been retrofitted with combustion controls that allow the boilers to operate at about 85% plus efficiencies, use variable frequency drives (VFDs) that reduce boiler parasitic loads, flue gas recirculation controlled by VFD's that reduce NOx to comply with air permit requirements and allow the backup boilers to be banked when needed to maintain a "spinning steam reserve" yet be responsive to a sudden full load need in about 2 minutes. Graphical explanations of operating efficiency and emissions gains will be described later.

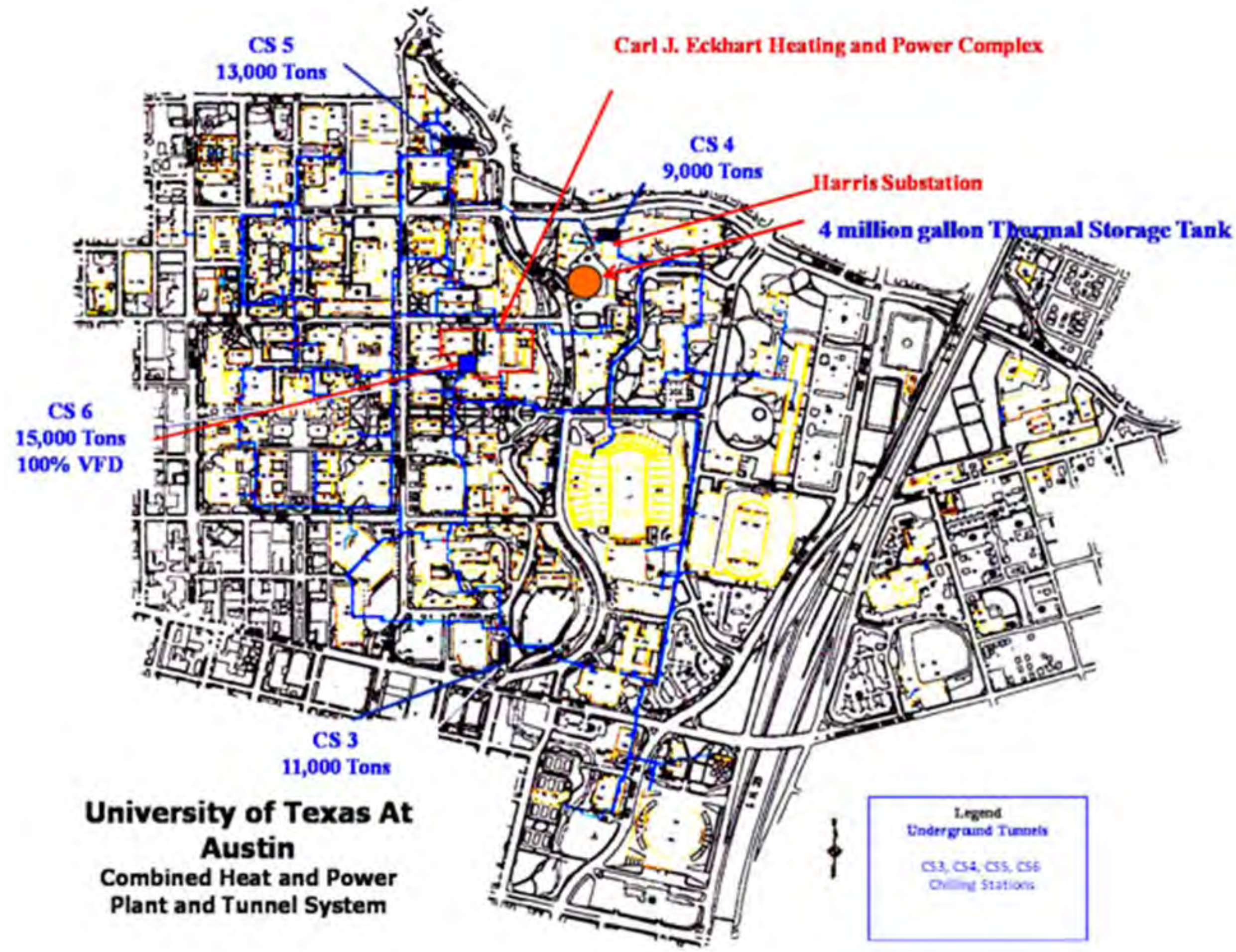
Compressed air for building controls and laboratory use is produced in the power plant as a byproduct of a combustion turbine (CT) with standby electric air compressors for backup. The university also maintains a recovered water system that recovers water from campus building air conditioning cooling coil dehumidification runoff, pools, fountains, rainwater cisterns and underground sources totaling about 30 million gallons annually for use as makeup water for cooling towers in the power plant and chilling stations.

## Distribution Network

Concrete tunnel systems distribute chilled water, steam, compressed air and recovered water to and from the buildings and plants. The tunnel system is a major advantage to the reliable operation of the campus because it allows for easy repairs as needed, replacement of valves and controls without impacting the operation of buildings. Required building outages are kept to a minimum.

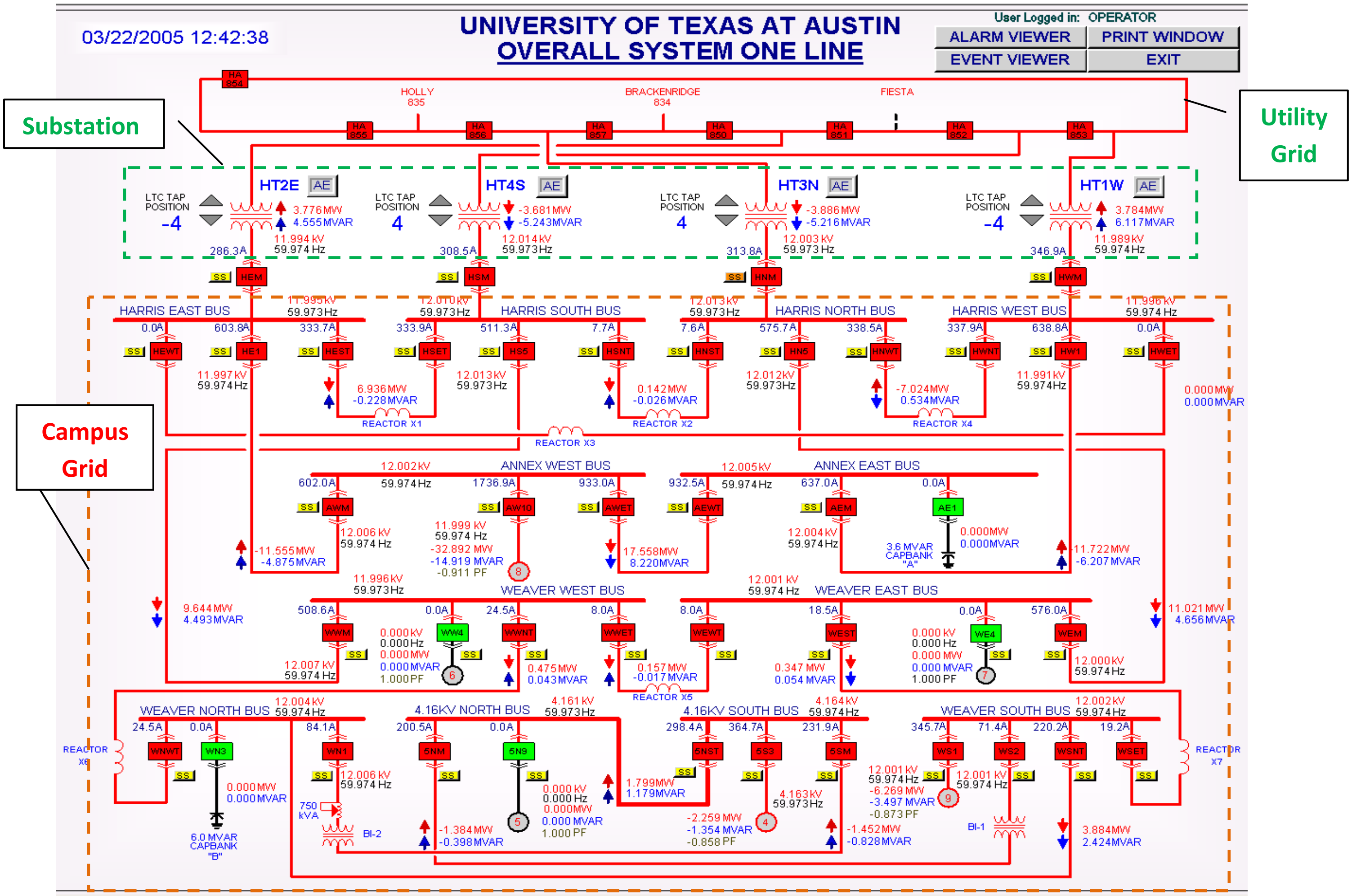
Reliability has been a key component of the operation and master planning of the utility system from the inception. To this end each building is equipped with two electrical substations, two chilled water connections, two steam connections and two domestic water connections.

The campus map below illustrates the tunnel system, the location of the power generating facilities, location of the four chilling stations and the new thermal storage facility. Though the tunnel distribution systems date back to the 1930's a recent condition assessment indicates that they are in very good condition and can continue to serve the campus for many more years.




The campus electrical distribution system is configured as a looped system with 100% redundant high voltage switch gear on 12 switch gear systems and is connected to a 69 KV to 12,000 KV substation with four 50 MVA transformers connected via a ring bus. This entire system is managed using a digital SCADA system.

The substation ring bus provides up to a maximum 100 MVA load though the campus exceeds 50 MVA only about 20% of the year. The substation was upgraded in 2004 to accommodate 30 years of projected campus growth and the entire power plant electrical distribution system was replaced and upgraded at the same time. In essence there is N plus 4 reliability currently at the substation 80% of the time and there is 100% backup for the power plant switchgear. The current maximum campus electrical peak is 65 MW.  The following illustration is a screen shot of the SCADA system of the entire campus grid.

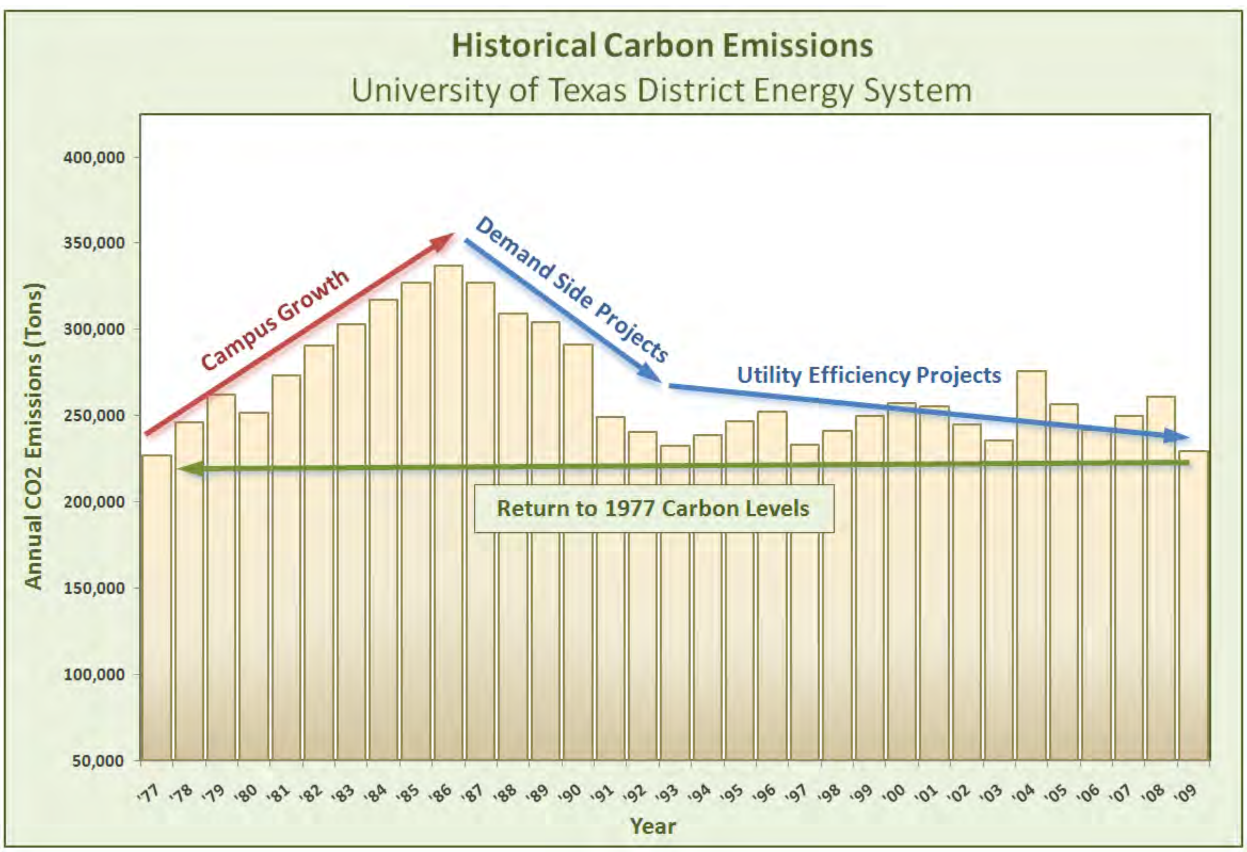

03/22/2005 12:42:38
UNIVERSITY OF TEXAS AT AUSTIN
OVERALL SYSTEM ONE LINE
User Logged in: OPERATOR
ALARM VIEWER
PRINT WINDOW
EVENT VIEWER
EXIT
Substation
Utility Grid
Campus Grid
HOLLY 835
BRACKENRIDGE 834
FIESTA
HT2E
HT4S
HT3N
HT1W
LTC TAP POSITION
HARRIS EAST BUS
HARRIS SOUTH BUS
HARRIS NORTH BUS
HARRIS WEST BUS
REACTOR X1
REACTOR X2
REACTOR X3
REACTOR X4
ANNEX WEST BUS
ANNEX EAST BUS
3.6 MVAR CAPBANK "A"
WEAVER WEST BUS
WEAVER EAST BUS
REACTOR X5
WEAVER NORTH BUS
4.16KV NORTH BUS
4.16KV SOUTH BUS
WEAVER SOUTH BUS
REACTOR X6
REACTOR X7
6.0 MVAR CAPBANK "B"
750 kVA
BI-2
BI-1

## Section 4, *Success in efficiency and environmental advancements*

The University of Texas at Austin is a constantly growing campus both in physical size and energy demands. As new buildings are built and existing buildings expanded, the heating and cooling demands increase. New classroom technology and advanced research labs require greater levels of electricity, while growing computer labs and server rooms further increases demands on chilled water for cooling. The increased energy needs push the capacity requirements of campus utilities while maintaining a focus on advancing efficiency and environmental projects. The Utilities & Energy Management Department has met this increased demand with innovations and initiatives that have increased efficiency and reduced the environmental impact to historic lows that far outweigh the alternatives.

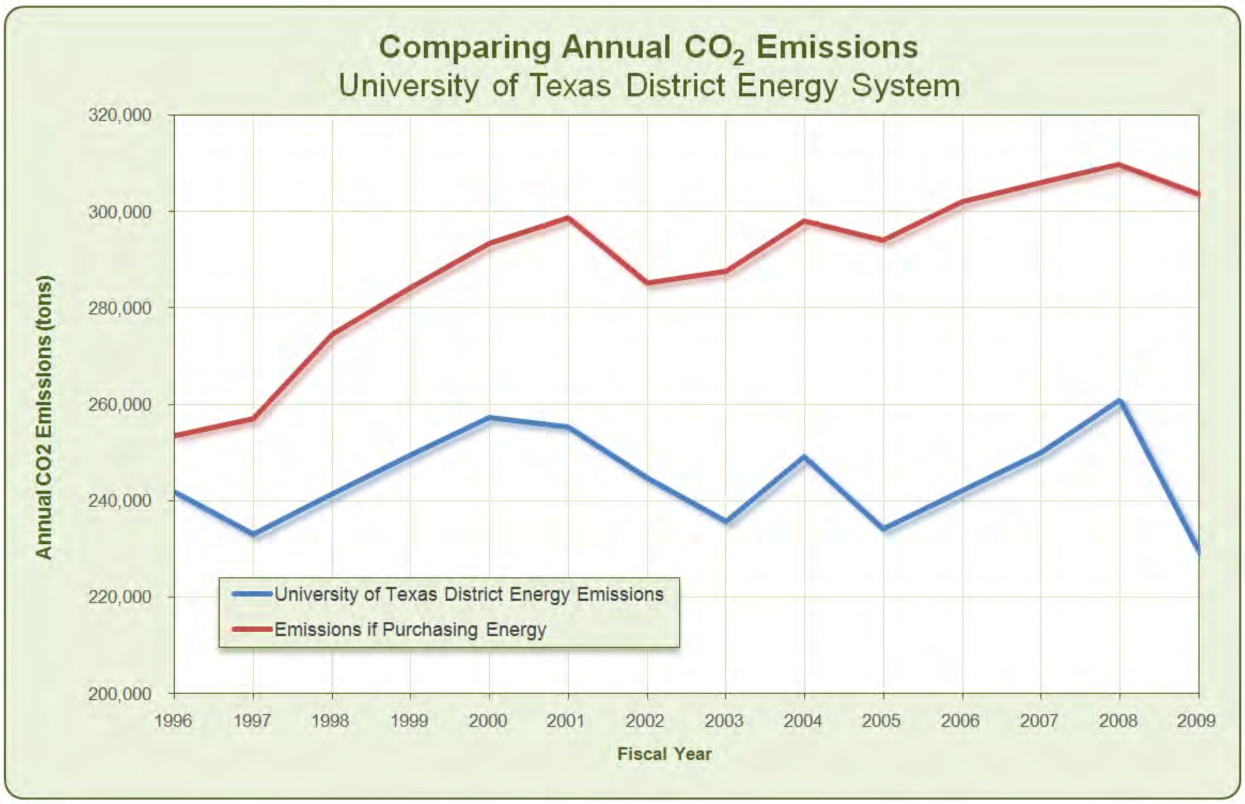
### Reduced fuel use and decreased CO2 emissions

All utilities on campus are ultimately generated from natural gas so while relatively clean burning, carbon emissions are still a large concern. However, due to the high efficiency and versatility provided by the campus's district energy system, and advances in the efficiency and operations in utilities generation (detailed in the next sections), carbon emissions have been held at steady levels in spite of the constantly increasing campus demands. The figure below illustrates the past 32 years of plant operations, demonstrating the years of campus growth with no efficiency initiatives, followed by a combination of demand side projects and ongoing utility improvements that have reduced carbon levels to 1977 levels.



Compared to 1977, the campus is now nearly twice the size (9,000,000 square feet to 16,000,000) with over double the electrical demand (183,000 MWh to 372,000 MWh annual) yet carbon emissions remain the same and are anticipated to decrease as new technology such as combustion turbine 10 and the thermal energy storage tank come online.

The alternative to generating electricity, steam, and chilled water on campus would be purchasing electricity and natural gas to meet campus needs. Purchasing grid electricity for building loads and chilling stations, and burning natural gas for space heating and hot water, would eliminate many of the advantages of the district energy system. The figure below shows the actual carbon emissions due to the university's current power plant, compared to the anticipated emissions resulting from electricity provided by the mix of power plants across Texas and burning natural gas on campus for heating needs.




Even with Texas boasting the largest amount of wind energy in the country and several nuclear plants, the mix of coal and natural gas used to generate grid electricity does not compare to the efficiency of the combined heating and power facilities on the university campus. The disparity between self-generated energy on campus and purchased grid energy will continue to widen, as efficiency improvement projects are continuously implemented on campus. The next few sections will cover a number of the efficiency projects already completed.

### Environmental compliance strategies

Prior to 2001 only combustion turbine (CT) 8 was registered with an air permit according to EPA regulations. The rest of the plant was grandfathered due to the age of the equipment commissioned before 1965. In 2001 the Governor of Texas encouraged state agencies to participate in a new Voluntary Emissions Reduction Program that had a target date of 2007. The program was based on the premise that agencies like the university could negotiate/propose strategies that would reduce NOx emissions and total emissions. The following proposal from the university was approved by the Texas Commission on Environmental Quality:

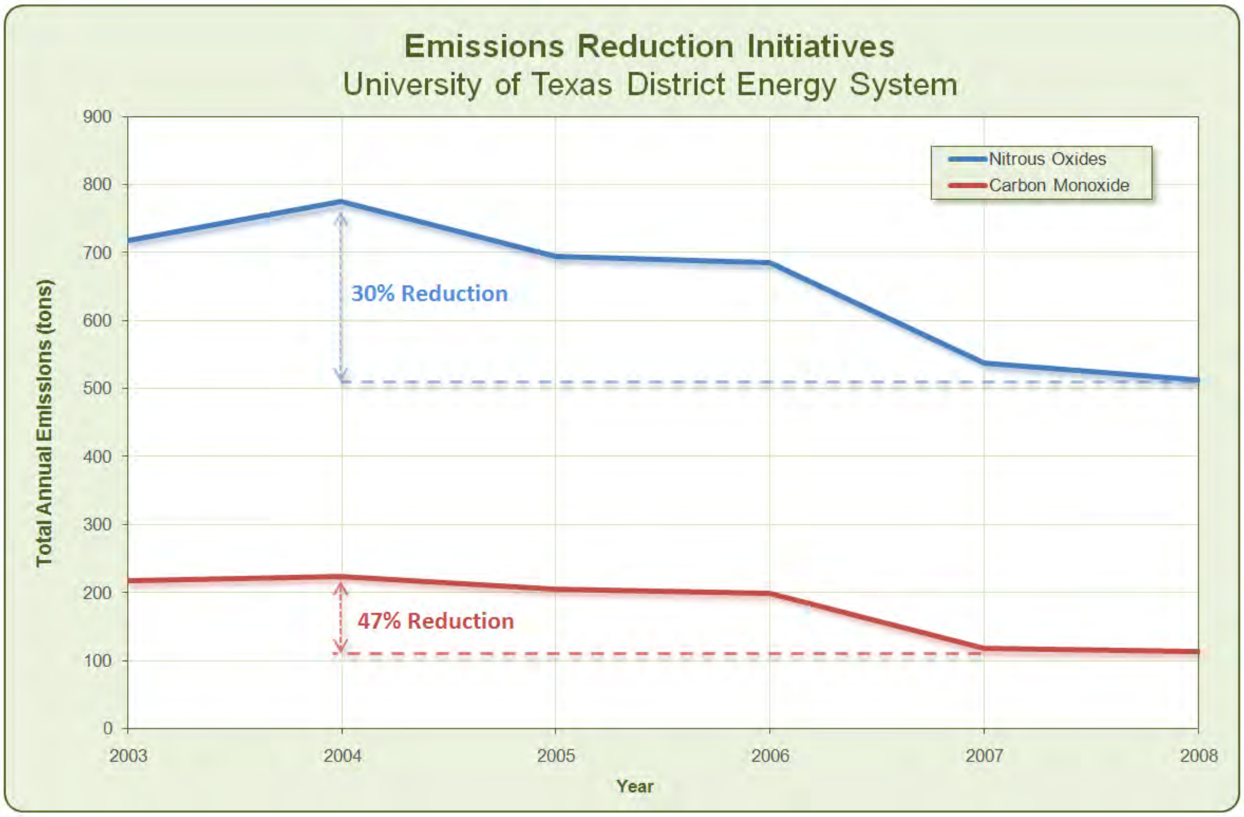
1. Boiler 3 (150,000 lbs/hr) and Boiler 7 (500,000 lbs/hr) fired with natural gas would be retrofitted with emissions reduction equipment that would reduce NOx from .21 lbs/mmbtu to.03 lbs/mmbtu. They would also not be be operated more than 720 hours at .06 lbs/mmbtu of NOx on fuel oil.

2. CT 6 (1965, 13 MW & 90,000 lb/hr HRSG) operating hours would be reduced to operate no more than 1,500 hours per year using natural gas. The CT was too old and inefficient to justify making a significant expense to reduce emissions. (This turbine has since been demolished to accommodate a new GE LM-2500 CT with HRSG in its space)

3. Boilers 1 & 2 (1948, 75,000 lbs/hr) operating hours would be reduced to operate no more than 2500 hrs/yr using natural gas. The boilers were too old and inefficient to justify making a significant expense to reduce emissions.

Rather than replace the burners on Boilers 3 & 7 with expensive low NOx burners compounded by the issue that the low NOx burner suppliers would not guarantee the target of .03lbs/mmbtu the university implemented an innovative NOx reduction approach that was half the price plus proposed an energy savings payback. The approach used flue gas recirculation, VFD's to regulate flue gas and combustion air, removed boiler dampers and used software to monitor excess $O_2$, NOx and regulate natural gas flow.

This strategy was very successful in achieving the emissions reductions for both natural gas and fuel oil plus significantly reduced fan horse power and allows unlimited turndown on the boilers which is important because the boilers are used only to handle swing steam needs above the free steam amount produced by the HRGS's. The unexpected recurring energy savings from this initiative amounts to 200,000 mmbtu's per year.




Since beginning the project in 2004, total plant nitrous oxide levels have seen a 30% annual reduction, carbon monoxide emissions have seen a 47% reduction, and sulfur dioxide emissions, even being initially low, dropped 38%. These are emissions reductions in the face of increasing campus energy demands, and will continue to decrease with the commissioning of combustion turbine 10 equipped with urea SCR.

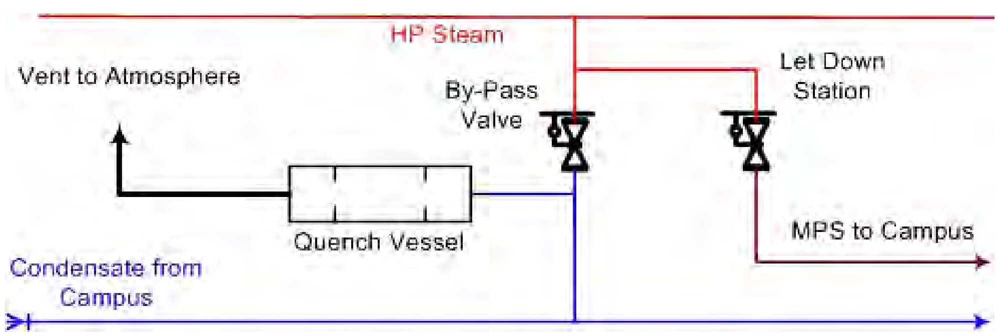
## Innovative technological solutions and future strategies

The university must continue to serve the campus energy needs utilizing natural gas due to the physical location of the facilities and the required reliability. Achieving reductions in $CO_2$ and other emissions must then come from increasing plant efficiencies. The Utilities and Energy Management Department has been focused on using innovative technological solutions as a strategy for the future for many years. The first example is the combustion controls retrofit for the boilers described above. The list below describes the other approaches used by the university:

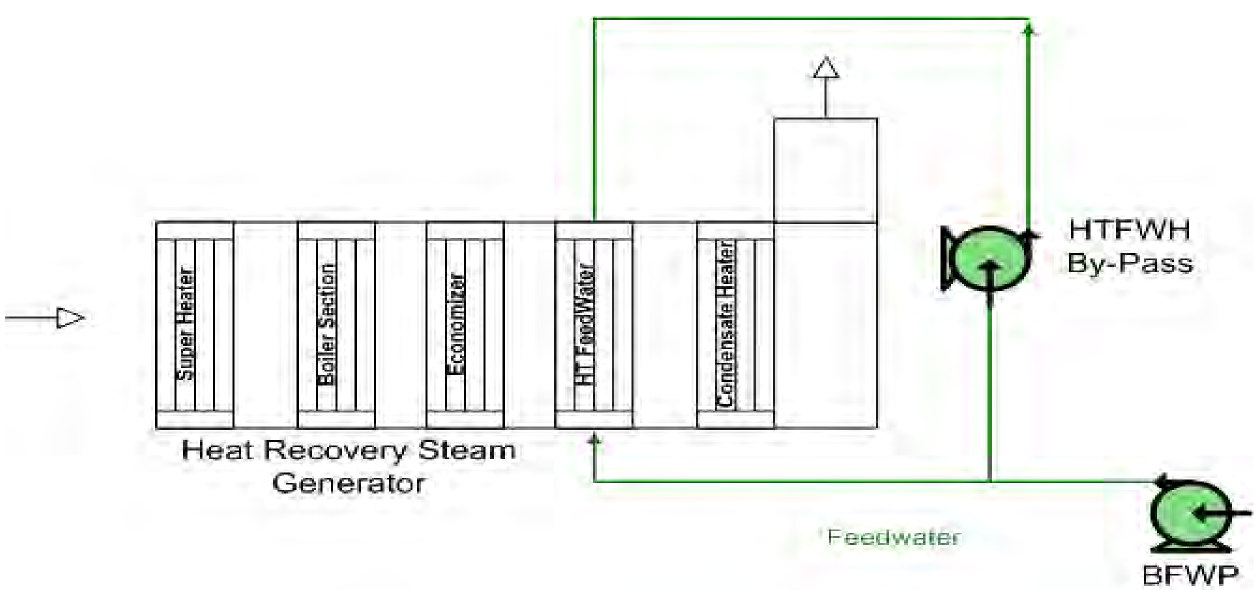
1. A passive steam dump system was installed to vent excess steam in the event of a steam turbine trip. As mentioned earlier, the power plant is located in the middle of the campus so if our 25 MW steam turbine were to trip off line, we would have 400,000 lbs/hr of 700 F steam at 420 psi more than could be supported by campus needs which would lift pressure relief valves with extreme noise (130 decibels).

   Prior to the installation of the dump system the plant would address this by banking two older inefficient steam turbines that are 1945 and 1955 vintage at 1 MW so that if a trip occurred they could be ramped up to handle up to 12 MW of steam. But because of the age of the equipment it was wasting steam 24/7 at 30,000 lbs/hr in the event “if” a trip occurred which was not often.

The dump system illustrated below is totally passive and does not use any energy when not needed. If an upset were to occur the excess steam is vented to the atmosphere only for the period of the upset without excess noise which provides around 200,000 mmbtu of annually recurring gas savings.




2. The HRSG associated with the base loaded combustion turbine #8 installed in 1988 had a design flaw that caused flashing in the feed water heating loop of the boiler. This prevented operating the CT at maximum output. A bypass system was installed that resolved this issue which now allows maximum output and efficiency of the CT thereby saving around 300,000 mmbtu of fuel annually . The diagram below describes this system.



3. The primary cooling tower for the power plant originally installed in 1958 was replaced with a new fiberglass cooling tower with variable frequency drives that allow matching cooling water needs exactly to the demand for cooling water. This project saves the campus about 50,000 mmbtu's per year of fuel.
4. The plant originally had only had one efficient 25 MW steam turbine that could be matched with the primary combustion turbine. This turbine was installed in 1978 and due to reliability needs it could not be regularly shut down for maintenance actions so a new more efficient 25 steam turbine was installed in 2004 which provides around 200,000 mmbtu of annual fuel savings.
5. A new 15,000 ton chilling station was just commissioned to replace a 50 year old steam turbine driven chiller plant. This new plant operated with 100% variable frequency drives on three 5,000 ton York OM chillers and all associated pumps and cooling tower equipment. This is the first 100% VFD plant at this size commissioned by York/Johnson Controls. This plant is producing chilled water at a total efficiency of .75 kW/Ton with all auxiliaries included. This plant was projected to save the campus around 20,000 mmbtu's per year but actual numbers will be much higher.
6. The above mentioned chilling station also provides chilled water to an inlet air coil for the largest combustion turbine so that full output and efficiency can be realized at all times. This project is projected to save the campus around 120,000 mmbtu's per year.
7. In process is the start up of our newest 34 MW combustion turbine with HRSG and a 4 million gallon thermal energy storage system both of which are proposed to save a combined 400,000 mmbtu's annually.
8. The university also uses modeling technology to operate, optimize and sustain efficiencies. The following list shows the technologies employed:
    a. PE Advisor developed by LightRidge Resources is a real time model of the entire plant system that is used to validate existing performance, evaluate operating scenarios that can improve efficiency and evaluate the optimum sizing and replacement of major equipment replacement options.
    b. Termis, developed by 7T is a real time hydraulic model of the chilled water distribution system that is used to operate and optimize pumping horsepower and optimum chilling plant dispatch needed to send the 50,000 gallons of chilled water through the 12 miles of piping in campus tunnels.

Summarizing recent initiatives, the following list shows plant improvements completed or underway that demonstrate fuel savings and the resulting emissions reductions in carbon and other emissions.

| Project Description | Resulting Gas Savings (MMBTU/Year) | Resulting Emissions Reduction (Tons/$CO_2$/Year) |
|---|---|---|
| Steam Turbine #9 | 200,000 | 11,000 |
| Cooling Tower #1 | 50,000 | 2,750 |
| Boiler FGR/NOx Retrofit | 200,000 | 11,000 |
| Steam/Feed Water By-Pass | 500,000 | 27,500 |
| Chilling Station 6 | 130,000 | 7,150 |
| Inlet Air Chilling | 120,000 | 6,600 |
| Thermal Energy Storage | 40,000 | 2,200 |
| Chilling Station Modernization | 20,000 | 1,100 |
| Gas Turbine # 10 | 399,400 | 21,967 |
| TOTAL | 1,659,400 | 91,267 |

## Increasing Efficiency of New and Existing Buildings

Starting in 2007, all new proposed building projects and major renovations on campus must obtain a minimum LEED Silver Certification. LEED (Leadership in Energy and Environmental Design) building certification requires adhering to stringent specifications that ensure a sustainable approach to construction and ongoing building operations, with heavy emphasis on energy efficiency. Additional guidance applies to the district energy system supporting the buildings, and the Utilities & Energy Management Department has four LEED Accredited Professionals on staff to assist in this process.

## Section 5, *Customer satisfaction*

The university CHP and district energy system is a not-for-profit operation that serves the entire campus on a mandatory basis. The end clients of the electricity, steam and chilled water are the students, faculty, and staff who study, research, and work on campus. The uninterrupted availability of utilities leaves many customers unaware of the district energy system around them, especially with the 99.998% reliability demonstrated over the past 35 years. Customer satisfaction is most greatly expressed as a lack of dissatisfaction, as utilities can always be relied on for the critical research and education occurring on campus.

Since the plant was originally commissioned in 1929, significantly aged infrastructure still exists posing a challenge to improving the infrastructure in a manner that has not interrupted utility service to the customers relying on consistent energy. The university prides itself in having fully complied with all state and federal emission permits requirements though this has come at a significant cost. Funding for the improvements has had to be performed in a budget neutral basis; that is, energy savings have had to be used to offset long term debt service. Over the last 11 years the university has invested about $150 million dollars and has been able to do it on a budget neutral basis. The university is proud to have exceeded 90% combined utility efficiency for the first time in campus history in the production of electricity, steam and chilled water. In June and July of 2009 the campus achieved 92% and 95% total efficiency, levels that ensure monetary resources can be devoted to the university's primary objective; education and research.

### Communications and Customer Services

The departmental website

http://www.utexas.edu/utilities/

has been a major communications tool to:

1. Communicate the value of current and past efficiency improvement initiatives
2. Provide a clear and open analysis of the performance of the system
3. Communicate to the campus community potential impacts to the reliability and travel in and around the plant facilities
4. Serve as a tool for clients to communicate with the service providers
5. Explain the utility billing process and who to talk to if there are issues
6. Communicate with vendors on procurement opportunities
7. Communicate with the 170 plus personnel in the department
8. Acknowledge and celebrate awards received from the campus and others

There is much curiosity and scrutiny from those studying and working on campus on the value and reliability provided by current operations as compared against conventional purchased utility grid electricity and separately produced thermal energy. There are also concerns on the amount of emissions as compared against conventional energy sources, especially being a power plant surrounded by 70,000 faculty, staff and students and walled in by downtown Austin, Texas, the State of Texas Capitol Complex, and dense residential neighborhoods. The Utilities & Energy Management Department welcomes and engages in constant communications with the campus community. Educational tours for campus environmental groups are frequently arranged; data and support is provided to interested students and professors performing efficiency and environmental analysis; and student journalists from The Daily Texan, the campus newspaper, often run stories detailing the operations and innovations occurring within the utilities department.

Regular meetings are also scheduled with key clients to describe the fuel procurement process, procurement strategies, and fuel budget status. Of the $70 million annual budget a significant cost is the total annual cost of natural gas which is the only fuel so this is of major concern. Regular facility forums are also scheduled to communicate and provide information to key clients and receive feedback.

There is also extensive cooperation between the Utilities & Energy Management Department and the College of Engineering. Tours for introductory courses are provided and even guided by power plant engineers. Student design projects occur every semester aimed at improving efficiencies, utilizing students to evaluate, analyze and design plant improvement projects that provide real world experience to future engineers and return a value to the university in projects that can be implemented. is the following lists typical past projects:

**2008**

- Design of a Water Recovery System for the Hal C. Weaver Power Plant
- Thermal Energy Recapture for Power Boilers.

**2007**

- Analysis of Gas-Turbine Blade Air Cooling and Supporting Systems.

**2006**

- Upgrading Utilities Fuel Oil Distribution System.
- Survey Assessment and Recommendations of Existing Steam Trap Equipment and Operation.
- Waste Heat Recapture in a Heat Recovery Steam Generator.

**2005**

- Design of Superheater Drain Water Collection System.
- Sediment Removal System for Cooling Tower Basins.
- Motor Database Creation and Economic Analysis.

**2004**

- Improving Cogeneration with Reverse Osmosis.
- Cavitation Elimination in Cooling Water Pumps at The University of Texas at Austin Power Plant.
- Design of a Chemical Delivery System for University System Chilling Stations.

## Section 6, *Additional recognition*

The Executive Director Juan M. Ontiveros and employees of the Utilities and Energy Management Department participate in many professional organizations such as the International District Energy Association (IDEA), The Association of Physical Plant Administrators (APPA), and the Texas and Central Association of Physical Plant Administrators. The Executive Director is the current Chair of the International District Energy Association. In addition to IDEA, Ontiveros is also a member and past president of the Texas Association of Physical Plant Administrators of Universities and Colleges. He has served on the Texas Comptrollers Energy Efficiency Task Force and on various Texas Higher Education Coordinating Board committees. He is also longtime member of APPA, an association of higher education facilities officers, and on the faculty of its Institute of Facilities Management. In November 2008, Ontiveros was appointed to a National Research Council committee to help make the Capitol Power Plant in Washington, D.C., more energy efficient.

Below is a summary listing all awards and recognition the department has received since 1993.

**2009**

- Executive Director, Juan M. Ontiveros is appointed to a National Research Council committee to help make the Power Plant in Washington, D.C. more energy efficient.
- Executive Director, Juan M. Ontiveros, P.E.  is elected Chair of IDEA in January 2009
- CHP Greenhouse Gas Reduction Report by CHP and EPA in recognition of the emission reductions of the university's CHP Project(s).

**2008**

- Texas Environmental Excellence Award by the Texas Commission on Environmental Quality for outstanding efforts in environmental protection and pollution prevention in the state of Texas. See website: http://teea.org/win08_lbtech_vid.htm

**2007**

- CHP Greenhouse Gas Reduction Report by CHP and EPA in recognition of the emission reductions of the university's CHP Project(s).
- Texas Association of Physical Plant Administrators (TAPPA) Outstanding Service Award presented to Miles Abernathy (retired) in appreciation of outstanding service, dedication and support of the facilities industry.

**2006**

- Certificate of Recognition by the Texas Comptroller of Public Accounts-State Energy Conservation Office for the university's efforts in energy efficiency and improving the air quality in the state of Texas.
- Engineering Excellence Awards (Gold Medal Winner/Texas and National Finalist) by the American Council of Engineering Companies for the university's project: Hal C. Weaver Plant Upgrades.
- CHP Greenhouse Gas Reduction Report by CHP and EPA in recognition of the emission reductions of the university's CHP Project(s).

**2005**

- Energy Star System of the Year Award for 2005 presented by the EPA and US Department of Energy for excellent leadership in energy use and management.
- The Rex Dillow Award by APPA/Association of Higher Education Facilities Officers to Leonard Friesenhahn for the Outstanding Article of 2004-2005: "The University of Texas Sewer Rehab: Using Trenchless Technologies."

**2004**

- Certificate of Appreciation by the International District Energy Association (IDEA) to Juan Ontiveros for promoting energy efficiency and environmental quality through the advancement of district energy and for contributing to IDEA.
- The Excellence in Construction Award by the Central Texas Chapter Associated Builders and Contractors, Inc. for The University of Texas at Austin Utility Infrastructure Renovation.

**2003**

- Recognition of Excellence in Pretreatment by the City of Austin Water and Wastewater Department.

**2002**

- Certificate of Partnership by CHP, EPA, and IDEA in recognition of efforts to improve the environmental performance of power generation in the United States through the promotion of pollution-preventing district energy and combined heat and power.
- Recognition of Excellence in Pretreatment by the City of Austin Water and Wastewater Department.

**2001**

- ICI Conservation Award by the Water Conservation Division Water and Wastewater Department, City of Austin.
- Recognition of Excellence in Pretreatment by the City of Austin Water and Wastewater Department.

**Other**

- Certificate of Partnership by CHP and EPA in recognition of efforts to improve the environmental performance of power generation in the United States by supporting combined heat and power.
- Recognition of Excellence in Pretreatment by the City of Austin Water and Wastewater Department – 2000, 1999, 1998, 1997
- Governor's Award for Environmental Excellence by the Texas Natural Resource Conservation Commission – 1998
- Reclamation and Reuse Award by the Water Conservation Division of the Planning, Environmental, and Conservation Services Department, City of Austin – 1996
- Conservation and Reuse Award, Direct Program for a Non-Utility by the American Water Works Association – 1995
- Recognition of Exemplary Water Conservation Programs by the Texas Water Development Board – 1993