Power Plant Efficiency

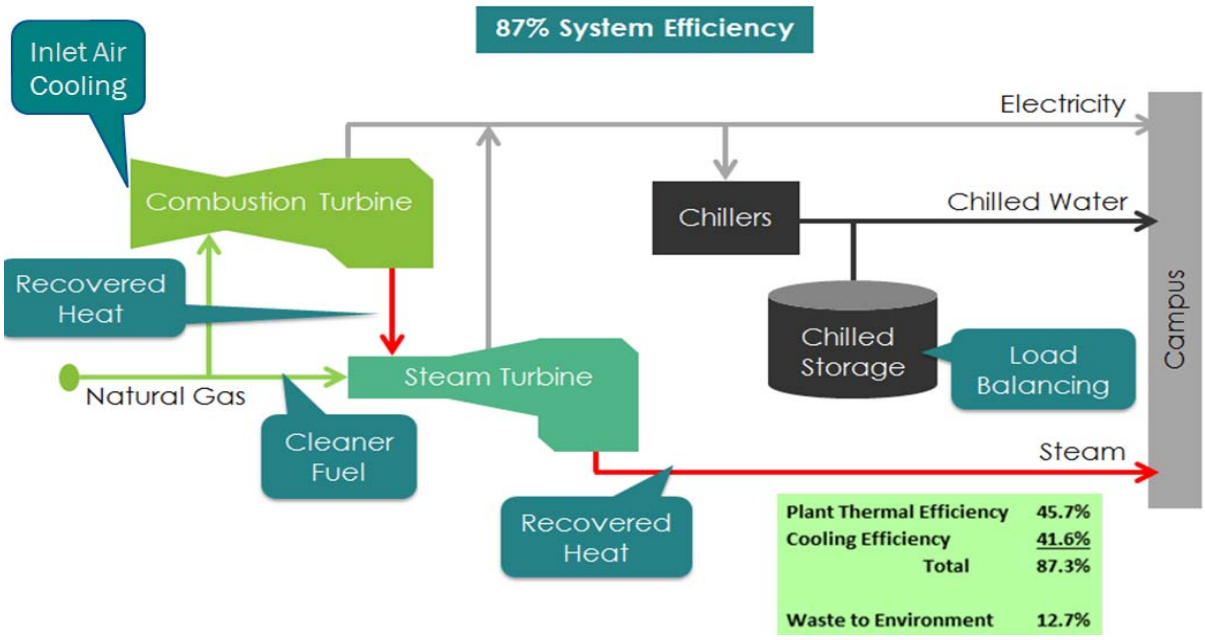
The Carl J. Eckhardt Combined Heating and Power Complex

Often described as the largest and most integrated microgrid in the U.S., The University of Texas at Austin campus features a Combined Heat and Power plant (CHP) with a 135 MW power capacity and 1.2 million lb/hr steam generation capacity. Peak load levels have reached 63 MW for power and 300,000 lb/hr for steam. The single largest electrical load on campus is the cooling system that provides 45,000 tons of air conditioning to the campus, which has reached a demand of 33,000 tons demand during peak hours.

The Carl J. Eckhardt Combined Heating and Power Complex provides 100% of the electricity and heating for the university's main campus. This includes 4 chilling stations and a 4 million gallon chilled water thermal storage tank that provides the cooling requirements for 18 million square feet. Connections to the City of Austin electrical grid exist only for emergency backup, providing the university independence in generating all utilities required for a campus the size of a small city.

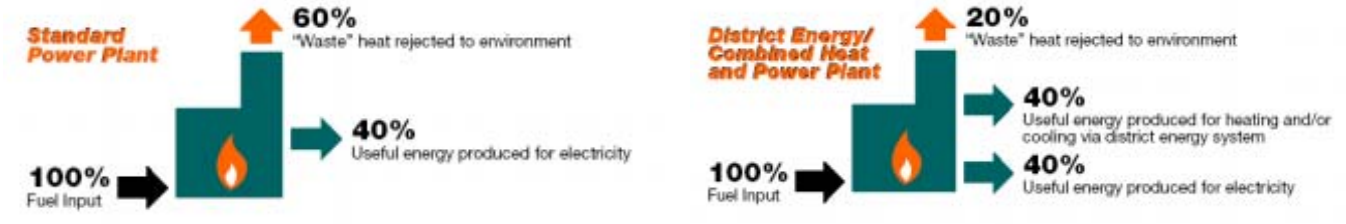
Operating as a CHP and district energy system, the university is able to function at a much greater reliability and efficiency than what is normally afforded through purchased energy. Typical power plants generate waste heat which is generally expelled into the atmosphere through cooling towers or into local reservoirs, and not used for electricity production. A CHP facility is able to convert around 80% of the heat and use it for productive purposes such as space heating and hot water.

How the University's CHP System Operates



Waste heat from the combustion turbine is recovered to the steam turbine. The recovered heat is then extracted as steam for heating and hot water generation in campus buildings.

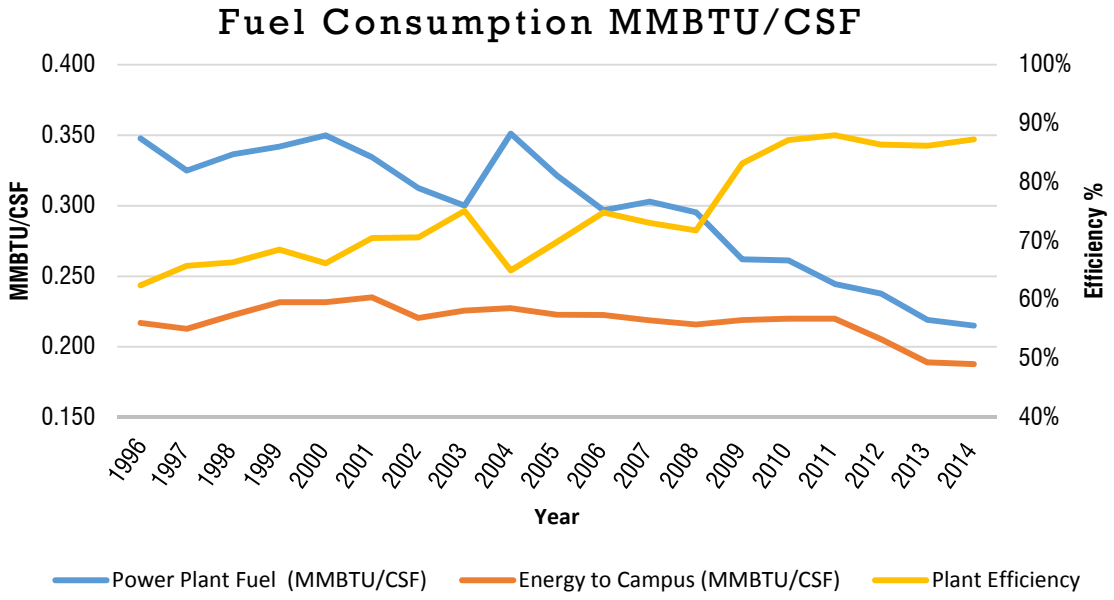
Standard Power Plant Compared to CHP Plant



Energy efficiency comparison of a standard power plant versus a combine heat and power plant.

Energy Efficiency

In 1996, the power plant's overall energy efficiency was 62%, compared to a typical power plant energy efficiency of only 40%. By 2008, the power plant efficiency increased to 72% efficiency due to plant modifications and real time sophisticated modeling technology. A new gas turbine and chilling station, made operational in 2010, have contributed to reduced fuel consumption and increased efficiency of up to 88%.



Carl J. Eckhardt Combined Heating and Power Complex has dramatically reduced fuel consumption and improved efficiency while maintaining energy flows to a growing campus between 1996 and today.

Reliability

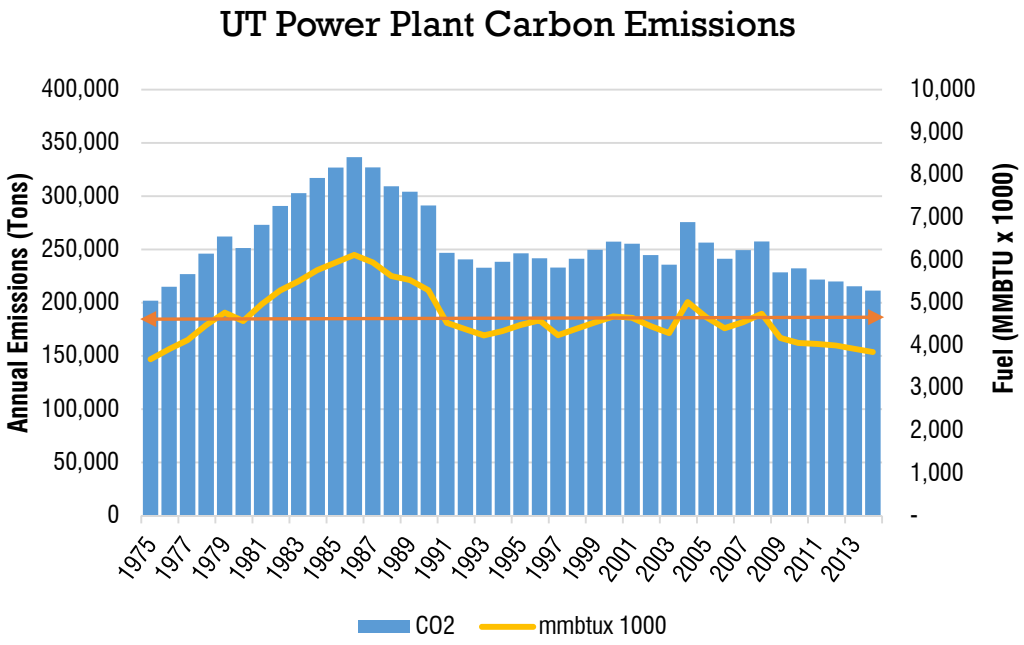
The UT Austin electric grid has operated with 99.9998% reliability over the last 40 years. Two measures commonly used to determine grid reliability are outage duration, measured within the industry as System Average Interruption Duration Index (SAIDI) and outage frequency, described by the System Average Interruption Frequency Index (SAIFI). Based on a 3-year average of the

grid's performance through the 2014 calendar year, the university's SAIDI score was 9.7 minutes with a SAIFI of 0.04. This is an incredibly reliable grid performance, as the nation's average SAIDI and SAIFI scores are 310 minutes and 1.6, respectively.[1]

Carbon Emissions Reductions

Emissions are an area of concern with fossil fuel power plants, more recently with a growing awareness of a facility's carbon footprint. While natural gas is considered one of the cleanest fossil fuels available, it is still a significant source of greenhouse gas emissions, notably carbon dioxide. Since 1996, the power plant has generated a total 4,568,000 tons of carbon dioxide, averaging about 240,000 tons per year.

The efficiency gains described above have avoided the cumulative release of 862,000 tons of carbon dioxide since 1996. These emissions reductions equate to taking nearly 164,630 cars off the road or preserving 6,038 acres of forest—an area roughly 15 times the size of the university's main campus.



The carbon emissions from UT's power plant have descended to 1975 levels.

The Carl J. Eckhardt Heating and Power Complex has enabled the university's main campus to continue growing while actively reducing the environmental impact of fuel and water consumption. As the campus grows, so too will the efficiency of the complex, maintaining its status as the most efficient university utility in the U.S.

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[1] Tejas Pevekar. 2014. Energy Manager, Utilities & Energy Management. The University of Texas at Austin.