

Overview

This document provides the supporting information required to demonstrate compliance with EAp2 & EAc1, and provides the metrics and methods to include UT Austin Main Campus DES and combined heat and power into the building energy modeling.

Method

The options and paths available are detailed in section 2.4, page 9, of the USGBC’s guidance document Treatment of District or Campus Thermal Energy in LEED V2 and LEED 2009 – Design & Construction. Specific calculations are detailed in Appendices C and D. To support UT Austin’s requirements for energy modeling of new construction projects (as well as maximize potential LEED points under EAc1), “Option 2 (full accounting)” under the “Performance path” shall be followed. For modeling the upstream generation efficiencies, the “monitoring” method will be followed using the historical data supplied in this document.

Supporting Data

The following sections detail the basis for calculating the data, with actual monthly data supplied as attachment to this document.

Cooling

If cooling to the building is provided by campus chilled water, the modeled virtual plant will utilize the historical monthly generation efficiencies of the campus chilling stations. These efficiencies were generated following the USGBC guidance document and are calculated from the **total chilling station electrical consumption and total plant chilled water production**, excluding distribution losses. Distribution losses will be assumed to be the default values outlined in the guidance document (**5% distribution loss**).

CHP Heating

If heating to the building is provided by campus steam, the steam is considered a product of the combined heating and power plant and the calculation requirements outlined in the guidance document will be referred to, again using the “monitored” methods.

The following variables are supplied as attachment and the basis of calculation for each is provided:

Total annual gross electric generation, CHP_ELEC_{TOTAL}

Total generated electricity at the generators less power plant parasitic loads (i.e. the net electricity

to distribution).

Total fuel input, CHP_{Fuel}

Total CHP fuel consumption, measured as total natural gas supplied to the power plant

Waste heat recovered

Total waste heat captured for utilization in DES. Measured as the total low pressure extraction steam to distribution

Fraction of CHP plant's waste heat production applied to DES, $X_{HEAT} = 1$

All captured waste heat as measured above is sent to distribution

Steam System Distribution losses = 15%

Chilled Water Distribution losses = 5%

Default value supplied by guidance document

Plant Efficiency is determined by measuring the total energy (electrical, steam & chilled water) sent to distribution and comparing it with total fuel used by the plant

Plant Efficiency = Total Energy to Distribution/Total Fuel Input to the Plant

Natural gas cost rate

The cost to the CHP plant for natural gas

Electricity cost rate

The fully burdened cost of electricity charged by the CHP plant to supplied buildings

FY 2015 - Monthly Report												
	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15
HEATING - COMBINED HEAT & POWER												
Total Lbs to Campus	39,505,031	45,854,925	77,057,487	84,104,044	100,770,721	84,642,203	81,199,146	59,431,781	49,101,524	41,487,762	41,184,413	40,494,390
Total Heating Energy to Campus (mmBTU)	47,998.61	55,713.73	93,624.85	102,186.41	122,436.43	102,840.28	98,656.96	72,209.61	59,658.35	50,407.63	50,039.06	49,200.68
(Enthalpy of Steam = 1215 BTU/MLb)												
COOLING												
Total Electrical Energy Consumed at Chilling Plants (MWHr)	11,707	8,561	3,519	3,559	2,466	2,789	4,207	7,248	9,570	11,658	12,698	12,125
Total Energy of Chilled Water delivered to campus (ton-hrs)	15,990,011	12,408,063	6,323,594	5,659,598	4,600,703	4,935,812	7,577,600	11,395,159	13,290,465	15,697,092	17,264,585	17,008,789
DES cooling plant (COP)	4.81	5.11	6.33	5.61	6.57	6.23	6.34	5.54	4.89	4.74	4.79	4.94
COMBINED HEAT AND POWER												
Total Electricity Generated by Cogen Plant (MWHr)	31,906	28,941	22,541	22,202	21,601	20,546	23,817	26,177	29,159	31,120	32,420	32,546
Total Fuel Energy Consumption by Turbines (mmBTU)	345,352	336,149	309,342	314,425	309,721	276,100	301,741	304,412	344,121	332,115	344,299	351,101
Utility Cost Rate for Natural Gas (\$/mmBTU)	\$4.528	\$4.488	\$4.633	\$4.523	\$4.380	\$4.474	\$4.381	\$4.369	\$4.380	\$4.401	\$4.451	\$4.420
Utility Cost Rate charged for Electricity (\$/kwh)	\$0.058	\$0.057	\$0.058	\$0.058	\$0.059	\$0.059	\$0.059	\$0.059	\$0.059	\$0.059	\$0.059	\$0.059
Thermal Efficiency (HHV)	47.18%	47.94%	56.00%	59.85%	67.06%	65.91%	63.17%	56.59%	48.39%	49.01%	48.46%	47.38%
Plant Efficiency	89.89%	82.12%	76.80%	75.43%	79.78%	81.91%	86.12%	90.66%	83.70%	92.41%	94.75%	92.47%