ESL-ITR-12-11-02

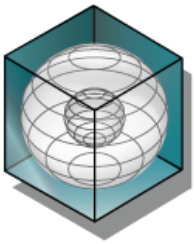
Energy Use Patterns and Savings Analysis Report

For

CATERPILLAR FINANCIAL

Nashville, TN

Prepared by



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November 2012

(Update on February 2013)

This report includes the building energy use patterns analysis and savings estimation updated to September 2012 for Caterpillar Financial, Nashville, TN. The analysis of this building is based on IPMVP Option C[1], which is based on the whole facility performance. During the pre-Continuous Commissioning® (CC®[2])period, a empirical model was developed using statistical techniques on the energy consumption data, which reflect the physical relationships between independent variable (outside air temperature) and the dependent variable (energy use). The relationship could be reflected by simple average, linear regression, or multi-parameter change point models. The developed baseline model is used to predict what the energy usage would be had the CC process not occurred, and then it is compared with the provided actual energy use. The differences between the predicted consumption and the actual measured consumption are the energy savings.

The chosen period for the electricity use baseline was from January 2006 to December 2007 and was found that the energy use pattern could be well represented as a function of temperature by a 3P change point (CP) model (E_{ELE} = 26992.49 + 241.52(60.04 – T)$^{+}$ [kWh/day]).

Figure 1 presents the time series for the normalized weather data and the electricity utility bills consumption by the bills number of days from January 2006 to December 2012. Figure 2 contains the representation of the normalized electricity consumption during the baseline period with its best fit line (baseline model) and the data on the post-CC period. Table 1 shows the monthly energy and the dollar savings for electricity use based on the actual monthly prices during the period of July 2008 through December 2012. The cumulative dollar savings with actual prices by the end of December 2010 is $276,414 and totals approximately $699,852 through December 2012 (see Figure 3). Figure 4 presents the dollar savings with actual rates for each calendar year from 2009 to 2012. Similarly, grouping the savings for each fiscal year (October -September) from 2009 to 2012 is shown in Figure 5.

[1] *International Performance Measurement & Verification Protocol*. Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, 2002.

[2] Continuous Commissioning® and CC® are registered trademarks of the Texas Engineering Experiment Station, a member of the Texas A&M University System, an agency of the State of Texas.

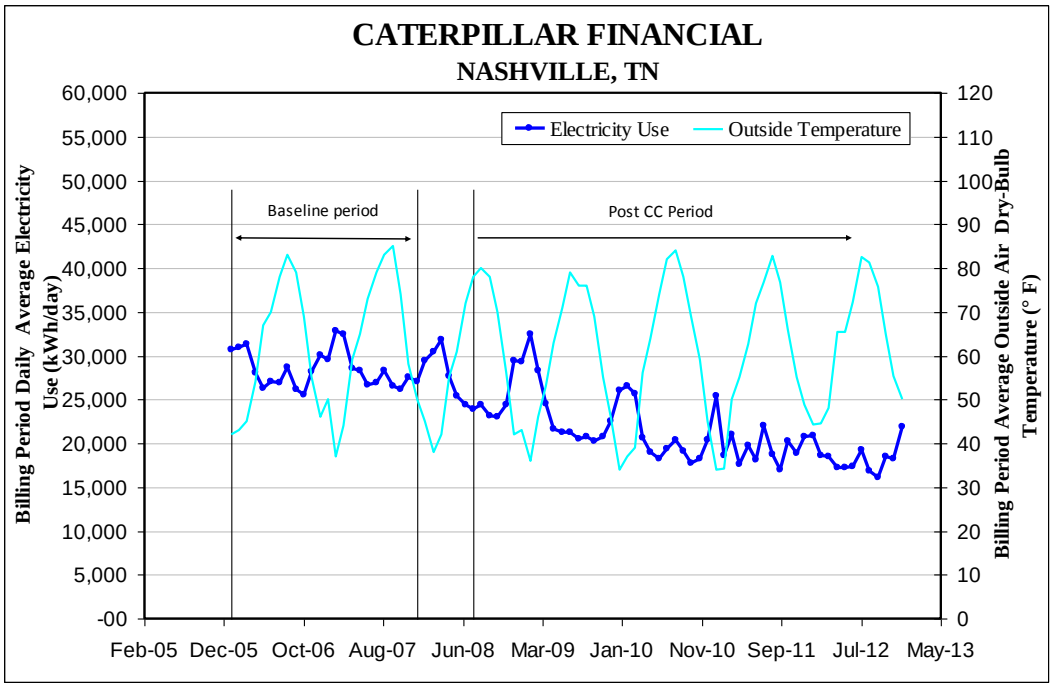

Figure 1 Electricity use for the period of January 2006 through December 2012 for Caterpillar Financial, Nashville, TN.

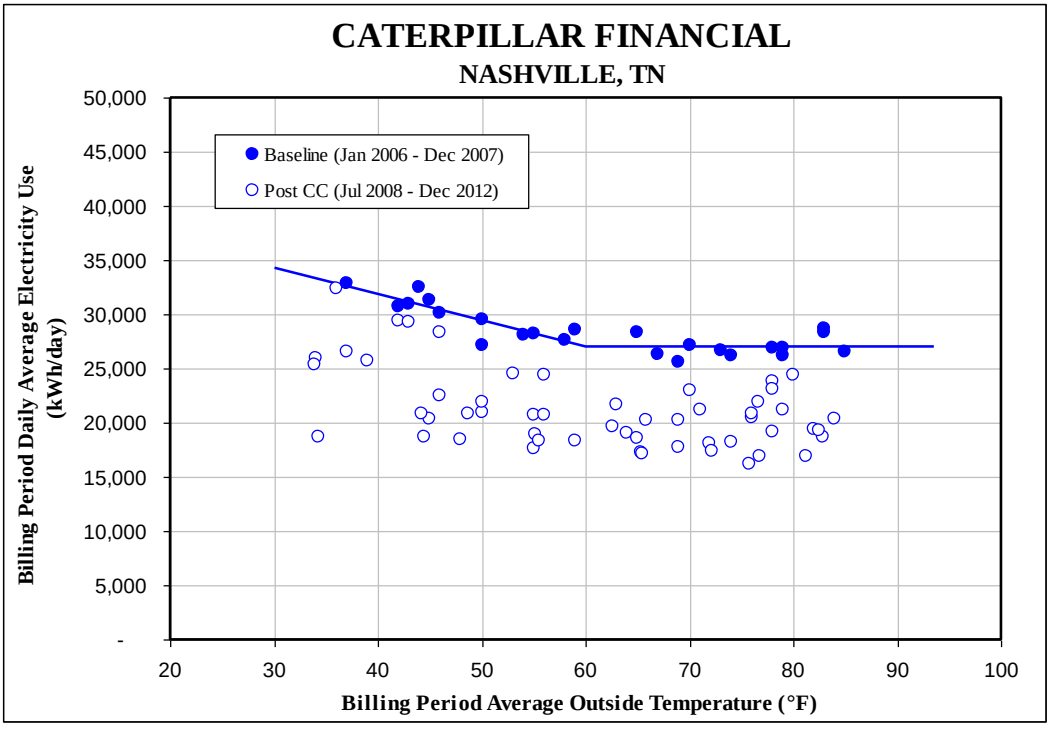

Figure 2 Electricity consumption data during baseline and post-CC periods and baseline model for Caterpillar Financial, Nashville, TN.

Table 1 Electricity consumption and dollar savings during the period of July 2008 through December 2012 for Caterpillar Financial, Nashville, TN.

CATERPILLAR FINANCIAL

					Measured	Baseline	Savings		
Month No.	Day	Year	Days/Mo	Tdb °F	Total Cons [kWh]	Total Cons kWh	kWh	%	USD
6	10	2008							
7	10	2008	30	78.0	715,500	809,775	94,275	11.6%	$4,864
8	10	2008	31	80.0	756,000	836,767	80,767	9.7%	$4,167
9	10	2008	31	78.0	717,000	836,767	119,767	14.3%	$6,179
10	10	2008	30	70.0	690,000	809,775	119,775	14.8%	$7,719
11	10	2008	31	56.0	757,500	867,015	109,515	12.6%	$7,058
12	10	2008	30	42.0	883,500	940,485	56,985	6.1%	$3,673
1	10	2009	31	43.0	909,000	964,348	55,348	5.7%	$3,297
2	10	2009	31	36.0	1,005,000	1,016,758	11,758	1.2%	$700
3	10	2009	28	46.0	793,500	850,736	57,236	6.7%	$3,410
4	10	2009	31	53.0	760,500	889,477	128,977	14.5%	$6,998
5	10	2009	30	63.0	649,500	809,775	160,275	19.8%	$8,697
6	10	2009	31	71.0	658,500	836,767	178,267	21.3%	$9,673
7	10	2009	30	79.0	637,500	809,775	172,275	21.3%	$8,846
8	10	2009	31	76.0	636,000	836,767	200,767	24.0%	$10,309
9	10	2009	31	76.0	645,000	836,767	191,767	22.9%	$9,847
10	10	2009	30	69.0	606,000	809,775	203,775	25.2%	$9,846
11	10	2009	31	55.0	642,000	874,502	232,502	26.6%	$11,000
12	10	2009	30	46.0	675,000	911,503	236,503	25.9%	$10,333
1	10	2010	31	34.0	805,500	1,031,732	226,232	21.9%	$9,567
2	10	2010	31	37.0	823,500	1,009,271	185,771	18.4%	$7,737
3	10	2010	28	39.0	718,500	898,074	179,574	20.0%	$8,049
4	10	2010	31	56.0	640,500	867,015	226,515	26.1%	$10,984
5	10	2010	30	64.0	570,000	809,775	239,775	29.6%	$11,780
6	10	2010	31	74.0	565,500	836,767	271,267	32.4%	$14,242
7	10	2010	30	82.0	580,500	809,775	229,275	28.3%	$11,773
8	10	2010	31	84.0	630,000	836,767	206,767	24.7%	$11,511
9	10	2010	31	78.0	594,000	836,767	242,767	29.0%	$13,891
10	10	2010	30	69.0	532,500	809,775	277,275	34.2%	$17,194
11	10	2010	31	59.0	567,000	844,554	277,554	32.9%	$16,095
12	10	2010	30	45.0	612,000	918,749	306,749	33.4%	$16,975
1	10	2011	31	34.0	787,500	1,031,936	244,436	23.7%	$13,427
2	10	2011	31	34.2	579,000	1,029,889	450,889	43.8%	$25,583
3	10	2011	28	50.0	586,500	823,482	236,982	28.8%	$14,738
4	10	2011	31	55.0	547,500	874,276	326,776	37.4%	$20,224
5	10	2011	30	62.7	591,000	809,775	218,775	27.0%	$13,584
6	10	2011	31	71.9	561,000	836,767	275,767	33.0%	$18,032
7	10	2011	30	76.6	658,500	809,775	151,275	18.7%	$9,974
8	10	2011	31	82.9	580,500	836,767	256,267	30.6%	$16,693
9	10	2011	31	76.8	525,000	836,767	311,767	37.3%	$19,542
10	10	2011	30	65.8	607,500	809,775	202,275	25.0%	$12,679
11	10	2011	31	55.2	585,000	872,892	287,892	33.0%	$18,477
12	10	2011	30	48.8	624,000	891,537	267,537	30.0%	$16,547
1	10	2012	31	44.3	646,500	954,969	308,469	32.3%	$18,274
2	10	2012	31	44.4	579,000	953,727	374,727	39.3%	$22,034
3	10	2012	29	48.0	535,500	867,434	331,934	38.3%	$20,231
4	10	2012	31	65.3	534,000	836,767	302,767	36.2%	$18,911
5	10	2012	30	65.5	516,000	809,775	293,775	36.3%	$18,508
6	10	2012	31	72.2	537,000	836,767	299,767	35.8%	$19,275
7	10	2012	30	82.5	579,000	809,775	230,775	28.5%	$14,359
8	10	2012	31	81.2	523,500	836,767	313,267	37.4%	$19,921
9	10	2012	31	75.8	501,000	836,767	335,767	40.1%	$21,714
10	10	2012	30	65.0	556,500	809,775	253,275	31.3%	$16,379
11	10	2012	31	55.5	567,000	871,010	304,010	34.9%	$19,660
12	10	2012	30	50.0	655,500	882,370	226,870	25.7%	$14,672
					34,740,000	**46,826,097**	**12,086,097**	**25.8%**	**$699,852**

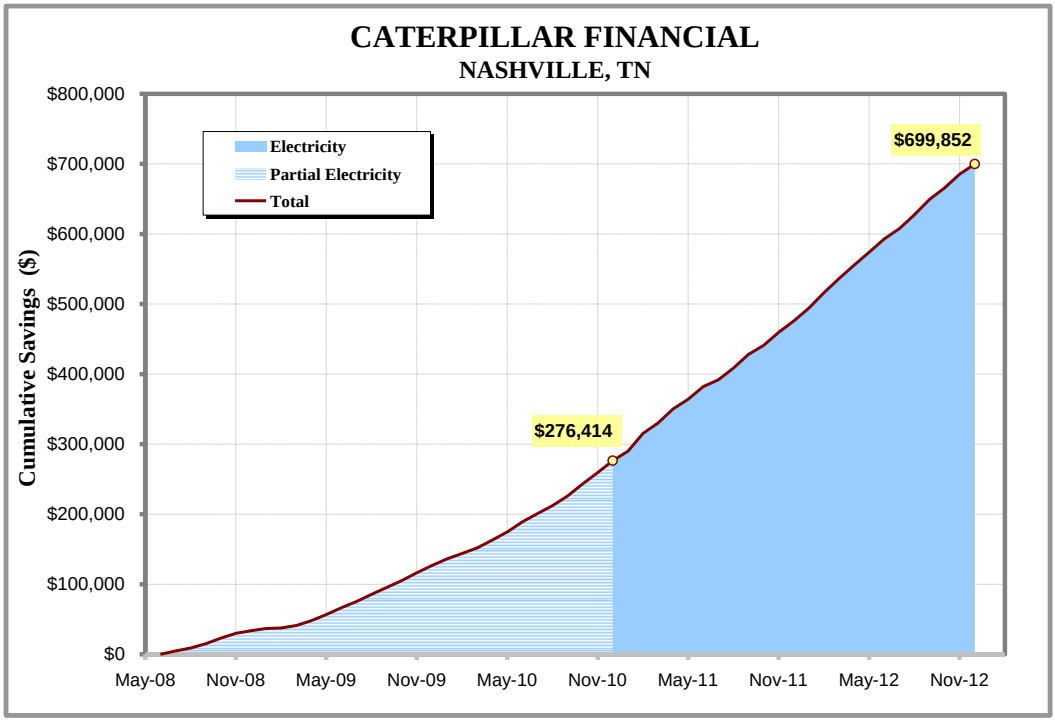

Figure 3 Cumulative dollar savings with the actual prices during the periods from July 2008 through December 2010 and December 2012 for Caterpillar Financial, Nashville, TN.

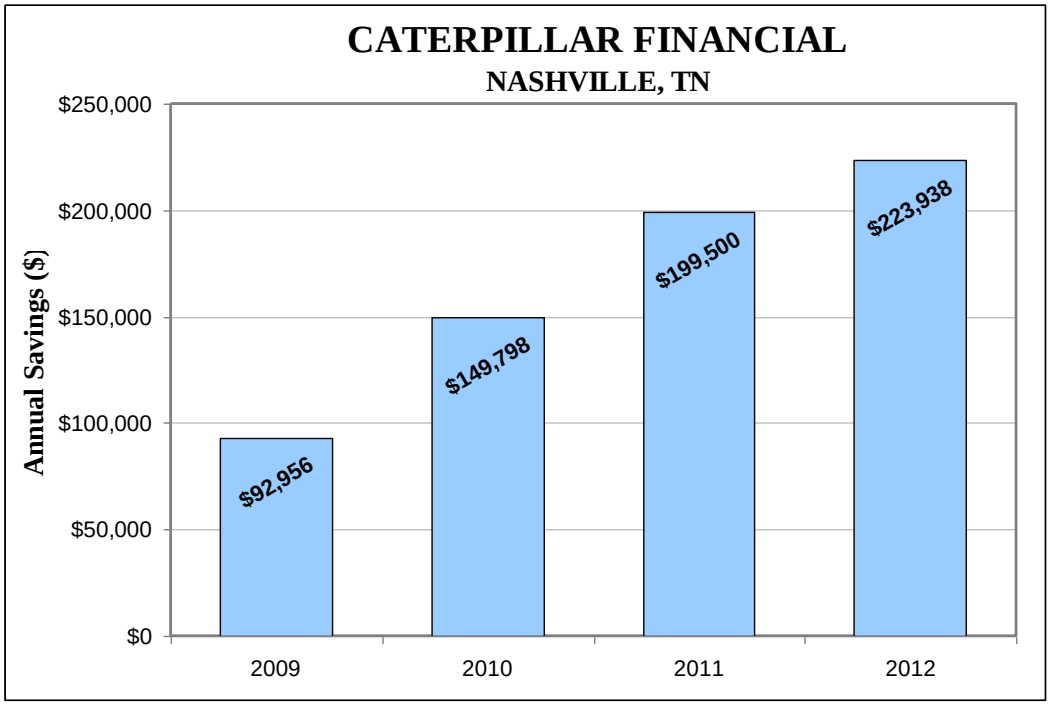

Figure 4 Annual dollar savings with the actual prices for the calendar years of 2009 to 2012 for Caterpillar Financial, Nashville, TN.

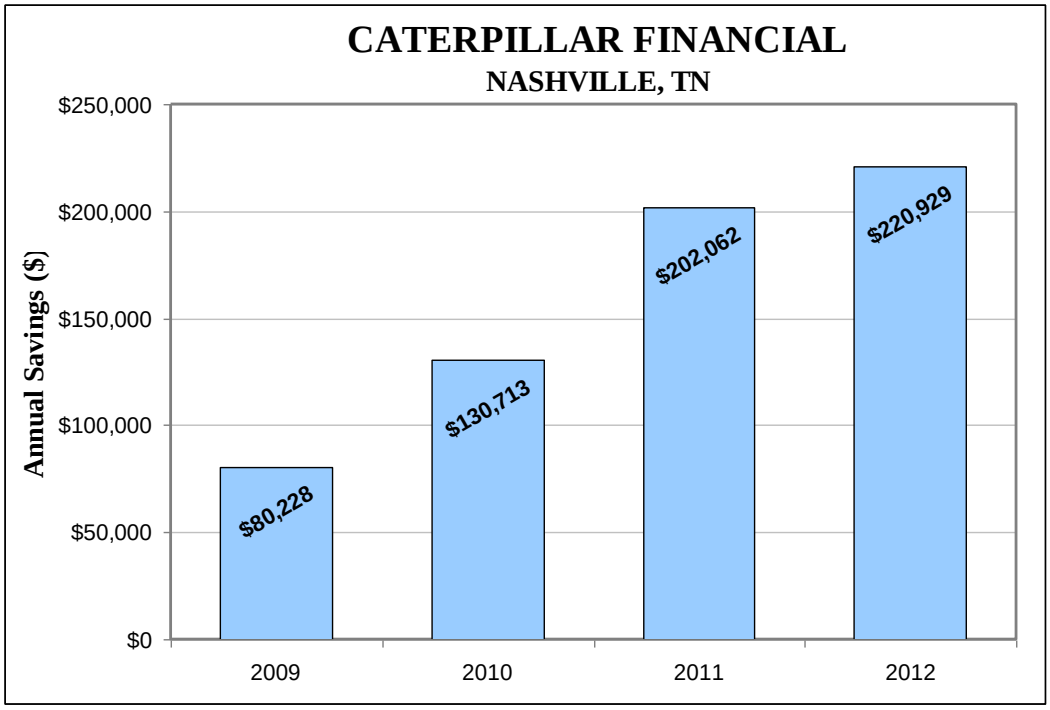

Figure 5 Annual dollar savings with the actual prices for the fiscal years of 2009 to 2012 for Caterpillar Financial, Nashville, TN.