

Maxeff Motor Test

Comparison of the energy consumption of a standard motor versus a Maxeff converted motor

City of Sarasota

8/26/2014

This report contains the data, results and analysis of an energy consumption comparison test. The test consisted of collecting energy data on a 50 HP well pump motor. The motor was monitored in its standard configuration and in a converted configuration to determine the energy reduction if any and what the ROI (Return on Investment) would be.

Maxeff Motor Comparison Report

Purpose: The purpose of this report is to provide data and analyses on the Maxeff Motor conversion, to determine if the savings in energy costs warrants the cost of conversion.

Description of Conversion: A Maxeff motor conversion consist of adding a separate generating winding to the standard motor stator providing an internal power source reducing the energy draw from the commercial power source. Capacitors mounted in a separate panel are also installed to aid in power factor compensation. Cost of conversion is \$4180.00. The motor used for the comparison is a 50 HP, 240 Volt, 3 Phase, squirrel cage motor mounted on a vertical turbine well pump. The comparisons were made using both a power analyzer data and the Power Company's (FPL) data summary based on monthly electric meter readings to confirm confidence in the results.

Analyzer Electrical Data: Energy consumption data was collected and recorded using a Power Analyzer on the electrical system at well #5 prior to the Maxeff conversion. The Motor was then removed from service, fitted with the Maxeff generator winding and control panel, reinstalled and put back in service. Energy consumption data was again collected and recorded using the Power Analyzer on the converted motor for comparison. The recorded data, listed below, includes Current draw and Voltage on each phase, average KWH, KVA, and KVAR and power factor. From this data energy costs and a ROI (Return on Investment) were calculated based on a 24 hour, 360 day run time. The charge rate used - \$0.0752/KWH - was calculated by averaging the actual rate charge per month over the test period using data from the FPL summary sheet.

Standard Motor	Maxeff Motor
Amps – 103, 100, 112	Amps – 87, 80, 82
Voltage – 239, 235, 240	Voltages – 239, 239, 241
KWH Average - 36.6	KWH Average – 33.8
KVA Average – 43.0	KVA Average – 34.3
KVAR Average – 22	KVAR Average – 5.7
Power Factor - 0 .85	Power Factor - 0.98

Cost Comparison

Standard Motor

36.6 KWH X 24 hr. / day X 365 days X \$0.0752/KWH = \$24,110.32

Maxeff Converted Motor

33.0 KWH X 24 hr. / day X 365 days X \$0.0752/KWH = \$21,738.82

\$24,110.32 - \$21,738.82 = **\$2,371.50 Annual Savings/year**

ROI - \$4,180 cost of conversion / \$2,371.50 savings = **1.76 year Return on Investment**

FPL Data Summary Spread Sheet: The Maxeff converted motor was run for a period of five (5) months. A Data Summary Spread Sheet was obtained from the power company FPL, which is included in the report. The spread sheet covers a two (2) year period providing data that includes pump run-time with the standard motor and the Maxeff converted motor. The data used is recorded on the separate Report Spread Sheet with a description of how the data was used for the comparison. In order to reduce data manipulation and reduce nonlinear shifts in the results certain data was not used but is shown on the spread sheet. Also because of the nature of the rate change and the reduced flow-totals calculated for certain months of the test period, it became more prudent to compare the motors based on gallons pumped per dollars spent. The result show on average an increase of 279 more gallons for each dollar using the Maxeff converted motor. The next to last column on the spread sheet shows the increase in gallons each month and the total increase during the test period using a Maxeff motor.

Final Analysis: The data collected indicates a cost savings and a reduction in energy using a Maxeff converted motor versus a standard motor. The Maxeff conversion provides an excellent ROI of 1.76 years and an increase in gallons per dollars spent of 279, projecting to a ½ million gallons of free water per month or 3.5 million over the seven month pre-conversion test period. Although the reliability of a Maxeff motor is yet to be determined, the increase in power factor to near unity does reduce total current draw thus reducing heat generation in both the motor and the support equipment increasing the life of the equipment. Coupling this with the reduced energy cost should decrease lifecycle cost of the electrical system as a whole.

Recommendation: The analysis indicates that motors in the horsepower range of the test are good candidates for a Maxeff conversion and that the City Utilities Dept. should invest in this technology. Motor candidates should also have a constant or near constant duty cycle in order to get the best ROI. Going forward the City is preparing to test a Maxeff converted motor in a submersible pump at Lift station #30.

Well #5 Flow and Energy Data for Standard and Maxeff Motor Comparison

The Data below is a comparison of flow totals and energy costs comparing a standard motor with a Maxeff modified motor. The flow totals (Col 7) are determined by taking instantaneous data points (Gallons per Minute not on sheet but available) for each pump run period based on the FPL monthly meter reading (col 1) at two hour intervals. The flows over this period are averaged and multiplied times the run times to get each monthly flow total (col 6). The FPL monthly rate is averaged (col 4) to ensure the same rate was applied for each month. The averaged monthly rate is multiplied times the KWH totals(col 2) to provide a monthly total cost. The monthly flow totals(col 6) is divided by the monthly charge(col 5) to get the gallons per dallors spent(col 7). Costs and flow totals are summed and the gallons per dollar spent are averaged. The difference between the standard and Maxeff motors final 279 Gals/\$ is multiplied time each montly charge(col 5) and indicates the increased total flow using a Maxeff motor(col 9).

Electric Service Period	KWh/Month	Actual Rate Charged	Rate/KWH Averaged	Electric charge		Gallons/Dollar Spent	Increase Gallons/Dollars	Projected Increase in gals using Maxeff modified Motor	Percent increase
				Based on Averaged Rate	Calculated Flow Total For Month				
Standard Motor									
1/11/2013- 2/12/2013	28,232	\$0.0691	\$0.0752	\$2,123.05	31,445,787	14,812	279	592,329.95	1.88%
2/12/2013 - 3/12/2013	24,596	\$0.0726	\$0.0752	\$1,849.62	26,954,200	14,573	279	516,043.76	1.91%
3/12/2013 - 4/10/2013	25,619	\$0.0700	\$0.0752	\$1,926.55	30,661,160	15,915	279	537,507.12	1.75%
6/12/2013 - 7/11/2013	15,228	\$0.0800	\$0.0752	\$1,145.15	15,118,584	13,202	279	319,495.62	2.11%
10/11/2013 - 11/11/2013	23,652	\$0.0732	\$0.0752	\$1,778.63	24,955,675	14,031	279	496,237.88	1.99%
11/11/2013 - 12/11/2013	26,486	\$0.0701	\$0.0752	\$1,991.75	27,428,116	13,771	279	555,697.47	2.03%
1/11/2013 - 1/4/2013	23,597	\$0.0743	\$0.0752	\$1,774.49	19,097,621	10,762	279	495,083.94	2.59%
Summation/Average			\$0.0752	\$12,589.23	175,661,143	13,953	279	3,512,395.73	2.00%
Maxeff Modified Motor									
1/13/2014 - 2/12/2014	21,638	\$0.0774	\$0.0752	\$1,627.18	22,235,673	13,665	279		
2/12/2014 - 3/12/2014	16,062	\$0.0862	\$0.0752	\$1,207.86	19,112,817	15,824			
3/12/2014 - 4/10/2014	21,613	\$0.0795	\$0.0752	\$1,625.30	24,204,751	14,893			
4/10/2014 - 5/12/2014	28,343	\$0.0742	\$0.0752	\$2,131.39	31,570,285	14,812			
5/12/2014 - 6/11/2014	26,375	\$0.0757	\$0.0752	\$1,983.40	28,647,239	14,444			
6/11/2014 - 7/11/2014	26,565	\$0.0755	\$0.0752	\$1,997.69	24,703,238	12,366			
Summation/Average		\$0.0752		\$10,572.82	150,474,003	14,232			

The Number below reprenents the actual increase in Gal/\$ The monthly flow totals are summed, the Monthly electric amounts are summed - the summed monthly flow totals are divided by the summed monthly total costs. The results of these quotients are subtracted. This result is multiplied time the electric charge and recorder in the next last row

Data collected below was not used. Low flow total cause a nonlinear increases in the rate charge. The non-linear affect adversely shifts the calculations and final results of the analysis.

4/10/2013 - 5/13/2013	890	58.54			795,203	
5/13/2013 - 6/12/2013	5,027	13.54			2,675,818	
7/11/2013 - 8/12/2013	1,289	39.67			1,087,584	
8/12/2013 - 9/12/2013	3,131	20.85			3,098,042	
9/12/2013 - 10/11/2013	6,390	12.71			6,704,042	



Energy and Billing Data																
A DATE	B DAYS	C KWH/MONTH	D W/HDAY	E ON-PK KWH	F % ON-PK KWH	G EFF-ON-PK ENRG CHRG CENTS/KWH	H EFF-OFF-PK ENRG CHRG CENTS/KWH	I TOTAL CENTS/KWH	J ACTUAL MAX KWD	K ON-PK KWD	L EFF-ON-PK DEM CHRG \$ / KWD	M I L E P MAX	N MISC CHARGES	O NOM UTILITY TAXES**	P BASE ELECT AMOUNT	Q TOTAL BILL AMOUNT
7/11/2014	30	28,565	886	6,945	26.14	9.92	4.43	7.55	37	37	\$12.57	99.70	\$0.00	\$165.17	\$1,840.41	\$2,005.58
6/11/2014	30	28,375	879	6,930	26.27	9.92	4.43	7.57	37	37	\$12.57	99.00	\$0.00	\$164.43	\$1,832.17	\$1,996.60
5/12/2014	32	28,343	886	7,313	25.80	9.91	4.41	7.42	37	37	\$12.56	98.70	\$0.00	\$173.08	\$1,928.63	\$2,101.71
4/10/2014	29	21,613	745	5,571	25.78	9.98	4.47	7.85	37	37	\$12.60	83.90	\$0.00	\$141.47	\$1,576.38	\$1,717.85
3/12/2014	28	16,062	574	3,969	24.70	10.07	4.61	8.62	37	37	\$12.25	64.60	\$0.00	\$113.97	\$1,270.03	\$1,384.00
2/12/2014	30	21,638	721	5,000	23.11	9.97	4.53	7.74	37	37	\$12.20	81.20	\$0.00	\$137.91	\$1,538.77	\$1,674.68
1/13/2014	33	23,597	715	4,885	20.82	9.95	4.51	7.43	37	37	\$12.20	80.50	\$0.00	\$144.30	\$1,807.94	\$1,752.24
12/11/2013	30	26,486	883	6,172	23.30	8.40	4.44	7.01	37	37	\$12.11	98.40	\$0.00	\$152.92	\$1,703.93	\$1,856.85
11/11/2013	31	23,652	783	6,086	25.73	8.42	4.46	7.32	37	37	\$12.12	85.90	\$0.00	\$142.52	\$1,588.13	\$1,730.65
10/11/2013	29	6,390	220	1,923	30.09	10.00	4.22	12.71	37	37	\$12.34	24.80	\$0.00	\$66.89	\$745.42	\$812.31
9/12/2013	31	3,131	101	1,232	39.35	10.56	4.74	20.85	37	37	\$12.44	11.40	\$0.00	\$53.77	\$599.20	\$652.97
8/12/2013	32	1,289	40	337	26.14	11.90	6.01	39.67	35	35	\$12.59	4.80	\$0.00	\$42.11	\$489.22	\$511.33
Sum		225,141	7,413	56,342									\$0.00	\$1,498.54	\$16,696.23	\$18,196.77
Avg	30	18,762	618	4,695	26.42	9.92	4.60	11.82	37	37	\$12.38	89.58	\$0.00	\$124.88	\$1,391.52	\$1,616.40
7/11/2013	29	15,228	525	3,663	24.05	9.62	3.90	8.00	35	35	\$12.21	62.50	\$0.00	\$100.34	\$1,117.98	\$1,218.32
6/12/2013	30	5,027	168	1,297	25.80	10.13	4.31	13.54	33	33	\$12.43	21.20	\$0.00	\$56.07	\$624.81	\$680.88
5/13/2013	33	890	27	350	39.33	13.04	7.16	58.54	37	37	\$12.58	3.00	\$0.00	\$42.91	\$478.08	\$520.99
4/10/2013	29	25,810	883	6,311	24.83	9.60	3.90	7.00	37	37	\$11.85	99.50	\$0.00	\$147.64	\$1,845.11	\$1,792.75
3/12/2013	28	24,596	878	5,848	23.78	8.48	4.58	7.26	37	37	\$11.85	98.90	\$0.00	\$147.15	\$1,639.65	\$1,786.80
2/12/2013	32	28,232	882	6,498	23.02	8.44	4.55	6.91	37	37	\$11.82	99.40	\$0.00	\$160.75	\$1,791.23	\$1,951.98
1/11/2013	31	27,216	878	6,116	22.47	8.45	4.56	6.95	37	37	\$11.83	98.90	\$0.00	\$155.86	\$1,738.67	\$1,892.53
12/11/2012	31	13,813	448	3,431	24.84	8.52	4.89	8.73	37	37	\$11.18	50.20	\$0.00	\$99.33	\$1,106.78	\$1,206.11
11/10/2012	30	0	0	0	0.00	0.00	0.00	2,481.00	0	0	\$0.00	0.00	\$0.00	\$2.04	\$22.77	\$24.81
10/11/2012	29	61	2	53	86.89	25.25	17.57	211.28	9	9	\$13.55	1.00	\$0.00	\$10.61	\$118.27	\$128.88
9/12/2012	30	17,715	590	4,550	25.68	10.28	3.96	7.63	34	34	\$11.16	72.40	\$0.00	\$111.30	\$1,240.17	\$1,351.47
8/13/2012	32	25,784	806	6,659	25.83	10.18	3.88	6.84	34	34	\$11.11	98.70	\$0.00	\$147.29	\$1,641.29	\$1,788.58
Sum		184,181	6,088	44,778									\$0.00	\$1,181.29	\$13,162.81	\$14,344.10
Avg	30	15,348	507	3,731	28.86	10.29	5.27	235.32	31	31	\$10.98	58.81	\$0.00	\$88.44	\$1,096.99	\$1,195.34

GENERAL INFORMATION			
CUSTOMER DATA		ACCOUNT DATA	
Address	1337 23RD ST # WELL 5	Account Manager	India MONAHAN
City	SARASOTA	Account Manager Phone #	941-483-2034
State	FL	Account Name	CITY OF SARASOTA
Zip Code	34234	Account Number	3908740578
Primary Contact		Premise Number	1271059
Phone Number		Meter Number	DJ98139
Email		Rate Code	70
		Rate Description	GSDT-1
		Account Active Since	5/4/1988
ELECTRIC SERVICE DATA		FACILITY DATA	
TLN#	5146965860	Air Cond. Sq. Ft.	0
Preferred Feeder	502832	Total Sq. Ft.	0
Emergency Feeder		Cur Mth ELE \$ / Sq. Ft.	0.00
Substation	PAYNE	12 M.O.E \$ / Sq. Ft.	0.00
Service Voltage		SIC Code	4942
Control KWD		SIC Description	ELE & GAS & SANIT-WELL PUMP DO

	12 MONTH COMPARISON		CURRENT MONTHS TO PREVIOUS MONTHS COMPARISON ***			
	THIS YEAR	LAST YEAR	INCR/DEC/NC	CHANGE	% CHANGE	
Total KWH Consumption	225,141	184,181	INCREASE	40,960	22.24	
Avg. KWH / Month	18,762	15,348	INCREASE	3,414	22.24	
Avg. KWH / Day	618	507	INCREASE	111	21.85	
Avg. On-Peak KWH	4,695	3,731	INCREASE	984	25.84	
% On-Peak KWH	26.42	28.86	DECREASE	(2.44)	(8.45)	
On-Peak Energy Charge (Cents/KWH)	9.92	10.20	DECREASE	(0.28)	(2.75)	
Off-Peak Energy Charge (Cents/KWH)	4.60	5.27	DECREASE	(0.67)	(12.71)	
Avg. KWD / Month	36.83	30.58	INCREASE	6.25	20.44	
On-Peak KWD	36.83	30.58	INCREASE	6.25	20.44	
On-Peak \$ / KWD	12.38	10.96	INCREASE	1.42	12.96	
Max KWD	37.00	37.00	NO CHANGE	0.00	0.00	
Avg. % Load Factor	89.58	58.81	INCREASE	10.77	18.31	
Billing Data						
Avg. Monthly Non-Utility Taxes	\$124.88	\$98.44	INCREASE	\$26.44	26.86	
Tot. Yearly Non-Utility Taxes	\$1,498.54	\$1,181.29	INCREASE	\$317.25	26.86	
Avg. Monthly Base Elect Amt	\$1,391.52	\$1,096.99	INCREASE	\$294.52	26.86	
Tot. Yearly Base Elect Amt	\$16,696.23	\$13,162.81	INCREASE	\$3,533.42	26.86	
Avg. Monthly Tot. Bill Amt	\$1,516.40	\$1,195.34	INCREASE	\$321.06	26.86	
Tot. Yearly Bill Amt	\$18,196.77	\$14,344.10	INCREASE	\$3,852.67	26.86	

*** GROSS RECEIPTS TAX, FRANCHISE CHARGE, MUNICIPAL TAX, FLORIDA SALES TAX, OPT. SALES TAX
 **** COMPARISON DATA HAS BEEN ROUNDED



Glossary Of Terms

Report as of: 8/12/2014 10:20:46 AM

Name	Description
Date	The day your facility's electric meter was read.
Days	Total number of Days in a given billing period.
kWh	A measure of the amount of electricity consumed over time. Represents the use of 1000 watts of electricity for one hour.
kWh/Month	Total Number of kWh used in a given billing period.
kWh/Day	The average kWh used per day in a given billing period.
On-Peak Periods	Summer - April 1 through October 31, Noon - 9:00 P.M. excluding weekends, Memorial Day, Independence Day, and Labor Day. Winter - November 1 through March 31, 6:00 A.M. - 10:00 A.M., 6:00 P.M. - 10:00 P.M. excluding weekends, Thanksgiving Day, Christmas Day, and New Year's Day.
Off-Peak Periods	All hours not designated as On-Peak.
On-Peak kWh	kWh used during On-Peak periods.
% On-Peak kWh	The percentage of total kWh used during on-peak periods of time.
Off-Peak kWh	kWh used during Off-Peak periods.
Seasonal On-Peak Demand	The kW to the nearest whole kW, as determined from the company's time of use metering equipment for the 30-minute period of customer's greatest use between the hours of 3 p.m. and 6 p.m. on weekdays during June through September, excluding Memorial Day, Independence Day, and Labor Day
Seasonal On-Peak kWh	The kWh consumed during the hours of 3 p.m. and 6 p.m. on weekdays during June through September, excluding Memorial Day, Independence Day, and Labor Day.
Seasonal Off-Peak kWh	All other hours during the months of June, July, August, and September.
Overall Cents/KWH	The total electric amount for a given billing period divided by number of kWh consumed in that period. This amount may be used for energy savings calculations where an overall unit cost including kWh, kWd, and tax components is desired.
Non Seasonal Demand	The kW to the nearest whole kW, as determined from the company's metering equipment, for the 30-minute period of the customer's greatest use during the month, for the months of January through May and October through December.
Non Seasonal kWh (Option A)	The kWh consumed during the months of January through May and October through December.
Non Seasonal kWh (Option B)	All kWh consumed during Non-Seasonal On-Peak period.
Non Seasonal Off-Peak kWh (Option B)	All kWh consumed during Non-Seasonal Off-Peak period.
Actual kWd/month	The highest kWd the meter registers during a 30-minute period in a given billing period.
Annual Maximum Demand	The highest monthly maximum Demand recorded during the last 12 months, as determined from the company's metering equipment for the 30-minute period of customer's greatest use.
On Peak kWd	The highest kWd the meter registers during a 30-minute on-peak period in a given billing period.
% Load Factor	The ratio, in percent, of the average kWd to the maximum kWd occurring in that period.
Eff \$/kWd	An estimate of the effective cost per kilowatt-demand (kWd) which includes additional charges consisting of the estimated kWd portion of the customer charge, capacity charge, franchise and tax charges. This amount may be used to estimate the total kilowatt-demand portion of the FPL invoice for demand savings calculations.
Effective Cents/kWh	The total electric amount for a given billing period divided by the number of kWh consumed in that period. This amount may be used for energy savings calculations where an overall unit cost including kWh, kWd, and tax components is desired.
Non utility Taxes	The taxes charged on electricity consumed at your facility. These taxes are pass-through charges collected and remitted by FPL to governmental entities.
Base Electrical Amount	All electric charges exclusive of taxes, franchise fees, or outstanding electric payments due.
Total Electrical Amount	The total charge for a given billing period.
Miscellaneous Charges	Charges include facilities rental charges, power monitor charges etc. This excludes tax figures, included in non-utility taxes column