JUSTIFY LUBRICANT UPGRADES WITH ENERGY SAVINGS

COURTESY OF Machinery Lubrication

HIGH FILM STRENGTH SYNTHETIC LUBRICANTS SAVE ENERGY, INCREASE PROFITABILITY

Every maintenance department seeks reduced maintenance costs, increased equipment utilization and improved equipment reliability. To achieve this, maintenance personnel often look to upgrade the plant's lubricants to the latest technology. However, they often find it difficult to immediately justify the higher cost of the oil because maintenance savings cannot be shown prior to purchasing the oil. Furthermore, records are not always user-friendly, making it difficult for personnel to accurately document the savings that result once the high-performance oil is used.

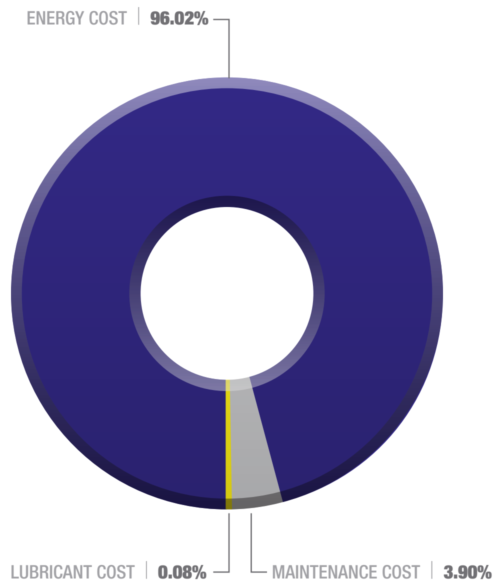
ENERGY COST - A NEW PERSPECTIVE

Some innovative maintenance personnel have successfully worked within this Catch-22 by documenting energy savings derived from using synthetic lubricants with a high film strength friction-reducing additive technology. Measuring energy savings provides a more immediate and definitive means of justifying the use of such performance-formulated lubricants. Because the cost of energy is a current operating expense, energy savings derived from the use of high-performance lubricants can immediately offset the increased purchase cost. And if the energy savings are sufficiently large, it eliminates having to justify the expenditure through maintenance cost reductions.

As energy costs continue to rise, the amount of energy used becomes a greater and more immediate concern to every company's profitability. Energy cost, often the largest expense of operating rotating equipment, can exceed the cost of maintenance on rotating equipment by 20 to 25 times or more. Because the energy costs are so great, even a one percent reduction in energy consumption produces large dollar savings. This is why significant improvements in lubricant quality offer immensely leveraged opportunities to reduce costs and increase the company's overall earnings.

MEASURING ENERGY SAVINGS

Energy savings are most easily measured by comparing the energy use of the electric motors that power the equipment prior to and following the equipment's lubricant(s) upgrade. Improved equipment efficiency, which is a by-product of the upgraded lubricant, can result in increased machine output, lower operating temperatures and / or reduced energy use. Therefore, accurate comparisons require the equipment to operate at equal work loads when readings are taken. While it is not always possible to measure each variable, a sufficiently large sampling will provide reliable results.



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CASE STUDY #1 | GIANT REFINING CO.

Giant Refining Co. produces 20,000 barrels of oil per day in its New Mexico refinery. In 1997, senior maintenance planner Cecil Cunningham conducted an energy study on lubricants. He selected eight electrically driven process pumps to test the energy savings potential of replacing the R & O mineral oil currently used with a premium lubricant. Cunningham's report concluded, "Based on our test data, using the synthetic lubricating oil Royal Purple® in all lubricated equipment should provide an eight percent average reduction in electrical amperage, a savings of approximately $216,000 per year." As a result of his testing, he was able to justify converting to the premium lubricant throughout the plant and the change has contributed significantly to Giant's overall profitability.

PROCEDURE

Phase 1 of the test was conducted in two stages. The first stage was to obtain baseline data from the selected motors. The amperage on each motor was checked one day per week, twice on that day, for three months. This was to balance differences in unit operation changes. Stage two was to upgrade the oil using a normal flush out procedure. Amperage draw was checked daily for an additional three-month period (Table 1).

Table 1 **Total energy use of these pumps was reduced by 8.5 percent.**

PUMP NO.	PREVIOUS AMPS	RP AMPS	PREVIOUS COST PER DAY, $	RP COST PER DAY, $	SAVINGS PER YEAR, $	INCR. LUBE COST, $	SAVINGS PERCENT	INCR. LUBE COST, $	NET SAVINGS PER YEAR, $
P105	87	85.09	174.00	170.00	3.82	1,394.00	2.2	60.00	1,344.00
P211A	20	19.42	35.00	34.00	101.00	368.00	2.9	60.00	308.00
P507	41	36.91	645.00	580.00	64.31	23,745.00	10.0	360.00	23,115.00
P507A	41	36.87	645.00	580.00	64.94	23,704.00	10.1	360.00	23,344.00
P902A	88	85.13	153.00	148.00	4.99	1,821.00	3.3	360.00	1,461.00
P908A	187	157.66	325.00	274.00	51.02	18,621.00	15.7	60.00	18,561.00
PD506	46.8	46.65	94.00	93.00	0.30	109.00	0.3	60.00	49.00
P605	48.5	44	84.00	77.00	7.82	2,856.00	9.3	60.00	2796.00
TOTAL						72,348.00		1380.00	70,968.00

scale: 1 - 10, 10 is excellent

- Increased oil cost based on oil changes two times / year.*
- Total energy use of these pumps was reduced by 8.5 percent.
- Note: Results taken from actual test data report. The daily cost numbers were rounded on the report. Voltage and service factors are not shown due to space restrictions.

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CASE STUDY #2 | MAJOR NORTH AMERICAN TIRE MANUFACTURER

A reliability technician for a tire manufacturer in the southeastern United States tested the energy savings potential of premium lubricants in February 1999. The technician randomly selected 14 pieces of equipment in several plants for evaluation. An ISO VG 32 synthetic lubricant was tested in pumps, compressors and conveyors. The company reduced total energy usage in the test equipment by three percent with an estimated annual savings of $26,884.97. Significant reductions in operating temperature for much of the equipment were also achieved (Table 2).

PROCEDURE

The amperage, voltage and operating temperature of the equipment were measured before and after the oil change. The data was collected using voltage and amperage meters plus a handheld infrared digital thermometer. Measurement readings were taken prior to the oil change at sufficient frequency to ensure an accurate baseline had been established. Following the oil change, data was monitored for an entire year to make sure that the improvements in performance were permanent.

Table 2 North American Tire Manufacturer

NO.	COMPRESSOR, OIL	AMP	TEMP °F	TEMP °F REDUCTION	COST PER HOUR, $	COST PER YEAR, $	SAVINGS PERCENT	SAVINGS PER YEAR, $
1	Chilled water pump	39.5	172.00	–	8.73	76,497.44	–	–
	After RP oil change	36	120	52	7.96	69,719.19	2.9	60.00
2	Backflush pump	20.4	140	–	.52	1,082.40	–	–
	After RP oil change	18.1	120	20	.46	960.36	10.1	360.00
3	Pump	4.5	113	–	0.11	1,005.57	–	–
	After RP oil change	3.9	100.05	12.5	0.10	871.49	15.7	60.00
4	Pump	3.9	118	–	0.10	871.49	–	–
	After RP oil change	3.4	99.2	18.8	0.09	759.76	9.3	60.00
5	Cooling water pump	20	114	–		38,732.88	–	–
	After RP oil change	18.5	93	21	4.09	35,827.92	7.5	1,904.97
6	Drag conveyor	84	114	–	2.14	18,770.55	–	–
	After RP oil change	83	114	0	2.12	18,547.09	1.2	223.46
7	Feedwater pump	35.9	127	–	0.92	8,022.18	–	–
	After RP oil change	32.5	109	18	0.83	7,262.42	9.5	759.76
8	Feedwater pump	34.9	148	–	0.89	7.798.72	–	–
	After RP oil change	34.5	139	9	0.88	7,709.33	1.4	89.38
9	Hot water pump	75.5	98	–	1.93	16,871.15	–	–
	After RP oil change	75	93	5	1.91	16,759.42	0.7	111.73
10	Hot water pump	78.5	95	–	1.95	17,094.61	–	–
	After RP oil change	75.8	90	5	1.93	16,938.19	0.9	156.42
11	Air compressor	72	105	–	15.92	139,438.38	–	–
	After RP oil change	70	97	8	15.48	135,565.09	2.8	3,873.29
12	Centrifical compressor	93	380	–	20.56	180,170.90	–	–
	After RP oil change	91	372	8	20.12	176,234.62	2.2	3,873.29
13	Centrifical compressor	92	376	–	20.34	178,171.26	–	–
	After RP oil change	89	371	5	19.68	172,361.30	3.3	5,809.93
14	Turbo compressor	96	88	–	21.22	185,917.84	–	–
	After RP oil change	95	86	2	21.00	183,981.19	1.0	19,936.64

- RP = Royal Purple Synerlec® 32
- Note: All voltage measurements were constant. Yearly savings were calculated at 24 hours / day on all equipment except the backflush pump, which was calculated at eight hours / day.

CASE STUDY #3 | VARIOUS AMMONIA REFRIGERATION COMPRESSORS

Over the past three years, energy savings in food processing plants were documented in reciprocating and flooded screw ammonia refrigeration compressors. The premium lubricant that was selected produced energy savings in ammonia refrigeration compressors in two ways: First, the lubricant reduces friction in the compressor. And second, it remains in the compressor and is not carried downstream with the ammonia into the cold side of the system where it can interfere with the cooling efficiency of the unit.

Table 3 provides a summary for the results on the 34 refrigeration compressors involved in this study. The high VI (Viscosity Index) synthetic lubricant produced significant energy savings regardless of compressor make, type and the previous oil replaced. The lubricant produced an average energy savings of 10.11 percent. In virtually every compressor, oil consumption due to carryover with the ammonia into the cold side of the system was either drastically reduced or eliminated.

PROCEDURE

Refrigeration specialist Bill Irvin collected data from various plant compressors before and after upgrading the oil to a new, high-performance lubricant. The duration of measurement varied based on the desires of each location. Typically, data was collected for one week before and after the oil change. To gather the information, Irvin installed a Pace Scientific XR440-M pocket logger with the appropriate sensors. This unit measured and recorded the suction pressure, discharge pressure and AC amperage of the compressors. Data was collected every two seconds, averaged every two minutes and was later downloaded into a PC laptop computer. Irvin eliminated periods of downtime and plotted the remaining data using 30-minute averages in Microsoft Excel. By comparing the before and after data on the compressors while operating at equal work loads, he was able to document the energy savings derived from the improvement in the efficiency of the compressors.

CONCLUSION

Due to the increasing cost and tightened availability of energy, the opportunity for significant savings in rotating equipment through improved lubrication is ever increasing. Energy cost is never a part of the maintenance budget, but a part of the operating budget. However, documenting energy savings resulting from improved lubrication creates the opportunity to reduce maintenance costs and increase equipment reliability and profitability. Though the potential for energy savings can vary greatly with different equipment, even a small percentage reduction in energy use will typically pay for the plant's total lubricant expense within a few months.

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Table 3

Various Ammonia Refrigeration Compressors

NO.	COMPANY LOCATION	COMPRESSOR TYPE	HP	PREVIOUS OIL	ELECTRICITY COST KWHR ($)	1,000 HOUR OPERATING COST ($)	SAVINGS PERCENT	SAVINGS PER 1000 HOURS ($)
1	Cold Storage Plant - Georgia	screw	75	mineral	0.0500	3,108.38	9.20	285.97
2	Food Plant - Arkansas	screw	300	synthetic	0.0400	9.946.80	7.90	785.80
3	Food Plant - Arkansas	recip.*	300	synthetic	0.0400	9.946.80	9.19	914.11
4	Food Plant - Iowa	screw	400	mineral	0.0550	18,235.80	11.48	360.00
5	Food Plant - Kansas	recip.	200	mineral	0.0500	8,289.00	11.53	360.00
6	Food Plant - Kansas	screw	4500	mineral	0.0410	15,293.21	6.37	955.72
7	Food Plant - Kansas	screw	200	mineral	0.0500	8,289.00	8.37	974.18
8	Kansas - Kansas	screw	700	mineral	0.0560	15,293.21	7.46	693.79
9	Food Plant - Oklahoma	screw	350	mineral	0.0370	8,289.00	8.48	2,423.97
10	Food Plant - Texas	screw	100	mineral	0.0680	5,636.52	37.30	2,102.42
11	Food Plant - Texas	screw	150	mineral	0.0680	8,454.78	5.70	481.92
12	Frozen Food Plant - Georgia	screw	200	mineral	0.0700	11,604.60	9.30	1,079.23
13	Frozen Food Plant - Oklahoma	screw	150	mineral	0.0700	8,081.76	9.00	727.36
14	Frozen Food Plant - Texas	screw	450	synthetic	0.0350	13,055.18	8.10	1,057.47
15	Frozen Food Plant - Iowa	recip.	75	synthetic	0.0550	3,419.21	4.65	158.99
16	Meat Plant - Nebraska	screw	75	mineral	0.0700	4,351.73	7.80	339.43
17	Meat Plant - Kansas	screw**	200	mineral	0.0415	6,879.87	11.14	766.42
18	Meat Plant - Kansas	screw	500	mineral	0.0415	17,199.68	10.32	1,755.01
19	Meat Plant - Kansas	screw	500	mineral	0.0415	17,199.68	11.11	1,910.88
20	Meat Plant - Kansas	screw	250	mineral	0.0500	10,361.25	16.97	1,758.30
21	Meat Plant - Kansas	screw	400	synthetic	0.0415	13,759.74	6.99	961.81
22	Meat Plant - Nebraska	screw	500	mineral	0.0200	8,289.00	8.21	680.53
23	Meat Plant - Illinois	screw	400	mineral	0.400	13,262.40	4.36	578.24
24	Poultry Plant - Alabama	screw	250	mineral	0.0500	10,361.25	11.27	1,167.71
25	Poultry Plant - Arkansas	screw	400	mineral	0.0450	14,920.20	9.42	1,405.48
26	Poultry Plant - Georgia	screw**	125	mineral	0.0600	6,216.75	8.48	527.18
27	Poultry Plant - Missouri	screw	500	mineral	0.0570	23,623.65	4.12	973.29
28	Poultry Plant - Missouri	screw	450	mineral	0.0570	23,261.29	22.77	4,841.19
29	Poultry Plant - Missouri	screw	500	mineral	0.0300	12,433.50	4.20	522.21
30	Poultry Plant - Oklahoma	recip.**	175	mineral	0.0600	8,703.45	10.80	939.97
31	Poultry Plant - Oklahoma	screw	500	mineral	0.0450	18.650.25	13.80	2,573.73
32	Poultry Plant - Texas	recip.	75	synthetic	0.0670	4,165.22	12.74	530.65
33	Poultry Plant - Texas	screw	450	mineral	0.400	14,920.20	9.00	1,342.82
34	Poultry Plant - Texas	screw	450	mineral	0.400	14,920.20	6.19	923.56

- * 502 Freon Gas
- ** Compressors in booster service 1 year = 8,760 hours
- Note: Royal Purple's proprietary Synerlec® additive technology enabled Uni-Temp™ to produce energy savings even when replacing other premium syntehtic oils.

Even the smallest reductions in energy savings can drastically leverage savings.

Author's Note: The names of the tire manufacturer and its reliability technician were withheld due to the company's policy prohibiting the use of its name.