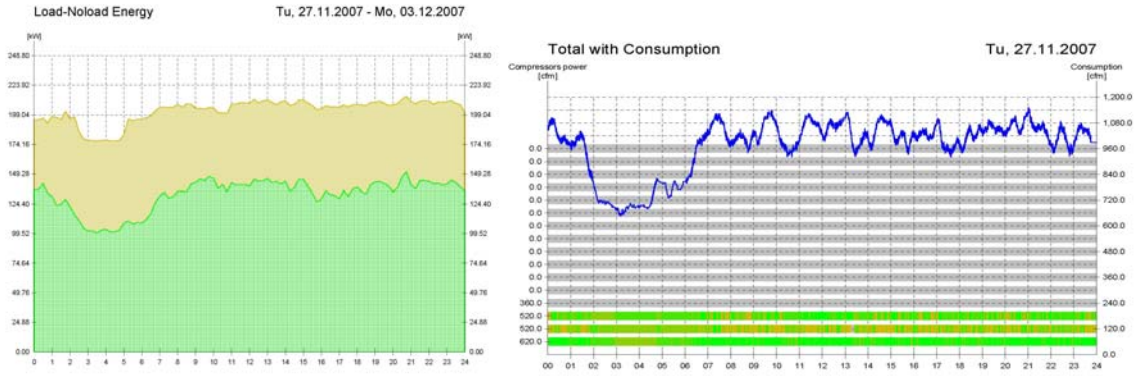
Controller Cuts Compressor Energy Costs

Lacks Enterprises, an automotive supplier painting facility in Grand Rapids, Mich., performed a compressed air energy audit using a purpose-designed datalogger to evaluate overall efficiency and indicate potential improvements based on CAGI compressor ratings. Based on audit results, Lacks installed a controller that raised efficiency from 25.8 KW/100 CFM to 17.88 KW/100 CFM. Payback was less than seven months.

No performance or cost information about the air compressor system was available. Multiple air compressors were running in load/unload without proper control. This resulted in a lot of wasted energy. The team was looking for ways to improve the energy efficiency of their compressed air system and increase awareness of compressed air cost and usage.

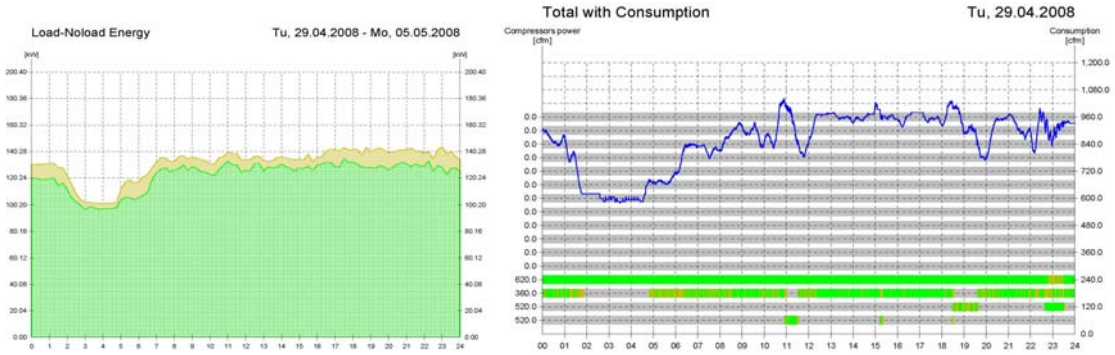
To evaluate the system efficiency, we performed an energy audit with the Airleader Data Logger. The Airleader data logger is designed specifically for compressed air audits. It captures data on KW usage, flow information, system pressure load/unload cycles, compressor starts and much more for seven days using one second readings. The KW usage can be based on three-phase amp and three-phase voltage probes. The evaluation software provides us with many data points, in particular the KW/100 CFM allows us to quickly evaluate the overall efficiency of the system based on CAGI Rating of the Compressors we can indicate efficiency improvement potentials.

After seven days of data collection, we evaluated the results. The overall system efficiency was 25.8 KW/100 CFM. The Theoretical efficiency of the various installed compressors are between 16.8 KW/100 CFM and 16.98 KW/100 CFM.



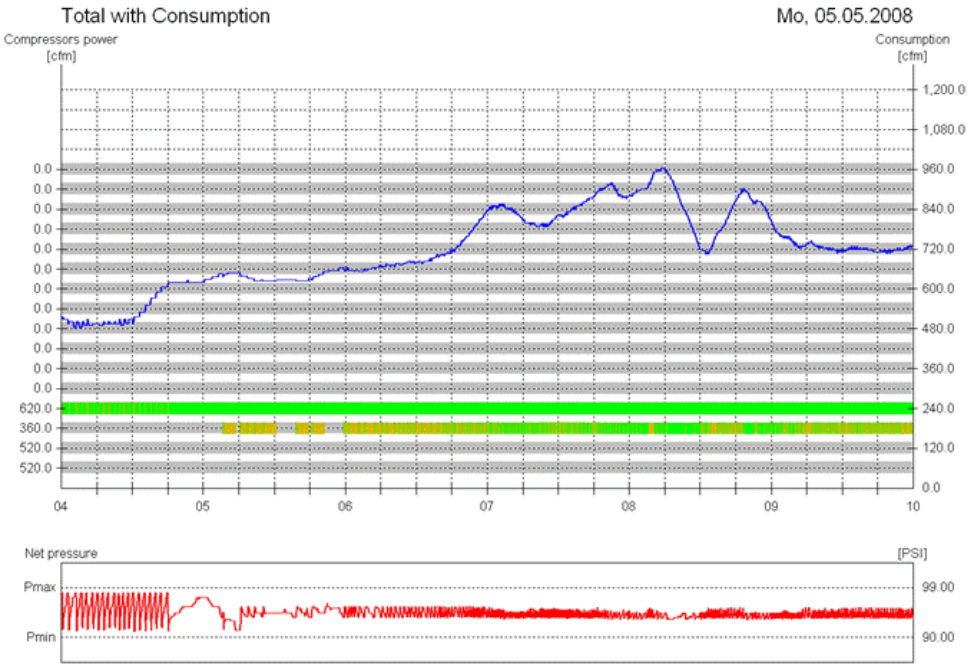
Using our simulation program, we calculated the effect installing the Airleader master control and monitoring system would have on the energy usage. The results showed an energy efficiency gain of 29.1%.

Based on the results of the audit and our calculations, the client approved the project to install the Airleader master control. After the system was installed, a second audit was performed with the following results:



Through the master control, we were able to eliminate the equivalent of one compressor and improve the energy efficiency of the system to 17.88 KW/100 CFM.

In the initial test run we realized that one compressor was not functioning properly. The Web-based monitoring system allowed our experts to evaluate system performance data made available using the Airleader master control using the Internet. The results indicated that the pressure transducer of this compressor was broken this restricted the Airleader to run the compressor in the pressure band between 94 and 96 PSI instead of the set pressure band of 91 and 98 PSI. With the installation of a new pressure transducer, this problem was fixed.



The blue line on the graph shows the air usage in the plant. The green and yellow bars indicate that the compressor is running in load (green) or unload (yellow). The red graph represents the net pressure in the system. This graph visualizes the problem encountered with the pressure transducer. Starting at 5:10 a.m., the demand increased above maximum capacity for compressor one and compressor two started. With the start of compressor two, the pressure band narrowed to 94 to 96 PSI

With the installation of the airleader master control, we were able to eliminate one compressor. This is a reduction of 1/3, resulting in a 1/3 reduction in maintenance related costs such as oil and filter changes as well as wear and tear. Additionally, the Airleader service scheduler automatically alerts interested parties

by e-mail or other means of communication when services are due. Services are performed based on actual hours running rather than following a fixed maintenance schedule. The Airleader master control allows predictive maintenance by alerting the maintenance staff before a compressor shut-down. E.g. Alert before compressor shuts down because of overheating: The Airleader master control can monitor the temperature. At a set temperature level (below compressor shut down) the Airleader alerts the maintenance team to correct the problem. E.g. clean cooling system.

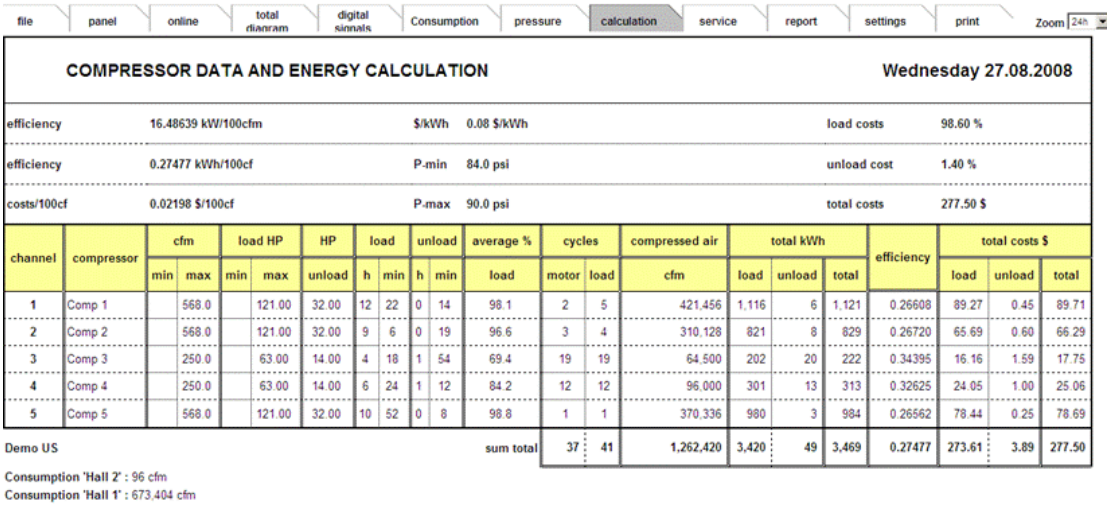
Energy savings amounted to 31.1% from 25.8 KW/100 CFM to 17.88 KW/100 CFM, thereby reducing the energy use from 1,774,462 kWh to 1,150,354 kWh for a total savings of 624,108 kWh per year. Over the span of 10 years, this amounts to a savings of 6,241 MWH. At an estimated energy cost of 10 cents/kWh, this totals to savings of $624,108.

Payback time for this particular installation was 6.9 months. Payback times vary greatly. Typically the payback time is between six and 24 months, while we have seen payback times of just a few weeks.

CO2 savings of this project amounts to 842,545 pounds/year based on the 2000 electricity mix. This energy savings is the equivalent needed to run the electricity of 55 average U.S. households based on 2005 EIA data..

Continuous Improvement possible with the Airleader Monitoring System:

The Airleader master control and monitoring system provides performance and cost information on a continuous basis, allowing for verification on cost saving projects.



file | panel | online | total diagram | digital signals | Consumption | pressure | calculation | service | report | settings | print | Zoom 24h

COMPRESSOR DATA AND ENERGY CALCULATION — Wednesday 27.08.2008

efficiency	16.48639 kW/100cfm	$/kWh	0.08 $/kWh	load costs	98.60 %
efficiency	0.27477 kWh/100cf	P-min	84.0 psi	unload cost	1.40 %
costs/100cf	0.02198 $/100cf	P-max	90.0 psi	total costs	277.50 $

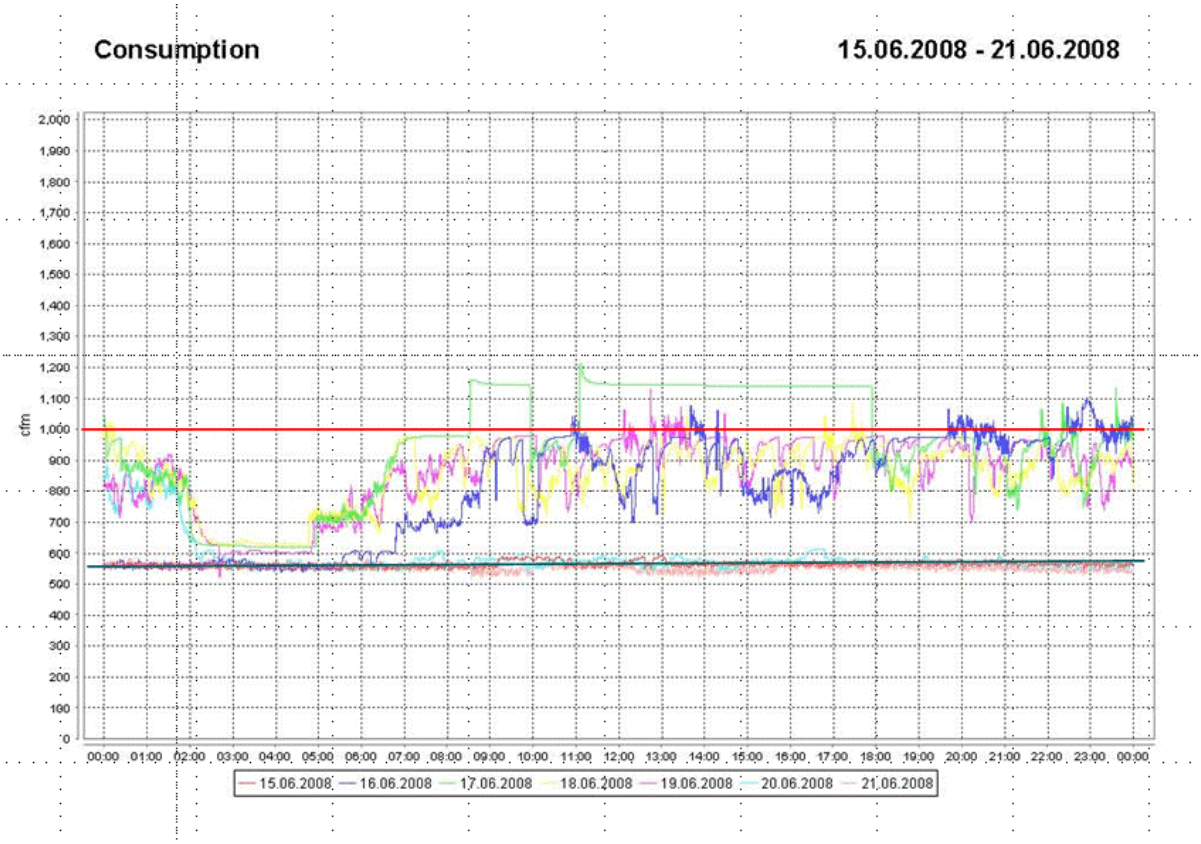
channel	compressor	cfm		load HP		HP	load		unload		average %	cycles		compressed air	total kWh			efficiency	total costs $		
		min	max	min	max	unload	h	min	h	min	load	motor	load	cfm	load	unload	total		load	unload	total
1	Comp 1		568.0		121.00	32.00	12	22	0	14	98.1	2	5	421,456	1,116	6	1,121	0.26608	89.27	0.45	89.71
2	Comp 2		568.0		121.00	32.00	9	6	0	19	96.6	3	4	310,128	821	8	829	0.26720	65.69	0.60	66.29
3	Comp 3		250.0		63.00	14.00	4	18	1	54	69.4	19	19	64,500	202	20	222	0.34395	16.16	1.59	17.75
4	Comp 4		250.0		63.00	14.00	6	24	1	12	84.2	12	12	96,000	301	13	313	0.32625	24.05	1.00	25.06
5	Comp 5		568.0		121.00	32.00	10	52	0	8	98.8	1	1	370,336	980	3	984	0.26562	78.44	0.25	78.69
Demo US											sum total	37	41	1,262,420	3,420	49	3,469	0.27477	273.61	3.89	277.50

Consumption 'Hall 2' : 96 cfm
Consumption 'Hall 1' : 673.404 cfm

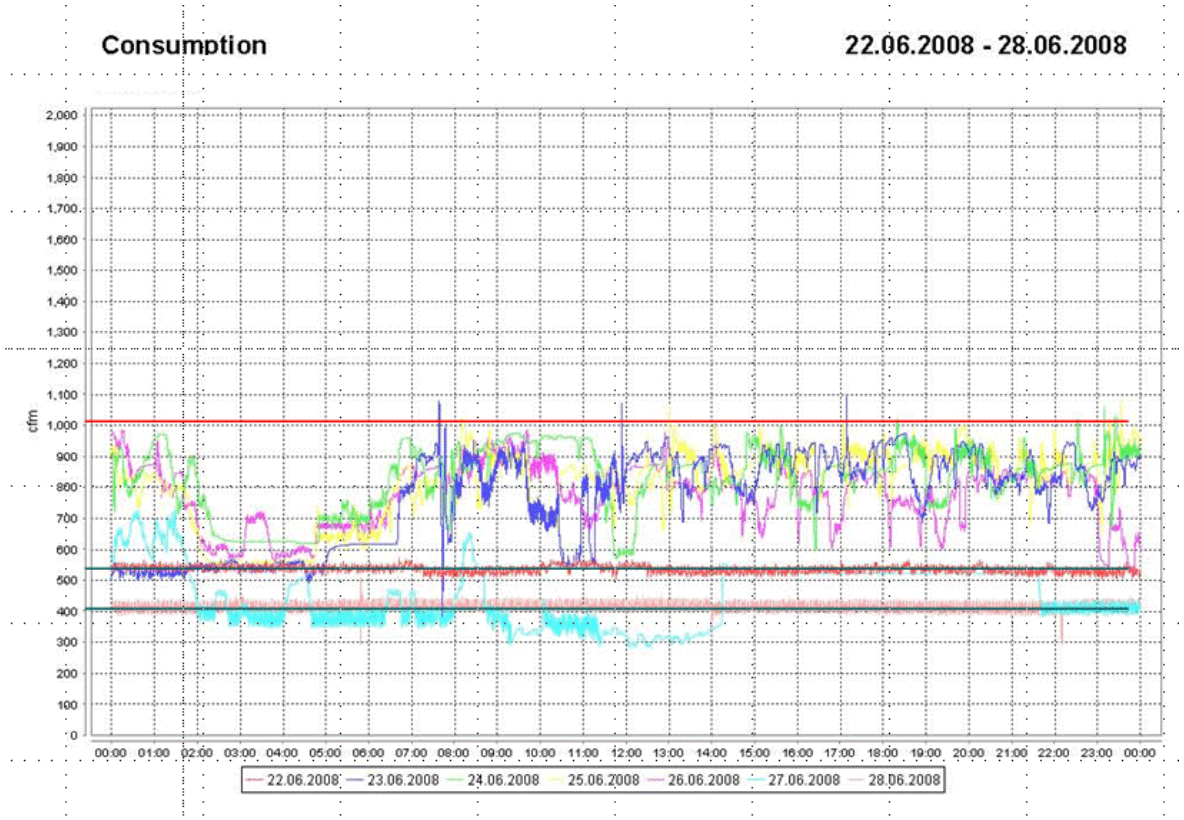
The following steps were taken by the client after the Airleader was installed.

1. Implementation of zero airless drains

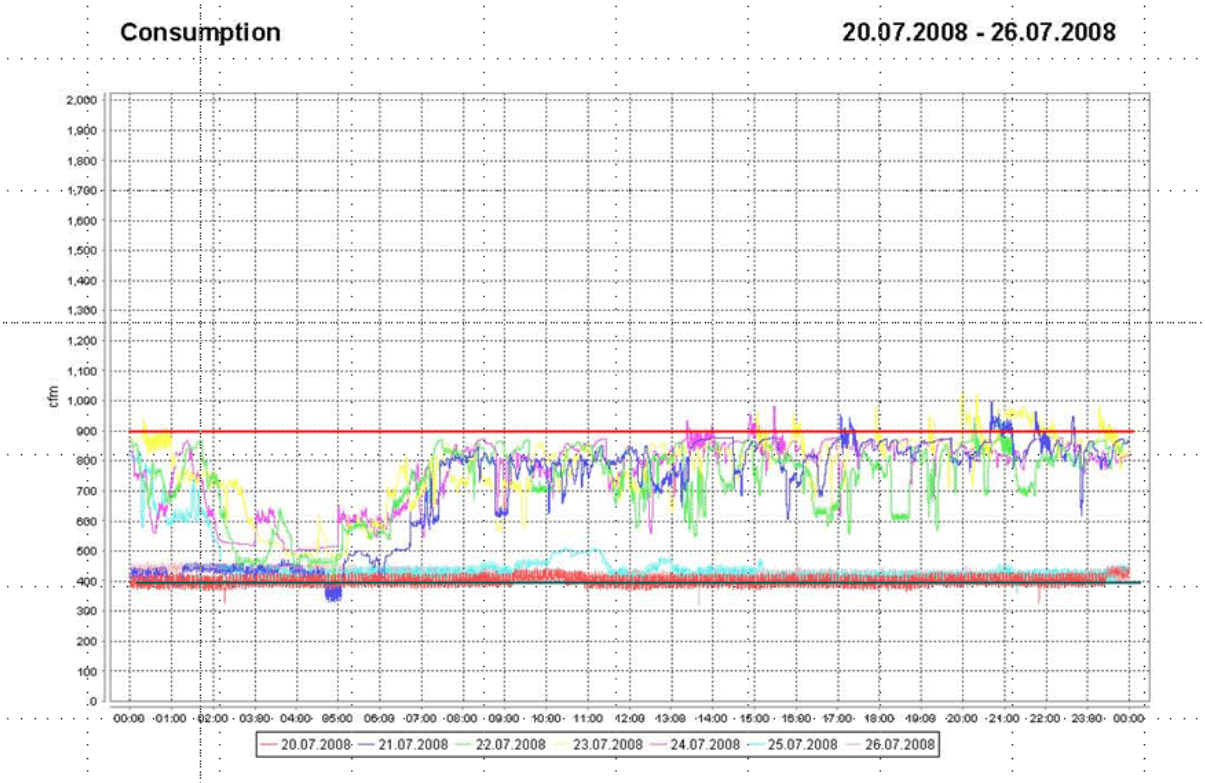
Cost savings from this project were verified by the Airleader. Before the installation of the zero airless drains, the average cost for weekend days was $150. After the installation, the cost was down to $122, amounting to an average daily savings of $28, representing savings of more than $10,000/year. The cost for the zero airless drains was $4,000, and the payback time was less than five months. The following graphs show the weekly air demand before, during and after the installation of the zero airless drains.



Before: air consumption averaged for weekend at 550 CFM and during the week peaking around 1,000 CFM.



During air consumption dropped from 530 CFM on Sunday to 410 CFM the following Saturday.

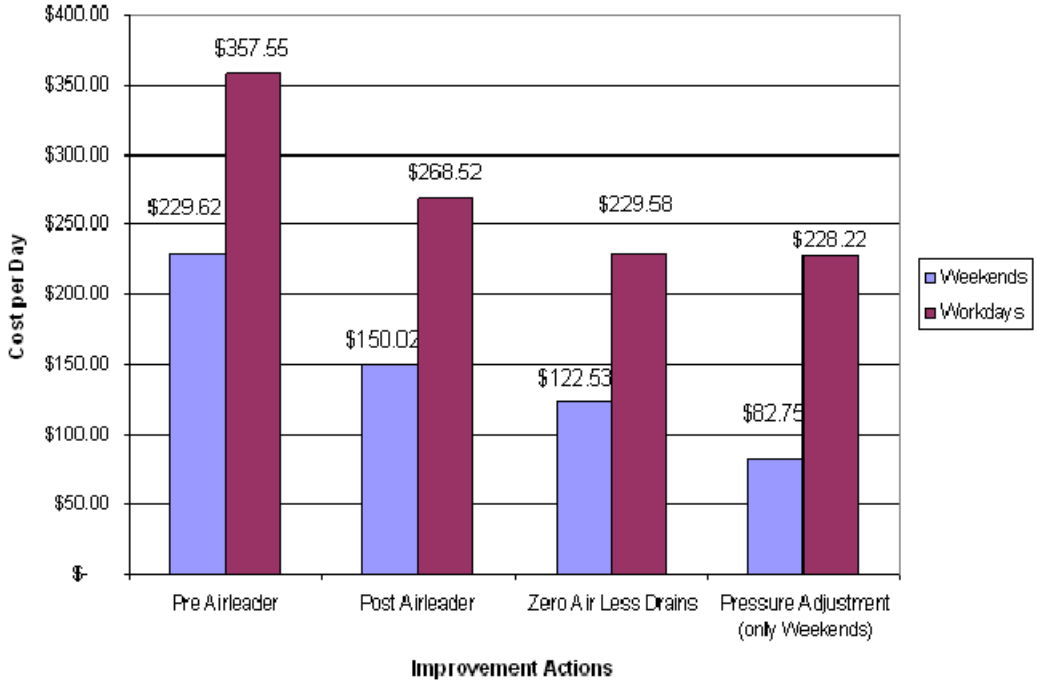


After: Air consumption average is now 410-430 CFM for weekend days and peaking around 900 CFM.

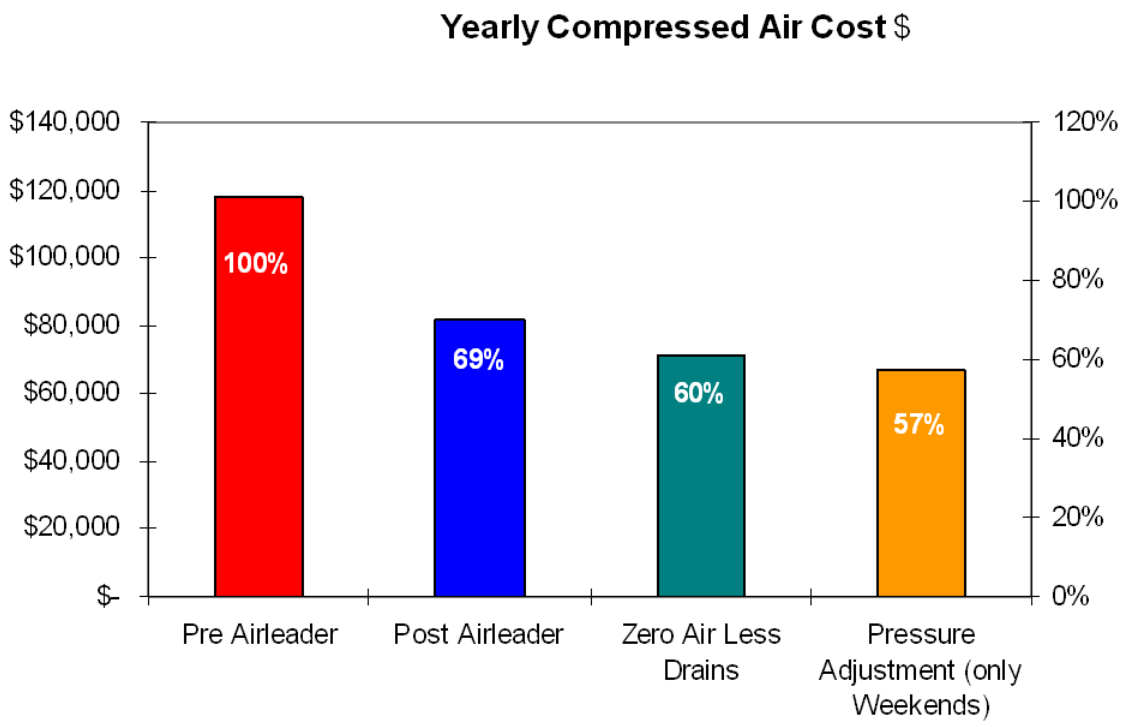
2. Lower system pressure on weekends and shut off equipment

   On weekends, the plant doesn't operate power tools or equipment requiring high pressure. To further save energy, we installed a switch to lower the system pressure band for weekend operation. This, combined with an effort to shut of unnecessary machines, resulted in energy cost of only $82 per day. This $82 became the benchmark to run the plant on weekend days.

The following chart shows the daily operating cost for weekend days and week day during each step of improvements.



The overall system savings totaled to 43% (see following chart), still having opportunity to save on the demand site with leak detection, blower application to replace air knifes and more.



System Performance Index: Input/Output Rating

The Airleader master control is an intelligent, self-learning compressor control. The following chart illustrates that trough every system improvement we made, the specific key performance rating was not influenced. The system continuously operated at around 17.8 KW/100 CFM; a confirmation that the Airleader operates compressors intelligently in real time based on actual plant demand.