WHITE PAPER

Energy Efficiency

How operational changes impact operating budgets without sacrificing space comfort

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Alpine Mechanical Services, LLC

SIEMENS

Nexant

Energy Efficiency Collaborative Audit Study

Summary

Energy Efficiency: how operational changes impact operating budgets without sacrificing space comfort was a study and collaboration between Alpine Mechanical Services, Siemens Industry, and Nexant. This collaborative efficacy study allowed these industry leaders to test HVAC preventative maintenance best practices within a retail environment. A big box retailer in Austin, Texas was the test site.

Objectives

The objectives of this collaborative study are to demonstrate how HVAC tune-up and efficiency can be quantified into a corresponding investment in energy efficiency for rooftop units, both for small retail stores and big box stores, saving them money and energy by minimizing risk of equipment failure and reducing service calls, while maximizing utility rebates in the process.

Challenge

Retailers have two types of end users, the customer who patrons their retail establishment and the employees who work there every day. Both expect to be comfortable while in the store, which means maintaining an optimal temperature of 74 degrees during the warm months and 68 degrees during cooler months. For the owner and manager, internal and external customer satisfaction should be their primary goal.

In order to maintain a comfortable store environment, it requires proper HVAC maintenance, which all too often means that the property manager and owner makes a decision between a proactive HVAC maintenance program and a reactive approach to maintaining their rooftop units. Cost to provide a quality preventative maintenance program versus cost to respond only as needed to repair the units is often the deciding factor. Many retailers do not know that deferring preventative maintenance increases their overhead as well as their emergency service visits, which risks customer and employee satisfaction. At the end of the day, retailers may ask if they are getting everything they think they are paying for from their HVAC vendors.

Solution

Purchasing an HVAC rooftop unit can be compared to buying an automobile. Let's face it: You purchase both to serve your needs and you hope to get the maximum life out of each, especially since each purchase requires a healthy investment and both depreciate over time. Would you purchase a car and not maintain the mechanics until an emergency occurred? Rooftop units are similar in that they are designed to provide 15 years of life — *if properly maintained*. Ensuring that your store has the proper PM program in place helps guarantee that you maximize the life of the unit.

Fortunately, with today's technology, HVAC equipment is much smarter. As used for purposes of this study, technicians can remotely monitor equipment with an EMS (Energy Management System) or with local hand-held devices such as the HVAC Service Assistant tool that more advanced HVAC technicians use today. Both tools are designed to allow remote monitoring and to more efficiently make decisions regarding servicing the units and/or replacing parts. New HVAC units are also designed more efficiently than in years past, reducing operational expenses, including energy bills and Repair and Maintenance (R&M). In fact, the ROI that newer units produce can allow for as little as 3–5 years amortization on equipment upgrades.

The goal of a quality Preventative Maintenance program is to maintain the rooftop unit/s at its maximum peak efficiency through periodic scheduled maintenance visits for services such as cleaning coils when required and checking the overall operation of the refrigerant charge and electronic components on the unit. Deferring this maintenance only defers a portion of the overall HVAC operations expense, and poorly maintained HVAC units suffer more emergency service calls. When HVAC units operate at their maximum peak efficiency, not only are customers more comfortable, monthly energy bills and service calls are also significantly reduced. For those retailers that implement the smart PM program, utility companies will reward them with energy rebates, further reducing their overhead.

Scope of Work

- HVAC Equipment (existing rooftop units)
- Energy Management System (EMS), providing remote, multi-site operations HVAC control
- HVAC Service Assistant, a diagnostic tool that allowed technicians to diagnose and detect maintenance problems specific to the heating and cooling systems.
- Re-commissioning of existing rooftop units, which provided a full-service upgrade and HVAC fine-tuning, bringing the unit back to its original factory performing levels

Results

The end result cost savings between the Preventative Maintenance (PM) program and a reactive approach to HVAC maintenance were impressive. The rooftops units that were properly restored, maintained and cleaned over the course of two months, during the hottest months of the year, used less energy (kWh) and operated at peak efficiency levels as predicted, as compared to the same time last year.

The collaborative study reported significant savings between August 1, 2013 and September 30, 2013. Additionally, outside air temperatures (OSA) during the same timeframe in 2012 were slightly cooler than OSA in 2013, during which the PM program was being conducted. For example, in August 2012 the actual OSA ranged from 89 degrees to 107 degrees as compared to actual OSA in August 2013 ranged from 96 degrees to 107 degrees. (source: AccuWeather.com)

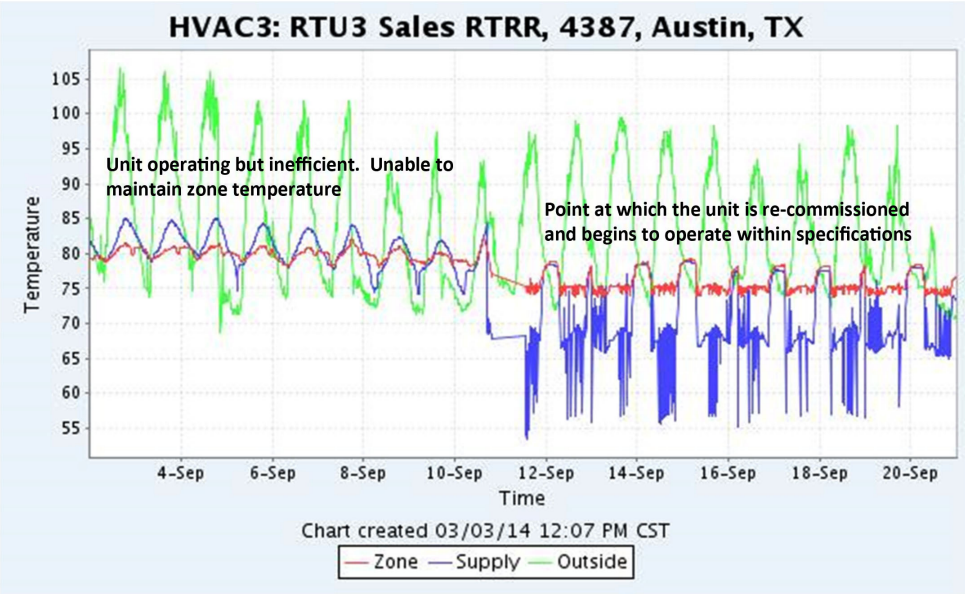
The actual difference in energy usage as compared to the same period in 2012 was 4,251 kWh across all RTU's. If we allow a 10% weather adjustment, this site experienced 3,826 kWh savings over that period. Annualized out, it is an estimated savings of over 35,000 kWh.

With the implementation of the Preventative Maintenance program, the experienced energy savings also qualified the retailer for utility company rebates. Customers and employees reported a marked difference in store temperature comfort levels, improving internal and external customer satisfaction.

HVAC Preventative Maintenance Audit Study

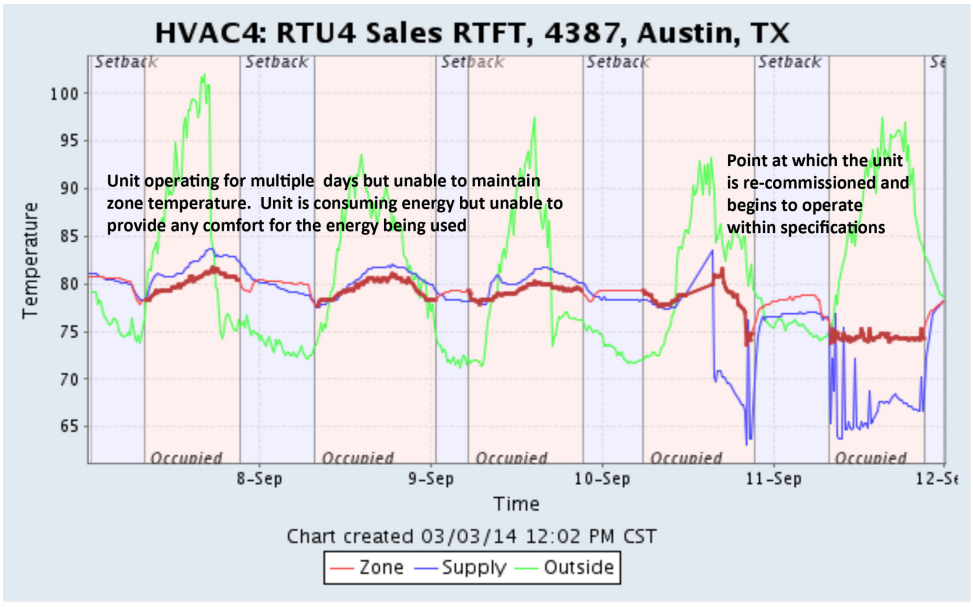
Site Number	Week Day	Day	kWh	Chg	Date	Min OSA	Max OSA	Ave OSA		YOY	% Chg	Site Number	Week Day	Day	kWh	Chg	Date	Min OSA	Max OSA	Ave OSA
4387	Thur	8/1/13	1,465		8/1/13	76	107	92		-86	-6%	4387	Wed	8/1/12	1,552		8/1/12	76	111	92
4387	Fri	8/2/13	1,787	321	8/2/13	77	104	90		41	2%	4387	Thur	8/2/12	1,746	195	8/2/12	75	108	91
4387	**Sat**	**8/3/13**	**1,451**	**-335**	**8/3/13**	**77**	**105**	**89**		**-123**	**-8%**	4387	Fri	8/3/12	1,574	-172	8/3/12	75	107	90
4387	**Sun**	**8/4/13**	**1,666**	**215**	**8/4/13**	**77**	**105**	**90**		**-1**	**0%**	**4387**	**Sat**	**8/4/12**	**1,667**	**93**	**8/4/12**	**77**	**106**	**91**
4387	Mon	8/5/13	1,499	-167	8/5/13	76	107	89		-140	-9%	**4387**	**Sun**	**8/5/12**	**1,639**	**-28**	**8/5/12**	**76**	**104**	**88**
4387	Tue	8/6/13	1,441	-58	8/6/13	76	107	90		-111	-8%	4387	Mon	8/6/12	1,551	-88	8/6/12	74	105	89
4387	Wed	8/7/13	1,549	109	8/7/13	77	108	90		-38	-2%	4387	Tue	8/7/12	1,588	36	8/7/12	77	109	93
4387	Thur	8/8/13	1,763	213	8/8/13	77	109	91		250	14%	4387	Wed	8/8/12	1,513	-75	8/8/12	77	109	93
4387	Fri	8/9/13	1,412	-350	8/9/13	73	108	89		-61	-4%	4387	Thur	8/9/12	1,474	-39	8/9/12	78	112	93
4387	**Sat**	**8/10/13**	**1,481**	**69**	**8/10/13**	**76**	**104**	**89**		**-278**	**-19%**	4387	Fri	8/10/12	1,759	285	8/10/12	78	115	93
4387	**Sun**	**8/11/13**	**1,224**	**-257**	**8/11/13**	**76**	**105**	**86**		**-303**	**-25%**	**4387**	**Sat**	**8/11/12**	**1,526**	**-233**	**8/11/12**	**74**	**112**	**93**
4387	Mon	8/12/13	1,438	215	8/12/13	74	105	88		-227	-16%	**4387**	**Sun**	**8/12/12**	**1,665**	**139**	**8/12/12**	**77**	**109**	**92**
4387	Tue	8/13/13	1,456	18	8/13/13	77	108	91		-103	-7%	4387	Mon	8/13/12	1,559	-107	8/13/12	80	110	93
4387	Wed	8/14/13	1,406	-50	8/14/13	77	111	87		-25	-2%	4387	Tue	8/14/12	1,431	-128	8/14/12	79	108	93
4387	Thur	8/15/13	1,613	207	8/15/13	71	103	83		106	7%	4387	Wed	8/15/12	1,507	76	8/15/12	78	109	91
4387	Fri	8/16/13	1,287	-326	8/16/13	71	99	83		-395	-31%	4387	Thur	8/16/12	1,681	174	8/16/12	78	106	91
4387	**Sat**	**8/17/13**	**1,249**	**-37**	**8/17/13**	**72**	**95**	**83**		**-644**	**-52%**	4387	Fri	8/17/12	1,894	212	8/17/12	79	108	93
4387	**Sun**	**8/18/13**	**1,364**	**114**	**8/18/13**	**67**	**97**	**84**		**-186**	**-14%**	**4387**	**Sat**	**8/18/12**	**1,549**	**-344**	**8/18/12**	**72**	**98**	**85**
4387	Mon	8/19/13	1,390	27	8/19/13	69	101	85		59	4%	**4387**	**Sun**	**8/19/12**	**1,331**	**-218**	**8/19/12**	**71**	**93**	**79**
4387	Tue	8/20/13	1,332	-58	8/20/13	71	99	84		-95	-7%	4387	Mon	8/20/12	1,427	96	8/20/12	72	103	86
4387	Wed	8/21/13	1,296	-36	8/21/13	73	100	84		19	1%	4387	Tue	8/21/12	1,277	-150	8/21/12	73	97	82
4387	Thur	8/22/13	1,615	318	8/22/13	72	101	86		257	16%	4387	Wed	8/22/12	1,358	81	8/22/12	72	96	84
4387	Fri	8/23/13	1,324	-291	8/23/13	74	104	88		-309	-23%	4387	Thur	8/23/12	1,633	275	8/23/12	72	99	86
4387	**Sat**	**8/24/13**	**1,372**	**48**	**8/24/13**	**77**	**102**	**88**		**-34**	**-2%**	4387	Fri	8/24/12	1,405	-228	8/24/12	74	105	88
4387	**Sun**	**8/25/13**	**1,419**	**48**	**8/25/13**	**75**	**97**	**85**		**68**	**5%**	**4387**	**Sat**	**8/25/12**	**1,351**	**-54**	**8/25/12**	**78**	**103**	**88**
4387	Mon	8/26/13	1,383	-36	8/26/13	72	91	80		-192	-14%	**4387**	**Sun**	**8/26/12**	**1,575**	**224**	**8/26/12**	**79**	**105**	**89**
4387	Tue	8/27/13	1,240	-143	8/27/13	72	90	79		-331	-27%	4387	Mon	8/27/12	1,571	-4	8/27/12	76	104	89
4387	Wed	8/28/13	1,348	108	8/28/13	72	100	85		-96	-7%	4387	Tue	8/28/12	1,444	-128	8/28/12	78	103	88
4387	Thur	8/29/13	1,623	275	8/29/13	74	105	89		89	6%	4387	Wed	8/29/12	1,534	90	8/29/12	81	100	90
4387	Fri	8/30/13	1,401	-223	8/30/13	75	107	91		-310	-22%	4387	Thur	8/30/12	1,711	177	8/30/12	78	105	91
4387	**Sat**	**8/31/13**	**1,396**	**-4**	**8/31/13**	**75**	**106**	**90**		**-26**	**-2%**	4387	Fri	8/31/12	1,422	-288	8/31/12	76	108	89
4387	**Sun**	**9/1/13**	**1,469**	**73**	**9/1/13**	**75**	**107**	**89**		**-71**	**-5%**	**4387**	**Sat**	**9/1/12**	**1,541**	**118**	**9/1/12**	**79**	**106**	**89**
4387	Mon	9/2/13	1,444	-26	9/2/13	76	106	90		-183	-13%	**4387**	**Sun**	**9/2/12**	**1,626**	**86**	**9/2/12**	**75**	**109**	**90**
4387	Tue	9/3/13	1,327	-116	9/3/13	74	106	90		-283	-21%	4387	Mon	9/3/12	1,611	-16	9/3/12	76	110	91
4387	Wed	9/4/13	1,385	58	9/4/13	69	106	88		-96	-7%	4387	Tue	9/4/12	1,481	-129	9/4/12	78	111	91
4387	Thur	9/5/13	1,344	-41	9/5/13	71	102	84		-97	-7%	4387	Wed	9/5/12	1,440	-41	9/5/12	76	113	91
4387	Fri	9/6/13	1,609	265	9/6/13	73	102	86		102	6%	4387	Thur	9/6/12	1,507	67	9/6/12	75	110	92
4387	**Sat**	**9/7/13**	**1,257**	**-352**	**9/7/13**	**74**	**102**	**82**		**-436**	**-35%**	4387	Fri	9/7/12	1,693	186	9/7/12	75	113	93
4387	**Sun**	**9/8/13**	**1,304**	**47**	**9/8/13**	**72**	**94**	**81**		**36**	**3%**	**4387**	**Sat**	**9/8/12**	**1,268**	**-425**	**9/8/12**	**76**	**90**	**83**
4387	Mon	9/9/13	1,286	-18	9/9/13	71	97	79		1	0%	**4387**	**Sun**	**9/9/12**	**1,285**	**17**	**9/9/12**	**63**	**96**	**79**
			57,115			**2953**	**4112**	**3467**		**-4,252**	**-7%**				**61,366**			**3033**	**4225**	**3572**
			$5,997.08			**73.8**	**102.8**	**86.7**	**-3.0%**						**$6,443.43**			**75.8**	**105.6**	**89.3**

Test Unit (month view)



From: 09/02/2013 To: 09/21/2013

Test Unit (day view)



From: 09/07/2013 To: 09/12/2013