CASE STUDY:

SCHOOL / 'BOX' RETAIL / MULTI – HVAC BUILDINGS

(Health Club)

POWERBALANCE

Work consciously • efficiently • sustainably

Health Club Case Study

The following study for (Southern California) Health Club, a 80,000 ft^2 full service gym with 54 roof top HVAC units, illustrates the impact of the PowerBalance system on energy use and demand for a subset of the facility. Below is an outline of the Study's Methodology:

1. The analysis of the historical and current energy usage and demand to identify the specific energy savings opportunities
2. The integration of the proprietary PowerBalance system to control and manage the current HVAC system will lower energy usage and manage energy demand.
3. The use of motion sensors to lower energy usage when rooms are not occupied.
4. The management and control of non-critical energy usage to provide cost savings.
5. Payback period on this project is less than 18 months.

PowerBalance Energy ("PB") summarizes the current HVAC Study for the racquetball courts and a portion of the performance center, and highlights the process for expanding the PowerBalance system to the rest of the Health Club's HVAC units.

Purpose Behind the HVAC Study

Monitor and control six HVACs units which service 4 racquetball courts, the boxing gym, and a portion of the Performance Center, in order to estimate potential energy savings throughout the entire facility.

1. Installation of energy-use monitors on the six HVACs in July of 2012 to provide daily energy usage and demand data, i.e. when the equipment was turning on and off and the effect on combined energy usage and demand.

2. Control the same HVACs through the installation of motion detectors and HVAC thermostats integrated with the PowerBalance platform. *Please note that HVAC#3 (Gym and Hall) is not connected to PowerBalance to serve as a control for the study.*

3. Compare the pre and post control data to identify the potential energy savings based on the performance behavior of the subset of HVACs being monitored and controlled.

Historical Energy Monitoring Overview:

PowerBalacne has been monitoring the energy performance of the 6 HVACs since Mid-July 2012. The scope of observation allows us to see the system's energy performance across a range of seasons: Summer, Fall and Winter.

Peak Summer HVAC energy (kWh) consumption ranged from ~225 kWh per day to a maximum of ~650 kWh per day (see Chart 1). Peak Fall HVAC energy (kWh) use ranged from ~75 kWh to a maximum of ~375 kWh per day (Not Shown). Peak Winter HVAC energy (kWh) ranged from ~60 kWh to a maximum of ~110 kWh per day (Chart 2).

As expected, the energy use of the HVAC system varies with seasonal changes in outside temperature. And at the beginning of the observation period in July, after hour operation of the HVAC system (10:00 pm – 5:00 am) was fairly limited. However, by mid-October without any further changes to the system, we observed consistent operation of the HVAC system after hours. It is likely that this decrease in energy performance is caused by human interaction with the system, as set points are reset and program schedules are changed. This degradation in system performance is typical of most commercial real estate and confirms California Energy Commission studies documenting a 30% degradation in energy performance within a year of a building's commissioning

Historical Monitoring Conclusions

There is an opportunity to improve the energy performance of the HVAC system serving this portion of the facility. Two broad strategies were used to improve energy performance: peak demand management and off-peak / unoccupied energy use management.

PowerBalance Monitoring and Control Logic

First, the operation times were adjusted so that the HVACs turn off (set points raised to 80 degrees) during the club's non-operational hours. The system automatically resets manual overrides on a regular basis to ensure occupant interaction don't compromise energy savings.

Second, PowerBalance sequenced the HVAC operation so that no more than two HVAC compressors operate at the same time, plus the experimental control, HVAC #3.

Third, motion sensors were installed in the racquetball courts and boxing gym. We increased the temperature to higher set points (78 degrees) so the HVAC will not operate when the court is unoccupied. (Prior to PB, the set point was at 70-72 degrees whether occupied or not.) Now, when an individual enters the courts and is detected by the sensors, PB lowers the set point to a cooler temperature (72 degrees).

Lastly, every ten minutes, PowerBalance prioritizes and reacts to the HVAC operations based on the live data.

Analysis of the Pre and Post PowerBalance Data

PowerBalance drove significant summer time energy savings for the facility by dynamically managing the operation of the HVAC units based on occupancy and overall system power demand requirements. Per Chart 1, facility energy use in the Summer of 2013 was significantly (50%+) lower than in the base case 2012 data period. This improved energy performance was achieved without impacting tenant comfort, as facility did not report any increase in tenant space comfort complaints.

During the winter season, per chart Chart 2, PB was able to significantly lower the HVAC system load. Prior to the implementation of PB on January 23rd, the maximum seasonal usage was as high as 110 kWh. When PB was deployed on January 23rd, the maximum usage decreased to 40 kWh, which included the control HVAC #3 at a usage of 30 kWh of the new maximum of 40 kWh.

PowerBalance creates savings by limiting the peak (kW) HVAC system demand and mitigating unnecessary kWh usage. The energy (kWh) savings derives from ensuring that the HVAC system

only air conditions space when it is occupied. The combination of peak demand and usage management through PowerBalance, provides a marked improvement over the current schedule based operation of the HVAC system that only maintains set point during all club hours.

Savings on the demand side are driven by the PowerBalance sequencing of HVAC operations to mitigate peak demand. Chart 3 illustrates that maximum demand prior to the implementation of PB was 28.5 kW (Sum of all HVAC kW readings at 4:00 pm). Upon implementation of PB, the maximum demand was 12.5 kW (Sum of all HVAC kW readings at 4:50 pm, including the control HVAC #3 usage of 1 kW). Thus, maximum demand for these units was reduced by 16 kW (a savings of 56%). This serves as an example of the savings during the most expensive peak summer hours.

The Project Energy and Financial Performance Summary below illustrates the Project Budget and financial performance of the observed savings.

PowerBalance Energy Survey, 6 HVAC Units Controlled:

Hardware:	Replace 6 thermostats with network-Controlled thermostats	$150 x 6 =	$900
	PowerLinc / ISY control network and Phase bridging, hardware and set up		$1,550
	Universal Devises EM3 Power Monitor With CTs	$500 x 2 =	$1,000
Software:	PowerBalance Load Mgt and building Monitoring platform (per 6 units)		$100 / month
Labor:	Switching out thermostats, installing Monitoring and control equipment		$1,500
	TOTAL HARDCOSTS:		~ $5,000

PowerBalance Cost Savings (for 6 units)**:**

Total Annual Savings from PowerBalance:	$4,000

Total PowerBalance Cost:	**$5,000**
Total Project Annual Observed Savings:	**$4,000**
Simple Payback:	**~ 1.25 yrs**
Projected Annual Power Balance subscription fees:	**$1,200**
Projected Simple Payback (net of fees):	**~ 1.75 yrs**

PowerBalance Implementation Budget – Whole Facility:

Hardware:	Replace 54 thermostats with network-Controlled thermostats	$150 x 54 =	$8,100
	PowerLinc / ISY control network and Phase bridging, hardware and set up	3 x $1,550=	$4,650
	Universal Devises EM3 Power Monitor With CTs	$500 x 8 =	$4,000
Software:	PowerBalance Load Mgt and building Monitoring platform	free with 36 month subscription	
Labor:	Switching out thermo-stats, installing Monitoring and control equipment		$3,250
	TOTAL HARDCOSTS:		~ $20,000

PowerBalance Cost Savings – Whole Facility:

Total Annual Electric Cost:		$168,000
Total Annual HVAC Cost: (40% of total use):		$ 67,200
Estimated Savings (50% - observed savings were 55%):		$ 33,500
Simple Payback:		less than 9 months
Annual PowerBalance Subscription Fee (Facility will require 5 PowerBalance units for 54 HVAC units):	5 x $2,400 =	$12,000
Simple Payback (net of subscription fees):		**~ 1 year**

Below, please find charts illustrating the facility's energy use and the savings generated by PowerBalance.

Appendix A: Energy Use and Demand Charts

Chart 1: Pre- and Post Power Balance Energy Use: July - August 2013 vs. July - August 2012

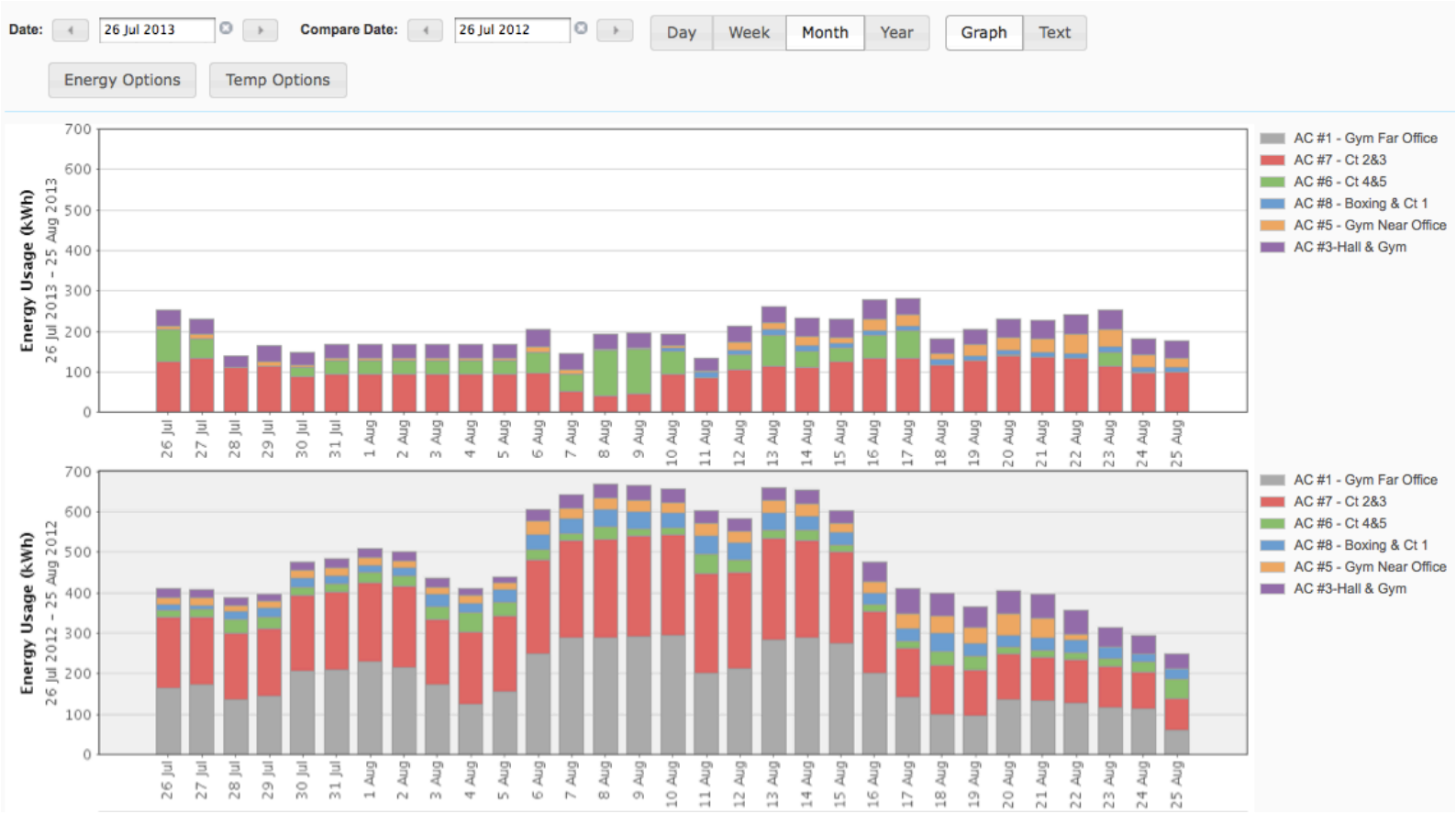

Chart 2: Pre and Post H Energy Use: Dec. 22 – Jan. 22 vs. Jan. 23- Feb 20, 2013

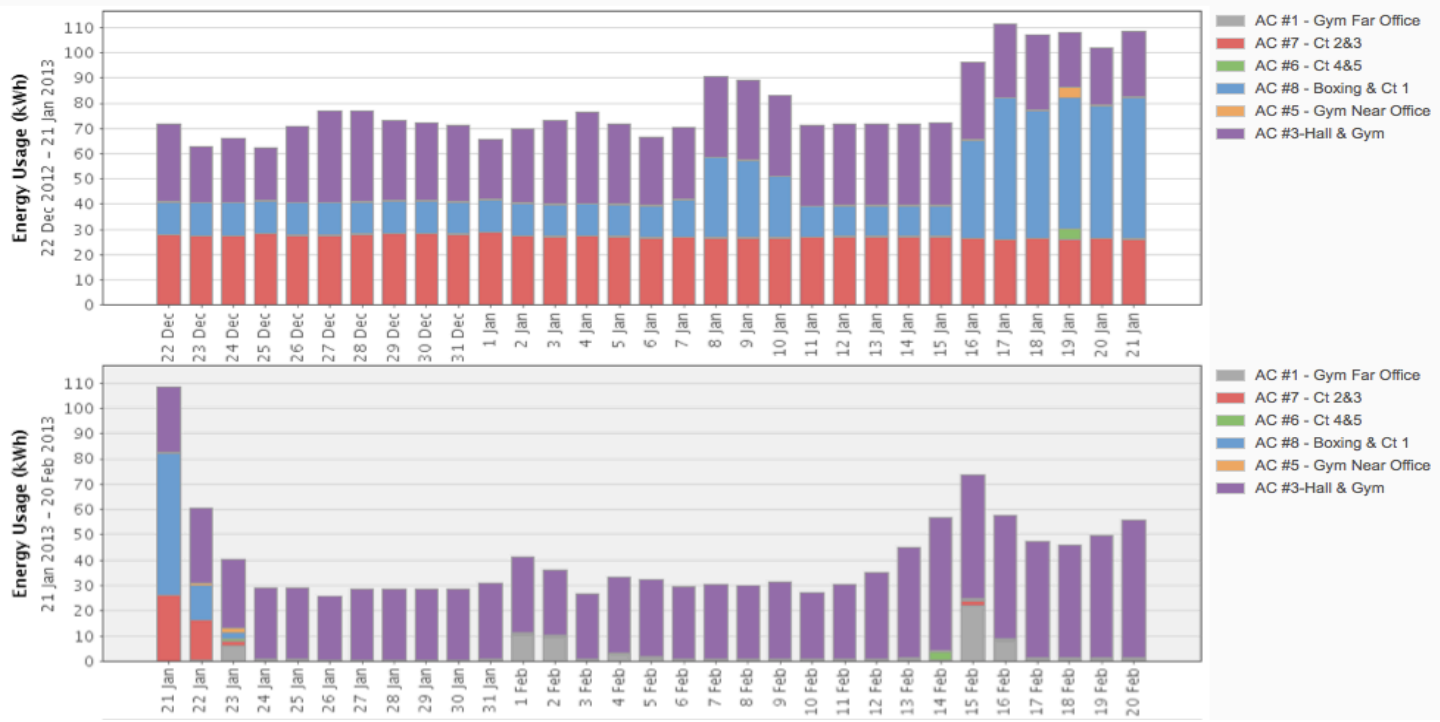

Chart 3: Pre and Post POWERBALANCE Power kW Demand