Power Trend Management System

Case Study

This document discusses a recent PTM system beta test project. The beta phase has concluded positively, and the client has opted to keep on being a PTM system user.

The client is a medium-sized mall in Alberta, Canada. Their facility energy usage for May, 2002 was 228,557 kilowatt-hours. Per hour, that averages out to 316 kilowatts. There are moments in time when the facility was drawing 543 kilowatts. The power company charges $6.71 per kilowatt for delivering energy at this rate. This was seen as a good place to apply a small scale beta test PTM system.

In a perfect world, this client would only have to pay for a demand rate that is equal to the average monthly power. This is too much to expect. Instead, a goal was set to improve their average monthly power efficiency. The *before* analysis of power efficiency was 65%.

A power trend management system was installed in summer of 2004 and made operational by September 1. Five large HVAC loads were hooked up for monitoring and power trend management. One year later the financial benefits were assessed, along with the intrinsic benefits:

1. From September 2004 to April 2005 the PTM system had little to do except monitor facility power. There were times when the incoming voltage exceeded specified limits. The HVAC units were kept from turning on until the utility voltage returned to normal for 15 minutes continuously.
2. Certain HVAC units are both heating and air conditioning units. The PTM system revealed that two units were not completely installed. It turned out that their thermostats were wired for heating only. This was corrected in spring of 2005 and these air conditioning units are now operating properly under PTM control.
3. There is a large central air conditioning system that covers the retail shops in the mall. When it was time for this unit to start working it was found to not be in good working order. This is typical for this old air conditioning system each spring. During testing the air conditioning technicians cycled the 100 kilowatt unit off and on five times within a ten minute time span. The PTM system revealed this by issuing an alarm. Mall management was able to implement policies governing technician activity that will save money in the future.
4. The PTM system has almost paid for itself in the first 12 months through preventive measures. After the central air conditioning unit was rebuilt a defect had developed in its thermostat control circuits. The unit was stuck on, running 24 hours a day. The PTM system revealed this and the necessary repairs were made by the technicians. By revealing this fault the PTM system prevented excessive energy usage that could have cost the facility management $27,000 over the summer months. This is more than 75% of the retail value of their PTM system.
5. The central air conditioning unit compressor attempted to turn on and one phase was not conducting properly. The PTM phase imbalance fault detection tripped the unit and locked it out. The main contactor was found to be faulty and was replaced. Without this feature the compressor motor may have sustained heavy damage to its

windings. A significant amount of energy would have been spent in the process, a sum that could have reached a few hundred dollars.

6. Despite the aforementioned impairments, the PTM system was found to have increased the mall's average power efficiency from 65% to 73%. This caused a lower peak demand to be locked in during the summer months. This equates to a demand charge saving that exceeds the monthly lease payment by 36% for the next 12 months.
7. Several utility power outages have happened over the course of the year. The PTM system remains operational on its own UPS during power outages. When the utility power was restored the PTM system allowed the HVAC loads to power up in a controlled manner that prevented setting a new demand peak. This also helped the electrical utility by having less of a cold-start load at the mall.
8. The PTM system is providing the following report data:
   - monthly peak demand (KW) forecast
   - monthly energy (MWH and megajoules)
   - unit run time hours
   - unit load duty cycle (issues an alarm if it exceeds a set limit)
   - unit fault forecast: overcurrent trip in XX hours
9. The PTM system provides the following basic unit protection:
   - over-current fault sensing and trip
   - over-voltage fault sensing and trip
   - under-voltage fault sensing and trip
   - phase imbalance fault sensing and trip
   - duty cycling monitoring and regulation

Summary

Power trend management is helpful as long as it covers its own cost and does not interfere with “business as usual.” The retail mall's PTM system sits in a locked utility room and works away with minimal human intervention. Office staff go in to check the alarms from time to time. An alarm lamp and soft beeper are to be installed in their main office area to let them know when the system needs a visit from a human.

A current sensor failed in early July and required replacement. It failed in such a way that caused the HVAC unit to be locked out unnecessarily. The unit controller was powered off by the mall's own maintenance technician. This allowed normal HVAC operation to resume immediately. The defective part was replaced within 24 hours and the HVAC unit was again under PTM control.

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