The Human Element must be considered when Energy Efficiency is used as a Resource

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Ecos

Company Snapshot

- Energy Efficiency & Sustainability Services
- Offices in Portland, Seattle, San Francisco and Durango
- National leader in Energy Management
- Founded in 1997, Recently Acquired by advantage IQ™
  - Largest U.S. provider of utility bill payment services
- Notable Ecos clients:

Coca-Cola
Pacific Gas and Electric Company
IBM
Northwest Energy Efficiency Alliance
NORPAC
Kendall-Jackson
NRDC
Department of Energy
Ocean Spray
APS
PSE Puget Sound Energy
EnergyTrust of Oregon, Inc.™
NVEnergy
Yellowstone Park Foundation
Natural Resources Canada

Typical Energy Efficiency Measures

- Typical energy efficiency measures involve installing new equipment, hardware, or control system that will allow users to meet operations needs but consume less energy than the equipment currently installed (baseline)
- Basic calculation for energy savings:

(Current energy use (kW) – new energy use (kW)) x hours of operation per year x expected life of measure in years = energy savings

- Simple Example: a existing light uses 400W and operates 4,000 hours per year; the proposed replacement light uses only 200W, operates the same hours per year, and is expected to have a life of 5 years (20,000 hours)
- Thus: (400W-200W) x 4,000 hours x 5 years = 4,000 kWh savings

Implied Assumptions of Typical Energy Measures

- Hours of operation are constant for the life of the measure
- The savings will continue for the full estimated life of the new equipment / hardware
- These are based on the core assumption: No changes to user operation will either end the measure prematurely, or change the current hours of operation

Core Problem:

- Real world is full of change – at any time a human error or intentional action can reduce or increase actual energy savings from a measure
- For Energy Efficiency to be treated as a Resource – equivalent to new power generating capacity - the human element must be considered

Commercial Example

- Four Story office building, 400,000+ Square feet, built in 2002
- Built with multiple energy efficiency measures
  - 100% outside air economization for “free cooling”
  - Automated, integrated building controls with occupancy sensors and time of use settings (night and weekend set-backs)
  - Heated with hot water that recovered waste heat from adjacent factory

Commercial Example

- Building was fully commissioned to ensure all equipment and controls were operating as designed
- Project received utility incentive funding for energy efficiency measures

Problem

- Two years after the building was occupied, original design team was participating in a walk-though of the building
- Building control systems was discovered to be operating in manual mode
  - Economization was disabled – system held constant at minimum outside air
  - Occupancy and scheduled (night and weekend) setbacks were disabled
- Maintenance had by-passed controls to enable adjustment of a terminal unit to meet comfort needs of a single (but very vocal) worker

Commercial Example

Root Cause of Problem

- Maintenance staff and management had no visibility or responsibility for building energy performance
  - No building electrical sub-meter was installed
  - Finance paid utility bills for entire campus and allocated costs based on space allocations (business groups with more office space received larger share of bill).
  - No one was responsible – or had visibility – to energy performance of building as a whole
- Maintenance staff was held accountable for occupant comfort and service – thus the need to respond to “hot / cold calls”
- Maintenance staff was not adequately trained on control system to make the needed adjustments to terminal unit and still enable building to operate in automated energy saving mode

Estimated financial impact: > $200,000

Industrial Example

- Large food processing facility with own waste water treatment facility
- Large, multi-stage air blower used to push air through water to provide oxygen for microbial digestion of sugars
- Utility provided incentive funding to replace blower inlet damper flow control (choke flow) with a Variable Speed Drive (VSD) motor control

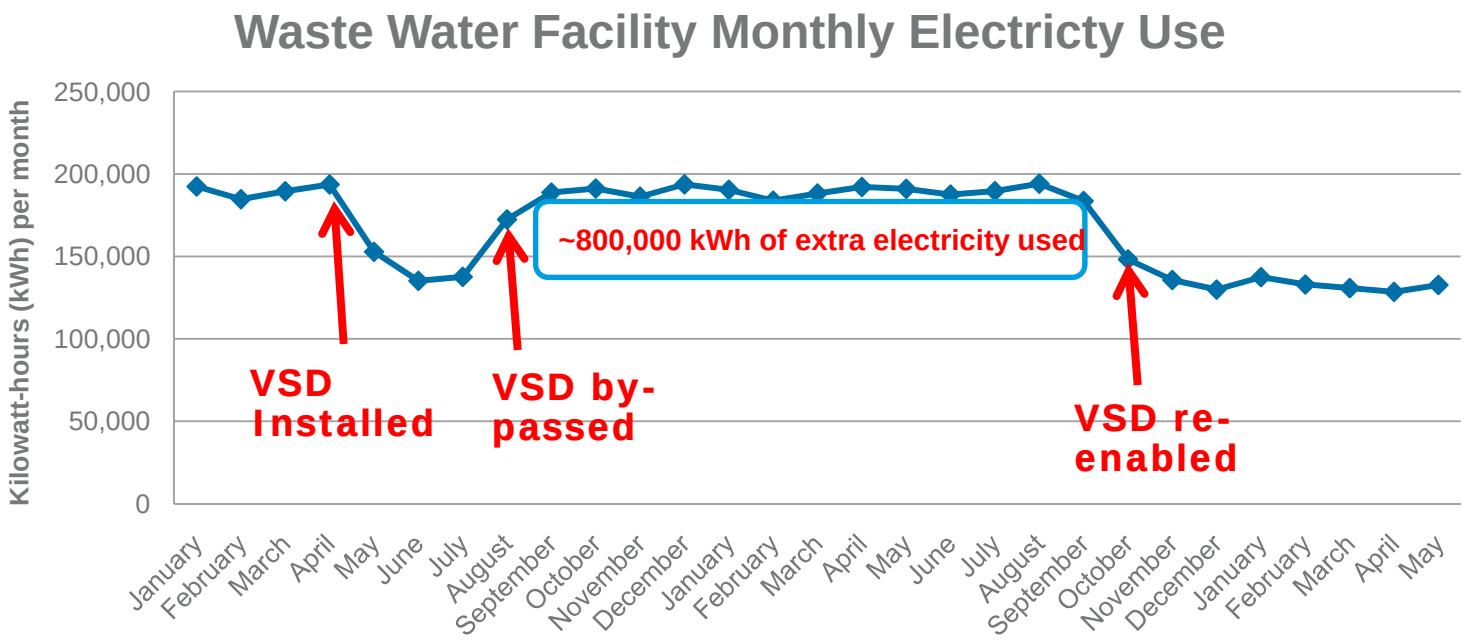
Problem

- A few months after initial start up of VSD, one operator was unable to properly control water oxygen level so VSD was by-passed and blower was manually reset to full power
- Facility energy use was not managed at that time so blower continued to operate with VSD by-passed for over a year

Industrial Example

Discovery of Problem

- Food processor implemented an Energy Management Program
- Energy team worked with utility to review historical energy use data
- Data indicates when VSD was first installed, when it was by-passed, and when it was returned to automatic operation



Proposed Solution

If Energy Efficiency is to be treated as a reliable resource for capacity to replace new generation then:

- All measures should be regularly monitored after installation for the lifetime of the measure
  - This does not require incremental data or utility direct involvement
  - One time – post installation verification is inadequate
- This will require an active and effective Energy Management Program by the customer
  - To meet the needs of verified persistence of savings the Energy Management program must be able to determine if a EE measure is performing as intended or not
  - If a measure is not performing, the Energy Management systems needs to have the tools and resources to make corrective actions
- This program is very cost effective – it ensures energy savings actually happen and may facilitate additional savings over time

Does NOT require more Utility Evaluation Programs

- The key idea is that it is in the customer's best interest to ensure energy efficiency measures continue to operate properly
- Utility needs to ensure customer has management practices in place to monitor the long term operation of measures
- The utility should require customers to provide updates on the operations of previously funded measures prior to awarding funds to new measures
- Use the continuing long term relationship between the utility and customer to ensure measures continue to provide savings – not new evaluation programs - to check on measures 5, 10, or 15 years after they are installed

ISO 50001 Energy Management

- International Standard Organization (ISO) 50001 Standard for Energy Management Systems to be released December 2010:
  - Standard defines how organizations integrate energy efficiency into their business practices
  - Could influence savings of up to 60 percent of world's energy use
  - Complements ISO 9001 Quality and ISO 14001 Environmental
- Ecos is working with DOE, EPA, and ANSI to create the Standard

"ISO 50001 is expected to similarly achieve major, long-term increases in energy efficiency"

Rob Steele, ISO Secretary-General

Effective Energy Management

- Iterative process based on:

  Plan-Do-Check-Act

- Management Systems to facilitate understanding and improving how people affect:
  - Energy Cost
  - Energy Productivity
  - Non-Energy Benefits