



Ongoing Commissioning Through an Operations and Maintenance Contract

enovity







Ongoing Commissioning

Through an Operations & Maintenance Contract


- Introduction
- Different approaches for RCx projects
- Different approaches for facility upgrade projects
- Case Study – Phillip Burton Federal Building
- Conclusions
- Q&A

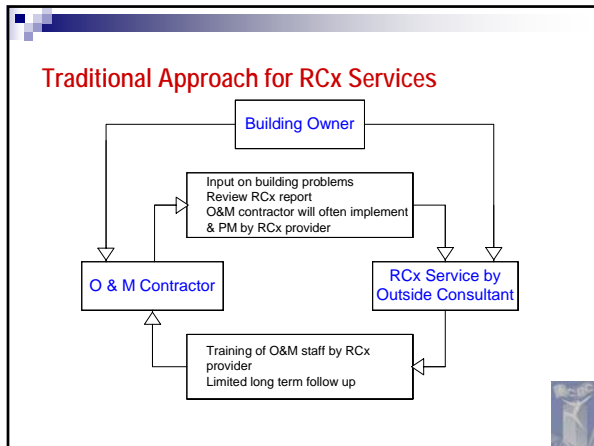


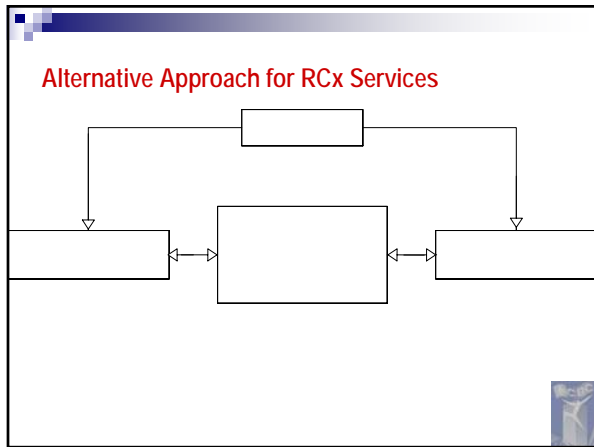


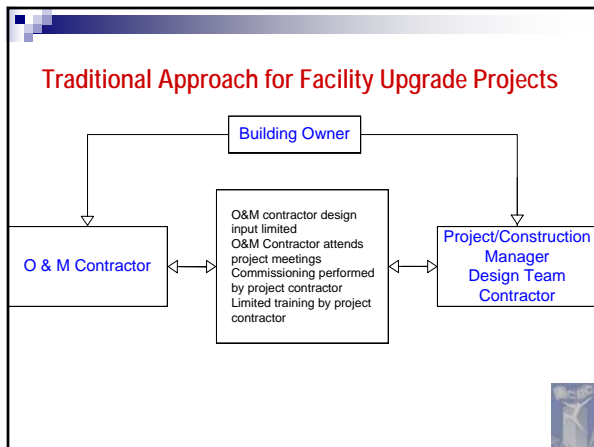
Introduction

- Every building needs operations & maintenance (O&M) contractor
- Traditional role of the O&M contractor
- More comprehensive role for O&M contractor offers many advantages



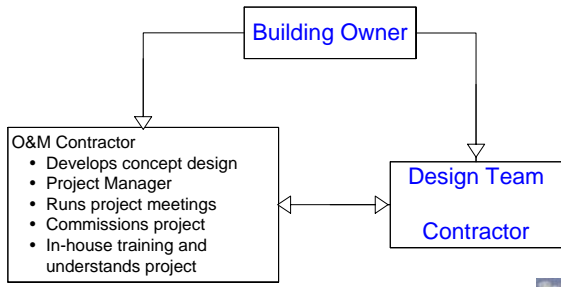






Building Owner

Alternative Approach for Facility Upgrade Projects



Case Study: Phillip Burton Federal Building



Case Study: Phillip Burton Federal Building

- Largest federal office building and courthouse west of Mississippi
- Constructed in 1963
- 1.4 Million sq.ft, over 20 stories and two basement levels
- Enovity principals have participated in projects since 1997
- Enovity has been involved with projects and building operations since Enovity was founded in May 2002
- Enovity has held full operations and maintenance contract since January 2004

Phillip Burton HVAC Systems

- Central cooling plant: 3 centrifugal chillers with primary variable flow CHW distribution
- Central heating plant: 3 gas fired hot water boilers with primary variable flow HW distribution
- Eight (8) VAV dual duct air handlers
- Over 1200 VAV boxes
- Many smaller single zone and multi-zone CV air handlers



Phillip Burton Control Systems

- Alerton Envision BACnet DDC system
- First commercial demonstration of BACnet
- Incorporates ALC Webctrl for VAV boxes on Floors 3, 4 & 5
- Interfaces with Square D PowerLogic system & Carrier BAClink
- Interface with Simplex fire alarm system in progress



Phillip Burton Electrical Systems

- Primary 12.5 kV electrical supply
- Two 12.5 electrical feeds with two main substations connected by tie breaker
- Six (6) additional double ended 480 volt substations with 12.5 kV/480 V transformers
- Two building back-up generators



Highly Trained Building Operations Staff

- Chief Engineer is a degreed engineer and has controls engineering P.E.
- Lead stationary engineer has a degree in mechanical engineering
- Operations manager and chief engineer have completed full Alerton factory training
- Other staff have attended numerous seminars, workshops & training
- Key staff involved in other projects outside of Phillip Burton to gain experience
- Operations manager and chief engineer have completed full Alerton factory training
- Self sufficient in all aspects of DDC controls and very little support needed from local controls company



RCx Projects at Phillip Burton

- RCx completed by Facility Dynamics in 2003 & Systems Manual produced
- RCx completed by Enovity in 2005 with energy focus



RCx Project by Enovity

- Enovity a RCx provider under the state wide BTU program
- GSA requested the services of Enovity for Phillip Burton and other California GSA buildings
- Enovity professional engineers worked with Enovity O&M staff to commission systems
- No barriers between O&M staff and RCx provider



RCx Process

- Scoping audit: very straightforward as intimately familiar with building, system problems and energy opportunities
- Detailed investigation: O&M staff available and willing to assist with pre-functional and functional tests
- Implementation phase: easy contracting mechanism for owner, all work self-performed by Enovity

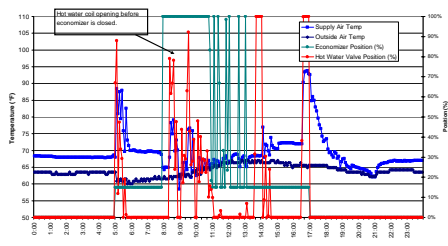


RCx Measures Low Cost

- Static pressure and temperature reset on main air handlers
- Optimize chiller staging
- Return fan control on main air handlers
- Economizer controls on small single zone and multi-zone air handlers
- Optimum start routine for main air handlers
- Revised equipment schedules for smaller air handlers



Economizer Sequence for Small Air Handler

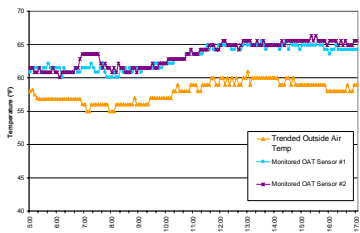


RCx Measures Medium Cost

- Install economizer fans for penthouse air handlers
- Install CO sensors in garage and VFDs on garage exhaust fans
- Install VFDs on outside air supply/exhaust fans for basement areas
- Re-evaluate VAV box minimum settings



Economizer Fans



Ongoing Commissioning

- Help ensure RCx measures remain implemented over time
- Identify new problems and sources of energy waste
- Predictive maintenance tool
- Prevent control sequences from being overridden over time
- Monitor equipment performance



Phillip Burton Building Ongoing Cx Tools

- Performance and Re-commissioning Analysis Tool (PACRAT) developed by Facility Dynamics
- Fault Detection and Diagnostic (FDD) tool developed by National Institute for Standards and Technology (NIST)
- Square D PowerLogic Electrical Monitoring System



PACRAT Methodology

- First automated diagnostic tool for HVAC system performance
- Mines trend data from building automation system
- Analyzes data through custom written algorithms
- Produces anomaly reports for specific HVAC systems
- Looks at trend data over time and develops anomalies that are consistent not momentary



PACRAT at Phillip Burton

- GSA hired the services of FDE to install and run PACRAT
- Installed on twelve (12) systems: eight main air handlers, three chillers and chilled water distribution system
- Generates anomaly reports every 3 months for each system
- FDE discusses anomaly reports with Chief Engineer
- Anomaly reports tied into Computerized Maintenance Management System (CMMS) work order system



Sample CMMS PACRAT Work Order

Number: 0041302
Description: 200V 4-800V deck supply air temp deviation from setpoint
Location: Phillip Burton F10P20 / Rm 200N-PL100M
Equipment: C-1 Air Handler 200V/142 DDC Sensors
Reported By: PACRAT
Reported Date: 4/10/2008 12:00 PM
Type: Corrective Maintenance
Priority: 3
Status: Open
Contractor: ENOVITY
Function: HVAC
Priority: N/A

FDD Tool Methodology

- Written into the HVAC system DDC code
- Generates an alarm on the BAS when a parameter is out of range
- Alarms generated in real time, but consider error over time

FDD Tool at Phillip Burton Building

- FDD tool running on approximately 1000 Alerton VAV boxes
- Programmed to pick up seven different faults
- FDD tool being used as predictive maintenance tool
- In process of installing FDD on small single zone air handlers
- Creates an alarm on the BAS which is automatically turned into a CMMS work order

Sample CMMS FDD Work Order

The screenshot shows a GSA CMMS FDD Work Order form. The form includes fields for: Number (1403307), Description (LINE ITEM: Alarm Code: 1000 PV104 High Edge Temperature Alarm), Location (Fuldy Bldg / FURD / RM 7E-24), Reported By (SAS), Reported Date (2/22/06 1:52 PM), Task (), Est Val (), Labor Hrs (0.30), Material Cost (), Removable (), Priority (), Status (), Time (), Priority (), Has Followup (), Parent (), Agency (), Phone (), Contract (), Actual Start (2/22/06 8:52:00 AM), Actual Finish (), Problem (), and Cancelled By ().

Square D PowerLogic

- Monitors Over 50 Electrical Loads in the Building
- Energy use and power quality can be tracked
- Generates alarms that are integrated with Alerton BAS
- In process of developing automated monthly energy reports

Square D PowerLogic Graphic

Phillip Burton Facility Upgrade Projects Completed

- Provided design and construction management for elevator standby power project
- Provided inspection and commissioning services for cooling coil replacements on main air handlers
- Provided concept design and construction management services for electrical substation retrofit



Phillip Burton Facility Upgrade Projects in Progress

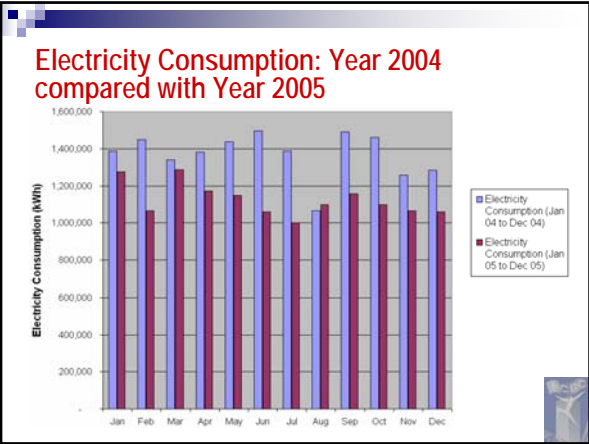
- Developing detailed concept design for a co-generation plant
- Providing construction management and inspection services for lighting energy project
- About to turnkey some lower cost energy efficiency HVAC projects

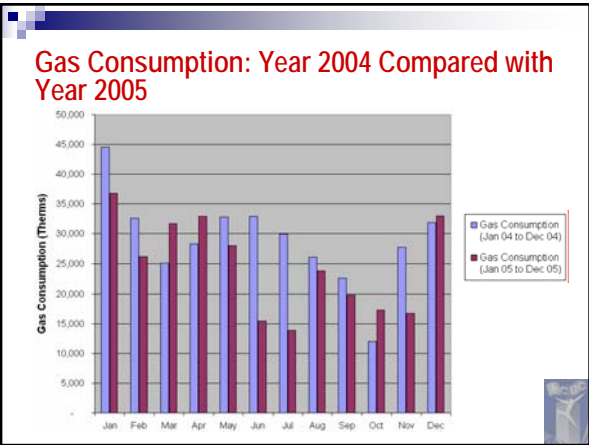


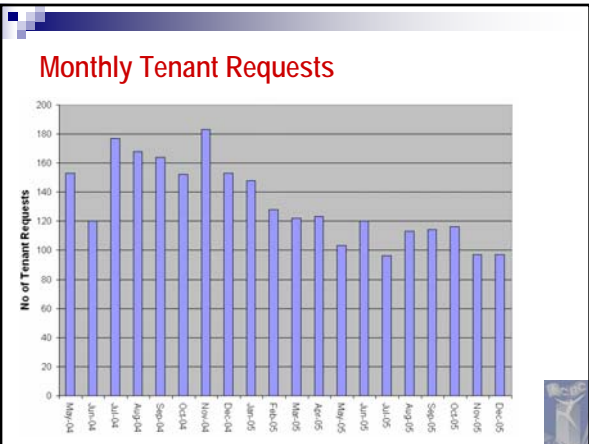
Improvement in Building Performance

- 18% reduction in electricity consumption in Year 2005 compared with Year 2004
- 15% reduction in gas consumption in Year 2005 compared with Year 2004
- Building comfort has improved and there have been fewer tenant requests
- Third party inspections of building have been favorable









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Conclusions

- An empowered O&M contractor can offer cost effective professional services for owner
- In O&M contractor's self interest to ensure that systems operate in the most efficient and optimized manner
- Requires a committed building owner





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Enovity is a commissioning provider and a member of the Southwest Chapter of the BCxA. The firm specializes in commissioning and r-Cx, facility operations & maintenance, and energy engineering, with a staff of professional engineers, OM&R engineers and building technology specialists. The firm is a licensed contractor and a member of the USGBC.