

Federal M&V Summit

April 21st – 23rd, 2004, Washington, D.C.

Effective Measurement & Verification of Savings with little to no Metering

Bonnie Piest
Project Development Engineer
Johnson Controls, Inc.

Venkat Kumar
Solution Design Manager
Johnson Controls, Inc.

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Effective M&V of Savings with little to no Metering

- Project Summary
- ECM Summary
- Summary of M&V Activities & Savings Analysis – By ECM
- Summary of M&V Results for Years 1 through 4
- Critical Success Factors

Effective M&V of Savings with little to no Metering

Project Summary

- Project Investment of \$4.43 million
- Contract Term of 19 yrs, ECMs Simple Payback of 8.5 yrs
- Year 1 Estimated Annual Savings of \$528,724
 - Year 1 energy savings of \$208, 774
 - Year 1 O&M savings of \$319,950
- Term Guaranteed Savings of \$12,739,694
- Performance Period Services include Operation Oversight, Maintenance Oversight, M & V
- Customer Required Flexibility to make mission changes, building additions, modifications, etc.

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ECM	Title	ECM Summary	M&V Methodology
1.1	Replace Boilers with New Steam Production System	Remove existing high pressure water tube boilers and replace with oil thermal transfer steam generation system	Generic Variable Load (GVL-B-01)
3.1	EMCS, Controls Upgrade & Life Safety Supervisory System	Extend EMCS to provide operating room served by AHU-6 of Building 200 with automated data gathering and energy reductions, recondition dampers, and replace base fire alarm system & integrate w/ EMCS	Constant Load Motors (CLM-A-01), Generic Variable Load (GVL-C-02)
3.2	Replace Medical Air Compressor	Remove three existing 25-hp air compressors and replace with two new 40-hp rotary air compressors	Generic Variable Load (GVL-B-01)
4.1	Replace Cooling Coils	Replace cooling coils in air-handling system AC2 and AC3 of Building 203 due to loss of heat transfer performance and excessive pressure drop resulting from corrosive material buildup on coils.	Constant Load Motors (CLM-A-01)
5.1	Lighting Retrofit	Remove and recycle existing lamps and ballasts. Install new high-efficiency lamps and electronic ballasts. Retrofit or replace existing fixtures with higher efficiency fixtures and install lighting controls	Lighting Efficiency (LE-A-02), Lighting Controls (LC-A-01)
8.1	Motor Efficiency Upgrade	Replace all existing electric motors with high-efficiency motors where payback is 9 yrs or less.	Constant Load Motors (CLM-B-01)

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Summary of M&V Activities and Savings Analysis – ECM 1.1

ECM 1.1: Replace Boilers w/ New Steam Production System – M&V Activities

- Instantaneous input kW measurements while equipment is operating at the system design temperature and pressure:
 - Four 40-hp transfer oil pump electric motors
 - Four 15-hp combustion air blower fan motors
 - Four 3/4-hp heat recovery circulating pump motors
- Run time of Oil Circulating pumps through Metasys
- Record Steam Production
- Record Natural Gas Consumption

ECM 1.1: Replace Boilers w/ New Steam Production System – Analysis

- Calculate kWh post-retrofit consumption, calculate post-retrofit boiler plant efficiency
- Compare with validated & agreed-to baseline information to determine savings

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Summary of M&V Activities and Savings Analysis – ECM 3.1

ECM 3.1: EMCS Upgrade & Life Safety Supervisory System – M&V Activities

- EMCS Annual Evaluation and Checkout of Calibration, Programming, Strategies
- AHU-6 & EF-5 Building 200 / Operating Room Controls – Verification of AHU motor occupied & unoccupied schedule, frequencies of VFD, kW of VFD
- AHU-1, Building 210 - Verification of AHU motor occupied and unoccupied schedule, frequencies of VFD, kW of VFD
- Damper Reconditioning – Verification of damper position schedule and damper actuation (once a day) to minimize “sticking “ due to corrosion
- Base Loop Fire Alarm System – No annual verification activities

ECM 3.1: EMCS Upgrade & Life Safety Supervisory System – Analysis

- Calculate kWh post-retrofit consumption, where applicable
- Compare with validated and agreed-to baseline information to determine savings

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Summary of M&V Activities and Savings Analysis – ECM 3.2

ECM 3.2: Replace Medical Air Compressors – M&V Activities

- Annual high pressure air-flow test to determine air delivery rate of the compressors using a (Aerometrix) compressed air-flow meter
- Annual compressor motor kW measurements during the air-flow test
- Verification of compressor operating hours using unit mounted microprocessor

ECM 3.2: Replace Medical Air Compressors – Analysis

- Correct measured air-flow rate to account for temperature
- Calculate annual kWh consumption for compressors using measurements
- Calculate air-delivery rate per kWh
- Calculate compressor efficiency savings by prorating baseline compressor kWh consumption with improved air delivery rate
- Compare with validated and agreed-to baseline information to determine savings

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Summary of M&V Activities and Savings Analysis – ECM 4.1

ECM 4.1: Replace Cooling Coils – M&V Activities

- Measurement of instantaneous input kW on AC-2 and AC-3 using handheld power meter
- Annual (pitot-tube duct traverse) air-flow measurements on AC-2 and AC-3
- Differential static pressure across cooling coils AC-2 and AC-3 continuously monitored.
- Field verification of differential static pressure w/digital hand held manometer

ECM 4.1: Replace Cooling Coils – Analysis

- Calculate motor bhp using measured airflow and measured static pressure drop
- Calculate electricity consumption using stipulated operating hours
- Compare with validated and agreed-to baseline information to determine savings

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Summary of M&V Activities and Savings Analysis – ECM 5.1

ECM 5.1: Lighting Retrofit – M&V Activities

- Measurement of instantaneous input kW on sample of retrofit fixtures using handheld power meter
- Measurements taken with participation of customer personnel
- Installed lighting equipment and occupancy sensors inspected
- Small quantities of burnt out lamps noticed and identified to customer

ECM 5.1: Lighting Retrofit – Analysis

- Extrapolate Sample measurements to total fixture population of scope
- Calculate electricity consumption using stipulated operating hours
- Compare with validated and agreed-to baseline information to determine savings

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Summary of M&V Activities and Savings Analysis – ECM 8.1

ECM 8.1: Motor Efficiency Upgrade – M&V Activities

- Measurement of instantaneous input kW on all motors using handheld power meter
- Measurements taken with participation of customer personnel
- Motors operating at reduced speeds due to VFDs and changed baseline conditions identified

ECM 8.1: Motor Efficiency Upgrade – Analysis

- Calculate electricity consumption using stipulated operating hours
- Compare with validated and agreed-to baseline information to determine savings

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Summary of M&V Results for Years 1 through 4

Project Energy Savings to Date

Yr End of Jan 31	kWh per year	Therms per year	Equiv. mmbtu / yr
2001	2,291,651	98,966	17,720.28
2002	2,244,695	136,932	21,356.58
2003	2,329,127	139,603	21,911.96
2004	2,327,795	136,033	21,550.41
Total	9,193,268	511,534	82,539.24

Project Cost Savings to Date

Year End of Jan 31	Proposed Estimated Cost Savings	Guaranteed Cost Savings	Actual Cost Savings
2001	\$528,724	\$507,575	\$517,973
2002	\$544,586	\$522,802	\$544,987
2003	\$560,924	\$538,486	\$568,684
2004	\$577,751	\$554,641	\$584,160
Total	\$2,211,985	\$2,123,504	\$2,215,804

Proprietary Information - JCI

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Critical Success Factors -

- Simplification of Contract M&V and Service Activities such that it is understood clearly by customer facilities personnel
- Good communication between JCI Performance Assurance Specialist (PAS), Customer and JCI Service Team, e.g. the use of calendar of proposed service activities
- Frequent Visits to maintain interaction with customer and be aware of ongoing changes to facilities, improvements, etc.
- Calibration of Measurement Equipment Used