

Charting a Course to Energy Independence

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Stronger, Faster, Cheaper M&V:
Standardized M&V Templates

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Overview

- Context / Need / Purpose of M&V
- Development process—
 - ☐ Working group approach
 - ☐ Key considerations
- End Results —
 - ☐ 2 M&V Plan Templates
- Current status and next steps



Importance of Measurement & Verification

- M&V is the core of an ESPC
 - ⊕ Energy Saving Performance Contract
- Without M&V, it is not a performance contract!
- M&V is the basis for any “guarantee”
- M&V provides integrity and confidence in the Program



M&V in ESPCs

M&V ensures:

- Government gets what it pays for
 - ☐ Projects are paid for from realized energy savings
- Savings persist
 - ☐ Issues affecting performance are addressed
 - ☐ Proper Operations & Maintenance activities are conducted



M&V Plan Content

Comprehensive & Detailed :

- ☐ Energy and cost savings calculation methods
 - Engineering details

- ☐ Data collection and site activities for the life of the project:
 - Inspections, measurements, reports, government oversight
 - Baseline, Post-installation, Annual / Periodic

- ☐ Verification and reporting responsibilities for ESCO and Agency on:
 - Operations, preventive maintenance, repair, and replacement



M&V Plans Issues

Common issues include:

1. Consistency in content & format
2. Ensuring minimum level of rigor
3. Balancing technical rigor with cost
4. Allocating risk fairly
5. Ability of Agency to evaluate approach



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Solution to #1: consistent content and format

☐ Mandated format and content for M&V plans and reports

- First included in 2004 IDIQ
- Developed via Working Group



Standardized M&V Approaches

Remaining issues:

1. Consistency in content & format
2. Ensuring minimum level of rigor
3. Balancing technical rigor with cost
4. Allocating risk fairly
5. Ability of Agency to evaluate approach



Standard Plans Working Group

Solution:

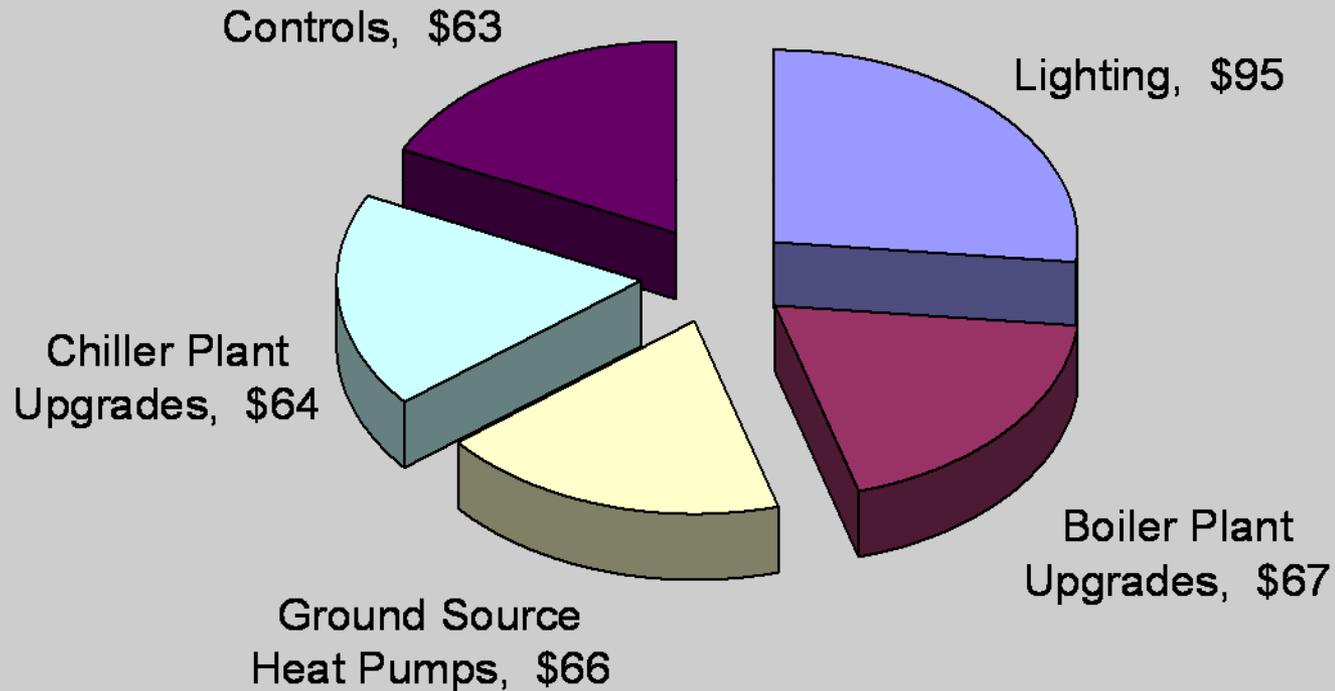
- ☐ Develop prescriptive M&V templates for most common ECMs

Collaborative Approach:

- ☐ Included ESCOs, DOE, Agencies
- ☐ Fall 2006 to Winter 2008



Top 5 ECMs - Millions \$ Invested





Selected ECM - Lighting

- Lighting Replacements
 - ☐ Retrofit or replace lighting fixtures
 - ☐ No controls changes
 - ☐ HVAC interactions ignored
 - ☐ Annual savings \geq \$100,000





Selected ECM – Chiller

- Chiller Replacements
 - ☐ One-to-one replacement of medium to large size chillers (~650 tons)
 - ☐ Provisions for changes in load, controls, peripherals
 - ☐ Annual savings \geq \$30,000





Results!



**Standard Measurement & Verification Plan
for
Lighting Equipment Retrofit or Replacement Projects
Conducted Under DOE's Super ESPC Program**

Revised January 15, 2007

Federal Energy Management Program (FEMP)
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy



**Standard Measurement & Verification Plan
for
Chiller Replacement Projects
Conducted Under DOE's Super ESPC Program**

FINAL
Approved by ESPC Steering Committee
6/05/08

Federal Energy Management Program (FEMP)
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy



Advantages of Standard M&V Plans

- Uses best-practice approaches
- Technical details aligned with typical risk allocation
- Easy to understand and review



M&V “Templates”

- Detailed instructions
- Fill-in sections for the project details
- Step-by-step instructions for complex engineering



Fill-in the blank format

Table 3-2: Fixture Power Measurements – Types, Monitoring Points, Results

Fixture Type*	Number of fixtures	% of Baseline Lighting kW**	Table Power, W	Number of Measurements	Average Measured Power, W	Std Dev, W	Actual C _v	Precision at 90% confidence
F41ES	73	2%	48	11	52	8	0.15	8%
F42ES	60	2%	82	11	86	10	0.12	6%
F44ES	1,339	87%	144	11	140	18	0.13	6%
I75/1	103	4%	75	11	73	5	0.07	3%
Totals	1,575	97%						

[**Minimum of 75% baseline kW required]



Step-by-Step Engineering

1. Baseline Phase

Data Collection

Baseline Step 1

Document the make, model, and locations of existing sensors. Ensure that sensors are properly located and that manufacturer's rated accuracies of sensors are sufficient, per requirements below. If not, replace sensors.

Baseline Step 2

Verify and document the accuracy and calibration of all instrumentation.

Table 4-1: Instrumentation Accuracy Requirements

Equipment Type	Purpose	Accuracy of Instrumentation
Flow meter	Chilled water flow (GPM)	±2%
Immersion temperature sensors	Chilled water temperatures (°F)	±0.3°F
Immersion temperature sensors	Condenser water temperatures (°F)	±0.5°F
Power meters	True RMS Power	±2%
Outdoor air relative humidity / wet-bulb temperature sensors	Outdoor air wet-bulb temperatures	±3%
Outdoor air temperature sensors	Outdoor air dry-bulb temperatures	±1.0°F

Baseline Step 3



Development Approach

- Allocated ‘Risks and Responsibilities’
- Included industry best practices to ensure technical rigor & accuracy
- Verified approach is cost effective



Allocated Risk

Financial	
Operational	
Operating hours:	See Load, below
Load:	ESCO is not responsible for changes in load.
Weather:	ESCO is not responsible for weather.
User participation:	See Operations, below
Performance	
Equipment performance:	ESCO responsible for equipment performance, as defined by kW/ton
Operations:	Customer must comply with operational sequence installed with ECM.
Preventive Maintenance:	Customer must comply with ESCO specifications and manufacturer's requirements.
Equipment Repair and Replacement	Negotiable



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Included Best Practices

- Instrumentation specifications
- Calculation methods
- Prescribed measurements, sampling
- Ongoing verification activities
- O&M reporting
- IPMVP Adherent
 - ☐ Lighting – Option A
 - ☐ Chiller – Option B



Verified Cost Effectiveness

Chiller M&V Budget	
Annual Chiller M&V Labor Hours (ESCO)	98
Annual ESCO Labor Cost @ \$75:	\$ 7,350
Annual Chiller Cost Savings:	\$ 37,000
Chiller M&V Cost / Annual Chiller Savings	20%
Overall Project M&V Budget	
Other M&V Costs (Ltg, ECMS, Water)	\$ 7,276
Other Project M&V Costs	\$ 14,626
Total Project Annual Cost Savings	\$ 275,750
Total M&V Cost / Total Annual Savings	5%



Challenges

- Getting the word out to agencies
- Convincing ESCOs to see it as valued approach
- Engaging DOE staff as partners



Benefits

- Consistent, technically vetted approach
- Higher confidence in savings estimates
- Simplified review and negotiations
- Quicker implementation of projects





Next Steps

- Develop additional plans
 - ☐ Boilers, GHP, Controls, other
 - ☐ Established approach
 - ☐ Working group - only for review
 - ☐ Leverage other M&V plans
 - IPMVP, Air-Force, ORNL



Action!

- Get the word out!

☞ <http://ateam.lbl.gov/mv/>

☞ CD-ROMs at the front!

- Use the templates

☞ Let us know!





Thank you!

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SENIOR ENGINEER

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