Helping Massachusetts Municipalities Create a Cleaner Energy Future

Massachusetts Department *of* Energy Resources

COMMONWEALTH OF MASSACHUSETTS

Deval L. Patrick, Governor
Richard K. Sullivan, Jr., Secretary
Mark Sylvia, Commissioner

Energy Management Services

Energy Saving Performance Contracting

Webinar

March 12, 2014

Massachusetts Department *of* Energy Resources

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Introduction: Green Communities Division

Lisa Capone

Deputy Director

Green Communities Division

Green Communities Division

Serves as the hub for all Massachusetts cities and towns on energy matters

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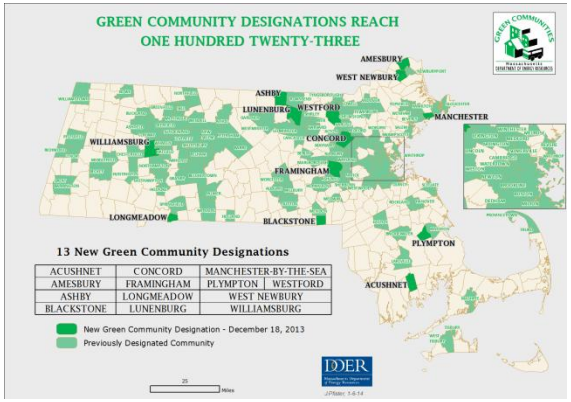
Green Communities Division
Programs & Resources for Municipalities



- Green Communities Designation and Grant Program
- MassEnergyInsight POWERING EFFICIENCY energy tracking tool
- Municipal Energy Efficiency Program
- Energy Management Services Technical Assistance (EMS)
- Mass Municipal Energy Group (MMEG)
- Website filled with tools & resources - www.mass.gov/doer
- Email updates via listserv – Sign up by sending an email to: join-ene-greencommunities@listserv.state.ma.us

GREEN COMMUNITIES
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Outreach - Regional Coordinators

- Regional Coordinators act as direct liaisons with cities and towns on energy efficiency and renewable energy activities
- Located at each of the DEP Regional Offices:

SERO – LAKEVILLE: Seth Pickering
Seth.Pickering@state.ma.us

NERO – WILMINGTON: Joanne Bissetta
Joanne.Bissetta@state.ma.us

CERO – WORCESTER: Kelly Brown
Kelly.Brown@state.ma.us

WERO – SPRINGFIELD: Jim Barry
Jim.Barry@state.ma.us

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Recording & Presentation

- The webinar is being recorded and will be available on our website in approximately 48 hours at:

  www.mass.gov/energy/greencommunities

- The slide presentation will also be posted at:

  www.mass.gov/energy/greencommunities

- Website and contact information is listed at end of presentation

Presenters

Eileen McHugh

Program Coordinator, Department of Energy Resources

Chris Halpin

President, Celtic Energy

Question #1

Who in the audience? Are you:

A. in some stage of a performance contract
B. considering a performance contract
C. just interested in learning about M&V
D. none of the above

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GREEN COMMUNITIES

Massachusetts Department *of* Energy Resources

Measuring and Verifying Savings

Webinar

March 12, 2014

Eileen McHugh
Program Coordinator

Agenda

Eileen McHugh

- Overview of Massachusetts M&V Requirements

Chris Halpin

- Overview; M&V Definitions and Process
- M&V Guidelines and Options
- Basic Energy Savings Calculation
- M&V and Risk in a Performance Contract
- M&V Cost
- Case Studies: State and Local Government Projects

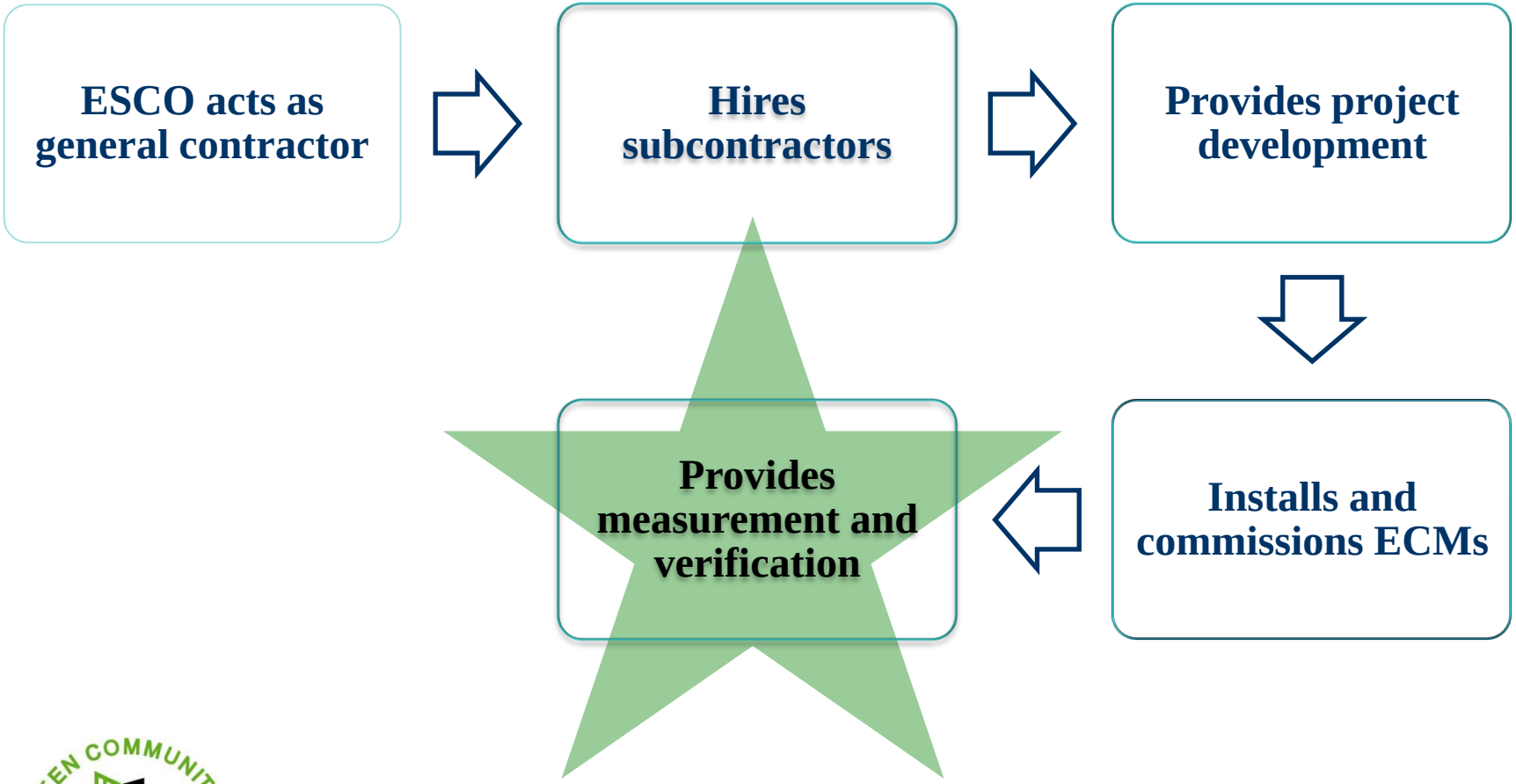
Energy Management Services (EMS)

- Energy Saving Performance Contracting (ESPC)
- Install energy efficient and/or renewable facility improvements
- Provides ***guaranteed energy cost savings*** or ***guaranteed onsite energy generation***

Guaranteed Energy Cost Savings

- Guarantee - ESCO must warrant annual guaranteed energy cost savings for the term of the contract
- Shortfall – ESCO must reimburse owner
- Excess savings – Excess savings remain the property of the owner. ESCO prohibited from "banking" to cover future or past shortfalls

ESCO Services



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Requirements

- Must Use Most Recent Version of FEMP M&V Guideline
- Measurement and Verification for the Full Term of Contract
- ESCO M&V Report at least Annually
- DOER Annual Report

Contract Administration

- Insurance & Bonds
- Review Design & Installation
- Coordinate Access
- Witness Progress
- Review Annual M&V Reports

DOER Resources

- EMS Web Page
- Model Documents
- In-house Expertise
- Regional Coordinators
- Education and Presentations

“Education is not the filling of a pail, but the lighting of a torch”

William Butler Yeats

Celtic Energy

Chris Halpin

PE, CEM, CMVP, LEED AP

PRESIDENT

CELTIC ENERGY

Definitions

What is a Performance Contract?

When a project includes a guarantee of *performance* (and savings), it is classified as a Performance Contract.

Some Owner's say: "Why do I need all this M&V stuff when the ESCO is guaranteeing the savings?"

Because the "devil is in the details" of the contract. Depending on contract language, guarantee can be worthless.

Definitions

What is M&V?

Measurement and Verification (M&V) is the *process* of determining savings in a Performance Contract

- *Measurement* of Performance
- *Verification* of Savings

The bank wants its money whether or not you achieve the savings, so it's important you have a robust M&V process. Most problems in ESPC projects are due to bad M&V.

Definitions

Savings as a Contractual Term…

- Energy Savings and Energy Cost Savings, when defined in a Performance Contract, are *contractual* terms

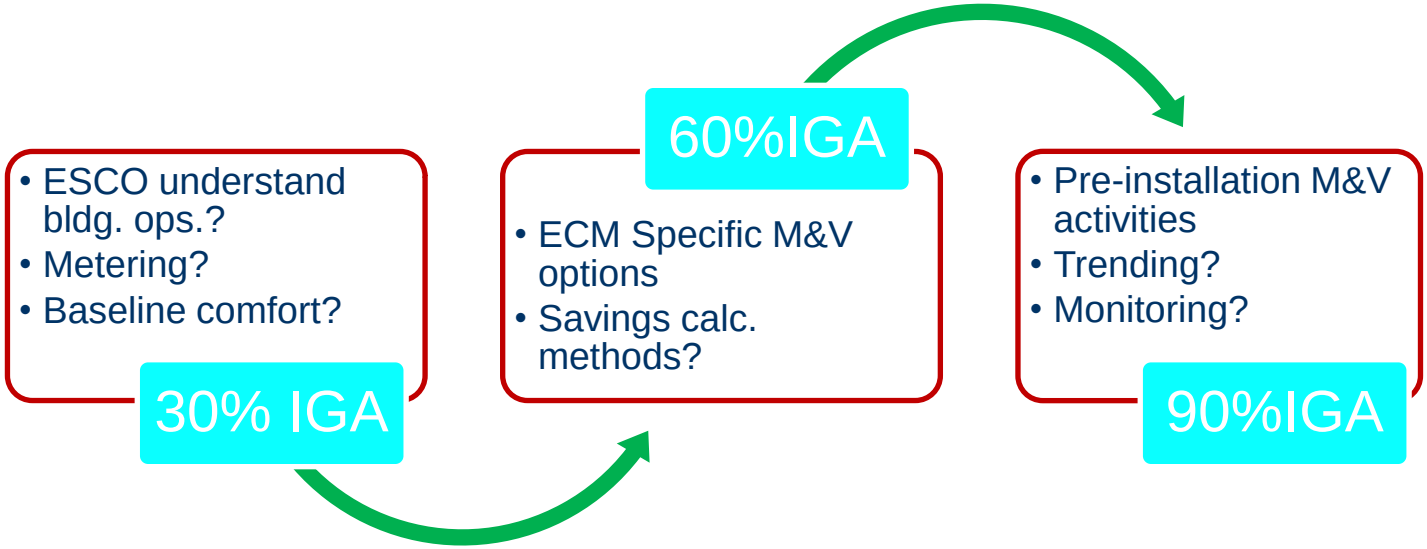
M&V Plan

- Fundamentally defines the meaning of the word "savings" for each project and the contract
- Project specific M&V plans are developed during the detailed Investment Grade Audit
- M&V Plan determines "contractual savings," instead of "actual savings" you may want to see on the bills

M&V Process

Phase	M&V Activity
ESCOs RFP Response	Conceptual M&V approach
Investment Grade Audit	Detailed M&V Plans, Baseline documentation → Contract
Installation	Various M&V activities → Post Installation Verification
Performance Period	Quarterly reporting, Annual Reconciliation, Regular Inspections → End of Term

Development of the M&V Plan



- Particular focus on M&V Plan development – "M&V" is a process – not something that happens at the end of construction. M&V interaction from beginning to end.
- Need robust Baseline development and detailed documentation to provide necessary confidence for M&V options/methods > credible ECMs and savings calcs

M&V Guidelines

- International Performance Measurement and Verification Protocol: *Concepts and Options for Determining Energy and Water Savings Volume I* IPMVP – January 2012

- M&V Guidelines: Measurement and Verification for Federal Energy Projects (*Required in Massachusetts*)
  FEMP/DOE – Version 3.0 – April 2008

- ASHRAE Guideline 14: Measurement of Energy and Demand Savings ASHRAE 14 – 2002
- Environmental Defense Fund's Investor Confidence Project
  - define open standards in order to enable the flow of private investment required to launch a global market for energy efficiency in the built environment.

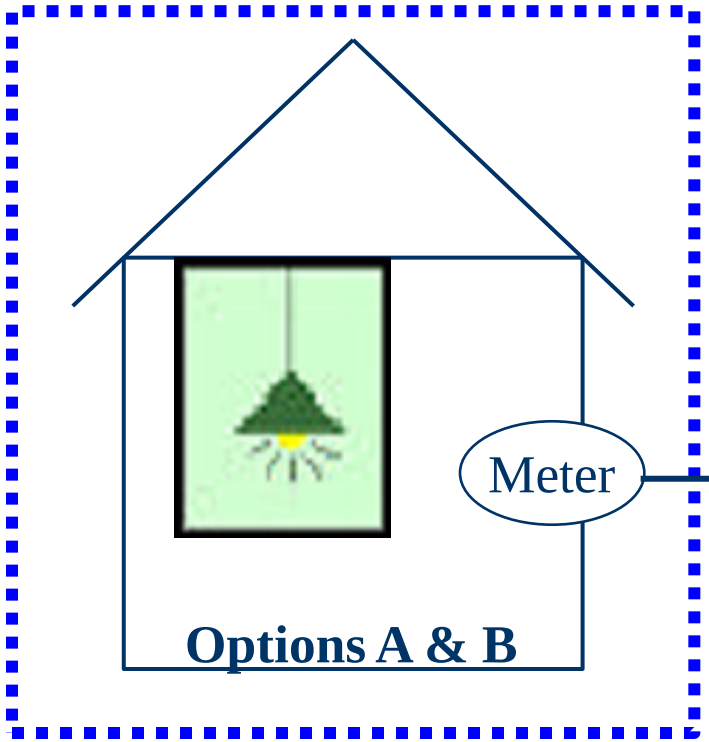
M&V Options

There are 4 basic methodologies or options used in the Industry today (IPMVP 2012)

- **Option A** - Retrofit Isolation: Key Parameter Measurement (e.g., lighting kW & operating hours)
- **Option B** - Retrofit Isolation: All Parameter Measurement (e.g., chiller kW, flows, temps)
- **Option C** - Whole Facility (e.g. electric meter reading)
- **Option D** - Calibrated Simulation (e.g., EQuest, Trace)

M&V Options

Retrofit Isolation vs. Whole Facility Methods



Options A & B are *retrofit isolation* methods

Options C & D are *whole building* methods

The difference is where the boundary lines are drawn.

M&V Options

Which option?

Depends on your specific project and contract needs

- Work through it with your internal team and *with* your ESCO
- Some situations are more obvious than others – work through the M&V plan creation process
- Document all assumptions & negotiations to create a "contract record" for posterity

Basic Energy Savings Equation

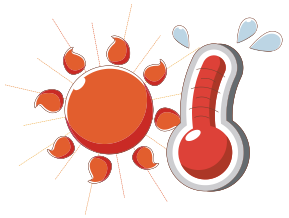
Energy Savings =

Baseline Energy Use – Post-retrofit

Energy Use ± Adjustments

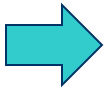
Basic Energy Savings Equation

Adjustments……

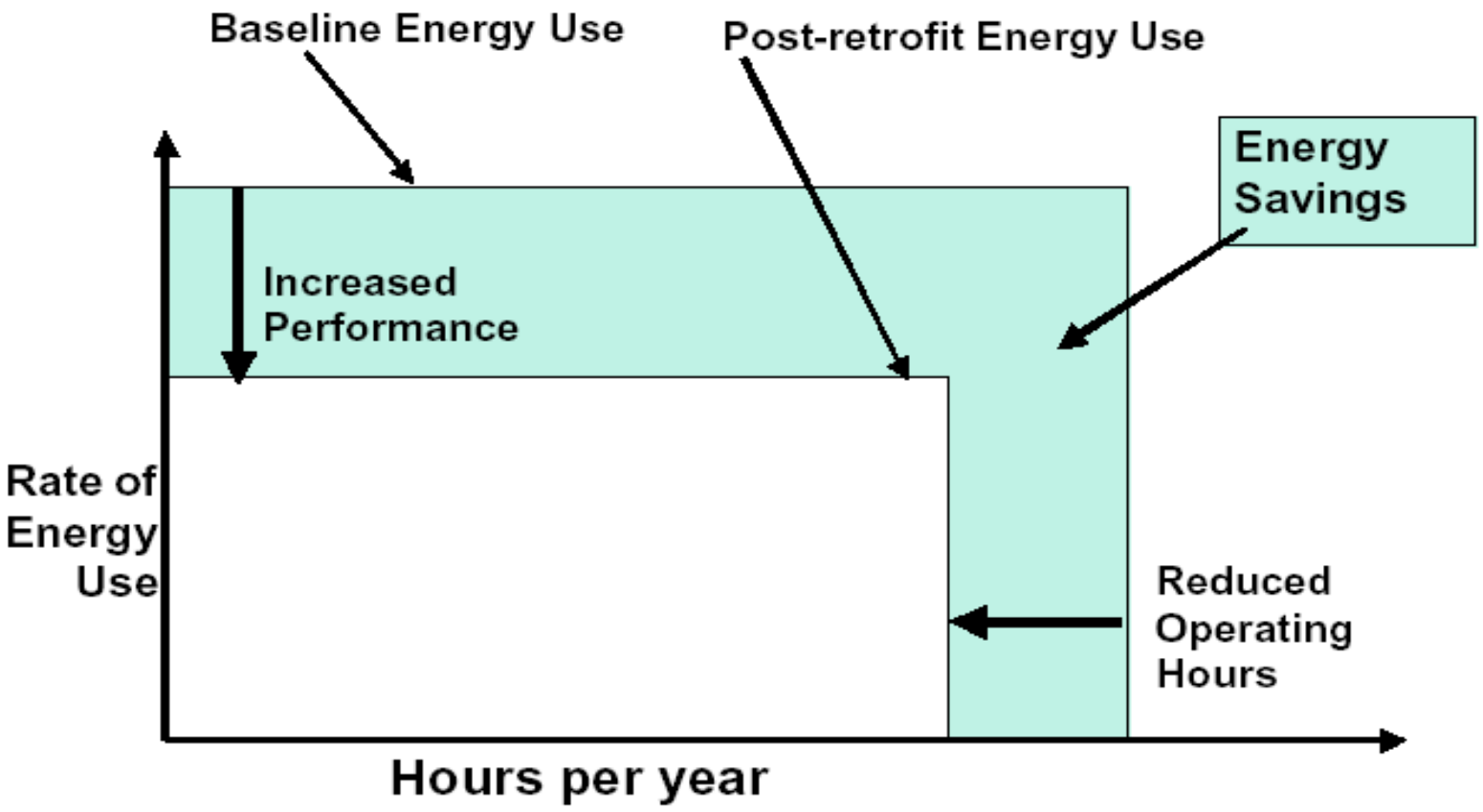


Option C terminology

- Derived from identifiable physical facts
  - Routine → weather, production level
  - Non-routine → additional equipment, changes in occupancy



Basic Energy Savings Equation



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Keys to a Successful ESPC

Risk Mitigation

- Team-based approach
- Process-focused, details, details, details (Documentation driven)
- 1st Priority - Maintain health, safety, and integrity of space
- Robust M&V plan is sole determinant for achievement of ROI
- Technical & EPC process Expertise enables effective vetting of proposed IGA measures, costs & contract

M&V and Risk

- M&V practices allow "project performance" risks to be understood, managed and allocated among parties
- M&V is primarily focused on the risks that affect the determination of savings
- These risks are defined in the terms of the contracts between the parties

Risk Responsibility Matrix

Risk Area	ESCO	Owner
Financial		
Energy Prices Construction Costs M&V Costs Delays		
Operational		
Operating Hours Load Weather		
Performance		
Initial Equip Perf Long Term Equip Perf Operation Maintenance & Repair		

M&V and Risk

Variables that might affect energy savings:

ESCO-controlled variables:

Retrofit Performance (e.g. chiller kW/ton)

Owner-controlled variables:

Facility characteristics, operation (e.g. operating hours, renovations, etc.)

ESCO- and/or Owner-controlled variables:

Maintenance – negotiated item to allocate costs and risks appropriately

Variables outside of either party's control:

Weather, energy prices

M&V and Risk

Uncertainty –

The Savings determination process itself introduces uncertainties through:

- Instrumentation Error
- Modeling Error
- Sampling Error
- Planned or Unplanned Assumptions

The M&V process should focus on managing the uncertainty

There is no such thing as an absolutely "correct" savings number

A hallmark of a successful ESPC project is open communication between Owner, ESCO, and 3rd Party Consultant , it reduces uncertainty

Question #2

With respect to M&V, when can "Monitoring" take the place of "Measurement" in a well executed ESPC?

A. Sometimes
B. Anytime
C. Never

M&V Cost

General estimates from early IPMVP….

Option	Estimated % of Total Annual Savings	Comments
A	1 – 5%	Depends on # of measurements & thoroughness of perf. period reporting
B	3 – 10%	Depends on # and type of measurements and the term of analysis
C	3 – 10%	Depends of # and complexity of parameters in billing analysis and adjustments
D	5 – 20%	Depends on # and complexity of systems evaluated/modeled

M&V Cost

Cost of M&V needs to be weighed among many factors including;

- Cost of the ECM and the savings
- Responsibility of risk
- Level of uncertainty that is comfortable and affordable

(law of diminishing returns)

In general…….over the life of the contract…

Total cost to *determine* savings should typically be less than 10% of the savings

Summary

Well-executed M&V can…

- Accurately assess energy savings for a project
- Allocate risks to the appropriate parties
- Reduce uncertainties to reasonable levels
- Ensure that payments are made only for realized savings
- Monitor equipment performance
- Find additional savings
- Improve operations and maintenance
- Verify savings guarantee is met
- Allow for future adjustments, as needed

Summary

Get Comfortable…

"An energy performance contract requires that both parties *believe* the information on which the payments are based is valid and accurate."

- Be active participants from the very beginning of discussions – at the *beginning of the process* (start of the investment grade audit phase)
- KISS: Keeping it simple is a good goal for M&V, but simplify in a knowledgeable and educated way for your particular contract
- If you don't have time to focus on the M&V process to do it justice or you just don't feel comfortable → *get help*

Independent M&V Assistance

- US Department of Energy SuperESPC Program requires the use of a pre-qualified Project Facilitator. The PF provides technical assistance, including M&V plan review during IGA, and annually during contract.
- Many states including North Carolina, Connecticut, others require a Professional Engineer to review M&V plan review during IGA, and annually during contract.
- Many municipal PACE Programs require M&V review.
- Consultants should have 5+ years of M&V experience, have a PE, and Certified M&V Professional.
- More info at ESPC Best Practices for MUSH Market

UNC System – M&V

- Independent PE's letter concurring with M&V plan methodologies
- Rigorous calculations and measurement requirements
- Review energy models for proper baseline assumptions, and ECM savings
- Transitioning from Option A dominated to more comprehensive measurement -based Option B in more complex ECMs
- Improved metering systems allowing increased use of Option C
- Annual Independent M&V Report reviews

City of Henderson, NV

$2M pilot project on Justice Facility (2006-08)

$20M+ project on 52 City bldgs. (2009-2011)

AEE Region V Project of the Year 2012

27,735 street light upgrades to leading edge induction technology

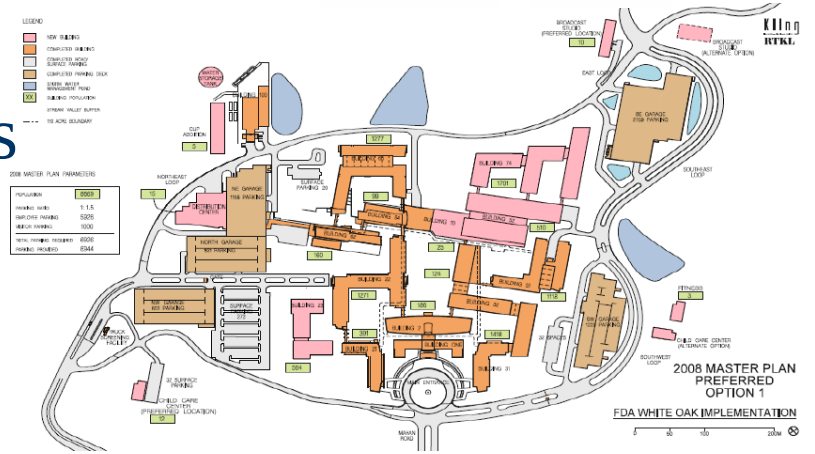
ECM Savings:	$1,722,679
Guaranteed Savings:	$1,626,036
Difference in Savings: + $ 96,643 (6%)	

Examples: Street lighting – Option A (2002 IPMVP)
ESCO measured wattage of up to 650 fixtures of different lamp/ballast combinations, both parties agreed to operating hours

Solar PV– Option B ESCO measured power at inverters

Federal Research Center – White Oak

- ESPC with over $290 M in assets
- 60 MW gas fired turbines
- 20,000 tons of HE chillers
- Solar power array
- ECMs in buildings
- New Phase 3 to be:
  - True MicroGrid, fully “Islandable”
  - SmartGrid/PJM compliant
  - Robust M&V and CX plans



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Take Away

- Start M&V development at beginning of IGA, otherwise "That horse has left the barn…"
- Work closely and openly with ESCO and Consultant
- Read "Guarantee Clause" very carefully
- Engage O&M staff from the start; they are the greatest asset an Owner has to ensure persistence of savings
- Comprehensive commissioning yields superior M&V
- Robust M&V Plan can improve financing rates
- Annual M&V reports provide proof of good investment for years after project is complete

Questions?

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