

# Energy Management Services Guide 3.0

*GUIDE TO PROVIDING ENERGY SAVINGS THROUGH GUARANTEED ENERGY PERFORMANCE CONTRACTING*

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**Acknowledgement**

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**Disclaimer**

The Massachusetts Department of Energy Resources prepared this document to assist local governmental bodies in understanding how to improve the energy efficiency of public buildings through Energy Management Services (EMS). This document provides a guideline for procurement procedures to implement an EMS project under 225 CMR 10.00 or 225 CMR 19.00.

The information contained within is general and subject to change. It serves as an introduction to elements pertaining to energy management services (guaranteed energy performance contracting) and is not a substitute for a thorough analysis of facts and the law.

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## LIST OF ABBREVIATIONS

DOER	Massachusetts Department of Energy Resources
DHCD	Massachusetts Department of Housing and Community Development
DCAMM	Massachusetts Division of Capital Asset Maintenance and Management
ECM	Energy Conservation Measure or Energy Efficiency Measure
EMS	Energy Management Services
EMSA	Energy Management Services Agreement or Contract
ESCO	Energy Services Company or Contractor
FEMP	Federal Energy Management Program
IEQ/IAQ	Indoor Environmental Quality/Indoor Air Quality
IPMVP	International Performance Measurement & Verification Protocol
NPV	Net Present Value
RFP	Request for Proposal
RFQ	Request for Qualification

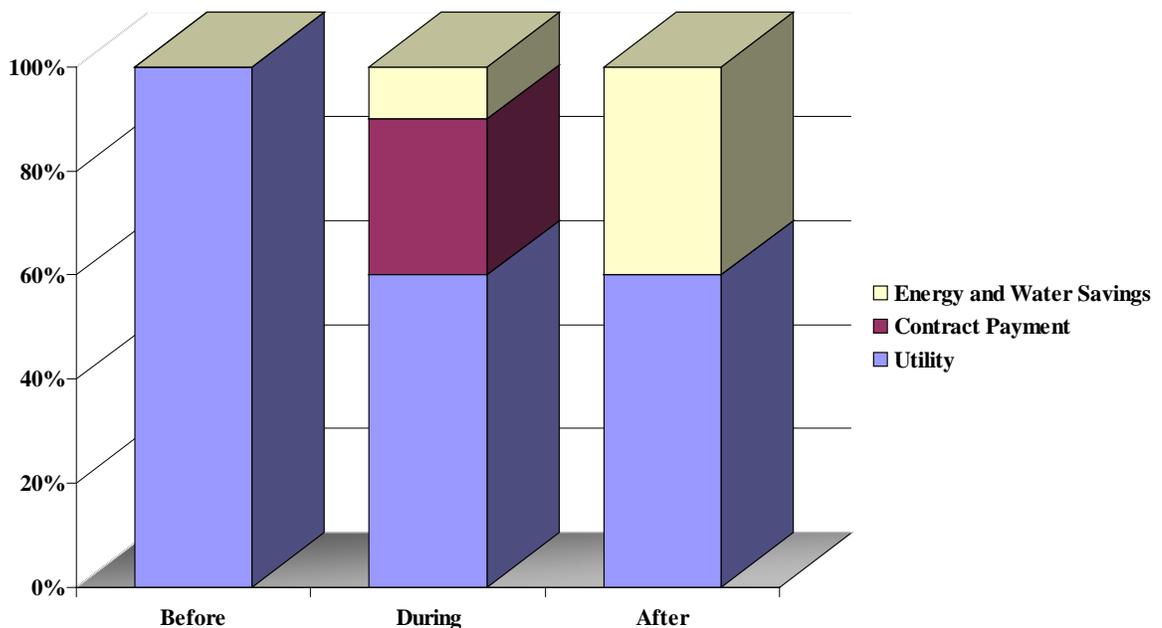
## INTRODUCTION

In Massachusetts, public agencies may use Energy Management Services (EMS) to contract with an Energy Services Company (ESCO) if the primary purpose for doing so is to reduce energy and/or water cost or to generate onsite electricity. Under 225 CMR 10.00 using a Request for Proposal (RFP) or 225 CMR 19.00 using a Request for Qualifications (RFQ), public agencies may seek to improve the energy efficiency of a facility or to produce onsite energy generation by contracting with an ESCO to design, purchase, install, operate and sometimes maintain its energy systems for a maximum term of twenty years.

The DOER regulations 225 CMR 10.00 and 225 CMR 19.00 provide for the procurement of energy, water, and utility conservation services, onsite energy generation, and cogeneration with two significant differences:

1. First, using EMS allows for a streamline, flexible procurement process to proceed from design to closeout without further public bidding.
2. Second, public agencies purchase performance results, not just new equipment. Guaranteed energy savings pay for the project; in other words, a public agency purchases capital improvements to a facility and, in return, pays for the improvements with cost savings attributed to the ESCO's performance on energy expenditures. The following graph illustrates costs and savings to a facility under an Energy Management Services arrangement.

**Figure 1: Cost Savings over the Term of a Project**



Local governmental agencies may also be subject to additional requirements in their jurisdictions such as local ordinances and/or grant program requirements.

## I: FUNDAMENTAL CONCEPTS OF ENERGY MANAGEMENT SERVICES

EMS is a self-funding financing mechanism structured so that the cost of implementing the Energy Conservation Measures (ECM)<sup>1</sup> may be recovered from utility savings created by the performance of those measures. Equipment purchased and installed using EMS may include any equipment or system upgrade designed to reduce the cost of energy and/or water use or to generate onsite electricity, including improvements to existing equipment. This type of contract offers a scope of associated design, installation, and sometimes maintenance services, with a contract period that may range from 10 years up to a maximum of 20 years.

What distinguishes these contracts is the provision of a performance guarantee on energy and water savings from the installed retrofit measures.

Many public agencies use EMS because of the lack of adequate capital funds to address equipment replacement needs, lack of a sufficient amount of staff, or simply do not have the appropriate technical expertise to manage these complex projects in-house. The traditional capital budget process may take as long as five years or more to do a project that an ESCO could deliver in less than two years. The savings opportunities that are lost by waiting three extra years or more for capital funds to implement efficiency projects creates a huge cost of delay.

Moreover, an EMS contract defines the method for establishing the baseline costs and the utility cost savings. Contracts must specify the method for determining savings and address contingencies such as utility rate changes and variations in the use and occupancy of a building. This guide is an overview of the process, however, there is no substitute for the assistance of experienced legal counsel and owner's agent when deliberating a large or complicated contract.

Two fundamental factors drive energy savings: performance and usage. Performance describes how much energy is used to accomplish a specific task; usage describes how much of the task is required, such as the number of operating hours during which a piece of equipment operates. For example, in the simple case of lighting, performance is the power required to provide a specific amount of light, and usage is the operating hours per year. For a chiller (which is a more complex system), performance is defined as the energy required to provide a specific amount of cooling (which varies with load), whereas usage is defined by the cooling load profile and the total amount of cooling required.<sup>2</sup>

### Getting Started

To determine if an EMS contract is a viable option, one will want to gather a variety of information. Using a preliminary feasibility survey helps evaluate the viability of using a performance based contract. Begin by determining various building aspects, such as, energy consumption, use and occupancy, recent energy improvement updates, space conditions, equipment inventory, and any planned remodeling. Collect historical energy data to calculate energy use, cost, and cost per square foot. This information provides the energy intensity of a building. An on-site walk-through provides an inventory of energy systems, equipment, and usage. This initial examination combined with historical energy use data aids in determining whether sufficient opportunity for energy savings exists. Gathering basic information is important for energy management; however, you will need an in-depth audit later in the contract process. Section II: Understanding How Buildings Use Energy, on page 5, explains various building aspects.

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<sup>1</sup> See glossary.

<sup>2</sup> Introduction to Measurement & Verification for DOE Super ESPC Projects, June 2007, FEMP, page 4.

## Organize a Project Team

If sufficient opportunities for energy savings materialize, engage on-site staff and organize a team responsible for the different aspects of the EMS contract. Typically, this includes the following individuals:

- Person with authority to execute a contract/make major decisions
- Facility and maintenance staff
- Technical resource
- Legal resource
- Financial resource
- Procurement resource, and the
- Individual responsible for monitoring the project

The contribution of each resource changes throughout the term of the contract, with continuing participation by the monitor responsible for assessing outcomes once construction is completed. When the savings period begins, the project monitor will need the expertise to verify the ESCO's annual performance reports to determine the outcomes of the project. Consider using an outside independent consultant or owner's agent familiar with the process if in-house staff is not sufficiently experienced.

Once opportunities emerge and the project management team is organized, the RFP/RFQ process begins. The DOER offers model documents. These model documents do not replace legal and technical expertise.

## Allowable Purchases

Typically, the ESCO provides a service package of retrofit measures to improve energy efficiency<sup>3</sup>. The scope of the improvements can range from work that affects a single part of a building's energy-using infrastructure (such as lighting) to a complete package of improvements for multiple buildings and facilities.

Multiple measures can improve all energy-using systems within a building (lighting, heating and cooling, controls, etc.). Multiple measures with a composite (combined) economic payback of up to seven years and individual measures with longer paybacks are good candidates when the expected life span of the measure exceeds its cost-recovery period.

EMS contracts often contain measures with short-term paybacks that offset improvements with long-term paybacks.

- **Equipment:** One may use EMS to purchase a wide variety of building equipment or renewable technologies. Energy-efficient lighting, heating, ventilating and air-conditioning systems, energy management control systems, motor replacements, and variable-speed drives for pumps and fans are common improvements.

One may not procure the services of an owner's agent using this method (for consultant services see M.G.L. c.30B). One may not procure meters (such as water meters) as an energy conservation measure. Meters may be installed only as a tool to measure actual energy or water savings, or as a strategy to measure onsite electricity generation.

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<sup>3</sup> EMS is also used for onsite energy generation.

- Miscellaneous Services: Because any equipment installed is ultimately owned by the facility, the ESCO also provides documentation for all installed equipment, including as-built drawings and operating manuals. The ESCO trains the on-site facility staff to operate and maintain the equipment. In some cases, the costs for facility staff to attend training programs provided by equipment manufacturers can be included in the project costs.
- Operations and Maintenance Services: In addition to equipment installation, documentation, and owner training, the ESCO may propose various repair and maintenance services. The ESCO may propose repairs to existing systems, such as re-installation of damaged or missing controls or repair of leaks in chilled water piping. They may also offer to take responsibility for long-term maintenance and repairs to all new equipment installed during the term of the contract. The contractor may also offer to take responsibility for maintenance and even operation of existing equipment. All of these services may be included as part of the proposal, if requested by the owner.

### **Suitable Projects**

In general, an EMS contracting arrangement is appropriate for projects that can: (a) produce reliable, significant, and long-term utility cost savings; and (b) capture all economically viable energy system improvements in an organization's entire stock of buildings and facilities. Because EMS contracting may offer continuing operations and maintenance services, it provides a valuable opportunity to capture long-term savings that may accrue to an organization.

Energy Management Services contracts are significant for organizations that:

- Lack necessary technical expertise
- Need to free up in-house resources for other priorities
- Lack the time to supervise or manage comprehensive improvements
- Are unwilling or unable to finance the initial costs of those improvements

Determining whether an EMS contract is appropriate for an organization's needs often depends on project size, the number of measures to be installed, and long-term building use.

### **Project Size**

It is important that a project be of a sufficient size for the utility savings generated to cover both the equipment upgrades itself and the project costs. Aggregating smaller projects together into a single contract and streamlining the bidding and assessment process by using standard practices may minimize costs. Project size is one determinant of whether an EMS contract is the best financing measure for a particular investment. While this type of contract is generally most appropriate for larger buildings or a set of buildings, smaller projects can also benefit from an effectively executed program.

### **Stable Building Use**

Building use is another determinant of the efficacy of EMS contracting. Improving buildings using this type of contract is generally more appropriate for buildings that have relatively stable use and occupancy during the contract period. Major changes in building use significantly affect energy consumption and require modifications to the originally agreed-upon baseline and/or savings and performance guarantees negotiated with the contractor.

## II: UNDERSTANDING HOW BUILDINGS USE ENERGY

Before determining how to reduce energy consumption, you will require some baseline<sup>4</sup> information to understand where things stand and what measures may help you reduce energy use. The information needed includes the characteristics of your building and the amount of fuel, water, and electricity consumed.

The following table is an example of a fuel consumption and cost data to record. Enter fuel codes for electricity (E), natural gas (N), distillate oil (D#2, D#4), etc. Enter the year and month of the data and the quantity in kilowatt-hours, gallons, Therms or CCF, etc. This information is required for both an RFP (3 years) and an RFQ (2 years).

**Table 1: Fuel Consumption and Cost Data**

Building Name:		Square Feet:						
Year:								
	Fuel Code	E (electricity)	Fuel Code	N (natural gas)	Fuel Code	D (distillate oil #2)	Fuel Code	QTY
FY Year	Qty(kWh)	Cost	Qty (CCF)	Cost	Qty (gals)	Cost	Qty	Cost
July								
August								
September								
October								
November								
December								
January								
February								
March								
April								
May								
June								
<b>Total</b>								

Use building plans and first-hand measurements and observations to determine:

- **Building age and general condition:** include the types of windows, roofing, and wall material and the approximate percentage of glass to wall space.
- **The total conditioned area (heated and cooled interior) of the building:** measured in square feet, not including unheated basement or attic space.

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<sup>4</sup> See glossary

- **The average daily number of occupants:** include normal operating hours and any weekend or special events.
- **The number of hours each day your building is used:** include weekdays, weekends, special holidays, and evening hours.
- **Brief descriptions and the locations of:**
  - ✓ Primary heating systems
  - ✓ Cooling systems
  - ✓ Ventilation systems
  - ✓ Lighting
  - ✓ Hot Water
- **Brief descriptions of any special systems:** include energy using areas such as laundries, kitchens, elevators, machine and electric shops, greenhouses, swimming and locker areas, etc.

This information gives you a building profile to help you spot potential areas of energy waste for each building involved.

### **MassEnergyInsight**

The Department of Energy Resources (DOER) offers [MassEnergyInsight](#) free to cities, towns, and other local and regional governmental entities such as school districts, drinking water districts and regional wastewater treatment plants. This web-based tool provides access to energy information for multiple uses.

MassEnergyInsight enables cities and towns to perform key energy management tasks:

- ✓ Develop an energy use baseline
- ✓ Examine energy use by departments and by fuel type
- ✓ Forecast energy budgets
- ✓ Show the results of energy efficiency investments
- ✓ Develop a greenhouse gas emissions inventory
- ✓ Facilitate communication and awareness about energy use
- ✓ Generate reports for stakeholders

If your municipality is one of the many that use this tool, then you can download the information to a spreadsheet for use in the RFP or RFQ.

### **Energy Efficiency and Indoor Air Quality**

There are potential positive and negative influences of specific energy conservation measures on indoor environmental quality (IEQ). Many energy upgrades have little impact on IEQ such as those upgrades related to fans, motors, drives etc., while other measures can improve IEQ. Some energy projects have the potential to degrade IEQ, but can be made compatible with appropriate adjustments. Interest is growing in studying the connection between indoor air quality and respiratory illnesses. For instance, while asthma affects about one in twenty Americans, in recent years some Boston neighborhoods were reporting rates of up to 30 percent.

**Table 2: Energy Efficiency Measures and Potential Adjustments**

Measure	Comment
<b>Air-side economizer</b>	Economizers use outdoor air to provide free cooling and may improve IEQ when operated to ensure that the outdoor air ventilation rate meets IEQ requirements. Calibrate on/off set points to both the temperature and moisture conditions of outdoor air (for example, by using an enthalpy controller) to avoid indoor humidity problems. One may need to disengage economizer during an outdoor air pollution episode.
<b>CO<sub>2</sub> controlled ventilation</b>	As an indicator of occupancy, CO <sub>2</sub> controlled ventilation varies the outdoor air supply in response to the CO <sub>2</sub> level. This may reduce energy use for general meeting rooms, theaters, etc., where occupancy is highly variable. The system should incorporate a minimum outside air setting to dilute building-related contaminants during low occupancy periods.
<b>Night pre-cooling</b>	Cool evening air pre-cools the building while simultaneously exhausting accumulated pollutants. To prevent microbiological growth, controls should stop pre-cooling if the dew point of outdoor air is high enough to cause condensation on equipment.
<b>Reducing demand (kilowatt) charges</b>	Caution is advised when using night pre-cooling and sequential startup of equipment to eliminate demand spikes if load-shedding strategies include changing the space temperature set points or reducing outdoor air ventilation during occupancy.

For more information on indoor air quality, including additional educational and assessment tools go to the [US Environmental Protection Agency I-BEAM](#).

### III: THIRD PARTY FINANCING OVERVIEW

Third-Party Financing is a means of financing energy and water conservation projects. The ESCO may assist the building owner to arrange financing through a third-party banker/financier. The building owner accepts responsibility for paying the debt and, as a backstop, the ESCO guarantees the building owner a certain level of utility cost savings. Procedures for calculating savings are included in the terms of the contract. The contract typically contains a non-appropriation clause based on a conditional (the energy savings guarantee) agreement.<sup>5</sup>

The financing agreement is a stand-alone, coterminous agreement, separate from the EMS contract, between the financier and the owner. The two agreements are linked through the savings guarantee provided by the ESCO; an institution familiar with or expert in performance contracting (EMS) typically provides the financing.

At the owner's request, the ESCO may manage the operation of the improvements to ensure the realization of anticipated savings. To mitigate risks for both parties, the contract may also include other clauses that address such issues as buy-out or early termination options. Payment and operating requirements vary from contract to contract. By using a RFP/RFQ process, the owner may pursue an approach that provides the opportunity to evaluate several alternatives and choose a satisfactory package that meets the criteria of all parties involved.

The savings are determined by using a standard Measurement and Verification Protocol (M & V) that identifies energy and/or water consumption baseline by using historical utility billing data. Adjustments to this data reflect changes in usage patterns, weather conditions, and building function so that the savings are not over or under estimated. The DOER regulations 225 CMR 10.00 (the RFP process) and 225 CMR 19.00 (the RFQ process) require that methods for measurement and verification of energy savings shall conform to the most recent standards established by the Federal Energy Management Program (FEMP).

#### **Cost-Benefit Analyses**

The major function of investment analysis is to determine which projects have greater benefits than costs (e.g., the most profitable investments). The cost-benefit method for evaluating project alternatives can range from simple to sophisticated. The following examples summarize three primary cost-benefit methods. These methods include simple payback analysis, internal rate of return (IRR), and net present value (NPV).

#### **Simple Payback**

Using the simple payback method<sup>6</sup>, divide a project's total cost by the energy-cost savings accruing to it in the first year after it has begun. A simple payback calculation provides a rough initial estimate of the time needed to recover the initial investment. This cost-benefit method is a valuable tool in marketing energy projects since individuals with minimal financial expertise easily understand it. However, investors are likely not interested in projects presented with simple payback scenarios because of the following drawbacks:

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<sup>5</sup> See U.S. Securities and Exchange Commission, Office of Municipal Securities for information on municipal financial advisors.

<sup>6</sup> The time it takes for the savings from an energy conservation measure to pay for the cost of the investment to implement that measure.

- Simple payback analysis does not reflect savings that will continue to accrue to the project after reaching the payback point. If the payback periods for two different projects are 2.5 years and 4 years, respectively, a decision based on simple payback ignores cumulative lifetime savings. Disregarding the benefits that accrue over the useful life of a project encourages smaller total savings through cream skimming.
- Simple payback analysis does not take into account the time value of money. This is a crucial drawback, especially in cases where the dollar value of a project is large and/or the useful life of the improvements is long. In order to compare properly the economic benefits of competing long-range upgrade projects, you need to discount the value of future dollars relative to today's dollars.

### **Internal Rate of Return**

Internal rate of return (IRR) is a cost-benefit method that evaluates the profitability of capital expenditures over their useful lives. It essentially gives an annualized rate of return for an investment based on life-cycle payments (negative cash flows) and income (positive cash flows from energy savings). IRR is the rate of return at which the sum of discounted future cash flows equals the initial investment outlay. Most government and private sector organizations set internal return rates that must be met. IRR gauges the useful life of an improvement and incorporates the time value of money.

### **Net Present Value**

Net present value (NPV) is a profitability indicator that takes into account both life-cycle cash flows and the time value of money – the higher the NPV, the greater the profitability of an investment. The following table, Table 3 on page 10, compares the profitability of a non-comprehensive and a comprehensive project using NPV calculations.

Calculate NPV by adding the initial investment (always a negative cash flow) to the present value of anticipated future cash flows (estimated savings) over the useful life of an improvement. In this example, this investment is \$100,000 for just a lighting system and \$400,000 for the comprehensive project with a useful life of ten years. The initial investment and annual cash flows are discounted at a rate of 12% to derive the present value for each year. The sum of the annual cash flow values gives the NPV.

Table 1 illustrates the effect of discounting on consecutive yearly cash flows. The discount rate of 12% reflects the organizations required rate of return that must be met before they will invest in a project. The key to performing this type of discounted cash flow analysis is to use a basic discounting formula, which is  $1/(1+r)^n$  (where  $r$  = discount rate and  $n$  = number of years). Use of this formula yields a discount factor. By multiplying the projected yearly cash flow by the discount factor, the present value for that year is determined. Discounting accounts for the time value of money by adjusting the worth of future dollars to the value of today's dollars. The sum of the discounted annual cash flows (including the original investment or outflow) yields the NPV for the investment, and clearly shows the higher profitability of the more comprehensive project.<sup>7</sup>

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<sup>7</sup> Financing Energy Efficiency in Buildings, (May 1998), U.S. DOE

**Table 3: Calculating Net Present Value**

Year	Lighting System Only			Comprehensive Retrofit		
	Cash Flow	Discount Factor (@12% rate)	Present Value of Cash Flows	Cash Flow	Discount Factor (@12% rate)	Present Value of Cash Flows
0	-\$100,000	1.000	-\$100,000	-\$400,000	1.000	-\$400,000
1	40,000	.893	35,720	100,000	.893	89,300
2	40,000	.797	31,880	100,000	.797	79,700
3	40,000	.712	28,480	100,000	.712	71,200
4	40,000	.636	25,440	100,000	.636	63,600
5	40,000	.567	22,680	100,000	.567	56,700
6	40,000	.507	20,280	100,000	.507	50,700
7	40,000	.452	18,080	100,000	.452	45,200
8	40,000	.404	16,160	100,000	.404	40,400
9	40,000	.361	14,440	100,000	.361	36,100
10	<u>40,000</u>	.322	<u>12,880</u>	<u>100,000</u>	.322	<u>32,200</u>
<b>Total</b>	<b>\$300,000</b>		<b>\$126,040</b>	<b>\$600,000</b>		<b>\$165,100</b>

Discount Factor= $1/(1+r)^n$

Source: USDOE

### Sources of Financing

There are various methods to finance an Energy Management Services project, including:

- **Loan:** The Awarding Authority obtains a loan to cover the cost of all conservation and electrical power generation improvements and equipment related to the performance contract.
- **Third Party Lease:** The Awarding Authority enters into a third party lease for conservation and electrical power generation improvements and equipment. Energy savings fund lease payments over the life of the lease.
- **Turnkey Agreement:** The Awarding Authority and the ESCO enter into a turnkey agreement whereby the ESCO owns the conservation and electrical power generation improvements and equipment related to the performance contract and leases it to the Authority.

Owners may contribute capital funds, grant funds, and utility rebates to buy down the project cost.

More information on the following examples may be found in the DOER's webinar [Energy Management Services/Performance Contracting](#):

- **General Obligation Bonds:** 2/3 debt vote required for borrowing authorization
- **Tax-Exempt Municipal Lease Purchase:** Rates tied to LIBOR (taxable rates) rather than MMD Scale (tax exempt rates)

- USDA Community Facility Financing for Qualifying Projects: Must finance initial project cash flow in short-term market
- Qualified Zone Academy Bonds for Public Schools: 35% or more of students must be eligible for free or reduced-price school meals
- Qualified Energy Conservation Bonds; 35% or more of students must be eligible for free or reduced-price school meals

In all cases, the ESCO guarantees the utility cost savings.

#### **IV: ADVANTAGES AND DISADVANTAGES OF PERFORMANCE TYPE CONTRACTS**

Using an EMS contracting arrangement streamlines the process for installation of energy conservation improvements and enables one to deal with a single company. While most companies are reputable, some ESCOs have taken advantage of owners by failing to explain or inform them of the key technical and financial decisions necessary in developing a project. Despite these drawbacks, EMS Contracting has a number of advantages. EMS may simplify the method for funding energy and water efficiency improvements when working within tight budget constraints. It also allows for a more comprehensive project.

##### **Benefits**

Expressly discuss any benefits with the ESCO to ensure they are met. One may want to consider an Energy Management Services Contract for the following reasons:

- **Accountability** – The ESCO is the single point of financial and technical accountability for all project measures.
- **Risk Reduction** – By guaranteeing a minimum level of performance, the ESCO takes away much of the risk of project non-performance from the owner.
- **No Capital Outlay** – EMS contracting eliminates capital investments by providing an alternative method of financing projects.
- **Equalized Cash Flow** – Payments for services are structured to maintain a constant fee schedule funded from actual savings realized.
- **Technical Risk** – An ESCO's main job is managing technical risk – The contract shifts that risk from your organization to the ESCO. The ESCO assumes the risk that the project performs as designed, while remaining within budget and that the equipment operates properly after installation.
- **Project Financing** – Cash flow demonstrates the intrinsic value to energy savings projects most clearly. While most energy savings projects are funded like capital works upgrades, ESCOs can demonstrate how to fund an energy savings project out of cash flow rather than capital expenditure.
- **Guaranteed Savings** – EMS Contracts involve a guarantee of achieved savings by the ESCO. This is normally structured so the loan repayment is less than, or equal to, the savings guarantee amount. In this way, you are assured of being able to meet your loan or lease payment obligations from the utility cost savings generated by the project. This is important if you are skeptical about the ability of identified improvements to achieve the energy savings claimed under a traditional tendered approach.
- **Expertise** – Since energy efficiency is its core business, the ESCO brings expertise to a project. While consulting engineers can offer similar expertise, and indeed frequently work for ESCOs, using a performance contracting arrangement enables one to streamline and deal with only one company. In addition, because the ESCO is interested in a partnership with the building owner

and is always looking to improve the performance of the project, it can bring a level of continuous improvement that would ordinarily not happen.

- Environment – Reduces energy consumption and efficient use of energy may provide environmental benefits including a reduction in greenhouse gas emissions (either directly from burning fossil fuels on-site or indirectly from electricity that is generated from fossil fuel power stations), reduced water consumption, reduced chemical use and reduced solid waste. Many projects now report reduction in greenhouse gas emissions.

## Drawbacks

Unfortunately, the problems of implementing an Energy Services Management Contract are well documented. When selecting this financing option, avoid the following drawbacks:

- Energy Baseline Development – Establishing an energy baseline is crucial for project development since energy savings are an estimate between actual use and the energy baseline (the energy usage if the energy conservation measures had not been implemented).
- Adjustments to the Energy Baseline – Define clearly the method of adjusting for changes in weather, occupancy, etc. (see FEMP M&V Guidelines)
- Operational Savings – Recurring savings generally result from reduced O&M expenses – these savings must be based on actual spending reductions.
- Cost Avoidance – This term applies to implementing measures that allow owners to avoid future costs, but does not save hard dollars compared to past budgets.
- Excessive Finance Charges – Check interest rates on the funds borrowed against local banks or other national institutions to assure the competitiveness of finance charges.
- Required Maintenance Agreements – Maintenance agreements may be expensive in relation to the value provided. The ESCO may claim that they cannot assure guaranteed savings unless their own staff performs the maintenance (a genuine concern). Other ESCOs guarantee savings while providing training for maintenance staff so they can handle maintenance requirements.
- Terms of Savings Reconciliation Versus Budget Cycle – Several standard ESCO performance contracts allow the ESCO to carry over savings that occur in early years to offset losses in later years. These terms do not benefit the Awarding Authority. In Massachusetts, all savings must be reconciled annually and stand alone on that basis.
- Quality Control – Before entering into a contract, ask the ESCO to provide detailed descriptions of both products and services proposed. Poorly defined contracts may mean lower quality products.

## **Cream Skimming**

“Cream skimming” is often an undesirable yet all too common practice of investing in simple projects with relatively low initial costs and quick paybacks. While such investments are financially attractive in the short term, pursuing them may prevent a building owner from capturing significant long-term benefits likely to result from comprehensive retrofits. Cream-skimming projects have impressive initial returns on investment, yet they commonly yield lower absolute energy and cost savings when compared to all-inclusive projects. Moreover, due to their emphasis on short-term paybacks, cream skimming weakens an organization's ability to finance more capital-intensive improvements that leverage the value of those short-term paybacks.

By utilizing bundling, project managers can more fully realize energy and cost savings objectives, while also meeting reasonable payback criteria. Bundling refers to the practice of including both short- and long-term energy-efficiency measures in the same project planning and financing scheme. When planning a comprehensive energy-efficiency project, using paybacks from short-term measures, like lighting system retrofits, offset costs for more system-wide measures with longer payback periods (bundling).

## **Risk Sharing and Assurances**

Among the key barriers to investment in energy efficiency improvements, are uncertainties about attaining projected energy savings and apprehension about potential disputes over these savings.<sup>8</sup> Risk is a measure of the potential inability to achieve overall program objectives within defined cost, schedule, and technical constraints and has two components: (1) the probability/ likelihood of failing to achieve a particular outcome, and (2) the consequences/impacts of failing to achieve that outcome.<sup>9</sup> In any performance contract, the ESCO takes on the risk of not achieving the expected savings. A contract can take account of factors that would affect the savings such as warmer winters or cooler summers, or changes in the use of the building. There are several ways to diminish risk, including the use of due diligence when assessing the project.

There is an increased use of technical strategies to reduce the risk of underperformance in energy savings projects. These include a host of diagnostics and commissioning processes that detect potential causes of underperformance and remedy them early on. The inclusion of commissioning in the ENERGY STAR Buildings process and basing the Building Label on actual (measured) energy use are prominent examples of this trend. The International Performance Measurement and Verification Protocol (IPMVP) is another type of technical strategy to reduce performance risk. Financial strategies are also increasingly used to reduce the risk of underperformance.

- Performance and Payment Bonds – Performance and payment bonds are typical construction bonds that offer another method of risk transfer applied to the construction phase of an energy savings project.
- Performance Guarantees – Guarantees are offered by ESCOs that retain the risk. In Massachusetts, ESCOs must guarantee EMS projects.

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<sup>8</sup> Risk Transfer via Energy Savings Insurance, October 1, 2001, Evan Mills, Energy Analysis Department, Lawrence Berkeley National Laboratory at <http://eetd.lbl.gov/insurance>.

<sup>9</sup> Risk Management Guide for DOD Acquisition, Fourth Edition, February 2001, Department of Defense, Defense Acquisition University, Defense Systems Management College

## V: OVERVIEW OF THE PROCUREMENT PROCESS

Figure 2 on page 20 illustrates the decision process for an EMS project. For the most effective application of an EMS project, a site should have:

1. Two or more years of stable energy consumption of greater than average use;
2. Reliable records of energy consumption;
3. On-site staff who are familiar with operations and are willing to provide assistance;
4. Predictable occupancy patterns;
5. A number of potential capital improvements;
6. No plans for major-structural improvements for the length of the contract (usually 5 to 10 years). (Please note: major structural improvements will distort savings calculations)

Once the site selection is completed, write an RFP/RFQ<sup>10</sup> for the project. The solicitation must contain a general description of the buildings, site-specific information regarding energy and water consumption and cost, minimum energy and water service and related requirements, and facility occupancy and use patterns. This data provides the ESCOs with an understanding of the facility and allows them to evaluate their interest in the project. Once the owner receives acknowledgement of their filing requirements, the solicitation is posted on the owner's web site and published in the Central Register.

The DOER model documents contain provisions to use in procuring Energy Management Services for both comprehensive projects and onsite energy under 225 CMR 10.00 (RFP) and 225 CMR 19.00 (RFQ). The DOER also provides model contracts.

Use the DOER's model documents to develop the RFP/RFQ specifications. To ensure full and fair competition among vendors and provide a basis of comparison for responses, the aforementioned regulations set out a number of minimum requirements for the contents of RFP/RFQ. The DOER provides the model documents and instructions for downloading on the [EMS web page](#).

1. Solicitations must describe the required services without "having the effect of requiring a proprietary supply of service, or procurement from a sole source." Provisions that pertain to performance guarantees may conflict with the statute if they eliminate all competitors except affiliates of particular manufacturers of energy conservation equipment. Note: However, this is not meant to restrict high efficiency standards in the project specifications.
2. Awarding Authorities must file:
  - A copy of the RFP/RFQ with the DOER at least fifteen business days before publishing (only redlined copies will be accepted)
  - A copy of the contract (including IGA) at least fifteen business days before signing an agreement
  - A copy of any contract amendments at least ten business days before signing.
  - An annual energy savings report<sup>11</sup>

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<sup>10</sup> See the DOER model documents at <http://www.mass.gov/eea/energy-utilities-clean-tech/green-communities/ems.html>.

<sup>11</sup> See the DOER annual report form at <http://www.mass.gov/eea/energy-utilities-clean-tech/green-communities/ems.html>.

3. Public Agencies must evaluate responses and award the contract based solely on the criteria set forth in the RFP/RFQ.

There are three major provisions that may not be changed:

1. Guaranteed Energy Savings: The guaranteed energy savings language may not be altered.
2. Commissioning: This provides that equipment is performing as designed.
3. Measurement and Verification: ESCOs must follow the most recent version of the Federal Energy Management Measurement and Verification Guidelines.

When procuring for EMS, it is the sole responsibility of each governing body to consult with legal counsel in preparing any documents and to ensure compliance with all applicable federal, state, and local ordinances, rules, regulations, and procurement procedures.

**Use the model documents as a foundation for the solicitation. The documents are intended as guidance to ensure compliance with the statute and the regulation.**

Example reasons for changes to the model document:

- Adding details applicable to the particular project, such as purpose, scope, and objectives.
  - Adding standard language required by the awarding authority.
  - Deleting language that does not apply to the project details.
1. Complete the relevant Certificate of Compliance Checklist
  2. File the solicitation electronically with the DOER fifteen days before the intended publishing date. To file bid documents, contracts, and annual reports with the DOER, email one complete electronic copy to: [EMS.DOER@state.ma.us](mailto:EMS.DOER@state.ma.us) and mail one complete copy to:

Massachusetts Department of Energy Resources  
Attn: **NOTIFICATION OF EMS PROCUREMENT**  
100 Cambridge St., Suite 1020  
Boston, MA 02114

Interested contractors may want to attend a pre-response meeting and to tour the facility, so that they may gain a better understanding of site and facility characteristics. Note: Pre-response meetings and facility tours are not required but, if held, must be open to all interested firms. Make sure to record all inquiries and responses during the pre-response meeting and facility tour and send copies to all contractors that have expressed an interest in the project. Also, make any changes needed to the original RFP/RFQ at this time and distribute a list of these changes, as an addendum, to all parties in receipt of the RFP/RFQ. Note: State the preferred method of deliver, such as using registered mail.

Following this process, ESCOs submit their responses. Allow at least four (4) weeks or longer for ESCOs to submit responses, depending upon the complexity of the project and required certifications. Publicly open the responses in the presence of at least two (2) witnesses at the time specified in the RFP/RFQ. Make sure to record the date and time of receipt for each response – reject all responses received after the deadline.

Engineers and staff (including the participating facility and project team members) then evaluate the responses. The first step is to make sure that all of the mandatory minimum qualifications listed in the RFP/RFQ are satisfied. The responses are then evaluated against minimum criteria, plus any other criteria the Awarding Authority determines necessary. Responses must be evaluated according to the criteria in the RFP/RFQ.

When using the RFP method an investment grade audit is optional; when using the RFQ method and investment grade audit is mandatory. The ESCO is responsible for completing a thorough investment grade energy audit (IGA) of the facility. If substantial savings exist, use of Energy Management Services Agreement (EMSA) implements the efficiency improvements identified in the audit.

### **Improving the Process**

In addition to the requirements of the statute, the following procedures may improve the process by ensuring full and fair competition in fact as well as appearance:

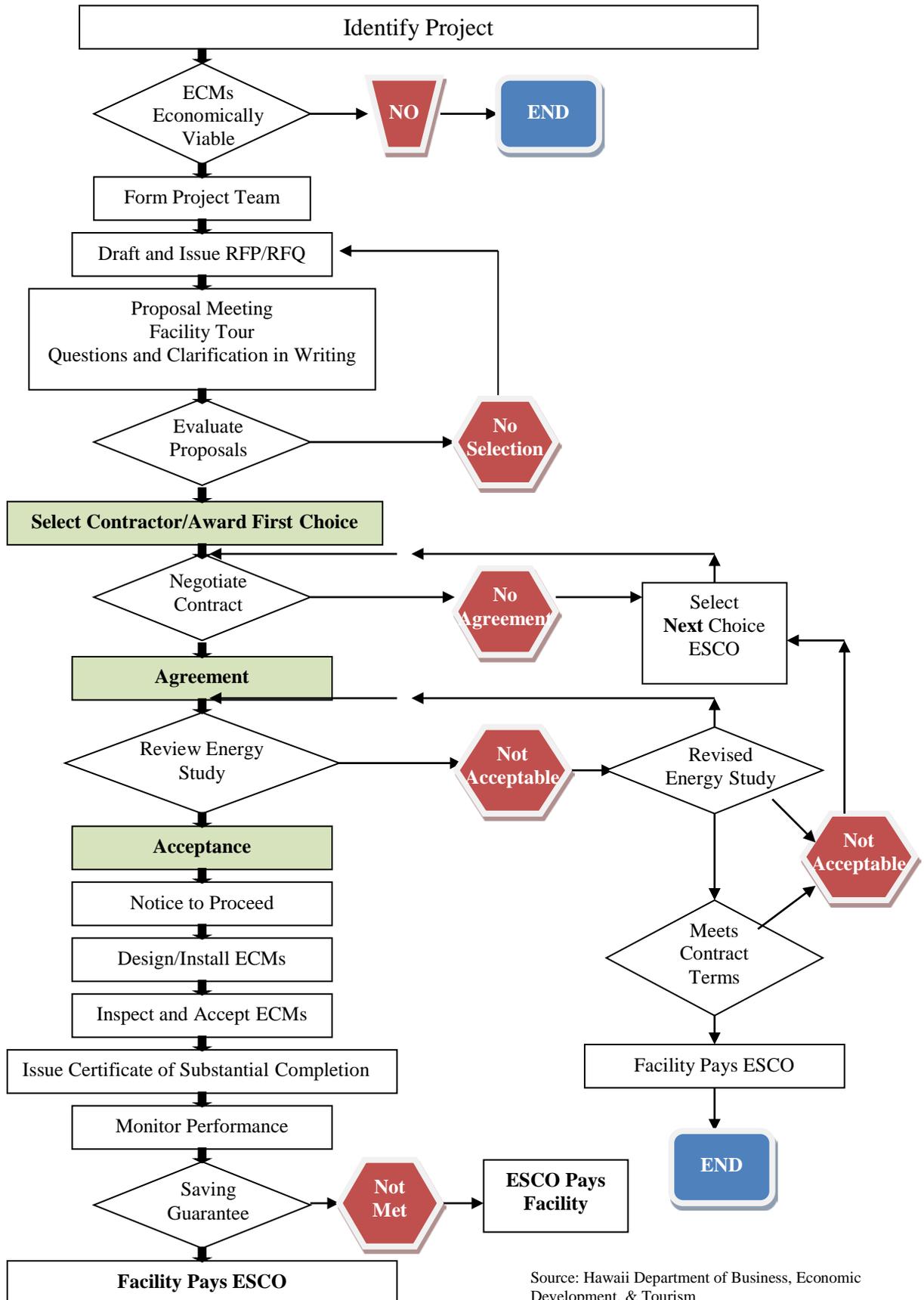
- 1) Avoid unduly restrictive provisions. *Example:* A provision requiring the manufacturer of energy equipment to guarantee satisfactory completion of services if the ESCO of those services fails to complete the contract. As a practical matter, manufacturers warranty equipment not the performance of the contract. ESCOs are required to provide construction bonds to cover any risk to the awarding authority. The requirement of appropriate performance and payment bonds provides protection for the public interest during the implementation period. Do not confuse the construction period performance bond with the guaranteed energy savings performance. ([See FAQs](#))
- 2) Request rather than require letters of intent to bid. This keeps the field of potential vendors open as long as possible, and maximizes competitive pressures on price.
- 3) Provide ESCOs with as much notice as possible for attendance at pre-bid meetings. ESCOs generally need at least three (3) weeks notice in order to attend meetings. The amount of notice is especially important in cases where failure to attend is grounds for automatic disqualification.
- 4) Allowing a longer period for the submission of a response in answer to a solicitation may be beneficial. Preparation of a bid to provide Energy Management Services requires a thorough understanding of the current operations and energy usage of the facilities. If the response period is too brief, vendors who are already familiar with the facility and its operation may have an undue advantage over other competitors in preparing its bid.
- 5) Given that the implementation of many Energy Management Services projects occur outside of the heating season, early planning for the procurement process is essential. If a project must be completed in time for the following heating season, then issue a solicitation no later than March of that year.

**Table 4: EMS Submission Guideline**

<b>Procurement Procedure</b>	<b>Request for Proposal (RFP) 225 CMR 10.00</b>	<b>Request for Qualifications (RFQ) 225 CMR 19.00</b>
Notice of EMS Procurement	<a href="#">RFP Compliance Certificate</a>	<a href="#">RFQ Compliance Certificate</a>
Bid and Addenda	File bids with DOER <u>at least 15 Business Days</u> prior to filing the bid with the Secretary of the Commonwealth for publication in the Central Register.	File bids with DOER <u>at least 15 Business Days</u> prior to filing the bid with the Secretary of the Commonwealth for publication in the Central Register.
DOER Acknowledgment	<p>Within <u>10 business</u>, DOER will confirm receipt; verify that all documents have been submitted.</p> <p>Within <u>15 business days</u>, DOER shall determine whether a bid is complete or notify the local governmental body that further review is needed.</p> <p>A local governmental body shall not issue or publish an RFP until it receives an acknowledgment of receipt from DOER.</p>	<p>Within <u>10 business</u>, DOER will confirm receipt; verify that all documents have been submitted.</p> <p>Within <u>15 business days</u>, DOER shall determine whether a bid is complete or notify the local governmental body that further review is needed.</p> <p>A local governmental body shall not issue or publish an RFQ until it receives an acknowledgment of receipt from DOER.</p>
Advertising Requirements	Once the acknowledgment is received, advertise in the <i>Central Register</i> under general contracts. Publication of an RFP prior to receipt of an acknowledgment is a violation of the procurement process under 225 CMR 10.00.	Once the acknowledgment is received, advertise in the <i>Central Register</i> under general contracts. Publication of an RFQ prior to receipt of an acknowledgment is a violation of the procurement process under 225 CMR 19.00.
DCAMM Certification	Required under prime contractor for energy services.	Required under prime contractor for energy services.
Filed sub-bids	No.	No.
Bid Deposit	No.	No.
Payment Bond	Required during construction period. Contractor must provide proof of bonding capacity before signing contract.	Required during construction period. Contractor must provide proof of bonding capacity before signing contract.
Performance Bond	Yes, 100%	Yes, 100 %
Prevailing Wage	Yes. Please confirm prevailing	Yes. Please confirm prevailing

	wage with the Department of Labor Standards at 617-626-6975.	wage with the Department of Labor Standards at 617-626-6975.
Contractor Evaluation	Yes.	Yes.
Investment Grade Energy	No.	Required before one may negotiate
<del>EMS Contract</del> (IGA)	<b>The guidelines for filing a contract are the same under 225 CMR 10.00 and 225 CMR 19.00.</b>	
<b>Submission Guideline</b>		
Contract Award	Required to provide public notice of the meeting at which it proposes to award the EMS contract at least ten days before the meeting; promptly publish notice of the award in the Central Register; provide such notice to DOER.	
Prior to executing a contract	Required to file a final version of the contract, a <a href="#">EMS Contract Certification</a> form and DOER's EMS Annual Report with projected energy and water cost savings estimates at least 15 business days prior to signing a contract.	
DOER acknowledgment of receipt	<p>Within 10 business days, DOER will notify the local governmental body confirming receipt of all documents that are under review. Within 15 business days, DOER will determine if it is complete and meets all requirements or if further action is needed. If incomplete, DOER will identify the deficiencies.</p> <p>A local governmental body shall only award a contract for EMS if all the requirements of the regulations have been met.</p>	
Term	Contract term shall not exceed 20 years.	
Measurement and Verification (M&V)	M&V must comply with the most recent version of the Federal Energy Management Program M&V Guidelines including all outside sections. EMS Annual Report must be submitted annually.	
Performance Guarantee	The contractor will provide a written guarantee, warranting that the owner will achieve a specific level of performance in each year. Excess savings inure to the benefit of the owner.	

**Figure 2: Decision Process**



Source: Hawaii Department of Business, Economic Development, & Tourism

## VI: THE ENERGY AUDIT

After the selection process is complete, deciding on capital improvements requires further study by a professional engineer or architect and the attention of financial and administrative personnel. The ESCO needs information to evaluate carefully each measure so one is able to select those improvements that save the most energy at the least cost. An Investment Grade Audit (IGA) is the further study to determine the nature, costs, and savings presented by these improvements. The IGA also takes into account the time-value of money, hence, the investment grade designation.

To obtain the best information, the ESCO provides an on-site professional investment grade technical audit. An engineer or architect trained in the design and maintenance of mechanical and electrical systems conducts an objective and detailed on-site audit of the building (s), quickly recognizing the sources of energy waste and the options available to correct them.

Expect to receive a complete, professional audit report that includes:

- A detailed analysis of the energy profile of the building, including consumption analysis at current levels and at levels of optimal efficiency.
- A listing of O&M measures not already identified, along with potential savings.
- A description and analysis of all applicable capital measures, including estimated costs of design, acquisition, installation, and acceptable mark-ups.
- The expected useful life of each capital improvement, and
- The estimated savings over the useful life of the improvement.
- The method used to derive these estimates.

The objective is to select the most cost-effective energy conservation measures to optimize utility cost savings.

In addition, the auditor can look at such options as solar and renewable energy projects and bring to your attention any zoning ordinances, building codes or other regulations that pertain to your plans or the possible need for an environmental study.

Not only does the IGA focus on the specifications for a particular capital investment, but also the overall potential efficiency of the building and ways in which to improve efficiency. Since energy systems are highly interrelated, evaluating one possible alteration must include an analysis of how that change might affect other parts of the energy system. For example, doing major work on part of the HVAC system may require that the entire system be rebalanced by a qualified HVAC technician, or excessive delamping in an area with incandescent lights may increase the heat demand for that area due to the loss of heat from removed lamps.

The IGA and approved audit report becomes part of your Energy Management Services Contract as an attachment or schedule. If the project is abandoned, the ESCO usually receives an audit fee (the amount agreed upon by both parties).

## VII: CALCULATING UTILITY COST SAVINGS

The utility cost savings performance guarantee in the EMSA is a contractual commitment by the ESCO to the owner that project implementation will result in a specified reduction in energy and water use, monetized over the term of the agreement. In many projects the energy use savings, when translated into dollars based on existing and projected utility rates, will be sufficient to offset annual debt service on the project financing. If in a given year the guaranteed reduction in energy use falls short due to an ESCO-attributable performance failure, the ESCO will reimburse the owner the resulting dollar savings shortfall.

The problem of identifying and capturing energy savings is very real. Measuring and verifying savings from EMS projects requires special project planning and engineering activities. Proper savings determination is a necessary part of good design of the savings program itself. The DOER regulations stipulate the use of the most recent version of the Federal Energy Management Measurement and Verification Guidelines (FEMP M&V Guidelines), which is an application of the International Performance Measurement and Verification Protocol (IPMVP). The Guidelines contain procedures for quantifying the savings resulting from energy efficient equipment, water conservation, improved operation and maintenance, renewable energy, and cogeneration projects.

The “performance” aspect of performance contracting refers to energy performance and drives the way in which savings are determined. Since the measurement and verification (M&V) approach calculates and documents energy savings, it is one of the most important activities associated with implementing performance contracts and is a crucial issue in contract negotiations.

Table 5: Steps to Verify Savings

Before Project Implementation	Step 1: Define the baseline conditions accurately.
	Step 2: Develop a project-specific Measurement & Verification (M&V) plan.
After Project Implementation	Step 3: Commission the systems to ensure that the proper equipment was installed and is performing to specifications prior to project acceptance.
	Step 4: Post-installation verification ensures that the equipment/systems continue to operate correctly and have the potential to generate the predicted savings.
	Step 5: Regular-Interval Verification During the Performance Period.  Verify that the installed equipment is being properly maintained, continues to operate correctly, and continues to generate the predicted savings achieved.

### Define the Baseline

It is essential to establish baseline conditions for estimating savings and comparing the baseline energy use with the post-installation energy use. To establish a baseline, ESCOs require at least 12 consecutive months of resources use data, and preferably 24 or 36 consecutive months. (The additional years of data allow for greater predictability of future resource use, with additional data helpful in smoothing dramatic fluctuations in resource use that result from extreme weather and aberrations in facility use.) The baseline

makes note not only of energy and water use data, but also of the operating conditions under which the resource use took place. These baseline conditions include:

- Type of use for each building in the project (e.g., office, residential/dormitory, laboratory, athletic/gymnasium, cafeteria/cooking, health care, etc.);
- Weather conditions during the baseline data period, with a particular observance of • “weather days,” or days when the locale experienced extremely hot and/or humid or extremely cold days relative to local norms;
- Number of occupants;
- Typical hours of operation; and,
- Utility rates and any existing energy and water procurement contracts

Baseline information is also used to account for any changes that may occur during the performance period (which may require baseline energy use adjustments) and is included in the ESCO’s final proposal. It is the owner’s responsibility to ensure that the baseline has been properly defined. If a whole building metering or calibrated simulation approach is used, it is important to document the baseline energy use of all end uses, not just those affected by the retrofit.

After implementing the energy conservation measure (ECM), one cannot go back and reevaluate the baseline. It no longer exists! Therefore, it is very important to properly define and document the baseline conditions. Deciding what needs to be monitored (and for how long) depends on such factors as the complexity of the measure and the stability of the baseline, including the variability of equipment loads and operating hours, and the other variables that affect the load.

ESCOs establish the baseline when conducting the Investment Grade Audit (IGA). The performance guarantee then defines the quantified reduction in energy and water use (in kilowatt/hours (kWhs), BTUs, gallons, etc.) from this baseline. The ESCO calculates the dollar value of the utility cost savings attributable to the Energy Conservation Measures (ECMs), which is then expressed as the total annual dollar amount, guaranteed for each year of the performance guarantee term. For example, an ESCO may guarantee that the reduced resource use will reach a level that would be equivalent to \$1,000,000 in annual utility bill savings for each year within a 15-year performance guarantee term, equating to a total absolute savings of \$15,000,000.

The primary sources of questions and complaints on EMS projects are the occasional situations where the owner does not think that savings are being realized. Adequate documentation of the baseline is critical to resolving any such disagreements that may arise.

To determine the energy or demand savings, compare measured energy use or demand before and after implementation of an energy savings program. In general:

$$\text{Savings} = \text{Baseline Energy} - \text{Post Installation Energy} \pm \text{Adjustments}$$

### **Performance Guarantee**

The ESCO guarantees the energy savings from an EMS project, which requires that the ESCO verify that energy savings have been achieved each year. The owner retains any excess savings – the ESCO pays guaranteed savings shortfalls. The ESCO must measure and verify the guaranteed savings at least annually and provide the owner with a Measurement and Verification Report. “Banking” excess savings to cover past or future shortfalls is not an option in Massachusetts. This practice virtually negates the

savings guarantee and shifts the performance risk from the ESCO to the owner. Banking excess savings has a negative consequence on cash flow used to pay down the debt service.

Properly applied, M&V can:

- Accurately assess energy savings for a project
- Allocate risks to the appropriate parties
- Reduce uncertainties to reasonable levels
- Monitor equipment performance
- Find additional savings
- Improve operations and maintenance (O&M)
- Verify that the cost savings guarantee is met
- Allow for future adjustments, as needed

## **Basic Steps**

The basic approach in savings determination is closely linked with elements of program design. As indicated by the IPMVP, the basic approach common to all good savings determination entails the following steps:

1. Select the measurement and verification option consistent with the intended scope of the project
2. Determine whether to adjust post-retrofit conditions
3. Gather relevant energy and operating data from the baseyear and record it for current and future use
4. Design the energy savings program. Include documentation of both the design intent and methods for demonstrating achievement of the design intent
5. Prepare a measurement and verification (M&V) plan. Include a definition of the word “savings” for each project. Include the information from the previous steps. This plan also defines the subsequent steps
6. Design, install, and test any special measurement equipment needed under the M&V Plan
7. After the energy savings program is implemented, inspect the installed equipment and revised operating procedures to ensure that they conform to the design intent of the energy savings program. This process is commonly called "commissioning"
8. Gather energy and operating data from the post-retrofit period, consistent with that of the baseyear and as defined in the M&V Plan. The inspections needed for gathering this data should include periodic repetition of commissioning activities to ensure equipment is functioning as planned
9. Compute and report savings in accordance with the M&V Plan

## **M&V Plan**

Other than developing the baseline, the M&V Plan is the single most important item in an energy savings guarantee. The plan defines how savings are calculated and specifies any ongoing activities that will occur during the contract term. Since the primary purpose of measurement and verification (M&V) is to validate payments or performance guarantees, the cost of M&V should be less than the payment amount or guarantee that is at risk.

Although the M&V Plan is usually developed during contract negotiations, it is important that the agency and the ESCO agree upon general M&V approaches to be used prior to starting the Investment Grade

Audit (IGA). The M&V method(s) chosen will determine what activities are conducted during the audit, and will affect the cost and duration of the audit.

The project-specific M&V Plan includes project-wide items as well as details for each ECM. Project-wide items include:

- Overview of proposed energy and cost savings
- Schedule for all M&V activities
- Agency witnessing requirements
- Utility rates and the method used to calculate cost savings
- O&M reporting responsibilities

ECM-level items include:

- Details of baseline conditions and data collected
- Documentation of all assumptions and sources of data
- Details of engineering analysis performed
- The way energy savings will be calculated
- Details of any O&M or other cost savings claimed
- Details of proposed energy and cost savings
- Details of post-installation verification activities, including inspections, measurements, and analysis
- Details of any anticipated routine adjustments to baseline or reporting period energy
- Content and format of all M&V reports (post-installation and periodic M&V)

## **Industry Best Practices**

Industry best practices are documented in several guidelines, including the International Performance Measurement and Verification Protocol<sup>2</sup> (IPMVP 2007) and ASHRAE Guideline 14: Measurement of Energy and Demand Savings (2002).

### **IPMVP**

The IPMVP 2007 is a guidance document that provides a conceptual framework in measuring, computing, and reporting savings achieved by energy or water efficiency projects at facilities. The IPMVP defines key terms and outlines issues that must be considered in developing an M&V Plan, but does not provide details for specific measures or technologies.

Developed through a collaborative effort involving industry, government, financial, and other organizations, the IPMVP serves as the framework for M&V procedures, provides four M&V options, and addresses issues related to the use of M&V in third-party-financed and utility projects.

The FEMP M&V Guideline contains specific procedures for applying concepts originating in the IPMVP. The Guideline represents a specific application of the IPMVP for federal projects. It outlines procedures for determining M&V approaches, evaluating M&V plans and reports, and establishing the basis of payment for energy savings during the contract. These procedures are intended to be fully compatible and consistent with the IPMVP.

## ASHRAE Guideline 14

ASHRAE Guideline 14, Measurement of Energy, Demand and Water Savings, is a reference for calculating energy and demand savings associated with performance contracts using measurements. In addition, it sets forth instrumentation and data management guidelines and describes methods for accounting for uncertainty associated with models and measurements. Guideline 14 does not discuss other issues related to performance contracting.

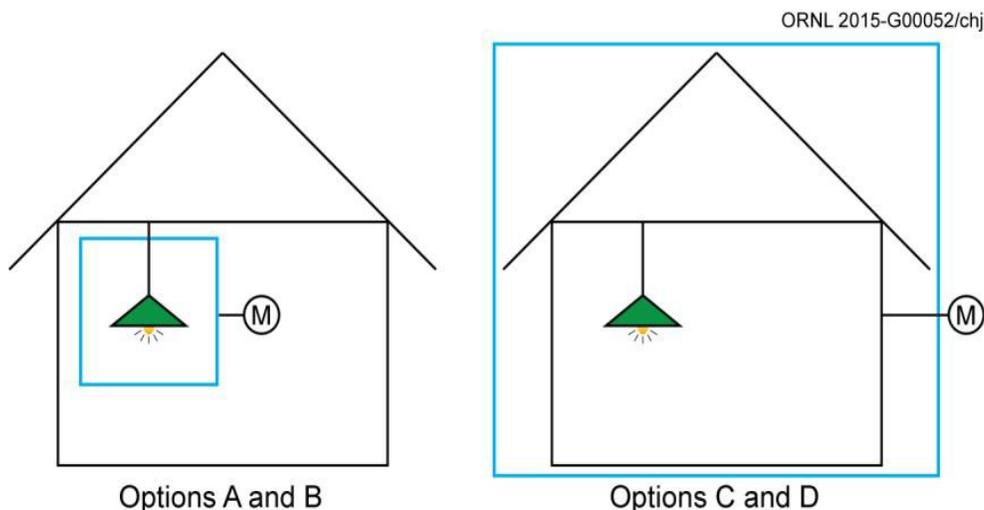
The ASHRAE guideline specifies three engineering approaches to M&V. Compliance with each approach requires that the overall uncertainty of the savings estimates be below prescribed thresholds. The three approaches presented are closely related to and support the options provided in IPMVP, except that Guideline 14 has no parallel approach to IPMVP/FEMP Option A.<sup>12</sup>

### FEMP M&V Options

FEMP M&V options provides an overview of current best practice techniques available for verifying results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities. Table 5 on the next page summarized the four options.

There are two general types of measurement and verification: retrofit isolation and whole facility. Retrofit isolation methods look only at the affected equipment or system independent of the rest of the facility; whole-facility methods consider the total energy use while ignoring specific equipment performance.<sup>13</sup>

Figure 3: M&V Approaches: Retrofit isolation (options A & B) versus whole-facility M&V methods (options C & D) – the difference is where the boundary line are drawn.



<sup>12</sup> M&V Guidelines: Measurement and Verification for Performance-Based Contracts Version 4.0, FEMP, page 4.

<sup>13</sup> Introduction to Measurement & Verification for DOE Super ESPC Projects, June 2007, FEMP, page 4.

Table 6: Overview of FEMP options A, B, C, and D

M&V Option	Performance and Usage Factors	Savings Calculation
Option A – Retrofit Isolation with Key Parameter Measurement	<p>Based on a combination of measured and estimated factors when variations in factors are not expected.</p> <p>Measurements are spot or short-term and are taken at the component or system level, both in the baseline and post-installation cases.</p> <p>Measurements should include the key performance parameter(s), which define the energy use of the ECM. Estimated factors are supported by historical or manufacturer’s data.</p> <p>Savings are determined by means of engineering calculations of baseline and post-installation energy use based on measured and estimated values.</p>	<p>Direct measurements and estimated values, engineering calculations and/or component or system models often developed through regression analysis<sup>14</sup>.</p> <p>Adjustments to models not typically required.</p>
Option B – Retrofit Isolation with All Parameter Measurement	<p>Based on periodic or continuous measurements of energy use taken at the component or system level when variations in factors are expected.</p> <p>Energy or proxies of energy use are measured continuously. Periodic spot or short-term measurements may suffice when variations in factors are not expected.</p> <p>Savings are determined from analysis of baseline and reporting period energy use or proxies of energy use.</p>	<p>Direct measurements, engineering calculations, and/or component or system models often developed through regression analysis.</p> <p>May require adjustments to models.</p>
Option – C Utility Data Analysis	<p>Based on long-term, continuous, whole-building utility meter, facility level, or sub-meter energy or water data.</p> <p>Savings are determined from analysis of baseline and reporting period energy data. Typically, regression analysis is conducted to correlate with and adjust energy use to independent variables such as weather, but simple comparisons may also be used.</p>	<p>Based on regression analysis of utility meter data to account for factors that drive energy use.</p> <p>Typically requires adjustments to models.</p>
Option D – Calibrated Computer Simulation	<p>Computer simulation software used to model energy performance of whole-facility (or sub-facility). Models must be calibrated with actual hourly or monthly billing data from the facility.</p> <p>Implementation of simulation modeling requires engineering expertise.</p> <p>Inputs to the model include facility characteristics; performance specifications of new and existing equipment or systems; engineering estimates, spot-, short-terms, or long-term measurements of system components; and long-term whole-building utility meter data.</p> <p>After calibrating the model, the savings are determined by comparing a simulation of the baseline with either a simulation of the performance period or actual utility data.</p>	<p>Based on computer simulation model (such as eQUEST) calibrated with whole-building or end-use metered data or both.</p> <p>Requires adjustments to models.</p>

Source: FEMP M&V Guidelines, V.4.

<sup>14</sup> Regression Analysis: A technique used to develop a mathematical model from a set of data that describes the correlation of measured variables.

The four M&V options may be applied to almost any type of ECM. However, the rules-of-thumb listed below generally indicate the most appropriate M&V approach for an application.

**Option A** may be applied when the most critical M&V issue is identifying the potential to generate savings, including situations in which:

- The magnitude of savings is low for the entire project or a portion of the project to which Option A may be applied
- The risk of not achieving savings is low

**Option B**, retrofit isolation, is typically used when any or all of these conditions apply:

- For simple equipment replacement projects with energy savings that are less than 20% of total facility energy use, as recorded by the relevant utility meter or sub-meter
- When energy savings values per individual measure are desired
- When interactive effects are to be ignored or are estimated using estimating methods that do not involve long-term measurements
- When the independent variables that affect energy use are not complex and excessively difficult or expensive to monitor
- When sub-meters already exist that record the energy use of subsystems under consideration (e.g., a 277 V lighting circuit, a separate sub-meter for HVAC systems)

**Options C**, billing analysis, is typically used when any or all of these conditions apply:

For complex equipment replacement and controls projects:

- When predicted savings are relatively large (greater than 10% to 20%) as compared with the energy use recorded by the relevant utility meter or sub-meter
- When energy savings values per individual measure are not desired
- Improving the accuracy of a savings estimate happen in two general ways:
  1. By reducing biases, by using better information or by using measured values in place of assumed or stipulated values, and
  2. By reducing random errors, either by increasing the sample sizes, using a more efficient sample design or applying better measurement techniques.

The concerned parties establish the appropriate level for any savings determination. Where the firm performing the energy savings determinations has more experience than the owner does, the owner may seek assistance in reviewing savings reports. Full review of baseline adjustments requires good understanding of the facility and its operations.

**Note:** *The FEMP M&V document contains examples of the aforementioned options. We suggest a review of this information to help determine which savings calculation is best for your circumstance. A link to the guide may be found on the DOER EMS web page at <http://www.mass.gov/eea/energy-utilities-clean-tech/green-communities/ems.html>.*

## Renewable Energy Projects

Although the traditional ESCO project has involved mostly building improvements, 25A allows public agencies to use this procurement process to install renewable energy on public land. Renewable energy projects involve the installation of devices and/or systems that generate onsite energy (e.g., electricity or heat) or displace energy consumption using onsite renewable energy resources. The idea of using performance contracting for renewables is not a new one. Since 1995, the concept of Guaranteed Solar Results has been applied to the implementation of solar projects. A particular level of energy delivery is guaranteed; compensation is made to the owner if measured delivery falls short of the guarantee.

Including renewable energy in performance contracts is becoming more common, particularly with municipalities, but also with colleges and universities. Solar photovoltaic (PV) systems are the most common technology included in these contracts, but small wind and small biogas power projects have been included as well. In performance contracts that include renewable energy systems, the ESCO makes an assumption about the renewable energy system's ability to reduce demand for grid-supplied electricity. In that sense, the renewable energy system is treated like just another energy-efficiency measure, in that it reduces traditional utility payments (and greenhouse gas emissions).<sup>15</sup>

There are several aspects of these projects that distinguish them from energy efficiency measures – obviously, renewables supply energy rather than reduce the amount of energy used. The measurement and verification strategy for renewable energy (standardized under FEMP as are the m&v standards for other measures) differentiates between a reduction in fossil fuel use caused by renewable energy delivery as opposed to one caused by a reduction in load by efficiency measures or curtailment.

Furthermore, because renewable energy technologies are used in an energy generation system, there is no need for a baseline if performance claims are based on generation rather than savings. Metering of delivered energy without a baseline is the recommended M&V approach for renewable energy systems because it is very accurate and relatively inexpensive.

Examples of technologies include photovoltaics (PV), active or passive solar systems for space conditioning or production of domestic hot water, and wind systems. For additional information on the measurement and verification of renewable energy projects, refer to IPMVP for renewables.<sup>16</sup> The most notable difference between renewable energy projects and other energy conservation measures (ECMs) is that renewable projects supply energy rather than reduce the amount of energy used. Measuring the energy supplied allows for a simplified approach to measuring savings that is not possible with energy efficiency projects. Option B deserves special consideration when evaluating M&V options for renewable energy projects.

Like many projects, the performance of most renewable energy technologies depends on the environmental conditions, such as solar radiation or wind speed.

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<sup>15</sup> Energy Performance Contracting Financing Options: EPC Toolkit for Higher Education, April 2009, Clinton Foundation, page 14.

<sup>16</sup> International Performance Measurement & Verification Protocol: Concepts and Practices for determining Energy Savings in Renewable Energy Technologies Applications, Volume II, August 2003.

## **Energy Metering**

Determining the electrical output of systems is relatively straightforward. This is because electrical output and parasitic loads can be simply measured with many commercially available meters. Measuring thermal output (e.g., hot water from a domestic hot-water solar system displacing an electric water heating system) is also straightforward, but not necessarily inexpensive, using commercial Btu meters, water flow meters, temperature transducers, etc. However, all of the thermal and electrical output from a system does not necessarily displace an equivalent amount of load. This is due to storage, system losses, and differences in time between when useful energy is produced and when it is needed.

### **1. Electrical Metering**

Electricity measurements associated with system output, parasitic loads, power to the project site, and power to third parties and the utility may be needed. All electrical meters (and related equipment) are usually provided, installed, owned, and maintained by the ESCO or the servicing utility.

When a net metering approach is used, meter(s) will typically show the measure's gross output (in kW and kWh) less parasitic use (e.g., pump motors) and sales to third parties or the local utility, as well as any local transformation and transmission and battery storage losses. The goal with this method is usually to measure net generation delivered to the project site. Metering, interconnection (including safety provisions), reporting, and other related issues are to be in accordance with current electrical standards and the requirements of the servicing electric utility.

With the net energy-use M&V approach, deliveries to and from the facility should be separately recorded and treated as separate transactions. For purposes of power delivered to the site, a single meter that records energy supplied to the site is preferred. If a calculated transformer loss value is used, it should be based on certified factory test data for that particular transformer.

The following are some suggested metering requirements:

- kWh and demand metering at the point of delivery
- Time of-delivery metering
- Provisions for remote meter reading

### **2. Thermal Metering**

Thermal meters (e.g., Btu meters) are required for measuring the net thermal output of certain renewable energy systems (e.g., hot water generated by an active solar system). Note that metering of thermal energy requires a "net" measurement of flows and enthalpy to and from a system. Measurements of thermal flows may need to take into account any vented or wasted energy that is produced by the system but not used at the site, as well as distribution and storage losses. Also note that small errors in enthalpy measurements (usually determined by temperature) can introduce large errors in the energy calculations; hence, meter precision, accuracy, and calibration are especially important.

## **Notes on Some Renewable Energy Technologies**

### **1. Active Solar Thermal Systems**

Active solar thermal systems include systems for producing industrial process heat, domestic hot water, and space heating and cooling. Useful monitoring includes 1) site inspections and brief temperature and system monitoring for diagnostics, 2) spot, short-term, or long-term monitoring of system key parameters such as temperatures, energy flows, and control status, and 3) utility billing analyses.

### **2. Passive Solar Systems**

Passive solar systems usually involve the performance of a whole building with architectural features such as overhang design and use of thermal mass. As such, this technology is different from other renewable energy measures, in that, mechanical devices with identifiable energy inputs and outputs are not involved. Thus, passive solar M&V typically involves the analysis of a whole building, and thus it is best to use utility billing analyses or calibrated simulation techniques, i.e., Options C or D.

### **3. Wind, PV, and Other Renewable Generation Projects**

With these types of systems, the performance characteristics of the components are usually well defined, such as the conversion efficiency of the PV modules or the Btu content of landfill gas. In addition, the electrical or thermal flows can usually be easily measured and Option B is typically utilized. The complexity of these projects lies in projecting long-term performance due to variation in the resources (e.g., solar insolation, wind resource, or reserve of methane gas in a landfill) and accounting for any variations between when the resource is available and when it is needed (i.e., the interaction of storage systems and their inefficiencies).

## VIII: NEGOTIATING AN EMSA

Awarding Authority's have the right to include additional terms or refrain from including terms in the final agreement (except for minimum terms). Parts of the DOER's model EMSA are outlined here along with provisions common to most contracts.

Following best practices, precisely defining the savings guarantee, and the performance of the energy conservation measures (ECMs) ensures optimum value throughout the life of the contract.<sup>17</sup> The services provided under an EMSA incorporate financing (typically a separate, coterminous, agreement with a financier), design, engineering, installation, project management, technical advice, training and sometimes repair & maintenance.

The allocation of responsibilities between the owner and the ESCO defines the specifics of the guarantee, who does what, and who pays for what during the term of the contract. In the development stage of the project, the ESCO and the owner evaluate how to allocate these responsibilities, taking into consideration the owner's resources and preferences.

At the heart of a performance contract is a guarantee of a specified level of cost savings and performance, with the ESCO carrying the risk for an unmet guarantee (shortfall). The question is:

1. What exactly is being guaranteed?
2. Who is responsible for factors that affect performance and savings?
3. Who pays for what?

### Financial Factors

1. **Energy Prices:** Energy prices, along with usage, determine the dollar value of the energy-cost savings guaranteed by the ESCO. Since the parties have no control over energy prices, owners, and ESCOs generally opt for simple and practical ways to arrive at prices to use in savings calculations. A common practice is to stipulate current energy prices for the first year of the contract and use historic data to determine potential increases or the energy price escalators published by the [US Energy Information Administration](#) (EIA) for succeeding years.

The chances that this approach will have serious financial consequences for the owner are very small. If prices turn out to be lower than expected, "savings" may be smaller on paper than projected, but the owner benefits from the lower prices and will be able to pay its bills. If energy prices are higher than projected, savings will exceed expectations, and the problem of higher prices will be easier to manage because the owner will be buying less energy than before the EMS project. Keep in mind that the primary purpose of the guarantee is to ensure that the owner will be able to pay all its bills for energy and related operations and maintenance (O&M) from its annual energy and related O&M appropriations.

2. **Construction Costs:** The ESCO can control construction costs and generally guarantees a firm, fixed price for the project, typically taking bids and locking in subcontractor prices before submitting the final proposal.

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<sup>17</sup> Portions of this section have been reprinted from the Federal Energy Management Program

3. M&V Costs: In considering the wide range of measurement and verification (M&V) options and costs, the key questions are:

A thorough awareness of all the options and associated costs can help a municipality negotiate a deal that uses resources effectively, makes good business sense, and yields optimum value.

- a) How much do I want to spend?
- b) What degree of accuracy do I need?
- c) What are the tradeoffs?

The M&V effort should be scaled to the value of the project so that the value of the information provided by the M&V activity is appropriate to the value of the project itself. Rule-of-thumb estimates put overall annual M&V costs at 2% to 5% of typical annual project cost savings. Often, some ECMs will entail greater M&V costs, but the overall M&V costs for the project are balanced by other ECMs that do not require substantial annual activities.<sup>18</sup>

4. Interest Rates: Neither the ESCO, the owner, nor the financier controls interest rates. However, financing transaction costs can be affected by the owner's choices. Understanding the structuring and costs of financing for projects will help the owner acquisition team keep financing costs as low as possible. Using a realistic interest rate (one that is actually available to the owner) when estimating savings is essential.

## Operational Factors

1. Operating Hours and Plug Load: The owner generally assumes financial responsibility for operating hours and load in one of two ways:
2. Baseline adjustments: The contract specifies baseline adjustments for changes in operational factors so that savings calculated in relation to the higher baseline will better reflect the savings attributable to the new ECMs. Baseline adjustments must be supported by measurements.
3. Stipulation: Both parties can accept stipulated operational factors and estimated savings based on engineering calculations and measurements as a fair representation of savings. If related requirements are met (i.e., satisfactory commissioning results and maintenance tasks performed), the guarantee is considered to be met.

Operating hours and plug loads are often stipulated. With well-proven, predictable technologies, stipulation is often the most practical choice. The alternative is for the owner to spend money on measurements and monitoring just to check up on itself.

4. Weather: A sensible approach is to normalize calculations of the baseline and yearly energy savings to a typical weather year. In mild weather years, savings will seem small, but the energy bill will also be smaller than normal and the finance payment manageable, with funds to spare. In extreme weather, savings will exceed expectations, and it will be easier for the owner to manage and pay all its bills than before the project.

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<sup>18</sup> FEMP M&V Guidelines v.4, page 5-4

5. **User Participation:** The behavior of building occupants is subject to only minimal control by anyone. One strategy for handling occupancy effects is to stipulate comfort settings to use in calculations and document the baseline.

### **Performance Factors/Responsibilities**

Performance of the ECMs is the foundation of the guarantee and the value of the project. The ESCO is ultimately responsible for selection, application design, installation, and performance of the equipment, and must maintain specified standards of service (temperature, humidity, lighting levels, etc.). To be negotiated and spelled out in the contract is:

1. How performance and standards of service will be verified (which option, A, B, C, or D)
2. What the consequences for unacceptable performance and standards of service will be. (How will the owner be made whole?)

Responsibility for O&M and equipment repair and replacement (R&R) is negotiable and may be assumed by the ESCO, owner staff, or subcontractors. In any case, it is critical to spell out how proper performance of these functions will be ensured.

Typically, the owner operates the equipment with ESCO oversight. Maintenance can go either way, but the ESCO is always responsible for defining the maintenance program and verifying execution. Generally, the ESCO is responsible for R&R through extended equipment warranties. However, owners should negotiate whatever arrangement best addresses their needs. Some choose to keep all of these functions in-house to minimize the cost of the project; others lack the in-house capability or prefer to pay more for the “insurance” of having one responsible party for all these functions.

### **Elements of the Agreement**

1. **Definitions:** This section contains definitions relevant to the contract and project. Make sure definitions match those in the statute or commonly used in engineering.
2. **Term:** This sets the duration of the contract. In Massachusetts, EMS contracts may have a term of up to twenty years.
3. **ESCO’s Services:** This describes the scope of work that the ESCO performs in the implementation and design of the energy conservation measures. This section outlines responsibilities related to the energy audit, equipment design and construction, maintenance, upgrades or alterations including timelines and standards of service.
4. **Responsibilities of the Customer:** This outlines the customer’s responsibility to conduct certain necessary measures to achieve savings. This ensures that the Awarding Authority understands its commitment and prevents the ESCO from unreasonably claiming that omissions by the customer resulted in unachieved savings.
5. **Measurement & Verification Plan**

- a) Baseline Development Procedure including detailed methodology for calculating savings, the energy baseline, utility rate schedules and floor and ceiling prices for energy and water.
  - b) Monthly Savings Calculation
  - c) Reconciliation of Dollar Estimate of Guaranteed Savings
  - d) All savings should be consistent with the savings presented in the IGA. The IGA report should become part of the contract.
6. Ownership of Property: Ownership describes how and when ownership of installed equipment passes to the customer, references a list of equipment warranties, and defines proprietary rights and risk of loss. Equipment ownership may be important to the ESCO for purposes of securing financing or for the tax treatment of the ESCO's revenues under the performance contract. Specific language may include that all equipment installed by the ESCO remains the property of the ESCO during the term and that ownership transfers to the Awarding Authority at the expiration of the performance contract. You may want to consult your attorney should the proposer wish to alter this provision.

In cases where the ESCO's equipment includes software, you should ensure that you receive a license, both during the contract term and perpetually afterwards, to use the software to the extent necessary to operate facility equipment.

7. Payment and Guaranty of Savings: Defines compensation, utility cost savings stated yearly, reference savings calculations and the method used in those calculations, and any adjustments, and define right to retain an independent audit of verified savings.

Again, in an EMSA, savings measurement is a vital issue. Savings calculation should be stated in energy saved multiplied by the per unit cost of that energy. To be budget neutral, the total yearly savings must cover the total yearly cost of the contract. You may use internal funds, utility incentive, state or federal incentives or grants to finance some ECMs. Make sure to account for the use of these funds.

8. Termination: Defines the conditions whereby the customer notifies the ESCO of termination, sets a notice schedule, and defines "material breach" and "termination value". Defines actions or conditions that would result in default of the contract by the owner and any that would result in default of the contract by the ESCO. Note: Early Termination describes terms and/or conditions for early termination by the owner and the financial considerations of early termination such as penalties, payments, etc.
9. Performance and Payment Bonds for Construction: This section describes in detail the payment and performance bonds provided with the project as they pertain to construction. These are typical construction bonds – do not confuse these with the performance guarantees.
- a) Performance Bond: Provides protection from financial loss to the project owner should the contractor or subcontractor fail to perform according to the terms and conditions in the EMSA.
  - b) Payment Bond: Provides assurance that specified subcontractors, laborers and suppliers associated with the project will be paid in the event of default by the ESCO

10. Insurance:

a) Describes provisions for worker's compensation and protective public liability insurance and property damage.

b) Provides for errors and omissions insurance

11. Force Majeure: There are events outside the ability of the parties to control, such as any cause beyond the reasonable power of the party claiming Force Majeure. It may include sabotage, strikes, acts of God, war, riot, civil disturbance, drought, earthquake, flood, explosion, fire, lightning, landslide, etc. However, customers should not accept risks properly borne by the ESCO. Economic hardship of either party does not constitute Force Majeure.

## X: COMMISSIONING

Commissioning of installed equipment and systems is considered industry best practice. It ensures that systems are designed, installed, functionally tested in all modes of operation, and are capable of being operated and maintained in conformity with the design intent (i.e., appropriate lighting levels, cooling capacity, comfortable temperatures, etc.). Benefits of commissioning include increased building comfort, reduced operational problems, lower installation costs, fewer contractor callbacks, and improved energy performance. ASHRAE Guideline 0, *The Commissioning Process*,<sup>19</sup> defines commissioning as “a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria.”

Commissioning usually requires taking performance measurements to ensure that systems are working properly. Because of the overlap in commissioning and post-installation measurement and verification (M&V) activities, some people may confuse the two. The difference is that commissioning ensures that systems are functioning properly; post-installation M&V quantifies how well the systems are working from an energy standpoint.

Building commissioning is a systematic process of ensuring that a building performs in accordance with the design intent, contract documents, and the owner's operational needs. Due to the sophistication of building designs and the complexity of building systems constructed today, commissioning is necessary, but not automatically included as part of the typical design and construction process. Commissioning is critical for ensuring that the design developed through the whole-building design process is successfully constructed and operated.

Both the customer's and the ESCO's operation and maintenance responsibilities are defined in the final contract. Both parties have a strong incentive to ensure maintenance is properly performed. Poor operation and maintenance reduces savings, causing standards of service and comfort to deteriorate below the contract requirements. To avoid this situation, integrate project operations and maintenance into overall facility operations and maintenance using appropriate procedures to measure and verify the performance and savings from the project. Summarize and report performance and savings results regularly to key decision-makers. Continue tracking over the long term to identify and correct for any performance deviations.

Because of the design-build nature of EMS projects, the details of the commissioning activities are developed along with the project scope, rather than being explicitly defined at the beginning of the project.

Please see Reference section on page 40 for the link to a guide to commissioning.

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<sup>19</sup> ASHRAE, *The Commissioning Process*, ASHRAE Guideline 0-2013 (supersedes ASHRAE Guideline 0-2005), the American Society of Heating, Refrigerating, and Air Conditioning Engineers, 2013.

## **XI: MONITORING AND MANAGING THE EMS PROJECT**

After the contract award, the owner's designated project manager is primarily responsible for the day-to-day oversight of the ESCO activities.

Subsequent to ESCO selection, the project proceeds in phases. The key to managing the project is to ensure timely and complete communication between the ESCO and facility staff. Meetings held at major project milestones establish a pattern of communication and mutually agreed benchmarks used to monitor and control the progress of the project. Table 6 on page 40 summarizes major milestones and topics for discussions. Once the contract is awarded, it is easy for the facility staff to turn their attention to their regular responsibilities and for the ESCO to focus on the current task and forget to keep the facility staff informed. A schedule of regular project meetings helps prevent surprises and keeps the contractor on track.

- **Investment Grade Audit:** Following ESCO selection, hold a project meeting to plan the ESCO's first major task—the energy audit. This meeting includes a facility presentation on measures to evaluate and procedures such as security, site check-in and check-out, parking, identification, access to occupied spaces, etc. The ESCO will describe its plan for the energy study, particularly on-site activities, and intermediate submittals for review. Review the audit contract as a reminder of the contract requirements for contents of the energy audit. Notes from this meeting will document mutually accepted procedures and a plan to complete the energy study within a specified schedule.

During the energy audit phase, project meetings between the ESCO's project manager and the owner's project manager (and other facility representatives as appropriate) occur. The purpose of these meetings is for regular updates and discussion of the existing conditions and energy efficiency measures on which the ESCO is focusing. The project manager can use these meetings to ensure the improvements that are important to the Owner.

- **Project Development Plan:** Completion of design development documents is part of the Project Development Plan. In addition, this phase includes a list of the final energy conservation measures being installed, further price discovery, calculation of the final energy savings guarantee, compensation to ESCO, energy use baseline, and methodologies to adjust the energy use baseline. This is a critical juncture in the process and the lack of regular and clear communications can make or break project.
- **Design and Construction:** The design and construction phase of the project requires the most coordination and interaction between the ESCO and Owner. This phase begins with Owner approval and acceptance of the audit report. The model contract requires the ESCO to develop, for the Owner's approval, a schedule for the performance of ESCO's services and submission of in-progress construction documents as needed.
- **Construction Documents and Measure Installation:** During this phase, regularly scheduled project meetings allow the ESCO to make status reports. Issues related to schedules, construction documents, and equipment, etc., are regularly updated in these meetings. Management of the design and construction phase of the performance contract is essentially the same as the management of a large design/build retrofit or repair and maintenance project.

- **Commissioning:** Project commissioning is critical to the success of the project. Commissioning begins with documentation of the design intent and continues through construction, Owner acceptance, and training of facility staff. It extends through the warranty period with actual and documented verification of the proper performance of each system and each piece of equipment.

Meeting on commissioning issues can be held in conjunction with regularly scheduled construction meetings. It is important to discuss any equipment, systems, or design problems during these meetings. For example, it is not uncommon for the commissioning agent to discover code violations or installation of incorrect equipment during construction. It is important to communicate those items to the Owner and ensure corrections are made.

- **Measurement and Verification/Energy Savings Guarantee:** In the audit report and the project development plan, the contractor documented the annual method of determining energy savings and compliance with standards of comfort that will occur throughout the contract term. This method should be referred to and checked against a schedule of first year measurement activities that the contractor submits for approval at the commissioning meeting. This schedule should include a joint annual inspection to verify that all contractor-installed equipment is being operated and maintained as designed. The annual meeting should review the calculation of energy savings for the previous year, including any material changes or modifications of the energy use baseline. At each annual meeting, the schedule of measurement activities for the following year should be reviewed and approved.

These annual meetings are not a substitute for ongoing monitoring of maintenance activities or standards of comfort or regular auditing of energy-savings estimates. They provide an opportunity for a comprehensive review of the performance of the project on a facility-wide basis. Because they are not in response to an immediate problem, the meetings make it easier to observe trends and long-term facility changes. They also serve as an annual opportunity for facility staff to ask questions and offer suggestions to the contractor regarding how to optimize system performance.

**Table 7: Milestone Meetings**

RFP	RFQ
<b>Energy Management Services Contract</b>	
Initial Project Meeting <ul style="list-style-type: none"> <li>• Discuss measures Owner wants evaluated,</li> <li>• Discuss security, site check-in and check out</li> </ul>	
Invest Grade Audit - <b>Optional</b>	Investment Grade Audit Agreement - <b>Required</b>
Energy Audit Implementation	Energy Audit Implementation
Hold regularly scheduled meetings to discuss existing conditions, energy measures, potential problems, etc. <ul style="list-style-type: none"> <li>• Present energy audit drafts</li> <li>• Discuss modifications to energy audit</li> <li>• Present final Technical Energy Audit</li> </ul>	Hold regularly scheduled meetings to discuss existing conditions, energy measures, potential problems, etc. <ul style="list-style-type: none"> <li>• Present energy audit drafts</li> <li>• Discuss modifications to energy audit, such as further price discovery</li> <li>• Present final Technical Energy Audit</li> </ul>
Project Development	Project Development
<ul style="list-style-type: none"> <li>• Hold regularly scheduled meetings to discuss progress, potential problems, etc.</li> <li>• Present plan and design document drafts</li> <li>• Discuss modifications to plan and design drafts</li> <li>• Present final Project Development Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Hold regularly scheduled meetings to discuss progress, potential problems, etc.</li> <li>• Present plan and design document drafts</li> <li>• Discuss modifications to plan and design drafts</li> <li>• Present final Project Development Plan</li> </ul>
Design and Construction	<b>Energy Management Services Agreement</b>
Initial Project Meeting <ul style="list-style-type: none"> <li>• Review contract requirements</li> </ul> Present schedule for the performance of ESCO services and interim construction documents	Design and Construction
Construction Documents and Measure Installation	Initial Project Meeting <ul style="list-style-type: none"> <li>• Review contract requirements</li> </ul> Present schedule for the performance of ESCO services and interim construction documents
Weekly meetings to: <ul style="list-style-type: none"> <li>• Discuss project status</li> <li>• Present interim construction documents</li> </ul>	Construction Documents and Measure Installation
Commissioning	Weekly meetings to: <ul style="list-style-type: none"> <li>• Discuss project status</li> <li>• Present interim construction documents</li> </ul>
<ul style="list-style-type: none"> <li>• In-progress testing/commissioning results</li> <li>• Notice of completion</li> <li>• Plan for acceptance testing of work</li> <li>• Plan for facility personnel training</li> <li>• Plan for installation documentation</li> <li>• Schedule for first-year measurement activities</li> </ul>	Commissioning <ul style="list-style-type: none"> <li>• In-progress testing/commissioning results</li> <li>• Notice of completion</li> <li>• Plan for acceptance testing of work</li> <li>• Plan for facility personnel training</li> <li>• Plan for installation documentation</li> <li>• Schedule for first-year measurement activities</li> </ul>
Annual Monitoring of Savings & Standards of Comfort	Annual Monitoring of Savings & Standards of Comfort
<ul style="list-style-type: none"> <li>• Calculation of energy savings and baseline reconciliation modifications</li> <li>• Schedule for next year’s measurement activities</li> <li>• Schedule for preventative maintenance and training</li> <li>• Outstanding issues</li> </ul>	<ul style="list-style-type: none"> <li>• Calculation of energy savings and baseline reconciliation modifications</li> <li>• Schedule for next year’s measurement activities</li> <li>• Schedule for preventative maintenance and training</li> <li>• Outstanding issues</li> </ul>

Based on *Guide to Energy Savings Performance Contracts*, Oregon Department of Energy

## Post Award Meeting Agenda Items<sup>20</sup>

### Safety & Environmental

- Job site safety walk-down and supervisor orientation schedule.
- Safety aspects of job evaluated, identified and workers informed.
- Check worker licensing and certifications.
- Burn Permit approval requirements.
- OSHA health cards up-to-date as required by site.
- Scaffolding inspections signed.
- Check job-site for any confined spaces and insure compliance with entry.
- Check to insure any underground utilities have been located and identified.
- Check to insure any in-the-wall utilities have been located and identified.
- Check to insure all hazardous materials either stored or as a part of the facility, have been located and identified. Site-specific requirements for hazardous material handling identified.
- Insure all personnel have been made aware of fire exit corridors and procedures.
- Site Injury reporting and response requirements.
- Emergency Notification Process.
- Environmental permits prior to construction.

### Organization and Communications

- Key Contractor and site contacts. (Names/Phone/Cell/Pager)
- Schedule for design/construction update meetings.
- Change notice review and approval process.
- Emergency Notification Process.

### Timeline – Design/Construction Schedule

- Design and design approval schedule.
- Construction Schedule.

### Design

- Engineering drawings approval requirements – prior to construction.
- Redline authority approved for as-build drawings during construction.
- Equipment data sheets submittal and approval requirements.

### Facility Access & Security Requirements

- Contractor personnel site and/or building access requirements.
- Security Badges.
- Escorts.
- Allowable equipment.
- Vehicle Access approval requirements.

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<sup>20</sup> [Federal Energy Management Program, Resources and Guidance](#)

## Outages

- Utility service interruption permits approval.
- Utility reconnect permits approval. (Including hot-wire permits.)
- Site personal support for outages.

## Construction

- Excavation permits approval requirements.
- Crane movements and locations reviewed for overhead hazards.
- Construction startup coordination requirements. (Building manager and occupants).
- Materials and equipment confirmed at job-site or scheduled to arrive prior to need.
- Establish acceptable lay-down yard and/or office space allocations for contractors.
- Job/Work lists prepared and approved.
- All worker certifications (welding, electrical, etc.) up-to-date.
- All vehicle licensing up-to-date.

## GLOSSARY

**Baseline:** Current energy utility, water, and fuel costs.

**Baseline Adjustments:** The non-routine adjustments arising during the post-retrofit period that cannot be anticipated and which require custom engineering analysis.

**Baseyear:** A defined period of any length before implementation of the ECM(s).

**Baseyear Conditions:** The set of conditions that gave rise to the energy use/demand of the baseyear.

**Baseyear Energy Data:** The energy consumption or demand during the baseyear.

**Commissioning:** A process for achieving, verifying and documenting the performance of equipment to meet the operational needs of the facility within the capabilities of the design, and to meet the design documentation and the owner's functional criteria, including preparation of operator personnel.

**Degree Day:** A degree-day is measure of the heating or cooling load on a facility created by outdoor temperature. When the mean daily outdoor temperature is one degree below a stated reference temperature such as 18°C, for one day, it is defined that there is one heating degree-day. If this temperature difference prevailed for ten days there would be ten heating degree-days counted for the total period. If the temperature difference were to be 12 degrees for 10 days, 120 heating degree-days would be counted. When the ambient temperature is below the reference temperature, it is defined that heating degree-days are counted. When ambient temperatures are above the reference, cooling degree-days are counted. Any reference temperature may be used for recording degree-days, usually chosen to reflect the temperature at which heating or cooling is no longer needed.

**Energy Audit:** *As defined in the statute*, a determination of the energy consumption characteristics of a building or facility which: (a) identifies the type, size and rate of energy consumption of such building or facility and the major energy using systems of such building or facility; (b) determines appropriate energy conservation maintenance and operating procedures; and (c) indicates the need, if any, for the acquisition and installation of energy conservation measures or alternative energy property.

**Energy Conservation:** *As defined in the statute*, shall include but not be limited to the modification of or change in the operation of real or personal property in a manner likely to improve the efficiency of energy use, and shall include energy conservation measures and any process to audit or identify and specify energy and cost savings.

**Energy Conservation Measure (ECM)** — *As defined in the statute*, measures involving modifications of maintenance and operating procedures of a building or facility and installations therein, which are designed to reduce energy consumption in such building or facility, or the installation or modification of an installation in a building or facility, which is primarily intended to reduce energy consumption.

**Energy Conservation Projects:** *As defined in the statute*, projects to promote energy conservation, including but not limited to energy conserving modification to windows and doors; caulking and weather-stripping; insulation, automatic energy control systems; hot water systems; equipment required to operate variable steam, hydraulic and ventilating systems; plant and distribution system modifications, including replacement of burners, furnaces or boilers; devices for modifying fuel openings; electrical or mechanical furnace ignition systems; utility plant system conversions; replacement or modification of lighting

fixtures; energy recovery systems; on-site electrical generation equipment using new renewable generating sources as defined in section 11F; and cogeneration systems.

**Energy Management Services (EMS):** *As defined in the statute*, a program of services, including energy audits, energy conservation measures, energy conservation projects or a combination thereof, and building maintenance and financing services, primarily intended to reduce the cost of energy and water in operating buildings, which may be paid for, in whole or in part, by cost savings attributable to a reduction in energy and water consumption which result from such services. (EMS is a type of energy saving performance contracting.)

**Energy Management System** — A computer programmed to control and/or monitor the operations of energy consuming equipment in a facility. (Not to be confused with the term “Energy Management Services”.)

**Energy Savings:** Actual reduction in electricity use (kWh), electric demand (kW), or thermal units (Btu). In dollar amounts, the same multiplied by the unit price. *As defined in the statute*, a measured reduction in fuel, energy, operating or maintenance costs resulting from the implementation of energy conservation measures or projects; provided, however, that any payback analysis to evaluate the energy savings of a geothermal energy system to provide heating, cooling or water heating over its expected lifespan shall include gas and electric consumption savings, maintenance savings and shall use an average escalation rate based on the most recent information for gas and electric rates compiled by the Energy Information Administration of the United States Department of Energy.

**Energy Services Company (ESCO):** A firm which provides a range of energy efficiency and financing services and guarantees that the specified results will be achieved under an energy saving performance contract (as used here, equivalent of an Energy Management Services Contract).

**Measurement & Verification (M&V):** The process of determining savings using one of the four FEMP Options.

**Metering:** Collection of energy and water consumption data over time at a facility by using measurement devices.

**Monitoring:** The collection of data at a facility over time for the purpose of savings analysis (i.e., energy and water consumption, temperature, humidity, hours of operation, etc.)

**M&V Option:** One of four generic M&V approaches defined herein for energy savings determination.

**Post-Retrofit Period:** The period of time following commissioning of the ECM.

**Regression Model:** Inverse mathematical model that requires data to extract parameters describing the correlation of independent and dependent variables

**Simulation Model:** An assembly of algorithms that calculates energy use based on engineering equations and user-defined parameters.

**Verification:** The process of examining the report of others to comment on its suitability for the intended purpose.

### *Typical Electricity Rate Schedule Terminology*

**Contract Demand:** Power level that the utility guarantees to supply to the building, usually the maximum demand level required for a building to operate.

**Demand Charge:** A charge for the maximum rate at which electricity is used during peak hours of the billing period (Peak Demand), in \$/kW-mo. May also have reduced charges for off-peak demand.

**Energy Charge:** A charge for the amount of electricity used in the billing period, in \$/kWh-mo. May be separated into peak- and off-peak components of consumption and may vary seasonally.

**Fuel Cost Adjustment, or FCA:** Consumption cost adjustment used to reflect the varying market value of fuel, in \$/kWhmo.

**Late Charge:** A fee applied to the entire monthly balance for overdue payment, usually a percentage of the total monthly bill, in dollars.

**Peak Hours:** Daily operating hours during which the highest level of demand for electricity from the utility exists. Electricity costs during these hours may be higher.

**Purchased Power Cost Recovery Factor:** Costs passed on to the customer for power purchased by the utility from other suppliers in \$/kWh-mo.

**Sales Tax:** Tariff based on amount of energy consumed in \$/kWh-mo.

**Service Charge:** An administrative charge fixed at a small flat rate based on services provided.

### *Typical Gas Rate Schedule Terminology*

**Allocation Charge:** Charge for consumption in excess of monthly gas allocation as defined in the service contract, in \$/CCF-mo. or \$/tTherm-mo. Usually only applied to larger customers.

**Contract Demand:** Maximum daily amount of gas that utility agrees to supply to the building, usually the maximum daily amount of gas that a building requires to operate.

**Demand Charge:** A charge for the maximum daily consumption of gas during the billing period, in \$/CCFday or \$/thermday.

**Energy Charge:** A charge for the amount of gas consumed during the billing period, in \$/CCF-mo or \$/therm-mo. This charge may fluctuate seasonally.

**Late Charge:** A fee applied to the entire monthly balance for overdue payment, usually 5% of the total monthly bill, in dollars.

**Pipeline Charge:** Utility costs for rental of pipeline space and recovery fees for financial losses resulting from deregulation, \$/CCF-mo or \$/therm-mo.

**Purchase Gas Cost Adjustment:** Costs passed on to the customer that reflect the fluctuations in the market value of gas, in \$/CCF-mo or \$/therm-mo.

**Ratchet Clause:** Penalty for an unusually high monthly demand. The ratchet demand will replace the actual demand levels on bills for 12 months following the peaking incident.

**Sales Tax:** Tariff based on amount of gas consumed, in \$/CCF-mo or \$/therm-mo.

**Service Charge:** An administration charge fixed at a small flat rate based on services provided, in dollars.

## ***ORGANIZATIONS AND AGENCIES***

**U.S. Department of Energy**, <http://www.energy.gov>

**U.S. Environmental Protection Agency**, <http://www.epa.gov/>

### **Energy Services Coalition**

A national nonprofit organization composed of a network of experts from a wide range of organizations working together at the state and local level to increase energy efficiency and building upgrades through energy savings performance contracting.

<http://www.energyservicescoalition.org/>

### **National Association of Energy Service Companies (NAESCO)**

The primary organization representing the energy performance contracting.

<http://www.naesco.org>

**Federal Energy Management Program**, <http://energy.gov/eere/femp/federal-energy-and-water-efficiency-project-financing>

**Illuminating Engineering Society of North America**, <http://www.iesna.org>

**Massachusetts Department of Labor and Workforce Development**, Division of Occupational Safety, Preventing Indoor Air Quality Problems during Construction and Renovation

<http://www.mass.gov/lwd/labor-standards/massachusetts-workplace-safety-and-health-program/indoor-air-quality-.html>

For links to additional resources please go to the DOER EMS web page at

<http://www.mass.gov/eea/energy-utilities-clean-tech/green-communities/ems.html>