Guide To

Energy Performance Contracting for Local Governments

Maryland Energy Administration

July, 2014

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This guide is adapted for Maryland local governments and public school systems from a report originally prepared for the State of Hawaii in 2011. Although some of the information contained here may be useful for state agencies too, our primary audience is the local government decision-maker: many local governments are less well versed about energy performance contracting than are their state agency counterparts. The original guide was sponsored by the United States Government and the State of Hawaii. The information, data, or work presented herein was funded in part by an *agency* of the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or services by trade name, mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government, any agency thereof, or the State of Hawaii or the State of Maryland.

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LIST OF ABBREVIATIONS

DOE	U.S. Department of Energy
ECM	Energy (and/or Water) Conservation Measure
EPA	U.S. Environmental Protection Agency
EPC	Energy Performance Contract or Contracting
ESPC	Energy Savings Performance Contract
ESCO	Energy Services Company
FEMP	Federal Energy Management Program
IGA	Investment Grade (Energy) Audit
IPMVP	International Performance Measurement & Verification Protocol
kWh	Kilowatt-hour
LEED	Leadership in Energy and Environmental Design
MEA	Maryland Energy Administration
M&V	Measurement & Verification
O&M	Operations & Maintenance
RFP	Request for Proposals

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1. INTRODUCTION

Most state, local and county agencies face increasing energy costs and the need to replace or upgrade aging, inefficient, and obsolete energy and water consuming equipment. Although these needs are often evident, capital improvement and operating budgets have typically been inadequate to fund the needed upgrades. To address these concerns, energy performance contracting (EPC) has been developed as an innovative approach to implementing energy and water conservation measures in a facility or facilities, using guaranteed energy and water savings to finance the projects. The guide assists local governments desiring to procure EPCs to achieve energy and water savings in their facilities, to measure and verify energy savings, and to provide for long-term maintenance. The purpose of this Guide is to educate key decision makers on how to effectively design and manage an energy performance contracting project. In November 2008, Lawrence Berkeley National Laboratory published a study, entitled *Performance Contracting and Energy Efficiency in the State Government Market*, which examined 12 leading states' EPC programs and identified "best practices" for successful state EPC programs. The study can be accessed at http://eetd.lbl.gov/ea/emp/reports/lbnl-1202e.pdf.

As described in this *Guide*, EPCs, first and foremost, allow agencies to implement energy and water saving projects that budget constraints would otherwise prevent. Under an EPC, an Energy Services Company (ESCO) identifies potential energy and water conservation project. These projects can then be implemented using the avoided future utility and maintenance costs to pay for new energy and water conservation equipment, ESCO's services (e.g., project development, training, and commissioning), and financing. The agency can install new high efficiency lighting, cooling, and other equipment without incurring any up-front project costs, which is very advantageous when the needed capital improvement funds are not in the current budget. The opportunities to save energy cost-effectively, in buildings with large lighting and equipment loads, have increased significantly. For example, the savings performance of lighting technologies, cooling equipment, and direct digital control systems has improved dramatically in the last five years. Large increases in costs for electricity, natural gas, and water in the last few years have made many efficiency projects much more economically feasible. After project costs have been paid off, the agency owns the equipment and retains all of the savings for the remaining useful life of the equipment.

A key aspect of this approach is that the ESCO provides corporate guarantees that the energy and water savings, which must be measured and verified at specific intervals, will cover all project costs. If the savings guarantee is not met, the ESCO is obligated to pay the difference to the agency. The use of measurement and verification and continuous commissioning help the agency and the ESCO ensure that the savings guarantee and equipment performance levels are met.

This Guide describes how local agencies may implement EPC projects using the process described in Section 4, "The Energy Performance Contracting Process." In Section 2, "What is an Energy Performance Contract?" the differences between conventional construction contracts and energy performance contracts, which contain long-term services and performance measurements, are explained. Features of various project financing options for energy performance contracts and the criteria for evaluating and selecting a project financing mechanism are described in Section 3, "Energy Performance Contract Financing." The later phases of managing and monitoring an EPC project are described in Section 5, "Managing and Monitoring the Energy Performance Contract." Section 6, "Measuring and Verifying Energy Savings and Commissioning," discusses how to measure and verify energy, water, and operational savings over the term of the contract. The importance and the benefits of having a plan for long term maintenance services are enumerated in Section 7, "Maintenance Plan and Services"; references and sources of additional information are listed in Section 9, "References and Sources of Further Information." In addition, there are a number of appendices to this guide that contain sample contracts, technical exhibits, financing agreements and other resource information.

The use of energy performance contracts by State agencies and local governments is authorized (and encouraged) by the Title 12, Subtitle 3 of the State Finance and Procurement Article of the Annotated Code of Maryland, Energy Performance. The current statute may be found at: http://www.lexisnexis.com/hottopics/mdcode/. NOTE: the statute is in the process of being changed at the time of this document.

In summary, this statute encourage state and local agencies to reduce energy, water, and operations and maintenance costs in their facilities through the use of energy-savings contracts, including energy performance contracts.

2. WHAT IS AN ENERGY PERFORMANCE CONTRACT?

This section provides an overview of energy performance contracts (EPCs), what sets them apart, and their benefits.

2.1 Overview of Energy Performance Contracting

An EPC is a comprehensive agreement in which an energy services company (an ESCO) performs an investment grade energy audit, and develops, designs, arranges financing for, installs, and often operates and maintains energy- and water-saving improvements for a customer, such as a state or county agency. Third-party lending institutions generally finance EPC projects. The agency uses future avoided costs from utility bills generated by the project to pay off the original investment, plus financing and maintenance costs, over the term of the contract, which can be up to 15 years.

Annual energy savings are contractually guaranteed by the ESCO. To ensure accountability, all EPCs include a formal measurement and verification (M&V) plan that specifies procedures the ESCO must follow to demonstrate that the installed energy conservation measures are delivering the guaranteed savings. If the savings guarantee is not met in a given year, the ESCO must pay the agency the difference between the guaranteed amount and the actual verified amount. This savings guarantee places the risk of performance on the ESCO, not the agency.

2.2 How Are EPCs Different?

An EPC differs significantly from the contracting methods typically used by state and county agencies to procure energy efficiency services and equipment, as discussed below.

2.2.1 Conventional Contracting

The conventional, *design-bid-build* process of purchasing energy-efficiency improvements can require several separate solicitations and contract awards. First, an agency solicits engineering services for a study to identify potential energy conservation measures at a specified facility. After reviewing the completed study, the agency selects the measures to be implemented and solicits proposals for engineering design services. Once the designer is selected and completes the plans and specifications, the agency issues one or more invitations for bids to select companies who will install the improvements. Finally, the agency solicits bids to request preventive maintenance services for any equipment the facility is unable to maintain with in-house staff. Throughout this process, the agency must identify and set aside adequate funding to pay for the various design and construction costs.

In recent years, several state and county agencies have employed a *design-build* contracting system to implement construction projects. Design-build is similar to performance contracting in that it brings the design and construction professionals together onto a single project team, working under a single contract. This approach eliminates the need for multiple solicitations and contract awards, and condenses the project schedule by overlapping the design and construction phases of the project.

2.2.2 Energy Performance Contracting

An EPC allows for a comprehensive approach to energy and water savings that is more desirable and cost effective than a single measure approach. Projects rely on the technical expertise of an ESCO to design and build a comprehensive and creative technical solution to rising energy costs. The crucial benefit of energy performance contracting for governments is that it allows future operating cost savings to pay for improvements.

EPCs go further than the typical design-build contract, and 1) include a measurement and verification plan to validate utility savings; 2) require that the utility and other operational avoided costs cover all project costs; and 3) usually use third party financing. ESCOs are required to guarantee utility savings and, based on an annual reconciliation, reimburse the agency for any savings below the guarantee. Also, with an EPC a guaranteed performance result is bought, not just new equipment. See Figures 2-1 and 2-2 on the following page for an illustration of the differences in project savings performance levels between conventional contracting and energy performance contracting. EPCs also contain guarantees of environmental comfort parameters, such as ventilation rates, temperature, and light levels.

EPC streamlines the conventional procurement process by using a single request for proposals covering all aspects of the project, and one services contract with the selected proposer. Using the performance contracting approach creates a mini-design competition between proposers, which encourages project constructability and results in more flexibility in defining the project scope. The ability to select equipment and services based upon their quality and value, rather than lowest first cost, is a significant advantage for delivering the lowest life-cycle cost. Having a single provider deliver a comprehensive project increases accountability for project performance and reduces administrative costs compared to a piecemeal implementation of project components.

A more detailed description of the EPC process can be found in Section 4 of this *Guide*.

Figure 2-1
Savings Erosion Over Time: Typical of Conventional Energy Projects

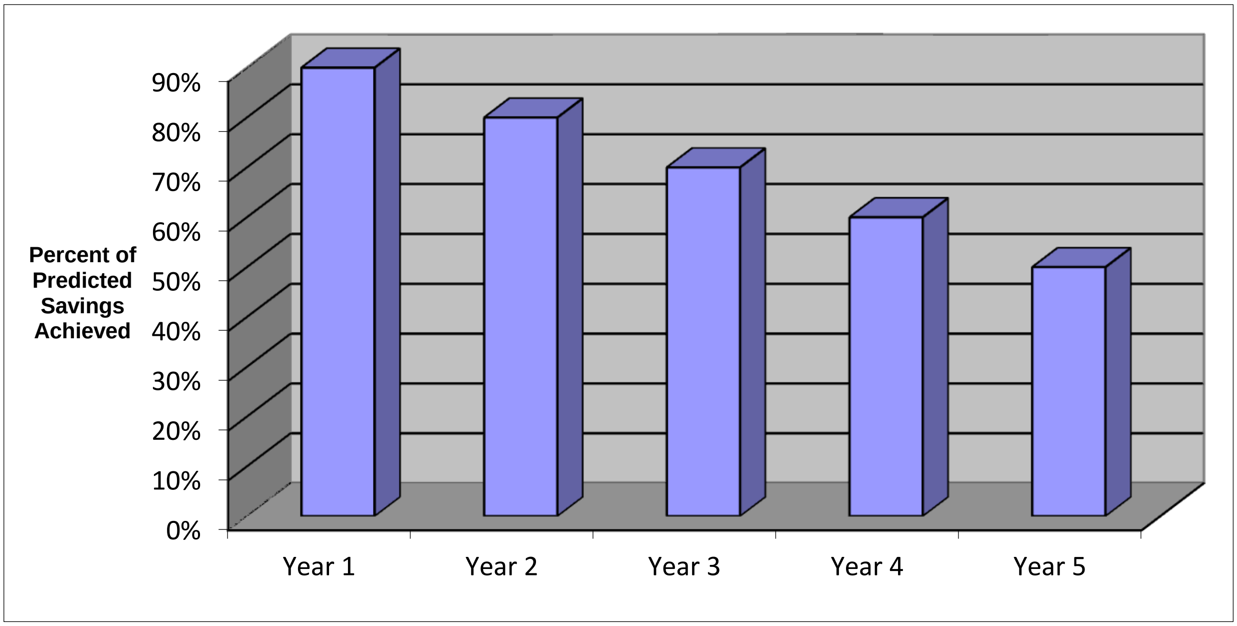
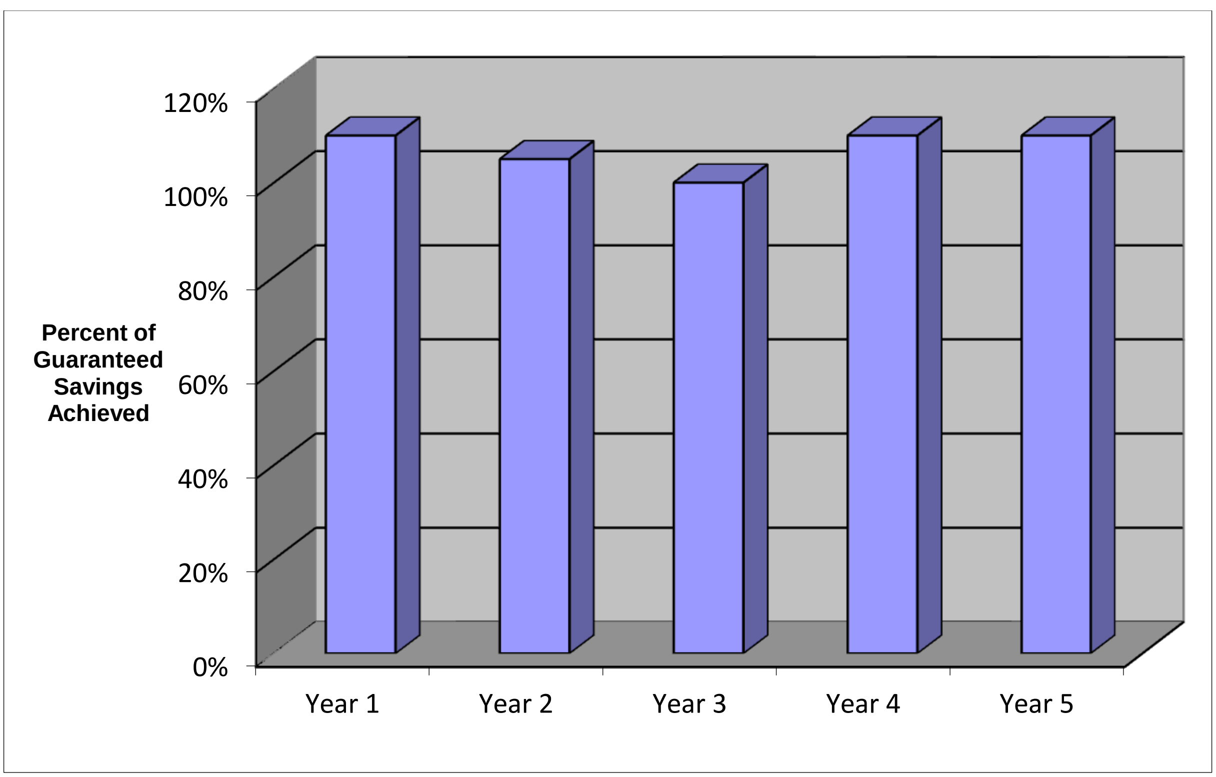


Figure 2-2
Stable Savings Guaranteed Over Time: Typical of EPC Projects



2.3 Business Case for an EPC

Energy performance contracting offers a number of features that address the concerns of many agencies in dealing with increased energy costs and the need to replace worn-out equipment, while lacking the necessary funding, expertise, or resources. These beneficial aspects of an EPC include the following:

- An EPC is structured so that the ESCO is responsible for the actual level of energy savings achieved. By law, the annual energy cost savings produced by the project must be guaranteed by the ESCO to be greater than annual project costs. A performance contract thus pays for itself. As savings must be guaranteed by the ESCO, it is in the ESCO's interest to maximize the energy savings and ensure that the savings are maintained for each year of the contract term.

- A single procurement is used to purchase a complete package of services in which one ESCO is accountable for project development, design, procurement, installation, maintenance, and operation of the energy conservation measures to guarantee optimum savings and performance.

- The ESCO can arrange or assist the agency in securing project financing.

- Energy cost savings from an EPC can be used to pay for an efficiency project that can include needed non-energy capital improvement projects. Budgetary concerns are acutely felt in all levels in the public sector, and funding constraints often result in the delay (and sometimes omission) of needed equipment replacement, maintenance, and renovation. Using performance contracts is a much faster way to deliver energy efficiency projects. Many public agencies do not have enough staff or the appropriate technical expertise to manage these complex projects in-house. There may be no incentive for in-house staff to accept the risk of project non-performance or to financially guarantee the results of the project's performance. Also the traditional procurement process for capital projects may require the acceptance of low-bid equipment instead of a best-value project design that minimizes life-cycle costs. Using the traditional c apital budget process for a comprehensive project may take as long as five years or more when an ESCO could deliver it in two years. And some local entities lack any capital budgets.

- A comprehensive approach maximizes the capture of savings opportunities available from a specific building or set of buildings. It minimizes the ratio of project management costs to the total savings produced from the project. It also provides financial leverage to do more expensive individual measures that would not be economical to do on a stand-alone basis. A comprehensive project allows the measures with quick payback periods to subsidize those with longer paybacks. A common error is for a facility to do only the shorter payback measures prior to a performance contract. The agency then has lost the opportunity to maximize project scope by using savings from short payback items to pay for longer payback measures.

- Energy system repair and maintenance costs associated with inadequate, aging, or outdated equipment are a substantial component of fixed operating costs. A properly implemented EPC can significantly reduce these costs. Replacing equipment near the end of its useful life, which has very high maintenance and repair costs, can produce significant operation and maintenance (O&M) cost savings.

- Improving temperature control, ventilation rate, and light levels, as part of an EPC will increase building occupant comfort, resulting in fewer complaints. The economic benefits for human health and productivity from better thermal, visual, and acoustic comfort, and better indoor air quality could be worth as much as the annual utility cost savings. Properly measuring these benefits could lead to larger investments in improving indoor environmental quality.

- As part of its performance-contracting obligation, the ESCO will provide up-to-date technical training on the operation and maintenance of the ESCO's installed equipment to building occupants and agency staff. This training helps maintain the persistence of savings.

- When in-house expertise is limited, the ESCO contract can be structured to include a cost that may be used to pay for an independent performance contract manager or consultant to oversee the ESCO and represent the agency's interests.

- Many ESCOs' staff are LEED accredited, a green building rating system developed by the U.S. Green Building Council, that provides a list of standards for environmentally sustainable construction, and familiar with the U.S. Environmental Protection Agency's (EPA's) ENERGY STAR tools and resources and can help facilities qualify for these programs.

- All costs associated with the energy efficiency improvements are paid for with utility cost and operations and maintenance (O&M) savings. This allows projects to be paid for with existing utility and O&M budget avoided costs, and no up-front funds are needed. See Table 2-1 EPC Case Study for an estimate of the value of utility and O&M savings.

- ESCOs commonly retain local subcontractors to work on a performance contract. This leads to economic development benefits, including the creation of "green" jobs and contributions to local economic growth. See Table 2-1 for an estimate of the jobs created/retained from the EPC project.

- By reducing utility consumption of fossil fuels, electricity, and water, performance contracting projects significantly reduce air pollution and preserve scarce resources. See Table 2-1 for an estimate of the environmental benefits derived from an ESCO project.

Table 2-1
Hawaii Project Case Study: Benefits of Project Implementation*

Project Savings	**Project Years****			**Annual Energy Savings**	**Annual Environmental Benefits**
	Year 1	Year 2	Years 3-20		
Jobs Created/Retained	421	421	20		
kWh				6,619,813	
KW				14,529	
H_2O (kGal)				19,426	
Sewer (kGal)				53,225	
Energy Savings ($)				$3,550,703	
O&M Savings ($)				$906,859	
Total Annual Savings ($)				$4,457,562	
Carbon Dioxide (CO_2) (lbs)					11,363,217
Nitrous Oxide (NO_x) (lbs)					30,699
Sulfuric Oxide (SO_x) (lbs)					34,865
Equivalent Trees Planted (acres)					2,158
Cars Removed from Roads					1,739

***Based on an energy performance construction project valued at $36,873,266, with an estimated annual value of project support services, including O&M, training and M&V, of $1,847,418.

**Information reported by NORESCO based on U.S. Department of Energy guidelines, which assumes that "1 job is created/retained for every $92,000 in project costs." Jobs created include electrical, mechanical, controls and maintenance. For Years 1 and 2, 401 project construction jobs and 20 support jobs are created/retained. In Year 3 through Year 20, 20 support jobs are created/retained and continue for the project term.

3. ENERGY PERFORMANCE CONTRACTING FINANCING

The most economical approach for public agencies is to secure their own energy performance contract (EPC) project financing with assistance from the ESCO and to require the ESCO to provide the savings guarantee that covers the annual financing payments and other project costs. Avoided future utility and operating costs are the source of savings for these projects. This is a key advantage of EPCs. Therefore, it is important that utility budgets be funded at baseline consumption levels for the duration of the contract. The tax-exempt status granted to a public agency enables it to access lower-cost financing than what is available to an ESCO. Using this approach means that the ESCO:

- Arranges or facilitates the necessary construction financing;
- Arranges or facilitates long-term financing so that the annual repayment obligation is less than the project's annual achieved savings;
- Is contractually liable to pay the agency for any shortfalls if the project's annual achieved savings are less than the financing payments; and
- Is familiar with various types of financing available for the specific project.

Successful EPC financing guidelines include:

- **Short Transaction Cycle**: Project financing that can be readily obtained and financing agreements that can be executed quickly after receipt of project technical approvals;
- **Flexibility of Financing**: This typically involves the use of third-party tax-exempt financing, which offers customized structures to maximize agency benefits;
- **Construction Progress Payments**: This is standard industry practice to fund the project costs into an escrow account and permit progress payments to an ESCO during construction;
- **Leverage of Financial Incentives**: Seek to leverage financial incentives offered by other government incentive programs;
- **Project Transaction Cost Minimization**: Encourage, when appropriate, the capture of transaction cost economies from the combination of capital funds with EPC financing. A more comprehensive project—including long payback measures, such as windows-- can be implemented more rapidly and with lower project management costs when available capital funds are combined with an EPC project; and

- **Transaction Cost Financing**: Typically, transaction costs are minimal and can be financed into the project cost to reduce or eliminate the upfront, out-of-pocket expenses of the agency in connection with EPC financing.

Most ESCOs have established relationships with financial institutions willing to provide financing for EPC projects. While the repayment obligation ultimately resides with the agency, the ESCO is financially liable for the savings guarantee needed to cover the financing payments and other project costs.

The quick access to cost-effective tax-exempt financing allows agencies to pay for capital projects without waiting for capital appropriations. Savings from comprehensive energy efficiency projects occur over time, irrespective of how the agency pays for the project. By deferring the implementation date of a project for years at a time, the savings that would have occurred had that project been implemented earlier represents the cost of delay. Operating funds are typically used to pay utility invoices for the commodity of utility service. When a portion of these utility funds is redirected to invest in needed energy savings capital improvements, the local government receives a greater value from scarce operating budget resources.

> ***COST OF DELAY: AN EXAMPLE***
>
> ***The annual value of energy savings from the project is projected at $3.55 million or approximately $300,000 per month. If local government customer had had to wait for two years for capital appropriations for the cost of this project, the cost of delay would have been over $7 million (24 months X $300,000). The value of these lost energy savings was so large that it eliminated any financial advantage of waiting until appropriated funds were available.***

An ESCO is effectively a competitive energy services provider that offers greater value than the utility is able to provide for the same or lower cost.

There are a number of factors to consider when assessing financing options for guaranteed energy savings projects:

- **Size of project investment**: Project investment varies depending upon the level of annual energy savings that can be achieved. For example, $1 million-$5 million; $6-$15 million; greater than $15 million.

- **Length of financing term**: Maryland statute allows for contract terms up to 15 years.

- **Type of financing instrument**: Examples of financing methods are General

Obligation (GO) bonds, tax-exempt leases and certificates of participation.

- **Interest rate**: Interest rates vary with the type of financing used and length of financing term.

- **Flexibility of escrow account structure**: The structure of the escrow account varies with the type of financing used.

- **Flexibility of financing instrument to fund project "soft costs"**: Most financing methods allow funding of "soft cost" such as design, engineering, construction management, etc.

- **Credit worthiness of the agency and ESCO**: The higher the ratings of the agency and ESCO the easier it is to obtain financing.

- **Length of construction period**: Depending on project size and complexity, the construction period typically takes 8-16 months.

- **Construction period financing**: Currently, most financing methods count the construction period as part of the financing term.

- **Equipment ownership**: Normally, title to the equipment resides with the agency. The financier retains a security interest in the equipment.

- **Project bonding requirements**: Payment and performance bonds are required for project construction.

- **Financing repayment schedule**: Repayment schedules can be variable with levelized or escalating payments which track the rising value of savings over time.

3.1 Financing Mechanisms

Capital for energy-efficiency improvements is available from a variety of public and private sources, and can be accessed through a range of financing options. In general, the following financing mechanisms are available for investments in energy efficiency and renewable energy projects:

- Currently available internal funds
- Traditional debt financing (e.g., GO bonds)
- Tax-exempt lease-purchase agreement (TELP) and certificates of

participation (COPs)

- Utility rebates and state and local government financial programs
- Special federal programs (e.g., Qualified Energy Conservation Bonds [QECBs], Clean Renewable Energy Bonds [CREBs])
- Power purchase agreements (PPAs)

Regardless of which financing mechanism is chosen, the following information will be needed by the lessor (e.g., bank or leasing company) prior to financing:

- Equipment description
- Cost of equipment
- Amount to be financed
- Financing term
- Repayment frequency
- Delivery date of equipment
- Anticipated funding date
- Escrow or non-escrow funded

3.1.1 Currently Available Internal Funds

Energy improvements are paid for by the direct allocation of appropriated funds from an organization's operating or capital budgets. Such allocations are normally made as a part of the organization's annual budgeting process. For large EPCs, the available levels of internal budget funds are usually sufficient to cover only a fraction of total project costs.

3.1.2 Traditional Debt Financing

Energy-efficiency improvements for local government and school system facilities can be financed through (a) commercial loans and (b) from proceeds from General Obligation (GO) or Revenue Bonds. The bonds are attractive to the financial market because they are backed by the full faith and credit of the issuer. This means that the issuer pledges its authority to tax, raise and collect sufficient funds to satisfy the bond obligations. These financings are considered to be "debt" from a constitutional standpoint, and there are statutory debt restrictions that may limit their availability if the issuer is close to its debt ceiling limit. Approval to issue the bonds must be obtained from the legislature or by public referendum that can impose significant project implementation delays. Energy projects must also compete with the bond financing of other essential government services and capital project needs. Debt financings often involve relatively high costs of issuance related to underwriter's fees and bond counsel fees.

3.1.3 Tax-Exempt Lease-Purchase Agreement (TELP) and Certificates of Participation

Tax-Exempt Lease-Purchase Agreement (TELP)

A TELP agreement is an effective alternative to traditional debt financing (bonds, loans, etc.) because it allows a public organization to pay for energy upgrades by using money that is already set-aside in its annual utility budget. It is the most frequently used financing vehicle for EPCs. When properly structured, this type of financing makes it possible for public sector agencies to draw on dollars to be saved in future utility bills to pay for new energy-efficiency equipment and related services today.

Because the interest component of the lease payments to the financing institution is exempt from federal income taxes, (IRS Code Section 47(c)(2)(B)(v)) the financier is able to pass these tax savings back to the agency in the form of lower interest rates. In addition, costs of issuance, if any, for a TELP are minimal.

A TELP agreement typically does not require legislative or voter approval. This type of financing also allows the agency to receive title to the equipment with an equipment security interest held by the lender. The ready access to TELP financing makes this method the most attractive and commonly used method for financing guaranteed energy savings projects by public agencies.

Key features of TELP financing include:

- All project "soft" costs -- audits, design, engineering, installation and construction management fees, finance and legal fees, construction interest, etc. can be financed
- Lessee takes title to the equipment at the beginning of the lease term
- Investor retains a first security interest in the equipment
- Lease payments are subject to annual appropriations each fiscal year (technically, does not create long-term debt, but it is legally considered such debt by most Maryland decision-makers).
- Construction financing can be arranged; net construction interest costs are capitalized in the lease proceeds with funds placed in escrow with trustee; all interest earnings on undisbursed construction monies accrue to lessee
- Flexible payment schedules can be arranged

- Fast access to funding

Certificates of Participation (COP)

COPs can also be used to finance projects and are structured similarly to a TELP, with repayment by the agency subject to annual appropriations. COPs can have lower interest rates for larger projects (e.g., more than $5 million), but the transaction costs of COPs are higher than for a TELP, so the total cost of project financing must be evaluated to determine which is the most advantageous financing mechanism. In addition, COPs issued publicly require upfront and ongoing disclosure by the state (similar to G.O. bonds). The investor holding the certificate receives a portion of each lease payment as tax-exempt interest.

3.1.4 Utility Rebates and State and Local Government Incentive Programs

While not strictly a project financing mechanism, utility incentives can be used to reduce the overall cost of a project and decrease the amount that needs to be financed. All ESCO contracts are obligated to seek out any applicable incentives and rebates from the utilities. Maryland electric utilities have an especially robust set of energy efficiency incentives for commercial and residential buildings, including public housing authorities. So too the MEA moderate and low income grant program may be used to leverage additional funds for an EPC.

3.1.5 Power Purchase Agreements (PPA)

In a PPA, a third party investor owns and operates the equipment (usually for large renewable energy projects and cogeneration projects). PPAs require an agency to take the electricity output from the third party-owned equipment as its first priority for power needs as part of a long-term agreement to supply energy at a specified price. A PPA requires no up-front capital investment by the customer, and the ESCO handles the equipment installation and O&M on behalf of the customer. The cost of power is based on a long-term rate with a pre-determined annual escalator. Additional information can be found at the U.S. EPA's web page http://www.epa.gov/greenpower/buygp/solarpower.htm.

3.2 Recommended Financing Approach

A tax-exempt lease purchase (TELP) agreement facilitated by the ESCO is the most widely available method used by public agencies to finance EPC projects. The quick access to tax-exempt lease financing makes this method, especially when combined with available utility rebates, an attractive way for public agencies to finance energy projects. A Sample Equipment Lease Purchase Agreement is located in Appendix L.

4. THE ENERGY PERFORMANCE CONTRACTING PROCESS

The steps necessary to initiate and complete the process of awarding an energy performance contract (EPC) are summarized in Table 4-1. As shown, the process begins with the identification and refinement of a potential energy efficiency project or projects, proceeds through the designation of an EPC project team and project manager and concludes with the selection of an ESCO and award of the performance contract. Each of these steps is described in further detail in the following paragraphs.

Table 4-1
Steps in the Energy Performance Contracting Process

STEP	ACTION	DURATION
1	IDENTIFY POTENTIAL ENERGY EFFICIENCY PROJECT(S)	1-2 MONTHS
2	DEFINE AND DEVELOP THE PROJECT ▪ IDENTIFY EPC PROJECT TEAM AND PROJECT MANAGER ▪ PREPARE PROJECT TECHNICAL FACILITY PROFILE FOR INCLUSION IN THE RFQ	1 MONTH
3	SELECT A CONTRACTOR (ESCO) ▪ DRAFT AND ISSUE AN INVITATION FOR PROPOSALS (RFQ) ▪ CONDUCT PRE-PROPOSAL MEETING AND SITE VISIT ▪ EVALUATE PROPOSALS AND SELECT AN ESCO ▪ NEGOTIATE AND AWARD THE INVESTMENT GRADE AUDIT AGREEMENT	3-4 MONTHS (or longer depending on project complexity)
4	INITIATE PROJECT ▪ ESCO CONDUCTS INVESTMENT GRADE ENERGY AUDIT ▪ AGENCY REVIEWS AND ACCEPTS INVESTMENT GRADE ENERGY AUDIT REPORT	3-6 MONTHS (or longer depending on project complexity)
5	FINALIZE ENERGY SAVINGS (EPC) CONTRACT ▪ NEGOTIATE FINAL PROJECT SCOPE AND ARRANGE FINANCING	2 MONTHS

4.1 *Step One – Identify Potential Energy Efficiency Project(s)*

There are a number of technical and project management considerations to evaluate when selecting a suitable project for an energy performance contract (EPC). In general, the facility should have high annual energy use, coupled with sufficient energy saving opportunities to generate the cash flow needed to amortize all project costs over the contract term and attract ESCOs interest. Some ESCOs are willing to implement projects for smaller facilities, but generally make those decisions on a case-by-case basis. Good candidate projects for EPC will possess most of the following characteristics:

- Minimal availability of funds for energy related capital improvements
- Annual utility costs greater than $200,000, unless part of aggregation with other local governments
- Aging buildings and equipment
- Recurring maintenance problems or high maintenance costs
- Comfort complaints
- Limited energy management expertise
- Too many demands on maintenance staff
- No recent upgrades of lighting, air conditioning, or controls systems
- Energy-using equipment that is ready for replacement
- Large amounts of deferred maintenance

Often, it makes economic sense to combine several facilities into a single project. Multiple building projects with excessive energy costs are usually very attractive to ESCOs and allow the agency to finance and obtain a greater number of energy improvements through a single procurement. Within individual facilities, quick payback measures (e.g., lighting) can be bundled with longer payback measures (e.g., boilers) to create an economically viable project. For additional project site selection criteria, see Appendix B.

In addition to the technical considerations for project site selection, it is important for the agency's management staff to support the project to ensure the success of the EPC project from development through the contracting process and overall project implementation. Management buy-in will be vital to guiding the project through the various review and approval processes and key to keeping the project on track.

Figure 4-1, on the next page, contains some of the prerequisites for agency management to assess when considering undertaking an EPC project.

Figure 4-1
Management Assessment for a Successful EPC Project

<u>Administrative Considerations</u>

- Recognizes the need for energy efficiency improvements
- Has identified a target list of potential improvements
- Committed to comprehensive building efficiency solutions
- Willing to partner and share data with an ESCO
- Open to new energy efficiency solutions (e.g., water, renewables)
- Values the improved knowledge about how their buildings operate
- Recognizes the value of buying best quality equipment
- Committed to using life-cycle costing for evaluating building solutions
- Views maintenance investments as insurance that provides reliable building operation
- Interested in comparing the selected facility against energy performance benchmarks

<u>Financial Considerations</u>

- Top financial decision makers understand the value of EPC
- Understands the economic cost of delaying EPC projects
- Understands the impact of poor indoor environmental quality on employee health and productivity
- Willingness to account for all costs and savings in various budget categories (e.g., energy, maintenance, health and productivity, environmental emissions, utility system cost savings)
- Values guaranteed savings performance
- Understands the trade-off between capital and operating budgets
- Willingness to incorporate capital dollars into an EPC project
- Motivated to reduce energy consumption

4.2 Step Two – Define and Develop the Project

4.2.1 Identify EPC Project Team and Project Manager

Developing and managing an energy performance contract (EPC) will benefit from assembling an EPC project team with a broad range of expertise including facilities planning, procurement, budget and finance, maintenance, and legal. An EPC project manager should be identified who can assemble a project team comprised of individuals possessing a variety of expertise including:

- Technical expertise to assist with site selection, RFQ evaluation process, review of the final energy audit report, development of the final scope of work and any other technical issues
- Knowledge of procurement and contracting to ensure that the process follows applicable procurement rules during the RFQ and contracting

phases, occupancy, maintenance problems and any planned equipment replacement or building renovation. At a minimum, a brief description of the premises and all major energy- using equipment should be provided. Several years of past utility consumption data, preferably by fuel unit and cost, also should be included. Instructions for preparing the Technical Facility Profile are located in Appendix D.

4.3 Step Three – Select a Contractor (ESCO)

The Maryland Department of General Services (DGS) has developed a qualified list of ESCOs to provide EPC services in Maryland. The pre-approved individual ESCO proposals included maximum audit costs, mark-ups and fees.

Participating jurisdictions may select qualified ESCO's from the Contractor List for the purpose of seeking proposals for their projects, but are not mandated to select from the listed Energy Service Companies. Waivers from the use of the Vendor List will not be required.

After the ESCO is selected, the agency will enter into an Investment Grade Audit (I G A) Agreement that provides for the negotiated cost of the audit to be rolled into the EPC project financing and repaid from the project savings. Should the agency decide not to proceed with the EPC project after an acceptable audit has been completed, the ESCO would then need to be reimbursed for its efforts at a negotiated price.

4.3.1 Draft and Issue a Request for Qualifications (RFQ)

The standard RFQ defines the scope of the project, project schedule, the procurement process, evaluation criteria, special contractual terms and conditions, and specific corporate and technical information to be submitted by the ESCO in writing. The primary purpose of the RFQ is to give form and substance to the project and to establish the ground rules for the ESCO selection and contracting process. Development of objective evaluation criteria is critical for ensuring that the most qualified ESCO is selected. This process is designed to identify the most qualified ESCO to implement the EPC project based on a comparison of the ESCO's relative abilities, experience, and expertise. Since the selected ESCO will be a partner for as long as 15 years, it is also important to select an ESCO that the agency is comfortable working with and that shares the agency's goals. The RFQ process is a good way to compare ESCOs technical approaches to the project, and evaluate their capabilities and commitment.

In addition, the RFQ should clearly state that guaranteed energy savings must pay for all project costs and on-going services (e.g., maintenance and savings measurement and verification etc.) for the duration of the contract. This requirement establishes the financial performance parameters of the installed project.

The RFQ addresses the essential components common to an EPC and contains the following information:

- A completed Technical Facility Profile that identifies the facilities to be considered, their current energy use, size and any unique conditions;
- The scope of services requested including the energy audit, engineering design services, equipment installation and construction management, equipment commissioning, energy savings measurement and verification, assistance with project financing, equipment operation, maintenance, and training services;
- Contractual terms and conditions that will apply to the project
- A description of the required proposal format and content
- Instructions for proposal submission, and a timetable for proposal review and ESCO selection
- The evaluation criteria that will be used as the basis for selection, including the relative importance of price and other evaluation factors

The RFQ should be sent to at least three ESCOs to ensure adequate competition among technically qualified firms. Figure 4-2 on the next page summarizes key information requested in the RFQ.

Figure 4-2
Key RFQ Information Requested

- Experience with implementing performance contracting arrangements
- Understanding of and experience with energy measures likely to be installed
- Financial stability and experience with project financing
- Background and EPC experience of all project personnel assigned to the project
- Performance record of past EPC projects managed by the ESCO's personnel who will be assigned to the project
- Calculation methods used to compute base-year utility use and project savings
- Savings measurement and verification and project monitoring methods
- Proposed approach to ongoing maintenance and other services
- Proposed structure for the savings guarantee and ESCO fee payments
- Technical energy audit cost
- Training services for the facility staff
- Sample investment-grade technical energy audit, project commissioning plan, maintenance plan, and customer savings report

4.3.2 Conduct Pre-Proposal Meeting and Site Visit

Following release of the RFQ but before submission of proposals, it is recommended that a pre-proposal meeting and a site visit be scheduled for all selected ESCOs. The purpose of the meeting and site visit is to answer any questions regarding the RFQ and for potential proposers to become acquainted with the proposed project facilities, interview facility and agency staff, and clarify technical matters.

The site visit will provide the information necessary to prepare an accurate and credible estimate of the cost to conduct the investment-grade energy audit that each ESCO must include in their proposals. The ESCOs' ability to provide a relevant sample audit, commissioning plan, M&V plan, and O&M plan will depend on observations made during the site visit. For very large and complex projects, ESCOs may request, and should be afforded, the opportunity to make additional visits to the proposed facilities.

4.3.3 Evaluate Proposals and Select an ESCO

Based on the evaluation criteria in the RFQ, proposing ESCOs qualifications are evaluated based on their project team, areas of technical expertise, past project experience, and preliminary project costs. ESCOs are also required to submit a preliminary cash flow analysis that illustrates how the project will financially perform over the term of contract.

The composition of an evaluation committee can involve any number of agency personnel, including, but not limited to:

- Facility/Operating Engineers
- Maintenance Staff
- Procurement Officer
- Energy Manager/Designated Project Manager
- Administrative/Financial Manager
- Technical Advisors/Consultants

However the committee is assembled, it is important to include individuals involved with daily facility operations during the entire procurement and evaluation process. Using a committee allows the evaluation to benefit not only from the expertise within the agency and the on-site knowledge of facility staff, but also from the EPC experience of personnel from other State and local agencies. It is strongly recommended that the evaluation committee receive training on the evaluation process.

It is recommended that the evaluation committee members review all written submissions before they begin their rankings. This initial review familiarizes them with each proposal's content and how the information is presented and organized, and further gives the evaluators a sense of the variations in qualifications between competing ESCOs.

It is important to note that this is a comparative evaluation methodology. Team members will be ranking the competing ESCOs in comparison to each other, not to an abstract standard. A simple way to conduct these evaluations is with a side-by-side comparison of the written submissions on each specific evaluation criterion. A numerical scoring system is used to rank the proposals.

It is important to select an ESCO that agency and facility staff can relate to over an extended period of time. Oral interviews with the ESCO project teams are strongly recommended. The use of a numerical ranking system to evaluate the ESCOs should also be used to evaluate oral interviews.

It is useful for two sets of questions to be prepared in advance of the interviews. One set of questions should be asked of **all** ESCOs on a variety of topics. The second set of questions should be based on the specific information contained in each ESCO's proposal. It is recommended that one evaluation committee member be designated as the question facilitator. The format should be open enough, however, so that all members of the evaluation committee have the opportunity to ask questions as they arise.

It is suggested that each ESCO be preliminarily ranked immediately following their oral interview. At the conclusion of all oral interviews, evaluators may re-rank the companies based on having heard all of the interviews and discuss their impressions with other team members.

By tabulating the numerical ranking data collected from the written proposal review and oral interview phases, a final ranking for each ESCO can be determined. The highest- ranked ESCO should be notified of its selection, and invited to enter into negotiations for the investment grade energy audit agreement and EPC energy performance contract.

4.3.4 Negotiate and Award the Investment Grade Audit Agreement

After the agency has approved the selection of an ESCO, negotiation of the investment grade energy audit agreement begins. An IGA audit template is included in the appendix. Once signed by both parties, this agreement authorizes the ESCO to conduct the audit of the project facilities. Under an EPC project, the negotiated cost of the audit will be rolled into the project financing and repaid from the project savings. If the agency decides not to proceed with the project after the audit is completed, the agency is obligated to pay the ESCO for use of the audit.

An investment grade audit is the technical and economic foundation of a successful guaranteed energy savings project. The audit needs to provide sufficient technical detail so that a technically competent reviewer can effectively assess the ESCO's proposed project. The audit results must also establish and define appropriate consumption baselines for all utilities (e.g., gas, water, electric, etc.) to allow a realistic analysis of potential energy and cost savings.

The investment grade audit should include:

- For each proposed energy and water saving measure: installed cost, annual cost savings, annual maintenance cost impacts, simple payback, expected measure life, and environmental impacts
- A full analysis and definition of baseline consumption for each utility type
- A full description of the analysis methods, calculations, data inputs, and all technical and economic assumptions

4.4 Step Four – Initiate Project

4.4.1 ESCO Conducts Investment Grade Energy Audit

The ESCO initiates the audit by collecting data and background information concerning facility operation and energy use for the most recent three years. It will be important for the agency to work diligently to furnish the ESCO with any operational data it may request including information not previously provided in the Technical Facility Profile.

The ESCO then interviews appropriate management, engineering, and maintenance personnel regarding equipment usage, operating schedules, recurring maintenance problems, significantly high maintenance costs, comfort complaints, and any energy or water using equipment that is ready for replacement. The ESCO will also complete an on-site engineering survey of facilities and inspect any major energy-using equipment, including lighting, air conditioning systems, electric motors, water usage, automatic temperature control systems, hot water systems, etc. A more detailed list of potential energy conservation measures is located in Appendix E. The resulting data are used to develop a preliminary list of potential energy and water conservation measures (ECMs). At this phase, the ESCO will also determine baseline energy and water consumption and cost for the individual systems that would be affected by the potential ECMs. A utility rate analysis would also be completed.

It is important that the ESCO conduct a thorough and comprehensive technical and economic facility analysis since this analysis serves as the basis for the project design and performance.

The time required to complete an investment grade audit varies by the facility size and complexity and data availability. Typically, the time to conduct an audit ranges from three to six months.

4.4.2 *Agency Reviews and Accepts Investment Grade Energy Audit Report*

The ESCO's IGA Report that will be submitted to the agency for review and approval describes the potential for utility savings, the approximate cost of the energy and water saving measures necessary to achieve these savings, and a cash flow projection indicating the overall financial effects of the project. A description of analysis methodologies, supporting calculations, and assumptions used to develop a baseline and estimate savings will be included. A properly documented baseline should be included in the contract.

The agency should conduct a rigorous technical review of the IGA report and meet with the ESCO to discuss the proposed energy and water conservation measures and projected project costs and savings. The goal is to structure a project that meets agency needs and is technically and economically feasible. In addition to specific technical measures and supporting technical and financial documentation the IGA report will include:

- **A Commissioning Plan** - to establish a systematic process of ensuring that the proposed array of energy conservation measures will be installed and tested to perform according to the design intent and the facility's operational needs. The initial commissioning report should certify that all newly installed equipment is operating and performing in accordance with the design parameters contained in the commissioning plan. The plan should also address a continuous commissioning process to assure the performance of the ECMs over the life of the project. The ESCO can be directed to hire an independent agent based on a recommendation from the customer.
- **A Measurement and Verification Plan** – to explain how the guaranteed savings from each of the proposed ECMs will be measured and verified. Agency staff should receive basic training on how to understand and interpret the results of M&V reports. Section 6 discusses the M&V process in further detail.
- **An Operations and Maintenance Plan** – describing the activities that the ESCO and the agency will perform related to preventative, predictive, and conditioned-based maintenance to prevent equipment failure or decline, with the goal of increasing efficiency, reliability, and safety. O&M responsibilities of the ESCO and agency personnel should be clearly defined in the plan, as well as any training the ESCO will provide. See Section 7 for a fuller discussion of Maintenance Plan and Services.

4.5 Step Five – Finalize EPC Energy Performance Contract

4.5.1 Negotiate Final Project Scope and Arrange Financing

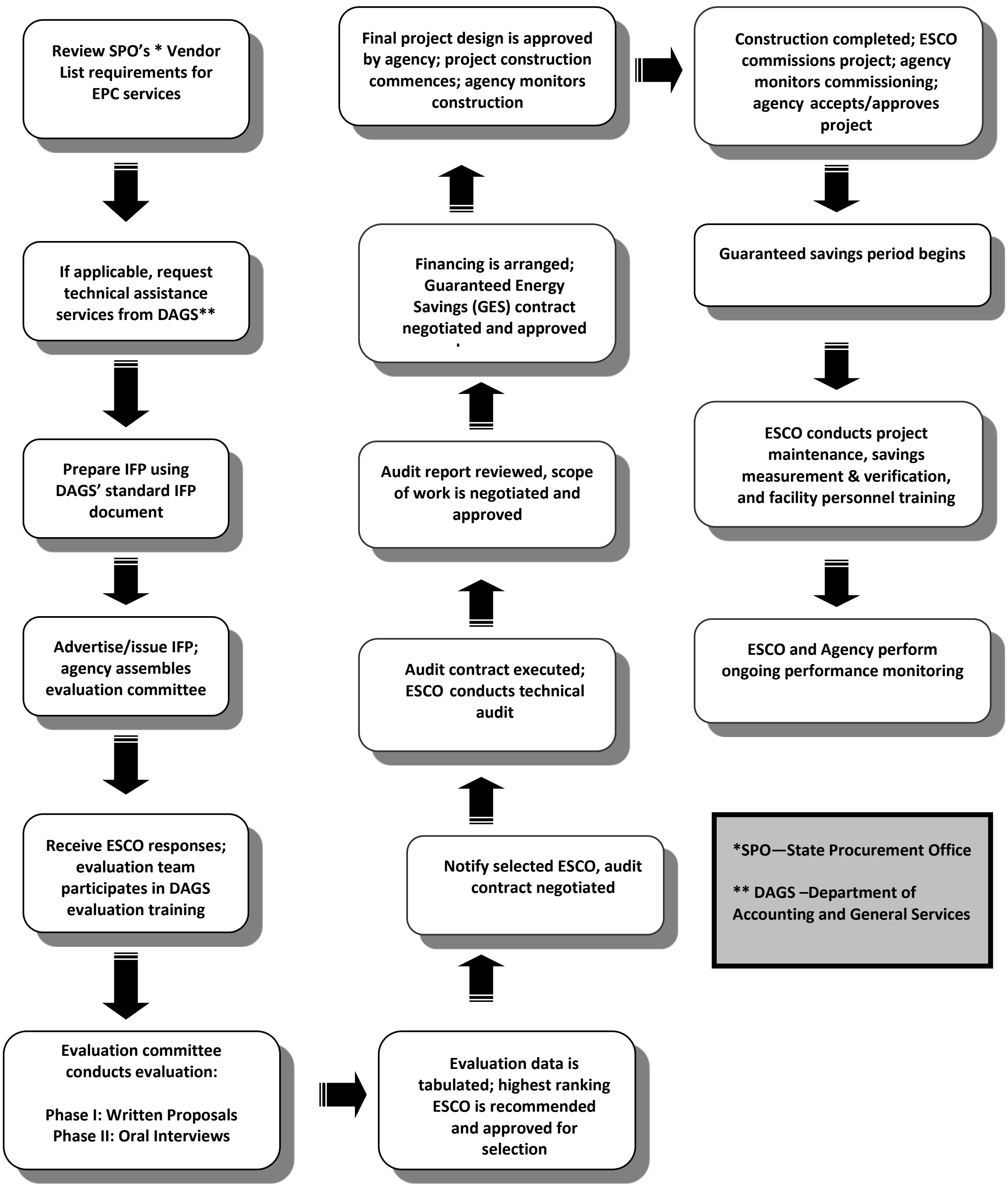
The final contract serves as the blueprint for how the project will operate over the contract term. The EPC should clearly define each party's roles and responsibilities and should explicitly state how the project is expected and guaranteed to perform. The relationship between the agency and the ESCO - including who will do what, when, at what cost, and under what conditions - needs careful review. Due to the long-term nature of this relationship, the contract should be specific yet flexible enough to accommodate both current and future facility needs.

The main body of the contract frames the basic legal provisions and allocates specific responsibilities to each party. It specifies governing laws, conditions of default and remedies, regulatory requirements (e.g., insurance, labor and wage rates, code compliance, etc.), and indemnification provisions. The contract can be customized to accommodate additional terms and conditions as necessary.

The Energy Services Agreement addresses the usual legal provisions and protections covered in an EPC project and can be customized to reflect the policies and requirements of your community. Since individual projects and circumstances vary, local agencies should consult appropriate legal counsel about individual ESCO projects and work closely with them to incorporate any special contract terms and conditions into the contract.

Figure 4-3 on the following page outlines the procedural steps for developing and implementing the EPC process.

Figure 4-3
Energy Performance Contracting Process Flowchart



5. MANAGING AND MONITORING THE ENERGY PERFORMANCE CONTRACT

It is necessary to properly plan for the various project phases before the start of construction.

Managing the EPC project involves several specific stages including:

- **The Design Phase –** consists of the final design details and installation planning for the agreed-upon energy conservation measures (ECMs). Considerations should include:
  - Paying careful attention to sizing equipment correctly
  - Evaluating interactions between equipment to maximize system performance and efficiency
  - Clearly defining the scope of work in sufficient detail
  - Basing designs on accurate existing conditions data
  - Designing projects to minimize life cycle costs
  - Simplifying equipment and materials inventory requirements by standardizing design choices
  - Reviewing long-term operations and maintenance implications
  - Schedule of review meetings and maintain complete written records on decisions

- **The Construction Phase –** Completion of the installed ECMs should include:
  - Focusing on the review and approval process
  - Coordinating early with other construction projects to avoid confusion and delays
  - Keeping complete written records
  - Monitoring construction progress regularly and spot-checking installations to catch quality issues.

- **Commissioning Phase –** to assure installed ECMs are operating as designed and maintaining the guaranteed savings. When evaluating the commissioning process consider the following questions:
  - Is a qualified independent commissioning agent available?
  - Is the commissioning plan appropriate and does it meet the project

needs?

  - Are the commissioning personnel qualified?
  - Is the test equipment calibrated?
  - Are the data accurate?
  - Are the technicians doing what they say they are doing?
  - If the ESCO is doing its own commissioning, who's monitoring the commissioning process?

- **Performance Monitoring –** monitoring of maintenance activities, standards of service and comfort and utility savings over the life of the performance contract. Some key questions for performance monitoring include:
  - What data will be collected, measured, calculated, simulated, or estimated to monitor performance?
  - What will be the content and format for the data in the performance monitoring reports?
  - How will maintenance tasks be allocated based on cost and capability between the agency and ESCO?
  - Does the responsible party have the required expertise, time, and budget to achieve the desired outcomes?
  - Who's verifying the guaranteed savings?

- **Measurement and Verification --**The formal measurement and verification of utility savings is discussed in Section 6 of this guide.

The key to successfully managing the EPC project through these phases is to facilitate timely and effective communication between the ESCO, the agency's EPC project team, and key facility staff. Meetings held at major project milestones establish a pattern of communication and mutually agreed benchmarks that can then be used to monitor and facilitate the progress of the project.

Table 5-1, summarizes major milestones and topics that need to be discussed and resolved. In addition to the these meetings, a schedule of regular (weekly) project meetings during the construction phase helps prevent surprises and keeps the ESCO on track.

Table 5-1
Milestone Meetings in Managing the Various Phases of an EPC

PHASE	ACTION
DESIGN	PRE-DESIGN MEETING ▪ ISSUE NOTICE TO PROCEED WITH SPECIFICATIONS DESIGN AND INSTALLATION PLANNING ▪ INSTALLATION PLANNING MEETING ▪ PRESENT AND DISCUSS INSTALLATION PLANS ▪ PRESENT, NEGOTIATE AND APPROVE COMMISSIONING PLAN
CONSTRUCTION	INITIAL CONSTRUCTION MEETING ▪ REVIEW PAYMENT AND PERFORMANCE BONDS ▪ REVIEW AND APPROVE CONSTRUCTION PLAN AND SCHEDULE ▪ PROVIDE A LIST OF CONTACTS AND REVIEW SITE ACCESS AND ADMINISTRATIVE PROCEDURES ▪ ISSUE NOTICE TO PROCEED WITH CONSTRUCTION ▪ WEEKLY PROGRESS MEETINGS ▪ PROVIDE CONSTRUCTION PROGRESS REPORTS ▪ REVIEW AND RESOLVE ANY CONSTRUCTION ISSUES
COMMISSIONING	ISSUE NOTICE OF CONSTRUCTION COMPLETION (CERTIFICATE OF SUBSTANTIAL COMPLETION) REVIEW AND APPROVE: ▪ PLAN FOR ACCEPTANCE TESTING OF WORK ▪ PLAN FOR FACILITY PERSONNEL TRAINING ▪ PLAN FOR INSTALLATION DOCUMENTATION ▪ SCHEDULE FOR YEAR-ONE PREVENTIVE MAINTENANCE ▪ SCHEDULE FOR YEAR-ONE MEASUREMENT ACTIVITIES
PERFORMANCE MONITORING	ANNUAL PROJECT REVIEW MEETING ▪ REVIEW OF ANNUAL RECONCILIATION REPORT AND STANDARDS OF SERVICE ▪ REVIEW SCHEDULE FOR NEXT YEAR'S MEASUREMENT ACTIVITIES ▪ REVIEW SCHEDULE FOR PREVENTIVE MAINTENANCE AND TRAINING ▪ DISCUSS AND RESOLVE OTHER OUTSTANDING ISSUES

Although management of the design and construction phases of the EPC seems essentially the same as the management of a large design-build retrofit project, performance contracts are more complex. Energy Savings contracts incorporate a number of technical schedules that specify various requirements of performance over different time periods; for example, the energy savings guarantee and continuous commissioning to ensure all ECMs are operating correctly and interacting properly with other building systems and equipment to provide desired results. Staff training, equipment maintenance, monitoring standards of service and comfort, and measuring and verifying savings are also important contract schedules. Unlike construction management efforts that are completed once the installation has been accepted, these other activities require ongoing attention for the duration of the EPC (up to twenty years) in order to receive full value from the project. Oversight of measurement and verification of energy savings, continuous commissioning, and effective maintenance are all essential to maximizing project performance.

The annual project review meetings, and inspections recommended during the performance monitoring phase, are not a substitute for the regular tracking of maintenance activities or standards of service and comfort. Rather, they supplement these ongoing activities and provide an opportunity for a comprehensive review of the performance of the project on a facility-wide basis. They also serve as an annual opportunity for facility staff and the ESCO to discuss strategies for optimizing project results.

6. MEASURING AND VERIFYING ENERGY SAVINGS & PROJECT COMMISSIONING

An EPC project should include monitoring of equipment, savings measurement and verification (M&V), and project commissioning in order to ensure persistent energy savings and reliable equipment performance.

In large buildings, computerized equipment monitoring provides better control of energy consumption. Regular equipment monitoring maximizes the persistence of cost savings over the contract term by improving equipment reliability and optimizing system performance. Periodic savings reports provide valuable data for cost accounting and budget forecasting. Verification of the value of achieved savings provides project performance accountability for the savings guarantee.

6.1 Measurement and Verification

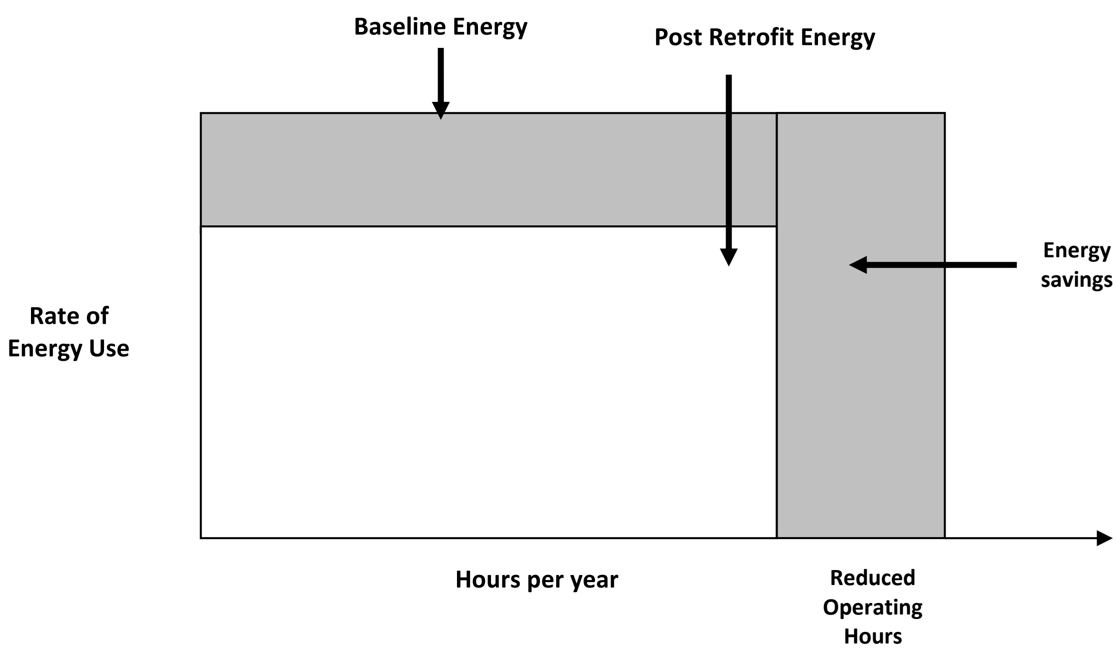
The foundation of an energy performance contract is the assumption that the installed energy conservation measures will result in reduced energy use, allowing the avoided cost savings to be used to pay for project financing and ESCO services for the duration of the contract. Measurement and verification (M&V) is the formal process of determining and documenting that the installed ECMs are producing the guaranteed savings.

When properly applied, M&V can:

- Accurately estimate energy savings for a project
- Allocate project performance risks to the appropriate parties
- Estimate emissions reductions from energy savings
- Quantify improvements in indoor environmental quality
- Give the ESCO a feedback mechanism on the quality of their engineering
- Maximize persistence of utility cost savings
- Reduce operations and maintenance costs (e.g., automatic dial-up alarms)
- Provide benchmarking data for cost reductions in similar buildings

Measurement and verification procedures allow quantification and calculation of the utility savings performance. Savings are determined by comparing baseline utility consumption to post-project utility consumption and accounting for non-project related impacts on utility consumption (e.g., the addition of new plug load equipment like computers). Energy savings are created by reducing the rate of energy use of specific pieces of equipment and their annual operating hours as shown in Figure 6-1 on the next page. These changes are possible because the new high efficiency equipment and controls are able to deliver the same or improved levels of lighting, ventilation air, and thermal services to the building occupants.

Figure 6-1
Energy Savings Depend on Performance and Usage



6.1.1 Measurement and Verification (M&V) Plan

An M&V plan is an integral part of an energy performance contract. This plan is a set of agreed-upon metrics and procedures that are used to establish baseline performance as well as to verify actual energy savings. In other words, the M&V plan defines precisely what "energy savings" means for an energy efficiency project, and specifically how savings will be quantified. The M&V plan also addresses unforeseen events that may occur over the course of the performance contract, such as changes in utility rates; variations in weather; or changes in building use, occupancy, and operating hours. A sample M&V plan is located in Appendix J.

A good M&V plan should:

- Identify and establish utility baselines for the project(s)
- Define the boundaries (individual energy systems or whole building) of the ECMs for savings determination, and rigorously document the methodology for determining the baseline conditions and the resultant baseline energy data
- Identify appropriate M&V options for different ECMs that are acceptable to the agency
- Specify quality control procedures for data collection and timely performance monitoring, as well as the format in which annual M&V reports will be submitted
- Provide cost effective M&V methods to verify project performance

The selection of the appropriate method to calculate the energy baseline and measure energy savings depends partially on what energy efficiency measures are adopted. Because of this, the ESCO should describe the method(s) used to calculate the energy baseline and measure energy savings in its IGA. The agency would then have an opportunity to review and approve or modify the ESCO's proposed method(s) in their review of the IGA.

One of the most contentious issues with respect to M&V has been the use of stipulated calculations for estimating savings. (According to the International Performance Measurement and Verification Protocol [IPMVP], whenever a parameter is not measured, it should be treated as a stipulated value; see Option A in Table 6-1.) At the heart of the debate is that M&V strategies that emphasize sub-metering can be very expensive and may not provide enough value to justify the expense. Indeed, there are measures for which stipulations based on reasonable calculations and industry data can substitute for expensive instrumentation, reducing the cost of verifying project performance. Some EPC customers, without fully realizing the risk/benefit profile of specific measures, have agreed to unreasonable stipulations, opting for the lowest cost M&V option while sacrificing the opportunity to more accurately measure savings results. More recently, U.S. DOE has been recommending Option D as the best practice.

To stipulate a parameter is to hold its value constant, regardless of what the actual value is during the contract term. A stipulation in an M&V plan is an agreement between the agency and the ESCO to accept a defined value of a specific factor (e.g., operating hours) in determining the baseline and/or post-installation energy consumption used to calculate the guaranteed savings. If related requirements are met (e.g., satisfactory commissioning results were submitted, annual verification of proper equipment operation is performed and necessary maintenance is being conducted), the guarantee is considered to have been met.

Stipulated values must be based on reliable, traceable and documented sources of information, such as:

- Standard lighting tables from major manufacturers
- Equipment Manufacturer's specifications
- Building occupancy schedules
- Maintenance logs
- Performance curves published by national organizations
- Weather data from government agencies
- Standard performance degradation curves

6.1.2 Measurement and Verification (M&V) Best Practices

The U.S. Department of Energy, recognizing significant potential for energy efficiency investment, began in 1994 to work with industry to develop a set of best practices for M&V. This work led to the establishment of the International Performance Measurement & Verification Protocol (IPMVP). The latest revision of the IPMVP was released in September 2010. The IPMVP is used throughout the United States and the world to help standardize concepts and options for measuring and verifying energy and water savings.

The IPMVP offers four options for measuring and verifying performance and energy and water savings. These options, titled A, B, C, and D, are the cornerstones of the standardized set of procedures contained in the IPMVP. In brief, Options A and B focus on the performance of specific ECMs. Option C assesses the energy savings at the whole-facility level by metering and analyzing utility costs before and after the implementation of ECMs. Option D is based on computer models of the energy performance of equipment or the whole facility, calibrated against historical utility consumption data to verify the accuracy of the simulation model.

Factors that affect the appropriate choice of M&V option include:

- Value of projected savings
- Cost of M&V options
- Level of savings uncertainty
- Number and complexity of savings measures
- Quality of baseline data available

Each M&V Option and its relative accuracy and cost is explained in further detail in Table 6-1.

Table 6-1
Description of IPMVP Options

OPTION	DESCRIPTION & RELATIVE ACCURACY	RELATIVE COST
A. Partially Measured Retrofit Isolation	Savings are determined by partial field measurements of an ECM's energy use. Some but not all parameters may be stipulated. Used when highly accurate measurements are not necessary or economically viable.	Lowest cost option
B. Retrofit Isolation	Savings are determined by short-term or continuous field measurement of an ECM's energy use. Used to track long-term performance when accurate savings measurements are needed.	Medium to high cost
C. Whole Facility	Savings are determined by measuring energy use at the whole facility level. Short-term or continuous measurements are taken throughout the post-retrofit period.	Medium to high cost
D. Calibrated Simulation	Savings are determined through simulation of the energy use of components or the whole facility. Simulation routines must be demonstrated to adequately model actual energy performance measured in the facility. Typically used for new construction or where baseline data are unavailable or unreliable.	Medium to high cost

Further information regarding measurement and verification can be found in the *M&V Guidelines* document published by the Federal Energy Management Agency (FEMP) and accessed at http://www1.eere.energy.gov/femp/pdfs/mv_guidelines.pdf and the *M&V*

Resource List, a frequently updated document that provides an extensive collection of resources and tools available to help users apply the International Performance Measurement and Verification Protocols.

Appendix I contains the FEMP Risk and Responsibility Matrix which addresses the risk variables associated with an EPC project. Section 9 of this document provides links to the web pages where these documents are available.

6.2 Commissioning and Retro-commissioning

Although Maryland statute does not explicitly define the concept, one state law (Hawaii) describes it as follows: *Commissioning means a quality-oriented process, which takes place during design and construction, for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria with regards to energy conservation design strategies and energy performance of buildings.*

"Retro-commissioning", is the process of monitoring a facility after construction is complete.

> *Retro-commissioning means a quality-oriented process which takes place after systems have been placed in operation, for achieving, verifying and documenting that the performance of facilities, systems, and assemblies perform as closely as possible to defined performance criteria, with regards to energy conservation design strategies and the energy performance of buildings.*

It is desirable—although not mandated-- to include commissioning and retro-commissioning activities in an energy performance contract.

6.2.1 Why Do Commissioning?

Field studies show that building energy-systems rarely function to their full potential. Poorly designed systems, improper equipment selection, inferior equipment installation, insufficient maintenance, and improper system operation all reduce energy cost savings. Typical problems in non-commissioned energy projects include:

- Serious air flow problems
- Poor documentation of project installation and operational requirements
- Underutilized energy management systems for optimum comfort and efficiency
- Incorrect lighting and equipment schedules
- Incorrect cooling and heating sequences

- Improperly installed or missing equipment
- Incorrect calibration of controls and sensors
- Lack of building operator training
- Short cycling of HVAC equipment
- Malfunctioning economizers

The value of commissioning has become more important in recent years because of the following:

- There is more diversity in the number of building specialized systems that need to be integrated
- Building systems, especially building controls, are much more complex
- HVAC systems are being designed with less excess capacity
- Building and safety codes are becoming more stringent
- There is wider recognition of the economic value of health and productivity benefits from properly operating buildings
- Rising building operation costs make efficient operation more valuable

6.2.2 EPC Project Commissioning Benefits

Depending on the complexity of the project, commissioning costs can vary significantly. Many investments in commissioning pay back in savings in less than three years. Commissioning can reduce future equipment repair costs, downtime, and replacement costs by 15 percent or more. Detecting equipment performance problems while under warranty can reduce agency costs by getting equipment manufacturers and ESCOs to remedy problems.

Benefits of commissioning include:

- **Increased building staff knowledge and improved equipment operation**
  Project commissioning provides the agency staff the knowledge to optimize equipment operating conditions and control. System level optimization improves coordination between building systems and enhances overall building performance. Improved systems control extends equipment life and improves operating reliability and efficiency.

- **Better planning and coordination for smoother equipment start-up**

  During project construction, commissioning provides better planning, coordination, and communication between the ESCO and agency. This results in shorter punch lists, and fewer callbacks. Commissioning also provides faster and smoother equipment start-up due to systematic equipment and control system testing procedures.

- **Better up-front performance accountability**

  Since problem prevention is less expensive than problem correction, commissioning provides front-end performance accountability and quality control. This can provide quick feedback to design professionals on the dynamic performance of their design. Proper commissioning can also reduce liability risks from equipment failure.

- **Improved building control and performance**

  Perhaps the most valuable benefit from commissioning comes from better building control that improves thermal comfort and indoor air quality. These help reduce occupant temperature complaints and employee absenteeism, increase staff retention, and save the agency money. While difficult to quantify, the annual health and productivity benefits of a comfortable building are likely to be worth more than the annual energy and operating cost savings.

6.2.3 Examples of Projects that Require Commissioning

- **Boilers, Furnaces, and Chillers:** Check for proper sizing**,** controls, efficiency criteria, and performance testing
- **Energy Management Systems:** Conduct functional performance tests on control capabilities, review sensor locations and calibration, and thoroughly train system operators
- **Air and Water Distribution Systems:** Check fan and pump motor sizing, system alignment and control, air filtration, and test and balance air, and water delivery systems
- **Lighting Control Systems:** Conduct functional performance tests, and control calibration

6.2.4 How Commissioning Works

During project design, the ESCO and agency need to identify the facility's commissioning requirements and prepare a plan. Effective commissioning requires the use of consistent performance criteria to guide the decision process from design through project acceptance. The ESCO should review the design documents with the agency and if applicable, incorporate the commissioning requirements into their bid specifications. From these requirements, the scope of the commissioning plan can be developed. The plan should include a commissioning schedule, all documentation requirements, and specific team member responsibilities. Commissioning activities need to be an integral part of the construction schedule. Generally, pre-functional equipment checklists are used to evaluate proper equipment installation. Separate functional performance tests are used to verify proper equipment operation. Based on the results of functional performance tests, equipment is either accepted by the agency or performance deficiencies are corrected and then retested.

A commissioning report that documents the commissioning process and a training manual for system operation and maintenance should be prepared for the agency.

Model commissioning documents and specifications are available from the Building Commissioning Association at *http://bcxa.org/resources/documents.shtm*

Keys to successful commissioning include:

- Start early during project design and establish a commissioning schedule
- Use an ESCO qualified to do commissioning or an outside commissioning expert
- Develop a clear and detailed scope of work
- Incorporate commissioning requirements into the subcontract specifications, if applicable
- Require an initial planning meeting
- Require regular progress reports

7. MAINTENANCE PLAN AND SERVICES

Energy performance contracts are used to purchase a wide variety of building equipment and services. In addition to equipment installation, the ESCO may propose various repair and maintenance services. As part of the EPC project, ESCOs often propose repairs to existing systems, such as re-installation of damaged or missing controls or repairs of leaks in chilled water or landscape irrigation piping. Sometimes, the ESCO assumes responsibility for preventive maintenance and repairs to all new equipment installed. Existing maintenance contracts can often be renegotiated to revise the scope of services or, in some cases, eliminated due to the installation of new equipment. The ESCO may also offer to take responsibility for maintenance and even operation of some existing equipment. For example, the ESCO may offer to provide remote monitoring and adjustment of temperature setpoints with a computerized building control system.

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 also trains the on-site facility staff to operate and maintain the equipment. In some cases, ESCOs even pay the costs to have facility personnel attend training programs provided by equipment manufacturers. For those agencies where in-house maintenance expertise is limited, the cost structure of an EPC can be arranged to allow for the retention of an ESCO-provided maintenance manager or technicians to support long-term project performance.

Because EPC projects often reduce equipment operating hours, equipment life is extended, which reduces future equipment replacement costs. Reduced runtime hours also limit the frequency of required preventative maintenance tasks. Better monitoring of equipment operating conditions increases the reliability of equipment performance. Increased building occupant satisfaction with working conditions and reduced sick leave are potential benefits of better maintenance.

The ability to quantify the value of these operations and maintenance savings requires a long period of evaluation to determine the net benefits (e.g., reduced equipment repair and replacement occurs over a period of 20 years). Existing agency maintenance staff can focus on preventative strategies if the ESCO project significantly reduces the time they spend on hot and cold comfort calls.

With planning and persistence, EPC projects can result in the capture of significant O&M savings. Filters must be cleaned, controls optimized, drive belts repaired, and HVAC systems repaired in a timely and consistent manner every year of the 20-year performance contract. Consider performance-based maintenance as a form of comprehensive, continuous commissioning. Maintenance should be condition-based, relying on measured parameters, such as run time, vibration analysis, thermographic and ultrasonic testing, and operating efficiency. High quality data on equipment performance is required for an effective maintenance program.

Be sure to specify how access to key project replacement parts and equipment will be available for quick delivery to avoid performance problems.

8. REFERENCES AND SOURCES OF FURTHER INFORMATION

8.1 International Performance Measurement and Verification Protocol (IPMVP)

IPMVP Public Library of Documents
http://www.evo-world.org/

Lawrence Berkeley National Laboratory
http://mnv.lbl.gov/

8.2 Project Commissioning

Commissioning Guidance for Energy Savings Performance Contracts
http://www1.eere.energy.gov/femp/pdfs/comm_guide_espc.pdf

8.3 Other References

National Association of Energy Service Companies
http://naesco.org/

Energy Services Coalition Website
http://www.energyservicescoalition.org/resources/index.html

U.S. Environmental Protection Agency
Energy Star Website
http://www.energystar.gov/
Cash Flow Opportunity Calculator
http://www.energystar.gov/ia/business/cfo_calculator.xls