Information Efficiency: Streamlining Energy Efficiency

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ABSTRACT

Industry-wide protocols for the measurement and verification (M&V) of energy savings have proven critical in the growth of the performance contracting market. International M&V protocols provide project financiers and facility owners assurance that energy efficiency project viability is measured consistently and impartially. As the standardization of and resultant reliance upon M&V protocols continues, the information processing requirements for projects will increase. A similar effort to standardize performance contract project data and develop techniques to efficiently handle energy information (InfoEfficiency) will lead to an even greater acceptance of performance contracting and a subsequent growth in the market.

The U.S. Department of Energy, through the Federal Energy Management Program (FEMP), is currently involved in an aggressive effort to increase the use of Energy Savings Performance Contracting by signing six regional contracts for up to $4.5 billion worth of work in federal facilities. As a means to manage this volume, and to lower the cost of implementing projects, FEMP is designing an integrated project information system which allows all project participants to quickly and easily evaluate projects, both during the planning stages and while the project is in progress. Several utilities and states are also working on performance contracting programs to supplement traditional DSM programs. Using the success of the industry-consensus M&V protocols as a model, the authors propose using these large programs as the testing ground for an industry-wide effort to raise understanding of information efficiency issues and to develop means for dealing with them.

Introduction

Performance contracting[1] is certainly nothing new for the energy efficiency industry. In the last few years, however, a number of concurrent activities have strengthened the market for performance contracts. These activities include the development of international measurement and verification (M&V) protocols. The International Performance Measurement and Verification Protocol (IPMVP) has become the standard for defining the level and duration of energy measurements that are required to verify savings in energy projects.[2] It has also helped project participants to agree on the basic elements of a performance contract.

While the IPMVP has proven successful in providing standard techniques for measuring performance, perhaps the most important contribution has been to demonstrate that a maturing performance contracting industry can set its own standards for basic business practices. Furthermore, while M&V was arguably the best and most important first step, there is important work remaining before the industry to establish consistent, transparent, financial and technical reporting standards.

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[1] Performance contracting refers to contracts for energy efficiency services wherein payments are made on the basis of measured energy savings.

[2] International Performance Measurement and Verification Protocol, US. Department of Energy, 1998, available from the Energy Efficiency and Renewable Energy Clearinghouse, 1-800-DOE-EREC.

Performance contracts are by their nature data intensive. Project information is currently developed, reported, and processed differently by the participants, often at great cost. Information is typically initiated by the facility operators and audit companies, handed on to Energy Service Companies (ESCOs) and project financiers, verified by M&V professionals, and managed all the while by program managers. All of these participants have different needs and practices for processing the data. Federal and utility programs typically include additional data requirements beyond what is necessary in private projects, as dictated by the various legislation and political processes that put the programs in place.

At the program level, The Department of Energy's Federal Energy Management Program (FEMP) is working on standard data inputs for its $4.5 billion worth of contracts. Similarly, California has made available standard forms for its $50 million worth of incentive payments on efficiency projects in 1998. Any data processing standards adopted by such programs will have a large impact on how the industry deals with the volumes of information required in energy efficiency projects.

More and better energy information has been largely beneficial to the efficiency industry, as it has helped create a new degree of credibility in the eyes of private businesses and utility regulators. At the same time, it has presented those involved with performance-based efficiency projects with a new set of problems and expenses. Only through a disciplined process of careful planning and cooperation between various parties will the promise of the information age be realized in the world of energy efficiency. This paper discusses representative performance contracting programs, the data management problems encountered, and suggests some steps to take to overcome the problems.

Past and Present Performance Contracting Programs

Federal Energy Management Program

The federal government is the largest consumer of energy in the U.S., and has taken steps to be the largest conserver of energy as well. EPACT and Executive Order 12902 set goals for reducing energy use in federal facilities and authorized all agencies to use energy savings performance contracts (ESPCs) to meet those goals. Two large-scale contracts, one developed by the Federal Energy Management Program (FEMP) and the other by U.S. Army Corp of engineers were created to streamline the implementation of ESPC by signing blanket contracts (Indefinite Delivery-Indefinite Quantity) that cover large areas of the country. While these contracts save on time and effort in procurement, they have created a need to develop efficient systems to process that data for each delivery order placed under the contract.

The DOE/FEMP SuperESPC covers U.S. Federal facilities with six regional contracts. Each regional contract divides a contract limit of $750 million among five to eight contractors. FEMP's solicitation strategy was based on RFPs in each region that included real sites. FEMP requires proposers to provide their bids in two sections, technical and financial. The purpose of including real sites in the RFP was to test the not only the contractor's ability to recommend creative energy efficiency solutions, but to present their case, both technical and financial, in a way that allowed the evaluators to easily analyze multiple proposals.[3]

[3] The average number of proposers in each region was around 20.

Financial information: Price schedules. The format for price schedules for a FEMP SuperESPC is based on standard procurement requirements in the Federal Acquisition Regulations (FAR). However, there are no requirements for how proposers actually account for their costs, or structure the finance sections of their proposals. Proposers may use the standard amortization equations provided in Microsoft Excel software, or they may develop their own procedures. Rather than dictate exactly what financial structure proposers should use, FEMP only requires that all price information be provided in Excel spreadsheets with the supporting equations intact. This allows DOE and other federal agencies to perform accurate scenario analysis with multiple bids. To illustrate this functionality, FEMP has developed similar, simpler spreadsheets to assist new users in understanding the essentials of a performance contracting deal.

Price proposal supporting information. While the SuperESPC Schedules contain the important financial overview data, there is still a great deal of supporting information in the form of unit costs for equipment and labor. Offerors are encouraged to provide this data in spreadsheets that are linked to the schedules.[4]

Technical information: Site Data Packages. Rather than require each proposer to collect basic data on the facility, FEMP created Site Data Packages.[5] Site Data Packages are designed to contain all of the relevant technical data in a performance contract. The Site Data Package Defines the prospective facility in two ways: physical characteristics (Facility Data) and operational characteristics (Energy Use Data).

Facility Data consists of the actual hardware and wiring that constitutes an energy-using system. It is a "parts list" that is structured systematically from components up to the whole facility. Information in the Facility Data package essentially describes a building with the plug pulled.

In a performance contract, Facility Data is only half the picture. It is impossible to decide what to retrofit and how much to invest without information on the energy consumption of each component. Hence, Energy Use Data is collected and stored at the appropriate level to support contractual decision making. The Site Data Package contains both facility and energy use data in types and amounts that support the contract being considered.

Utilities

Utilities nationwide have for several years offered different variations on performance contracting programs, wherein customers or their agents (usually ESCOs) are paid based on the performance of the efficiency projects they undertake. These programs have differed from traditional DSM programs in that they have more stringent measurement and verification (M&V) requirements. These programs have been offered by utilities under varying degrees of pressure from regulators, and have increasingly been viewed as a vehicle for injecting strength into a private energy services industry so that it can become self-sufficient in the absence of utility rebates. While the majority of program budgets go to contract payments, significant funds are spent both by utilities and by project participants on generating and processing project data.

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[4] Example Schedules can be found on the World Wide Web at http://velo.lbl.gov.

[5] The Site Data Package format can be found on the World Wide Web at http://velo.lbl.gov.

New Jersey (Standard Offer). The first utility to offer a true performance contracting program was Public Service Electric & Gas (PSE&G) in New Jersey, with the Standard Offer program. As the name suggests, the program offered standard prices for documented electricity and gas savings, varying by utility costing period.

In the first round of contracting, PSE&G tracked project data using a DOS based Paradox database. In hindsight, PSE&G realized that this system imposed unnecessary requirements on program participants, as most of the ESCOs involved had to learn how to use Paradox specifically for that program. Furthermore, data submittal formats did not necessarily match the formats the ESCOs were already using to store data in their own performance contracting efforts.[6]

Although the program as a whole was considered a success, PSE&G did incur significant expenses in processing data and working with project participants to clean up data submittals. The utility looked into developing software that would allow for some interactivity with project participants, correcting errors as they are made. However, due to time and resource constraints, such a system was never fully developed.

California (PSP, SPC, ENvest). In 1992, California followed suit and offered two different performance contracting programs, Southern California Edison's ENvest and Pacific Gas & Electric's Power Saving Partners (PSP). Under a regulatory mandate, the two utilities offered DSM bidding programs, wherein bids where solicited from firms to provide measured energy savings. In the case of Pacific Gas & Electric (PG&E), there was a second round of bids, under the PSP 2 program.

The ENvest program run by Southern California Edison (SCE) consisted of performance contracts offered primarily to SCE's larger customers. As of June 1995, SCE had signed up $45 million in contracts for energy services.[7] They are no longer signing new ENvest contracts.

PG&E's PSP program is another example of a successful utility performance contracting program, with measured savings in excess of program projections. However, to achieve this success, PG&E has had to invest significant resources both in working with project partners to teach them how to submit clean data and in processing that data once it has been received. A number of specific issues have arisen during the term of the contracts.

To begin with, PG&E, like most utilities, has a number of massive databases used for purposes ranging from billing to research to regulatory reporting. The problems encountered in PSP are characteristic of problems found in many large corporations. For example, data is gathered from a variety of sources, and can often be inconsistent, with gaps and obvious errors. It can also be difficult to correlate data such as billing information with the appropriate buildings. When attempting to use billing data to establish baseline energy usage, this is a major problem.

A common theme in all of these programs is frustrations on both sides (ESCO and utility) over data requirements. In the case of ESCOs, the issue may be that they are required to keep two sets of books: one for the customer which measures savings compared to pre-retrofit equipment, and one for the utility which measures savings compared to the relevant energy standards (such as Title 24 in California). Utilities, on the other hand, may be more concerned with how to mold data to fit into existing databases. If the time required to clean data prior to submittal and to process data after submittal can be reduced, these costs can be reduced.

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[6] Bob Laurita, PSE&G, personal communication, August, 1997.

[7] Holt, E., Gordon, F., and Tumidaj, L., "Low Cost Energy Efficiency Programs Summary," http://www.rapmaine.org/Lcsum.html, December, 1995.

Texas (LoanSTAR). The state of Texas established its LoanSTAR program in 1988 as a revolving loan program for energy efficiency in state and local government buildings. The program has seen remarkable savings in schools, state office buildings, and other buildings.[8] The program has developed a set of procedures for processing data using a UNIX database prepared specifically for this program. The LoanSTAR experience in developing such a database would be valuable in any larger effort to develop uniform data processing guidelines for performance contracting.

Other States. It is worth noting that other states, such as Colorado, have experimented with performance contracting programs as well, and are continuing efforts in this area. To the extent that performance contracting continues to be viewed as a means for smoothing the transition between DSM in a regulated environment and privately provided efficiency services in an unregulated environment, it is likely that these types of programs will continue to appear throughout the country.

Data Intensity: A Mixed Blessing

A performance contract is only as strong as the project data that supports it, since the project data is required as evidence of performance. As such, properly done performance contracts involve large amounts of data. Large energy efficiency programs carried out by utilities or government entities typically are even more data intensive, since the programs have to conform to certain laws, regulations, and guidelines which are not related to the performance of each individual efficiency project. With such large-scale programs, all of that data must be created, transferred, analyzed and stored, and each step involves a cost for the program administrator, the ESCO, the facility owner, or some combination of the three. If managed properly, this data strengthens a performance contract.

Data management on this scale can be bogged down by numerous problems not specific to energy efficiency programs. For example, database architectures generally differ between organizations, and are often not carefully thought out even within individual organizations. Data sets that change over time are particularly problematic, as data snapshots taken at any given point in time can differ. Furthermore, complex databases are susceptible to misuse, unless users are trained in how to structure queries properly. It is not uncommon to get two different answers from two different people using the same database.

An additional set of database problems is common in large organizations. For example, utilities often need to structure their programs to fit within existing database resources. Databases designed for other purposes are not necessarily the best way to track performance contracting data. Large organizations frequently use outdated databases, as the resources required to redesign and rebuild existing databases are enormous. Furthermore, existing data stored in utility or other corporate databases is often not clean enough to be of any use for efficiency projects. Gaps in billing records, incorrect values, and formatting problems are just a few of the issues that come up.

Data collection and entry can also be characterized by a number of problems. Utility billing data often has holes, for example, as well as other errors, making it of limited value for energy efficiency projects. The time spent on processing data can be quite costly. Every time a different organizational layer, or a different source of data is added on to the process, more possibilities for information inefficiencies occur.

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[8] Haberl, J., Sparks, R., and Chambers, R., 1997.

The transfer of data between parties can also add unnecessary cost. Without a standard project data structure, participants often need to invest time and money in converting data from one format to another. On a general level, the data required to support audits, project development, financial analysis (both prior to and during the term of the contract), modeling, and invoicing are similar from program to program. However ESCOs who have participated in different programs are finding that the data requirements vary between programs and are often different from what would be needed in the absence of the program.[9]

Utility program managers often find that they need to invest significant resources in educating project partners on submitting data properly. In cases where the project partners are ESCOs, they may not be used to refining their data to the level required for program participation. In cases where programs are working directly with facility owners and managers, the owners and managers are often unfamiliar with even the basic aspects of a performance contract. Several utilities report a marked difference between the companies that either already know or have quickly learned how to handle data and those that have not acquired data handling skills. Those that have learned are taking their knowledge and applying it in their own projects.[10]

The problems listed above are real, and they result in real costs for performance contracting programs. PG&E has one FTE in charge of the database for PSP and their part of the newer statewide program, the Standard Performance Contract (SPC) program. In addition, PG&E hires consultants to work with program participants to clean data prior to submittal. Like PSE&G, PG&E has expressed interest in providing program participants with electronic forms with a self-validating mechanism to ensure a minimum level of data clean up prior to submittal. As yet, they have not had the time nor the resources to develop this system.

Software Solutions To Data Management Problems

The generic data management problems currently facing the energy industry are not specific to this industry. A multitude of software tools are available to perform such tasks as forecasting energy savings, designing energy savings systems, recording and analyzing project data, and in general dealing with information management problems. Because project participants do not necessarily use the same tools to perform these different functions, it is important that attention be paid to how data is transferred between the different parties.

Information Technology

Computers have fundamentally changed business practice, quickly making the transition from novel to necessary. Software developments have both expanded the capabilities of low cost systems and made it easier for the average person to use computers. Taken collectively, computer hardware and software comprise the world of information technology (IT). Information technology is still in a stage of rapid development, creating a need for any industry that relies on data and information to continually revisit the techniques for efficiently applying IT. The energy efficiency industry may not have a voice in the architecture of the next microprocessor, but it has an imperative to agree on how to best utilize the mountains of data that IT has made commonplace - to make InfoEfficiency a habit.

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[9] Jim Flanagan, PG&E, personal communication, March 1998.
[10] Jim Flanagan, PG&E, personal communication, March 1998.

The current de facto standard platform for business applications in the an IBM-compatible computer (P.C) based on an Intel microprocessor running a Microsoft operating system. Software compatibility has not been nearly as pervasive. While most energy analysis software now runs on the p.c. and all necessary input and output files are at least stored on the same hard drive, there is practically no way for programs to talk to each other.

Efforts are under way to create standards for future software standards that will allow building energy related software to "inter-operate" - energy analysis software will feed into Computer Aided Design (CAD) tools and vice versa. The Industry Alliance for Interoperability (IAI) is perhaps furthest along in an effort to define the industry foundation classes (IFC) that will form the basis on this inter-operability. In the short term however, these efforts will not change the fact that most ESCOs, agencies, and owners cannot share information efficiently. One solution would be to embark on the creation of new software that specifically address the need of the performance contracting industry. In order to make proper use of software tools, however, it is important to involve individuals with a thorough understanding of both the energy industry and with data management.

The first step to understanding how software can help (and hurt) data management is to understand the way software packages operate and the available tools. As an illustration, we will examine issues that might arise in developing a data entry package for a performance contracting program. Table 1 illustrates the several of the elements to consider when determining what software package to use.

Table 1. Software Considerations for Performance Contracting Data Packages

• Accommodate a wide a variety of computer platforms and operating systems
• Accommodate data relating to physical characteristics of a facility as well as the dynamic properties, such as energy use over time
• Simple for users to understand
• Provide direction for users as to how to fill in different fields, and how to correct obvious errors
• Automatic import of metering data from metering equipment
• Perform some preliminary analysis and calculations for prescreening prior to data submittal
• Easy navigation between various portions of the entire package, including data entry sheets and informational (text) pages.

A primary issue in computer programming is the variety of computer platforms used. When supplying a software package to program participants, certain assumptions are made regarding the type of computer (i.e., Mac or PC), the operating system (i.e., Windows 3.1 or Windows 95), and existing software (i.e., Microsoft Excel, or Lotus 1-2-3). One option is to provide several versions of the software, covering a broad range of possible users. This generally means additional programming time, however. Furthermore, it is unrealistic to think that the first release of a software package will be the final release. If you have multiple versions of the program, each will need to be updated whenever there are revisions.

Spreadsheet programs, such as Excel, offer a middle ground and are a common choice for data management applications. As opposed to pre-packaged software applications, spreadsheets are

inherently more flexible and work on multiple platforms. Furthermore, spreadsheet programs are familiar to most professionals in the energy industry and training is easy to find.

Spreadsheets can also be created with embedded query screens, which can be designed to more closely approximate audit sheets and other types of paper forms people are used to using. Buttons can also be used to initiate certain actions, like jumping to different parts of a workbook (the name for a series of spreadsheets comprising a single file) or instructions sections. These functions can be used to create an audit input screen which incorporates facility information already collected, and which generates data to be aggregated into total savings estimates.

Databases offer an even greater degree of sophistication for handling large data sets, but current versions of popular spreadsheet/database suites such as Excel/Access have blurred the lines between the programs by providing much of the power of the database functionality in the intuitive environment of the spreadsheet. In addition, versatile programming languages such as Visual Basic, allow the more sophisticated developer an almost unlimited ability to generate custom interfaces that still communicate with other, simpler spreadsheets.

In short, the current "canned" software environment provides our industry with all of the information tools we will need for the foreseeable future. It is now time to agree on the some the industry-specific terminology and procedures that will allow all parties to concentrate on implementing energy efficiency, not adapting their programs to multiple formats. One good first example would be to standardize the names and codes for the most common retrofit, lighting. Standard terminology for lamps, ballasts and fixtures could serve as a model.

Another issue is setting up the structure of the tables in the spreadsheet so that data from other programs can be imported. There are many energy analysis software packages available (see the U.S. Department of Energy's energy tools webpage at www.eren.doe.gov), all of which provide output data in a slightly different format. Prior to designing the layout of the spreadsheet, it is important to determine which tools are being used by program participants.

Using a programming language called visual basic, a spreadsheet can be programmed to perform some basic checks prior to submittal of data. Depending on the needs of the program, we can have it ensure that any number of fields have been filled in, and that calculated values meet certain predetermined minimums.

Example Data Package

The Federal Energy Management Program (FEMP) has put together a Standard Data Package for projects in its Super Energy Savings Performance Contract program, as described above. The table below outlines the hierarchy used in these data packages. In essence, data related to the project is presented first at the facility level, and then broken down through each building, through each energy using system in each building, and through the components of each system. Using such a structure, data can be linked from one level to another.

Table 2. Data presentation for FEMP SuperESPC Projects

Level of Information	Facility Information	Energy Usage Information	Operational Information
Site -Whole Facility	Name, Address, Agency, Contact, Use	Utility Rate Information	
Building	Name, Size, Age, Floors, Use, Type of Energy Systems	Building Level energy consumption	Schedule-Occupancy, production schedules
Energy Consuming System	Type of System	End-use data, energy consumption	End-use profiles, control data
Components	Type of equipment, part name/model #, number of pieces, location, nameplate energy consumption data	Equipment energy consumption	End-use data, control data

Proposed Effort

The authors propose a dialogue between existing entities supporting energy information standards for a more efficient energy efficiency industry. The existing IPMVP committee could coordinate this work.

Any effort to coordinate these programs would require participation by the ESCOs who will be performing the work. Many ESCOs already have developed or are in the process of developing their own internal standards for dealing with their data. This proprietary work will give those companies developing them a competitive advantage over other companies that have not invested the resources in data processing standards. However, the current trend in the deregulating energy markets is spawning performance contracting programs. All parties involved will benefit from reducing the cost of participating in these programs. Furthermore, as the industry continues to evolve, there will still be room for motivated companies to invest time and resources into staying ahead of the game.

In the short run, these efforts will benefit specific performance contracting programs currently underway and under development. It must be remembered, however, that these programs generally are using public funds for the purpose of strengthening the private energy efficiency market. The success of these programs will be measured by the degree to which the energy efficiency industry is able to walk on its own once the crutches of public money have been taken away. Measures which help to make these programs less costly and more attractive to customers will have a positive impact on the industry as a whole.

Agenda

Different organizations within the energy efficiency industry, particularly ESCOs, have begun taking steps towards dealing with the issues raised in this paper. However, there is as yet no joint effort

underway to coordinate the various efforts. The authors propose bringing together those interested in these issues, with the end of developing a set of guidelines and protocols that can help move the industry forward. To the extent that the move towards a higher level of data intensity benefits the efficiency industry by making it more credible, it is essential that the industry learn how to control the costs of processing project data.

One possible model on which to base this effort is the International Performance Measurement and Verification Protocol (IPMVP). Although the IPMVP is led by the U.S. Department of Energy, the document itself is written by both industry and government volunteers, and its adoption is purely voluntary. The Protocol does not attempt to precisely define details of M&V, but rather establishes a framework and common language which provides those involved in performance contracts with a basis for negotiation. The IPMVP committee structure is already set up to handle sub-groups focussing on different topics. The IPMVP would be made stronger by the inclusion of a section dealing with the issues discussed in this paper.

Parties to Include

This effort should represent a broad range of interests and experience. Likely participants include utilities, building owners, ESCOs, government officials (including those running performance contracting programs, national lab researchers, and policy advisors), M&V professionals, and information processing specialists. The last category mentioned, information processing specialists, should include some individuals not involved in the energy industry. The issues to be addressed are relevant to other industries, and the efficiency industry can benefit from the experience of others.

As with the IPMVP, the activities of the group will benefit all those involved. As businesses become more comfortable with the concept of performance contracting, selling people on projects will get easier. Even groups that are able to invest resources in developing proprietary tools for handling these issues will benefit by raising the standard used to deal with the data intensity of efficiency projects.

Desired Outcomes

Once the appropriate group members have been identified and brought on board, the group will meet periodically and discuss how an Info Efficiency Appendix to the IPMVP or similar document might be shaped. Key elements of such an Appendix might include:

- Specification of general data requirements for performance contracts
- Database architecture
- Building sets of tools for generating the data
- Coordination with other relevant efforts

Conclusion

The energy efficiency industry, like many other industries, stands to benefit substantially from advances in information technologies. The potential applications extend far beyond the details of performance contracting discussed in this paper. However, until the industry as a whole raises its information efficiency standards, money will continue to be spent on cleaning up data problems instead of purchasing new energy efficient equipment. Although it will not happen overnight, the first step

towards raising the bar is to initiate an ongoing discussion and come to an understanding in regards to some minimum standards to which all the players can adhere. Through such an effort, the energy efficiency industry can move forward into the new millenium prepared to reap the benefits of society's technological advances.

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