Energy Efficiency as a Commodity: the Emergence of a Secondary Market for Efficiency Savings in Commercial Buildings

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Synopsis:

With measurement, diagnosis, and the new NEMVP Protocol, retrofit becomes reliable. Greater consistency and improved savings can unleash private capital to replace diminishing DSM funds.

Abstract

The energy efficiency industry is constrained by lack of financing. For example, in the United States, commercial and public buildings need an investment of $100 billion for cost-effective retrofits with an average payback of about four years. But the current level of financing in the U.S. is stagnant at only about $3-5 billion per year. Worldwide, the potential is enormous. The U.S. Department of Energy (DOE) has led the development of the Building Energy Measurement and Verification Protocol (formerly the North American Energy Measurement and Verification Protocol). This Protocol will increase the reliability and quality of estimated efficiency savings and improve realized savings.

Increasing the reliability of savings can reduce interest rates for loans for energy efficiency. A critical element in the development of low cost financing and a secondary market—whether for homes or credit card debt—is the adoption of protocols to provide uniformity and reliability of the product. This is also true of energy efficiency installations, which have in the past been characterized by inconsistency in installation methodologies and, frequently, unreliability of savings.

This Building Measurement and Verification Protocol (BMVP), Version I of which was published in April 1996, is a DOE-led effort involving ASHRAE, NAESCO, NARUC, NASEO, EPA, Canada's CAESCO, and Mexico's CONAE and FIDE (see acronyms list at end of paper). DOE has begun to build on this Protocol to develop new forms of lower-cost financing including, ultimately, development of a secondary market for energy efficiency. This could double financing for building energy efficiency within five years.

1. Introduction

The United States annually spends approximately $500 billion for energy: buildings ($210 billion), transportation ($180 billion), and industry ($110 billion). The $210 billion for buildings is split: $120 billion for residences, and $90 billion for non-residential. The $90 billion is further split into $25 billion for public buildings (federal, state, local, schools, hospitals, higher education, etc.) and $65 billion for the private commercial sector (EIA, 1995a). Many buildings can be cost-effectively retrofit to reduce energy costs by 25% (with a simple payback time of 4-5 years). Restated, this says that for every annual $1 of utility bill, it is cost-effective to make a one-time investment of $1- $1,25 in retrofit. So U.S. commercial buildings (including both private commercial and public buildings), with their $90 billion annual utility bills, merit an efficiency investment of around $100 billion.

The federal government, quasi-governmental organizations, and utilities have already undertaken considerable investments in residential energy efficiency in the United States (on the order of $3-5 billion), but efficiency expenditures in these sectors appear to have leveled. One field of efficiency financing that appears to be growing is for "shared savings" contracts (also known as ESPCs or "Energy Service Performance Contracts") under which an "ESCo" (Energy Service Company) provides or assists in finding the capital to retrofit a building, as well as undertaking the development and installation of efficiency measures. Upon completion of the retrofit, the savings are then shared three ways: debt repayment, ESCo payments, and "profit" to the host. DOE's FEMP (Federal Energy Management Program) assists all federal agencies with ESPC financing to supplement dwindling "in-house" funds. All providers of efficiency services and equipment share the desire for market growth, and the BMVP Protocol and the development of a secondary market will transform the relatively stagnant demand for efficiency to one of high growth — benefitting all energy efficiency firms.

1.1 Why Is this a Good Time to Reduce the Risk of Energy Retrofits?

1.1.1 Technical

Until about 1980, a new U.S. car usually had defects, and the owner had to make several inconvenient trips to take it in for repairs. By the mid-1990's, partially thanks to electronics in the factory and onboard, new cars are delivered with a far lower defect rate.

Like cars, buildings are complicated systems. However, since buildings are more individualized, the quality control and "tune-up" problems in buildings have lasted longer, and are just now beginning to subside. Recent studies on "commissioning" of new buildings point towards significant savings potential from careful building commissioning. (See the following for a more complete discussion of commissioning: Piette and Nordman, 1996; PECI, 1992; ASHRAE, 1989; Yoder and Kaplan, 1992.) Another major contributor to quality control is the arrival of reliable electronics for control, data logging, and communication with a real-time measurement and diagnostic center. [See Section 3.]

1.1.2 Current State of Efficiency Financing

The level of energy efficiency investments is stagnant. Important sources of efficiency financing—utility demand-side management (DSM) programs, state energy efficiency programs, and federal and state appropriations—are contracting. In 1995, utility expenditure on these DSM programs amounted to about $2,9 billion. This is expected to decline, and discussions with senior utility managers indicate that this decline may be on the order of 5% to 10% per year for the next several years. The predicted decline in utility financing is not a result of a decline in potential projects, but rather to the impending deregulation and restructuring of the utility industry in the United States. These declines are occurring at the state and Federal level as well.

These declines are beginning to be offset by a shift toward performance contracting and increased private sector investment in efficiency. It is the intent of DOE that the efficiency financing efforts built on the BMVP Protocol (-described in Section 4.3) will accelerate the growth of private sector financing and more than compensate for declining utility, state, and federal funding for efficiency.

1.2 Improving Reliability

As discussed in section 4.3 and elsewhere, efficiency investments are often characterized by inconsistent implementation and unsubstantiated savings. Over the past five years there have been a range of efforts to overcome these problems by establishing standard methodologies for implementing measurement and verification of efficiency savings. These protocols have tended to improve the level of realized savings and reduce variability of savings. The characteristics are illustrated in Fig. 1-1 and can be described as follows.

(a) Initial savings level. Efficiency which are not measured and verified according to an efficiency M&V protocol often achieve less than projected savings. In contrast, installations made following an M&V protocol tend to come in near or even above the projected level of savings. In both cases, there is a period of a year or two in the case of new buildings or a period of three to six months in the case of retrofits during which building commissioning corrects obvious problems.

(b) Persistence of savings. M&V protocols tend to require the installation of metering equipment that includes

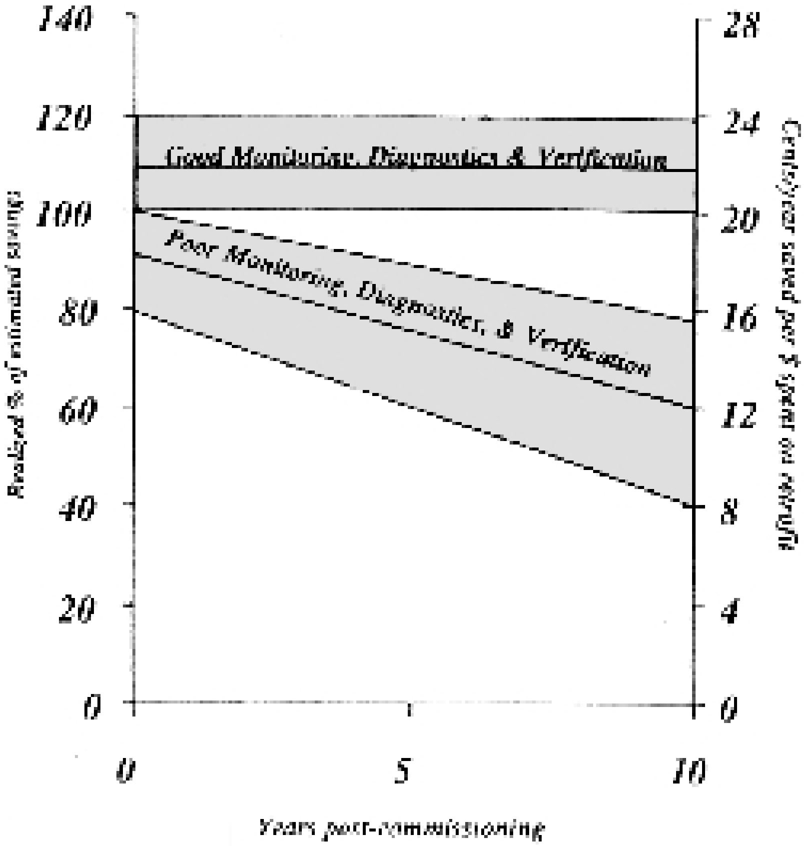

Figure 1. Time trends of savings with and without regular monitoring, diagnostics, and verification (MD&V)

The two sloping lines are smoothed idealizations of actual bumpy individual histories, e.g. a drop as a chiller fails, followed by a rise when a more efficient chiller is installed. The shaded bands represent variability within the central value and illustrate approximate relative performance.

To construct a right-hand scale, we assume an engineering estimate of 25% annual savings on each $1 of annual utility bills. With a retrofit investment of $1,25, there was an estimated 5-year simple payback period. The estimated annual savings (25 cents) corresponds to a 20% real return on investment (ROI). In the illustration above, ***Poor Monitoring, Diagnostics, and Verification*** Retrofit averages only 70% of the estimate, i.e., 14% ROI, and the Good Monitoring, Diagnostic, and Verification averages 110% of estimate, i.e., 22% ROI. The higher line then beats the traditional one by 8%/year, which far exceeds a 3 to 5% one time cost of sensors and electronics and approximately 1%/year for recording and reporting data.

aggregation of performance data from multiple measuring points at a single computer terminal which effectively serves as a diagnostics center. Not surprisingly, installations that boast real-time measurement of savings tend to have higher savings initially and experience savings levels that remain high. Installations without such monitoring equipment tend to experience substantial drops in efficiency savings, often within a few years.

(c) Variability. A third element of risk in efficiency performance is the degree of consistency of savings. We believe that installations undertaken with real-time metering tend to perform more consistently and reliably over multiple projects when these projects follow a protocol that requires long-term metering at multiple locations. In contrast, the variability or standard deviation of savings in non-metered installations tends to be much larger.

Together, these three measurements of performance reliability provide a compelling explanation of why efficiency installations have traditionally been viewed with suspicion by finance firms and why these same finance firms are so strongly endorsing the BMVP Protocol.

It may be instructive at this point to draw a parallel between financing for energy efficiency and financing for home mortgages. Before FHA was created in 1934, the longest mortgages were for only 6 years (vs. 30 today) and were limited to 20% of the price of the home (vs. up to 100% financing available today). FHA started to offer insurance for _%/year, and then in 1938 FNMA (“Fannie Mae”) offered longer-term mortgages and began to create a “secondary market” in which mortgages are “blended” (to reduce risk) and resold on bond markets. A critical feature of Fannie Mae’s influence on mortgages is the development of a uniform set of requirements, which all lenders enforce and all borrowers understand. These uniform conditions, which make home mortgages affordable to the middle class, are a model for the Building Measurement and Verification Protocol (BMVP).

1.3 How Does Utility Deregulation Affect this Effort?

The prospect of retail wheeling and the ongoing rapid deregulation and restructuring of the utility industry has caused utilities to begin cutting back their energy efficiency (demand-side management) investment programs, as mentioned above. Reduction of this major source of efficiency funding makes the need for sources of financing more compelling and the development of a secondary market for efficiency particularly timely.

Restructuring of the electricity supply industry has also prompted the growth of Independent Power Producers (IPPs) who now offer power contracts for gas fired plants at roughly 3 cents per kWh at the bus bar, or about 40% of the average current electricity prices to customers. For utilities, the availability of low-cost power makes efficiency investments much less attractive. Consumers, on the other hand, still have to pay bills that reflect embedded rather than marginal costs of electricity. Given large stranded assets for which consumers will have to pay, electricity prices are not expected to drop significantly in the coming years. This will provide a continued strong incentive to make efficiency investments even in a deregulated, retail wheeling environment.

2. Potential to Save Energy, Create Jobs, and Reduce Pollution

As we mentioned in Section 1, U.S. commercial building operators spend about $90 billion annually for their utility bills, and, by investing approximately $100 billion, they could reduce this bill by roughly 25%, i.e., by approximately $25 billion. This creates jobs and reduces pollution, described as follows.

2.1 Jobs

Estimates of the number of jobs created by energy efficiency vary widely. Because energy efficiency is more labor-intensive than energy production (e.g. electricity generation and distribution) it is generally assumed that increased energy efficiency investment leads to a net generation of jobs.[1]

One method for determining the employment impact of energy efficiency involves the use of an input/output model to represent the interactions of the different sectors of the economy. The business-as-usual case is compared to cases in which money is invested into sectors of the economy other than power supply. The workings of these models have been addressed elsewhere (Geller, DeCicco, Laitner, 1992). The quantitative results of such modeling efforts vary widely, however. Furthermore, model results from the U.S. cannot necessarily be transferred directly to other countries, as the interactions of different sectors of the economy may differ. For example, in the U.S., it is assumed that most of the energy bill savings will be retained by energy customers, who will then reinvest the savings into the economy in a certain way. In a country where energy is subsidized by the government, however, much of those savings will accrue to the government, which has more control over how those savings will be spent.

2.2 Fossil Fuel

Savings from a $100 billion investment (e.g. $10 billion annually for ten years) will save about $25 billion per year. In the U.S. economy with a $500 billion annual energy bill, this would represent a roughly 5% decrease in energy usage, the majority which is from fossil fuels. In the United States, the production and combustion of fossil fuels is responsible for almost all emissions of CO_2 (the primary greenhouse gas), SO_2 (the primary cause of acid rain), NO_x (the primary precursor to urban smog), 75% of health damaging volatile organic compounds (VOCs), and about half of respirable (unhealthy) smog. (EIA, 1995b).

3. Experience with Retrofit, Commissioning, and Persistence of Savings

3.1 Technical

In the 1980's, a building owner could expect to eventually achieve 80-100% of the savings estimated by engineers, but only after 3-6 months commissioning for retrofits or 1-2 years for new buildings, and then savings started to sag. [See Fig. 1.] But already at the 1994 ACEEE Summer Study, Claridge, Haberl, et al. [1994] published a paper with the bold title, "Can you Achieve 150% of Predicted Retrofit Savings?" Their title certainly attracted our attention and was not exaggerated. Today the Energy Systems Lab at Texas A&M University, as a contractor to the Texas State Energy Conservation Office (SECO), monitors over 300 public buildings retrofit by SECO's Texas LoanSTAR program. With good measurement and diagnostic programs, and skilled engineers, they now report 145%of engineering estimates for energy savings. This number includes roughly 26% in savings achieved from operations and maintenance improvements prior to any retrofit activities (Haberl, 1996). The experience of the LoanSTAR program is presented below in Table 1. Clearly, use of good metering and monitoring increased the level and persistence of savings.

We estimate that current annual commercial building retrofit investment is a few billion dollars/year; only a fraction of what it should be, but plenty to generate interesting data. Accordingly, we have started a survey of results (Flanigan et al, 1997). We insert as Table 1 a preliminary version of the results.

Table 1. Preliminary Survey Results for Building Retrofits

	A	B	C	D	E	F	G	H	I	G	
	Project/Program[a]	**Description**	**Projected Savings**	**Actual Savings**	**Realization Rate[b]**	**Simple Payback[c]**	**Year Completed**	**Years a of Dat**	**M&V Leveld**	**Real. Rates**	**Real Rate averages**
1	LoanStar Program	153 buildings at 22 sites	$18.101.000	$26.300.000	145%		1990-96	1 to 5	***	145%	
2	LoanStar: U.T. Austin Ed. Bldg.	251,161 sq. ft. building	$161.956	$249.209	154%	2,6	1991	2	***	154%	
3	LoanStar: UT Austin Teaching Cntr.	152,690 sq. ft. building	$118.179	$143.980	122%	2,5	1990	3	***	122%	
4	LoanStar: UT Austin Library	483,895 sq. ft. building	$373.621	$709.271	190%	1,0	1990	3	***	190%	
5	LoanStar:UT Austin Gearing Hall	61,000 sq. ft. building	$26.387	$46.478	176%	3,1	1991	2	***	176%	
6	LoanStar:UT Austin Waggener Hall	57,600 sq. ft. building	$20.400	$30.496	149%	2,9	1991	2	***	149%	
7	LoanStar: UT Austin Burdine Hall	103,441 sq. ft. building	$42.049	$90.034	214%	1,5	1991	2	***	214%	
8	LoanStar: UT Austin Nursing Bldg.	94,815 sq. ft. building	$41.235	$59.573	144%	2,9	1991	2	***	144%	
9	LoanStar: Stroman High School	210,474 sq. ft. building	$33.094	$43.339	131%	4,5	1991	2	***	131%	
10	LoanStar: UT Austin Painter Hall	128,409 sq. ft. building	$65.955	$83.333	126%	3,1	1992	1	***	126%	
11	DOE Forrestal Complex	36,832 fixture lighting retrofit	$399.058	$433.346	109%		1993	2	***	109%	
	Weighted Average Three Star Impact					**145%**	**2,7**		**2**		**151%**
12	Xenergy	"12 projects; 40 buildings (yrs. payback)"	4.8 yrs.	4.2 yrs.	114%	4,2		2	**	114%	
13	MicroGrid Project 1	350,000 sq. ft. building	5,300 MWh	5,000 MWh	94%	7,1	1991	4	**	94%	
14	MicroGrid Project 2	112,000 sq. ft. building	3,000 MWh	3,700 MWh	123%		1994	2	**	123%	
15	MicroGrid Project 3	350,000 sq. ft. building	3,750 MWh	3,000 MWh	80%		1992		**	80%	
16	MicroGrid Project 4	5+ buildings, 800 acre resort	2,000 MWh	2,500 MWh	125%		1990		**	125%	
17	MicroGrid Project 5	250,000 sq. ft. building	1,500 MWh	1,700 MWh	113%		1995		**	113%	
18	Viron Energy Services: Project A	14 building School District	724,687 kWh	868,643 kWh	120%	3,4	1991	4	**	120%	
19	Viron Energy Services: Project B	4 school buildings	78,630 kWh	81,189 kWh	103%	3,8	1992	3	**	103%	
20	Viron Energy Services: Project C	1 building Civic Center	183,065 kWh	203,978 kWh	111%	4,4	1991	4	**	111%	
21	CES/Way Int'l: Johnson C. Smith U.	27 building campus	$300.000	$356.043	119%	2,3	1989	1	**	119%	
22	CES/Way Int'l: Kutztown University	34 buildings, 2 million sq. ft.	$600.000	$599.275	100%	3,3	1988	1	**	100%	
23	Iowa DNR: Human Services Dept.	205 buildings, 3.8 million sq. ft.	$718.420	$801.523	112% (99%avg.)		1988	6	**	112%	112%
24	Iowa DNR: Corrections Dept.	132 buildings, 2.1 million sq. ft.	$345.759	$384.336	111% (110%avg.)		1988	6	**	111%	111%
25	Iowa DNR: General Services Dept.	18 buildings, 1.4 million sq. ft.	$170.268	$250.151	147% (115% avg.)		1988	6	**	147%	147%
26	Iowa DNR: Dept. for the Blind	1 building, 98,606 sq. ft.	$13.134	$11.267	86% (96%avg.)		1989	5	**	86%	86%
27	Iowa DNR: Transportation Dept.	247 buildings, 1.3 million sq. ft.	$265.847	$351.099	132% (122% avg.)		1990	4	**	132%	132%
28	Iowa DNR: Public Safety Dept.	17 buildings, 65,231 sq. ft.	$8.444	$5.558	66% (74% avg.)		1991	3	**	66%	66%
29	Iowa DNR: Independence MHI	18 buildings, 558,035 sq. ft.	$732.242	$792.381	108% avg.		1988	6	**	108%	108%
30	Iowa DNR: Fort Madison St. Pen.	21 buildings, 625,215 sq. ft.	$677.765	$842.958	124% avg.		1988	6	**	124%	124%
31	Iowa DNR: NE Iowa Comm. Col.	9 buildings, 325,297 sq. ft.	1,253 MWh	1,466 MWh	117%		1989	4	**		117%
32	Energy Masters Corporation	4 commercial office buildings	$433.000	$452.356	104%		1993	2	**		104%
33	Energy Masters Corporation	7 schools	$108.754	$133.438	123%		1993	2	**		
34	Energy Masters Corporation	1 large high school	$339.292	$399.397	118%		1991	4	**		118%

35	Energy Masters Corporation	5 schools	$110.863	$173.019	156%		1994	1,67	**	156%
36	Energy Masters Corporation	16 schools	$521.274	$507.029	97%		1992	3	**	97%
37	Energy Masters Corporation	40 schools	$279.310	$294.613	105%		1994	1	**	105%
38	Energy Masters Corporation	7 schools	$278.717	$301.736	108%		1993	2,5	**	108%
39	Energy Masters Corporation	10 schools	$585.081	$686.415	117%		1992	3	**	117%
40	Citizens Conservation Corporation	157 unit multifamily complex	26,5%	30,8%	116%		1986	7	**	116%
41	Citizens Conservation Corporation	104 unit multifamily complex	31,0%	43,8%	141%		1986	6	**	141%
42	Citizens Conservation Corporation	16 unit multifamily complex	48,0%	37,6%	78%		1986	7	**	78%
43	Citizens Conservation Corporation	124 unit multifamily complex	35,0%	28,4%	81%		1987	7	**	81%
44	Citizens Conservation Corporation	123 unit multifamily complex	14,0%	18,2%	130%		1987	6	**	130%
45	Citizens Conservation Corporation	90 unit multifamily complex	52,7%	45,5%	86%		1988	6	**	86%
46	Citizens Conservation Corporation	161 unit multifamily complex	27,0%	24,3%	90%		1989	4	**	90%
47	Citizens Conservation Corporation	40 unit multifamily complex	27,0%	42,9%	159%		1989	6	**	159%
48	Citizens Conservation Corporation	38 unit multifamily complex	54,0%	45,0%	83%		1990	4	**	83%
49	Citizens Conservation Corporation	10 unit multifamily complex	40,0%	45,2%	113%		1990	3	**	113%
50	Citizens Conservation Corporation	10 unit multifamily complex	40,0%	81,5%	204%		1990	3	**	204%
51	Citizens Conservation Corporation	292 unit multifamily complex	60,0%	69,4%	116%		1990	3	**	116%
52	Boston Edison Encore	1.5 million sq. ft. facility	7.8 GWh	7.2 GWh	92%		1993		**	92%
	Simple Average Two Star Impacte				**113%**	**4,1**		**4**		**113%**
53	California Com'l. DSM Programsf	98 programs			126%			1 to 4	*	126%
54	California Res. DSM Programs	60 programs			88%				*	88%
	Northeastern utilities' programs	MECo, BECo, and WMECo DSM savings	1,101 GWh	881 GWh	80%		1994	4	*	80%
56	PacifiCorp Energy FinAnswer	10 commercial buildings	4,304.4 MWh	4,005.6 MWh	93%				*	93%
57	Northwest Com'l Evaluation Project	Draft Retrofit Report			84%				*	84%
58	Northwest Com'l Evaluation Project	Draft New Construction Report			49%				*	49%
59	Energy Edge	Evaluation of 28 buildings (kWh/sq ft/yr)	20,87	29,21	140%	3,1	1986-1989	10	*	140%
60	Anonymous ESCO	200 buildings			~75%		early 1980s	5	*	75%
	Simple Average One Star Impacte				**92%**	**3,1**		**6**		**92%**
	Simple Average of the three subset totals				**116%**	**3,3**		**4**		**116%**

Source: Ted Flanigan, Ted Jones, Greg Kats, and Art Rosenfeld, forthcoming, 1996.

a A variety of primarily non-residential projects and programs from around the United States that depict individual and aggregate information, some self reported and other third party sources.

0%

b "Realization rates are from the most recent year of data unless specified; averages presented in addition where reported"

c Simple payback is defined as installation costs divided by annual savings in energy costs

d "Subjective assessment of the rigor of monitoring and verification consistently applied using the following parameters: * =Basic billing analysis; ** = limited sub-measurement;" *** = sub-measurement plus real-time monitoring and diagnostics

e Preliminary estimates indicate that the weighted average and simple average for the Two Star category are roughly equal, but there is a discrepancy in the One Star category between the simple average of 92% and the weighted average of approximately 105%.

f The California Demand-side Management Advisory Committee (CADMAC) report evaluates activities of four CA utilities from 1990-92 representing a total utility DSM investment of $772 million.

The table lists performance data for projects representing over 900 buildings. Projected savings and actual savings are shown in either dollars, watt-hours, payback period, or as a percent of pre-retrofit energy usage, depending on the format in which the data were supplied to IRT. Actual Savings (Column 'E') was divided by Projected Savings (Column 'D') to determine the Realization Rate (Column 'F'). Where available, data on Simple Payback, Year Completed, and Years of Data are also included. The M&V classification system used in Column 'J' is as follows

* = Basic billing analysis; ** = limited sub-measurement; *** = sub-measurement plus real-time monitoring and diagnostics.

The data show clearly that increased levels of M&V have led to higher realization rates in the projects surveyed. In addition, the few projects for which persistence data exists seem to indicate that good M&V results in realization rates that increase over time. Since most of the projects listed in the tables are relatively new, data on persistence over time are still at this point relatively thin. However, it is anticipated that more data will further substantiate this trend.

3.2 Current Financing

The "guaranteed savings" approach has become the most popular approach because it provides a specific performance guarantee, unlike the "shared savings" approach popular in the 1980's. The savings generally exceed the payments, providing positive cash flow to the client. The ESCo often provides construction financing and secures longer-term financing from a bank or leasing company.

Regardless of the specific financing arrangement, the application of the BMVP Protocol provides greater consistency and a higher level of savings, facilitating project financing. This is the result of four factors: better measurement/estimation of energy use before and after retrofits; greatly improved long-term measurement of savings; improved building management that results from greater diagnostic capability made possible by real time measurement of energy use in multiple points throughout a building; lower transaction costs made possible by use of a generally agreed upon and applied methodology.

A key step in financing, envisioned by DOE since early 1994, is that the greater reliability provided by the BMVP Protocol will allow the efficiency savings stream to serve as the primary collateral for financing. Ultimately, we envision development of a secondary market for efficiency contracts in which the future efficiency savings stream can be sold into a secondary market, thus providing lower-cost project financing (Kats, 1995; Lenssen, 1996).

4. Steps Taken or Underway

Following is a brief review of activities taken to date in which the U.S. DOE has played a leading role. These activities fall into two parts: development of the North American Energy Measurement and Verification Protocol and the use of this Protocol to develop new, low-cost forms of financing for energy efficiency.

4.1 History of the Development of BMVP

In early 1994, we began work with colleagues in the efficiency industry and the finance community to answer the question: What can DOE do to strengthen and expand efficiency investments in commercial and public buildings? We soon began to focus on the potential for DOE to initiate and manage an effort to establish national consensus standards for efficiency in order to improve the reliability and consistency of efficiency savings. The range of existing and planned measuring protocols resulted in a patchwork of inconsistent approaches to measurement of savings. Unreliability of efficiency savings discouraged efficiency investments. In contrast, a single national measurement and verification protocol, such as the BMVP, both increases savings and increases lender confidence in retrofit performance, thereby lowering the cost of financing.

The Protocol is developed through two main committees. The Technical Subcommittee is comprised of a dozen technical and industry experts who meet by telephone and e-mail to revise and rework the Protocol text. Overall guidance to the Technical Subcommittee is provided by the BMVP Policy Committee, comprised of 35 people representing the large range of institutions involved.

The NAFTA-linked Commission for Environmental Cooperation kindly provided funding to support extension of the Protocol development to include Canada and Mexico. Participating organizations include the Canadian Association of Energy Service Companies and Mexico's FIDE and CONAE.

The first version of the document (entitled the North American Energy Measurement and Verification Protocol, NEMVP) was edited and updated on-line using the internet, allowing very broad participation in shaping it. In the end, 250 individuals and organizations contributed comments. The open and inclusive nature of this drafting process allowed very broad participation and has allowed the Protocol to gain near-universal industry support. We are updating and improving the Protocol through the continued work of the existing committees and through the same open consensus process. Distribution of the document is being handled through the Energy Efficiency and Renewable Energy Clearinghouse.[2] In addition, the document is available on the BMVP website at http://www.bmvp.org.

The BMVP has also benefitted from parallel ASHRAE efforts to develop guidelines for measuring energy conservation retrofits. ASHRAE's GPC-14P, also a consensus document, is projected to be completed in the next year or two and will contain technical details about how to instrument, measure, and analyze energy savings.

4.1.1 About the Pr otocol

The BMVP Protocol represents a consensus across the energy efficiency industry (including energy service companies, manufacturers of energy efficient equipment, financiers, and regulators of efficiency.) This North America-wide consensus Protocol describes the best practical methodology for ensuring reliable efficiency savings.

The Protocol describes several methodologies for determining a "baseline" or level of energy usage before retrofit. The Protocol describes four levels (A-D) of performance measurement and verification methodology from which the user can choose. The four options are provided in recognition of the fact that projects vary in their complexity, ranging from simple (such as lighting replacement) to a complex, weather-dependent, whole building or multiple building retrofit. (See the NEMVP for more details on these options.) In other words, the Protocol is the collective common sense consensus for the sequence of steps that should be followed to ensure reliable, consistent, and cost-effective efficiency installations.

We are confident that this Protocol is technically the best protocol in existence, in large part because it draws on the best of the existing protocols. Equally important is that the intensive and broad consensus process used to develop the Protocol means that formerly fragmented industries has collectively moved toward consensus about how efficiency installations can best be done. This voluntary, political, and methodological convergence and consensus is as important as the technical merits of the Protocol.

4.1.2 Version II of the Pr otocol

Two international industry-wide voluntary working groups have been established to extend the Protocol to cover water efficiency and new buildings. Extending the Protocol to embrace water will encourage future retrofits and new design to achieve higher levels of water and energy efficiency in an integrated, low cost fashion. The cost savings from water efficiency investments include lower water bills, lower energy bills, and large avoided capital costs for expanded water and waste water treatment facilities.

The Protocol's extension to cover new buildings involved developing the fourth M&V Option: Option D, based on building modeling. Standardization of this "calibrated simulation" approach to modeling efficiency investments in new buildings will help ensure greater ease and lower cost for future efficient buildings design. This is particularly important in developing countries with a high rate of new construction.

4.2 Areas of Implementation

There is large potential for energy savings across all building sectors, including public buildings, hospitals, and universities. DOE has begun to use the Protocol to help these sectors achieve savings.

4.2.1 Application of the BMVP to Federal Buildings

The U.S. Department of Energy's Federal Energy Management Program (FEMP) has developed an early application of the BMVP Protocol for federal buildings. It provides guidance in establishing M&V procedures for federal contracts and is intended to be compatible and consistent with the BMVP Protocol and is expected to significantly accelerate efficiency investment in U.S. Federal buildings.

Mexico's FIDE has taken the lead in applying the Protocol to 100 of the largest Mexican Federal buildings. British Columbia also appears likely to use the Protocol in 900 provincial and public buildings.

4.2.2 Higher Education

The country's 3.600 public and private colleges and universities have energy bills of $6,5 billion, and could cut this by one quarter or more through cost-effective efficiency investments of about $8 billion. Many colleges and universities are not able to secure adequate low-cost financing for efficiency retrofits. This situation has probably worsened over the past five years. State colleges and universities, most of which have experienced reduced state funding, have less money for investments in efficiency improvements than they have in the past. DOE is working with officials in several states to help structure pooled bond financing for efficiency in education and health facilities based on the BMVP.

4.2.3 Inter national

Version I of the NEMVP, released in March of 1996, was largely the effort of individuals and organizations representing Canada, Mexico, and the United States. However, since its release, the Protocol has been adopted by organizations for projects around the world. Already, the Protocol has been translated into Spanish and French, and is in the process of being translated into Hungarian, Portuguese, and Russian as well.

Because the Protocol is spreading so quickly, the BMVP Committee has taken action to ensure that the next version of the Protocol reflects a truly international effort. This geographic broadening, and the extension of the Protocol to embrace water efficiency as well as energy efficiency prompted us to change the name from the North American Energy Measurement and Verification Protocol to the Building Measurement and Verification Protocol. In addition, the Committee continues to actively search out individuals internationally to participate in the development of Version II of the Protocol. Already, input from some of the international members has provided valuable insight into issues surrounding M&V in areas of the world such as the Far East.

One avenue for expanding the international use of the Protocol has been through the multilateral development banks (MDBs). Currently, the volume of MDB loans for building energy efficiency is a very small percentage of total energy sector lending. Some of the MDBs have made progress in developing policies to encourage more lending for efficiency, but the policies are in some cases slow to be adopted by project managers. Because of the financial implications of the Protocol, however, it can be used to make energy efficiency projects more attractive to MDBs. By removing some of the risk, and standardizing the verification of the performance of a project, the Protocol can help to make energy efficiency projects more attractive from a financial standpoint.

Already, the World Bank has adopted the Protocol for use in two efficiency projects totaling $350 million, one in Russia and one in the Ukraine. In the collaborative spirit of the BMVP process, a World Bank representative has been added to the BMVP Policy Committee. The Department of Energy is working to have the World Bank adopt the Protocol as a requirement for building energy efficiency projects.

DOE is also working with other MDBs to encourage adoption. Several projects with the Asian Development Bank

(ADB) and the Inter-American Development Bank (IDB) have been identified as potential model projects for Protocol adoption. Protocol adoption by these institutions would greatly expand the credibility of the projects.

4.3 Financial Issues

The establishment of a standard consensus on factors to be considered in efficiency installations, measurement, and verification provides an opportunity to develop new and lower cost of financing for energy efficiency. As described earlier, standardization in home mortgages paved the way for lower cost mortgages that today allow home owners a large range of flexible loan options for up to 100% of the value of their home. The following is a description of three financing approaches we are developing with industry and Wall Street that build on the standardization and quality improvement offered by the BMVP Protocol to develop new, lower-cost financing for energy efficiency.

4.3.1 Pools and Credit Enhancement

Preliminary discussions with the three largest national credit enhancement agencies—AMBAC, FGIC, and MBIA—have indicated that they would consider accepting energy efficiency savings as the primary underlying collateral for loans (as long as this was backed by additional collateral, e.g. 20% reserve backed by general obligation funds). Colleges and universities have limited borrowing capacity and many competing, high-priority uses for funds. With multiple alternative uses of funds (maintenance, capital improvements, etc.) combined with a cap on borrowing, many institutions choose not to invest in efficiency. Use of the Protocol and the resultant enhanced level of savings could allow institutions to borrow for efficiency with at least a portion of borrowing not counted against a borrowing cap.

We are working with NACUBO, APPA, heads of state energy offices, and our financial advisors to identify a pool of $50-$100 million in efficiency investments identified by academic institutions in each of several states. A bond would be issued simultaneously through conduits in each state (probably through health and education financing authorities) for use at each of the borrowing colleges or universities. Issuance costs would be spread across all participating institutions. All institutions would use the Protocol both in helping to identify efficiency investments and in carrying out efficiency retrofits. Universal adoption of the Protocol provides higher, more consistent levels of saving and a single, standard approach that will greatly cut the cost of measurement, paperwork, etc.

4.3.2 Increasing Borrowing Capacity

We are working with finance firms to develop a second approach to allowing efficiency investments to not count toward debt capacity. Lowering energy and water bills leaves institutions or home owners with more money, in theory making them better credit risks. This fact is recognized in the widely available but little used mechanism for “Energy Efficient Mortgages” for homes that allow buyers of efficient homes to increase their “stretch ratio,” that is to borrow about 10% more money because their utility bills will be lower. Existence of a standard, reliable approach to implementing, measuring, and verifying efficiency savings also offers the possibility that credit rating agencies, such as Standard & Poor’s, would recognize the increased credit worthiness of institutions by allowing efficient institutions to increase borrowing. DOE is working with Standard & Poor’s and Moody’s to help them include energy efficiency investments that are made following the Protocol as part of their credit rating criteria - a first for the industry. This would provide an important incentive to invest in efficiency for the many institutions that are at, or near, borrowing limits.

4.3.3 Securing Benefits from Emissions Reductions

As noted above, reduced energy use also cuts emissions of pollutants, including NO_x and SO_2. In a half-dozen U.S. airsheds, emissions reductions have value as “credits” under a “cap and trade” market system established by the Clean Air Act and administered by the EPA. One of the national participants in shaping the BMVP Protocol is EPA, which has an established and specialized protocol for determining and allocating emissions reductions credits. The BMVP Protocol is designed to be compatible with the EPA protocol. This means that institutions that invest in energy efficiency will be able to use the BMVP Protocol with the EPA protocol to establish reductions in energy use and determine emissions reductions. This will serve as the basis for claiming the value of the emissions reductions credits in the growing number of areas where permits for these emissions are traded. This model could easily be transferred to other countries with emissions trading regimes.

4.4 Additional Benefits of Protocol Usage

We have begun work to extend the Protocol to address indoor environmental quality (IEQ) issues. An IEQ working group representing a broad industry spectrum will develop language to extend the Protocol to include measurement and verification of specific IEQ measurements, such as CO_2 and total VOCs. We believe that these IEQ measurements will result in consistently and verifiably higher levels of IEQ.

We are also working with the insurance industry to develop the application of the Protocol to reduce both insured losses and potentially to lower insurance premiums in two areas. First, we believe that application of the extended Protocol will result in lower costs relating to the “sick building syndrome,” and should lead to the development of lower premiums for buildings that follow the Protocol. Second, efficiency measures, such as double paned windows result in buildings that sustain lower damage in severe weather events such as hurricanes (-Mills, 1996). Again the Protocol offers a tool that the insurance industry can use to influence their customers to make investments that lower insurance payouts. In turn, we expect that this will lead forward thinking insurance firms to lower insurance rates to encourage these kinds of efficiency and risk mitigation investments.

Endnotes

1. A summary of a number of studies on the employment impacts of investment in energy efficiency can be found in Geller, DeCicco, and Laitner, 1992.

2. To obtain the Building Measurement and Verification Protocol
(BMVP):

A) Printed copies can be ordered through the “Energy Efficiency and Renewable Energy Clearinghouse (EREC)” by calling 1-(800) DOE-EREC (1-800-363-3732). International callers dial int + (703) 287-8391. Orders can also be faxed (int +(703) 893-0400) or emailed (doe.erec@nciinc.com).

B) Via the World Wide Web: Electronic copies can be obtained by accessing the BMVP Homepage at http://www.bmvp.org/info

Acronyms

AMBAC: American Municipal Bond Assurance Corporation
APPA: Association of Physical Plant Administrators
ASHRAE: American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
BMVP: Building Measurement and Verification Protocol
CAESCO: Canadian Association of Energy Service Companies
CONAE: Comision Nacional Para El Ahorro De Energia
DOE: U.S. Department of Energy
DSM: Demand-side management
EPA: U.S. Environmental Protection Agency
ESPC: Energy Service Performance Contracts
EREN: Energy Efficiency and Renewable Energy Network
ESCo: Energy Service Company
FEMP: Federal Energy Management Program
FGIC: Financial Guaranty Insurance Corporation

FHA: Farm Home Administration
FIDE: Fideicomiso De Apoyo Al Programa De Ahorro De Energia Del Sector Electrico
GPC-14P: ASHRAE's Guideline Project Committee 14-Proposed
IEQ: Indoor Environmental Quality
MBIA: Municipal Bond Insurance Association
NACUBO: National Association of College & University Business Offices
NAESCO: National Association of Energy Service Companies
NARUC: National Association of Regulatory Utility Commissioners
NASEO: National Association of State Energy Officials
NEMVP: North American Energy Measurement and Verification Protocol
PECI: Portland Energy Conservation Incorporated
SECO: State Energy Conservation Office (of Texas)
VOCs: Volatile organic compounds

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