Making Energy Efficiency Bankable: Lessons Learned from a Global Market Transformation Effort

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ABSTRACT

In May 2007, former U.S. President Bill Clinton launched an ambitious energy efficiency best practices effort. The Energy Efficiency Building Retrofit Program of the Clinton Climate Initiative (CCI) explored ways to make efficiency retrofit projects more bankable by using unsubsidized, commercial models applicable in a variety of countries and considerably more scalable globally than current regulated and legislated models tied to local jurisdictions. This paper describes the innovative pilots undertaken, lessons learned, and implications for a broad acceleration of energy efficiency investment. It also confirms the emergence of a new Asian center of innovation in energy efficiency project finance.

The authors provided *pro bono* advisory services to building owners in over twenty large cities worldwide, negotiating technical and financial performance terms on more than a hundred projects. Their experience suggests that, when deployed in combination with each other, these models can potentially transform the global market for energy efficiency retrofit projects, especially in the underserved private sector where financing is perhaps most difficult.

- Energy Performance Contracting (EPC) – An updated performance-based, design-build approach to contracting energy efficiency retrofit projects designed to be the *sine qua non* of EE project finance by turning energy savings guarantees into a true credit enhancement
- Energy Performance Lending – For mortgaged properties with limited refinancing options, a new form of collateral and underwriting process for energy efficiency projects
- Managed Utilities – For multi-tenanted buildings, a special entity structure that removes a significant decision hurdle by aligning incentives between owners and leaseholders
- Municipal Leasing – For local governments, thinking about existing public finance mechanisms in new ways that eliminate capital budget competition and concerns over agency borrowing limits associated with traditional bonding
- Tax-exempt Equipment Leasing – For nonprofit institutions, partnering with public finance agencies, outside accountants, and credit rating agencies to create a new class of energy efficiency projects not subject to normal borrowing limits or rating concerns

Introduction

Secretary of Energy Steven Chu once lamented publicly that the country might have more energy efficient homes were it not for the fact that people preferred granite counter tops (Wald, 2008). A 2006 survey by Lawrence Berkeley National Laboratory found that the commercial buildings sector is, relatively speaking, underserved by the energy services industry and also observed that total energy services industry investment in efficiency projects was no

more than the authorized budgets of all ratepayer-funded electric and gas efficiency programs (Hopper, 2007). In the authors' view, the reasons behind such meager levels of investment in energy efficiency are structural, not economic; and potential solutions can be summed up in one word, bankability.

For the energy efficiency market to develop globally, projects must become more easily bankable. The terms and underwriting requirements dictated by the providers of capital to many energy efficiency projects currently make investing needlessly difficult. An appropriate analogy is the situation faced by nineteenth century home buyers offered loans covering only fifty percent of the property's value for a term of less than five years (Weiss, 1989, p. 110). In the past century, financing a home has changed in ways that dramatically accelerated *per-capita* home ownership; and that is the kind of progress needed to transform the market for energy efficiency.

The data behind this paper was collected by the authors during their work as *pro-bono* advisors to public and private building owners around the world. The CCI best practices effort entailed working on behalf of building owners in a number of ways:

- Negotiated uniform performance contracting terms and conditions with ESCOs representing 60% of global industry revenue and made it a requirement on every project.
- Provided capacity building and technical assistance to building owners, investors, and lenders in over twenty global capitals committed to taking action on climate change.
- Connected building owners and providers of investment capital willing to work under the new model, shaping underwriting rules and term sheets.
- Pre-qualified ESCOs capable of meeting the stringent EPC terms, qualified project economics, and represented owners in negotiations with vendors.
- Established uniform performance monitoring processes to measure energy savings.

The Clinton Foundation program successfully demonstrated a number of commercial banking solutions which appear to be broadly applicable without intervention by government or regulators (WJCF, 2007). In that critical regard, they go beyond financing models described elsewhere in the literature, notably recent reports funded by The Energy Foundation (Kats, 2011) and The Rockefeller Foundation (DB Climate Change Advisors, 2012). Over the course of a hundred projects, every model described was demonstrated in at least one sovereign jurisdiction, most in several. Two of the models depend on U.S. laws and tax code, while three have been demonstrated outside the U.S., in Bangkok hotels, South African municipal buildings, Chinese state-owned enterprises, Indian shopping malls, and London public transportation facilities.

The advantage of commercial models over others presently under consideration is that the legal and regulatory environment does not have to be manipulated for them to work, eliminating a significant barrier to adoption. The rights and obligations of the principals work equally well in a number of sovereignties and banking regimes and without special inducements. It is hoped that focusing attention on commercial structures and processes will facilitate globalization of energy efficiency project finance and create the scale needed to attract substantial capital.

Model 1: Energy Performance Contracting

Energy performance contracting (EPC) has been practiced in the Federal Energy Management Program (FEMP), particularly HUD (Belkin, 2008), and by ESCOs (Johnson Controls, personal communication, 2007) since the early eighties. There are a number of variants, but FEMP has thrived owing to the U.S. government's favorable credit rating and bank willingness to offer favorable terms for Federal receivables. Over the years a reliable market has emerged, making it practical for ESCOs to accept financing in the near-certain knowledge that project receivables can be bundled and sold to banks on favorable terms (Honeywell Building Services, personal communication, 2007).

That secondary market in turn released contractor balance sheets for future projects and prompted sustained industry investment in Federal sector energy efficiency. In part because of FEMP, EPC is sometimes understood in the private sector as a financing mechanism; but receivables cannot be sold under similarly attractive terms when they are not Federal government obligations. A lack of alternative financing options creates a market pinch point. To facilitate energy efficiency finance, the Clinton Foundation and the energy services industry concluded a uniform agreement on an updated performance contract to deliver more credible savings guarantees and make third-party financing more attractive (CCI, 2007).

Model 2: Energy Performance Lending

A mortgage is typically used by commercial building owners to finance capital improvements. Common lending practice complicates energy efficiency projects because it can be difficult to add debt without refinancing a property completely. As proponents of PACE finance (both residential and commercial) have learned, the rights of first mortgage holders cannot be easily ignored without consequences to the entire edifice of real estate finance.

Energy performance lending uses underwriting criteria which lean on energy efficiency project cash flows to secure loans. An analogy is the way that a drilling project is secured using the expected cash flows from oil. When used in conjunction with the enhanced EPC model, an energy efficiency project underwritten in this way can be laid on top of any existing debt structure at any time without significantly affecting prior security interests.

Model 3: Managed Utilities

In tenant occupied buildings, traditional commercial leases normally pass along operating cost reductions to tenants, even when owners make the energy efficiency investments. One consequence is that owners lack proper incentives to make such investments.

Managed utilities treats energy use as an outsourced service, transferring capital debt taken on for an energy efficiency project to a special purpose entity owned by a third party such as the lender and converting repayment obligations to operating expense. Tenants have an incentive to participate because, when projects are linked to the enhanced EPC model and cash flows are positive, tenants are protected against rent increases by savings guarantees, and rents decline at the end of the contract's performance period with ongoing savings to tenants.

Model 4: Municipal Leasing

Despite significant investment to date, local government energy efficiency efforts are constrained by reliance on capital budgets because of limits on total borrowing and intense competition by other high-priority projects (Bharvirkar, 2008). With its high transaction costs and inflexible terms, bonding is in some ways ill suited for smaller energy efficiency retrofit projects unless implemented as part of a much larger capital project.

Virtually any essential-use energy efficiency project can be financed using a municipal lease (EPA, 2002), usually at a cost comparable to bonding. Depending on the project, the total cost of lease financing is not greater than bonding because slight cost-of-funds premiums are offset by avoiding significant transaction costs and by flexible payment terms. Legal opinion holds that leases are not normally subject to the same borrowing caps as bonding.

Model 5: Tax-exempt Equipment Leasing

Nonprofit institutions rely on state financing agencies for tax-exempt borrowing as states alone have the authority to issue tax-exempt bonds to investors, and all states have at least one agency that can bond on behalf of tax-exempt institutions. However, institutional borrowing is often limited by an institution's balance sheet and possibly credit rating agencies as well. For this reason, energy efficiency projects in institutions face intense competition for limited capital budgets and are often given lower priority over initiatives considered more strategic.

Institutions have begun using a tax-exempt project finance structure linked to a reliable performance-based contract that qualifies for off-balance-sheet treatment. The bonding agency agrees to hold title to the project during the performance period. Selected bonding agencies are chartered to assist its clients' missions, and a client request is normally sufficient reason to facilitate such transactions (DASNY, personal communication, 2008). With constraints eliminated, institutions are freed to undertake projects based on their inherent economics.

Models in Practice

Energy Performance Contracting

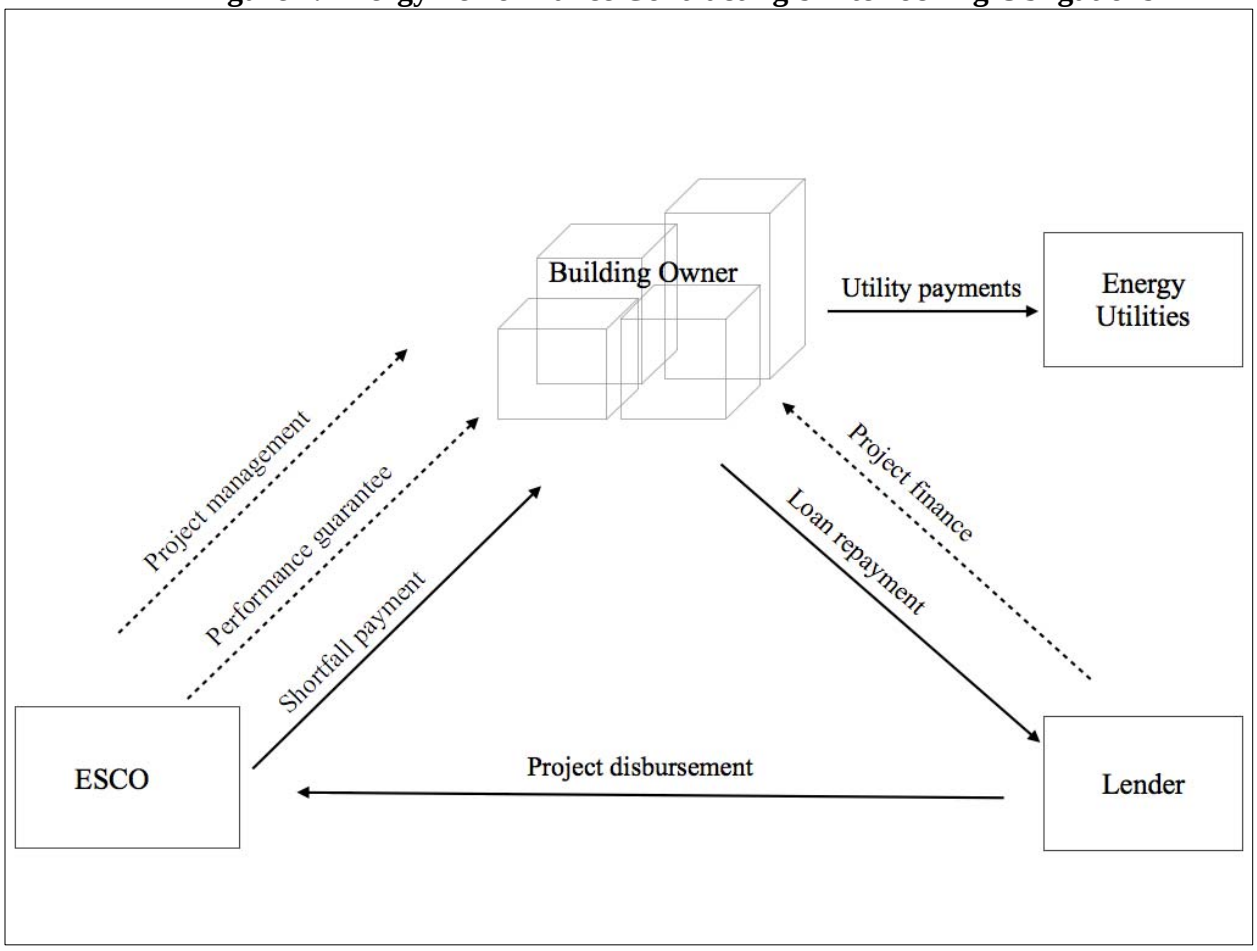
Performance contracting taps operating savings in a building efficiency retrofit project to enable contractual guarantees that help secure bank financing (Hopper, 2007). Properly defined and measured, such guarantees make it possible to fund deep energy management projects based on their inherent economics, provided corresponding financial terms are available.

Figure 1 schematically illustrates the obligations (dashed lines) and funds flows (solid lines) of energy performance contracting as practiced in its updated form. Note that building owners have separate obligations to their utility, their lender, and their contractor. However, the obligations are effectively interlocking – that is, obligations to the bank are covered by firm contractor guarantees and are required by the loan underwriting process. EPC liquidated damages are fixed by contract at a level needed to cover potential savings shortfalls to meet cash flow projections. Like any other corporate warranty, the value of savings guarantees is a function of the contractor's credit rating.

Outside the U.S., performance contracting is still considered by some to be a funding

source because contractors have tried in the past to finance projects themselves, but outside of the Federal public housing market that funding model has been largely abandoned as unsustainable in all but a few markets around the world (FEMP, 2012). Third-party financing is the current industry norm, hence the need for more bankable projects. One role of an updated EPC model is to ensure a credible energy savings guarantee with contract language that assures vendor performance and cash liquidated damages to be paid whenever there is any shortfall. In this approach, underwriting EPC projects involves a simple cash flow analysis – that is, projects are bankable to the extent they can generate credibly guaranteed savings equal to or greater than the project's debt service requirements (principal & interest payments).

Figure 1. Energy Performance Contracting's Interlocking Obligations



The design-build contracting model has a hard time of it because professionals representing owners can be less familiar with the procurement, negotiation, and contracting process by comparison with traditional new construction. Experience on several dozen projects suggests that such unfamiliarity is one impediment to EPC adoption. Two cases illustrate the point. Legal counsel and procurement professionals in both the U.S. (Daley Center, City of Chicago, personal communication, 2008) and E.U. (Transport for London, London Metropolitan Area, personal communication, 2007) initially held that city ordinances prohibited design-build

contracts. A close review revealed otherwise, and the conventional wisdom was overturned.

As EPC prime contractors are essentially guarantors, they do not bid for contracts based on price. Instead, primes normally supervise competitive bidding on implementation and supply subcontracts by others. Design-build contracts can be "open book" so that owners are able to satisfy themselves that the best pricing is obtained; and contracts can also include cost-reduction incentives which incorporate gainsharing between owner and contractor for any implementation cost savings achieved. The net effect of such features is to ensure value for money.

Open Issues and Next Steps. ESCOs have a reputation in some quarters for implementing only certain kinds of measures, perhaps to limit their exposure to risk or to fit the client's financing constraints (often three years or less). However, many of the same companies implement quite extensive energy efficiency projects for HUD when financing is available for 15 to 20 years, suggesting that projects naturally deepen with appropriate financing. Given the demands of their shareholders, it makes sense that ESCOs would try to capture the entire budget available for any given project. At the same time, ironclad savings guarantees under the EPC model restrain ESCOs from over promising because that only increases their warranty exposure — that is, contracted shortfall payment obligations. Also, ESCO pre-qualification focuses on the suitability issue. Just as every ESCO cannot give a credible savings guarantee, not every ESCO has the track record required for deep energy projects.

Another key to successful performance contracting is precise contract language, down to the level of engineering formulas, along with legal counsel capable of competent advocacy during negotiations. Today, most in-house counsel are not up to that task without assistance from specialists; so capacity building in the legal ranks might be needed to promote adoption, specifically cooperation with financial and legal educators and industry associations to improve understanding of EPC procurement, contract drafting, negotiation, and vendor performance.

Energy Performance Lending

In cooperation with the Clinton Foundation, in 2007 the City of Chicago Department of Housing recruited a consortium of banks led by J.P. Morgan Chase to develop an innovative vehicle to finance energy efficiency projects in affordable housing. Known as the Multi-Family Energy Retrofit Program, it was a multi-sector collaboration with an emphasis on private sector involvement, supported by public and nonprofit resources (Brookings, 2009).

Rather than traditional mortgage finance, energy performance lending relies on a project finance template that underwrites energy efficiency loans based on credible energy savings guarantees. Energy performance lending solves the problems of an owner who cannot easily refinance or whose property has already been pledged as collateral on one or more mortgages.

Project Development Process. To qualify for underwriting under the model, a project was required to follow a prescribed process approved by the local housing and neighborhood preservation agency and community lending institutions.

1. Underwriting banks and their supporters in local government encourage those building owners with capacity and interest in making retrofit improvements to engage with ESCOs and determine whether their projects comply with loan program requirements.
2. Specific retrofit measures, project costs and expected energy and water savings are identified in particular projects that meet minimum loan program requirements through an investment grade energy audit performed by a qualified energy services company.
3. A performance guarantee of energy and water savings is provided by the ESCO to the building owner for each qualifying project.
4. A subordinated loan (third or fourth mortgage) for specified improvements on qualified projects is made to the building owner through an originator, with repayment based on expected operating savings resulting from the energy reductions and reflected in the performance guarantee. Under terms drawn up by the providers of capital, funds are advanced by a managed credit pool.
5. Retrofit improvements are made by the ESCO and its subcontractors under the energy performance contracting model described above. ESCO is paid for project on completion and owner repays lender directly.
6. Independent measurement and verification (M&V) services conforming to international standards are provided under contract to validate savings. ESCOs must pay owners in cash for performance shortfalls in an amount sufficient to cover any loan repayments due.

Loan Features and Terms. Under the proposed structure, initial loans in the pilot carried a maximum term of seven years and were priced at a premium over seven-year U.S. Treasury bonds. The loan program required only a third or fourth mortgage, but also required owners to provide the lender with an energy performance guarantee backed by an offsetting ESCO guarantee to the owner which is acceptable to the bank. The owner's savings guarantee is a simple way of linking project savings with the loan application process.

Open Issues and Next Steps. The Chicago Multi-Family Energy Retrofit Program had a single successful pilot at Mercy Housing Lakefront (CCI, 2009); however, the 2008 financial crisis and ensuing turmoil in U.S. banking effectively stymied the funding needed to demonstrate the model at scale. Significantly, in the past few years a new center of innovation in energy efficiency finance has emerged in Asia, where CCI helped launch two funds using key features of the Chicago model. Together, the Mekong Brahmaputra Clean Development Fund and the Kasikorn Bank K-Energy Saving Guarantee Program provide a total of just under $100 million in loan capital for efficiency projects (WJCF, 2012).

A U.S. fund based on the Chicago model is a logical next step and might be expanded from a single municipal jurisdiction to a regional fund so that owners in smaller cities could participate. Municipal housing and neighborhood agencies might take the lead in program development while local lenders, landlords, contractors, and other facilitators might cooperate in deploying the program. Once commercial feasibility is established and costs are better understood, perhaps within five years a national master fund might be created with separate sub-

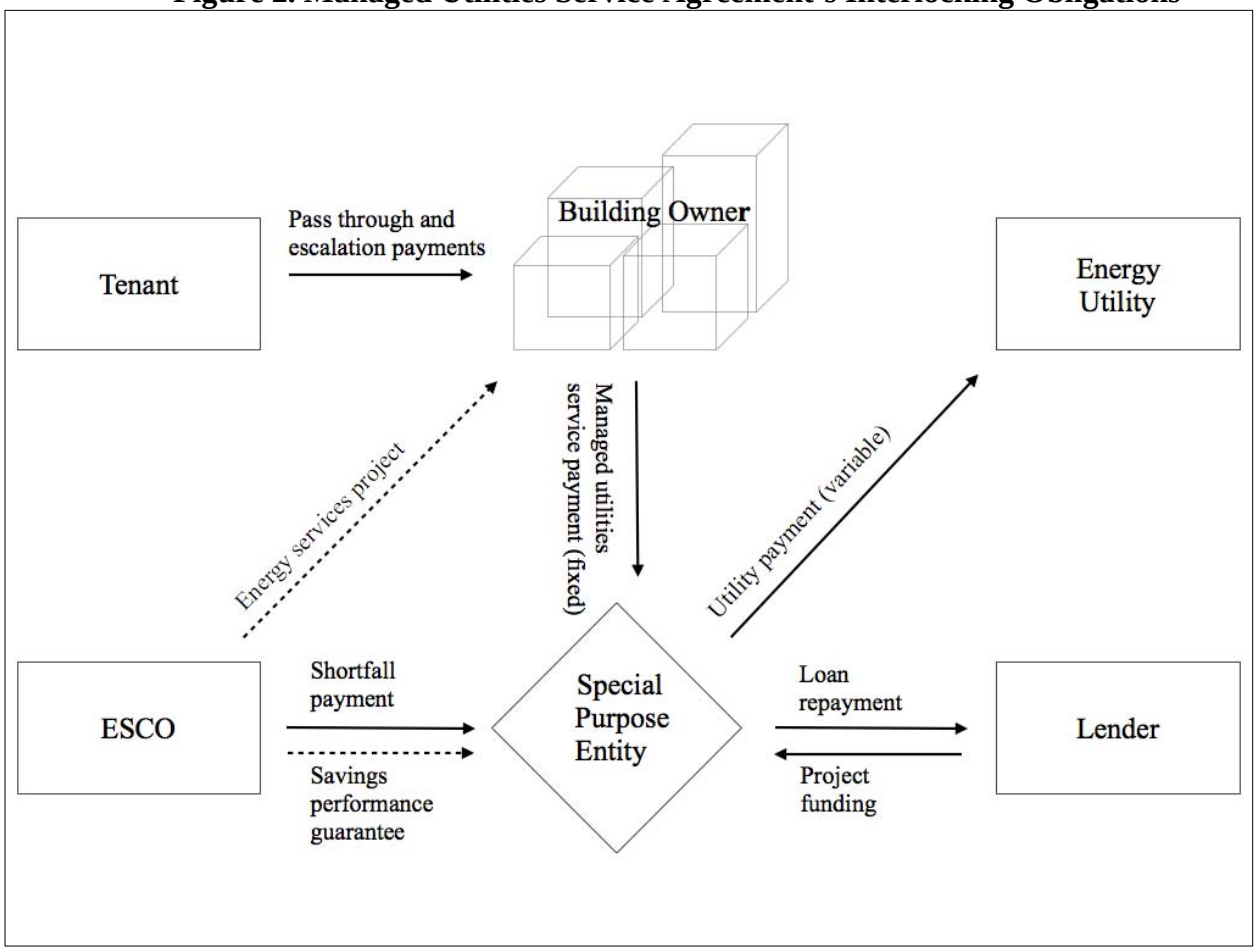
funds for which investors and donors can specify their preferences for selected geographies and types of projects.

High loan loss reserves, fifty percent in the initial pilot, are an obstacle to wide scale adoption. The model is unsubsidized and expected to be profitable for originators and loan investors alike, so the reserve ratio is expected to decline somewhat with additional experience and as energy performance lending gains a reputation as a safe commercial practice. Another key policy determinant of success might be the attitude of bank regulators toward a new type of loan whose risks are presently unknown. Engaging experts at the Federal Reserve to examine risk might hasten banker confidence and possibly drive down reserve requirements more quickly.

Managed Utilities

Managed utilities (also called managed energy) agreements transfer control of energy plant equipment and services to a third party and remove one of the most common barriers to energy efficiency projects in tenant-occupied buildings by realigning the economic interests of all stakeholders. Managed utilities is a service contract that eliminates borrowing constraints on building owners by converting nominal capital debt to operating expense and transparently transferring repayment obligations to a special purpose entity (SPE) owned by a third party serving as project facilitator, possibly a bank-sponsored entity set up to facilitate lending at scale.

Figure 2. Managed Utilities Service Agreement's Interlocking Obligations



The model's lynchpin is a credible energy savings guarantee from the project developer, normally a qualified ESCO. Energy performance contracts obligate ESCOs to guarantee a project's energy savings, effectively covering the SPE's payments to the lender. Title to a project is held by the SPE for the duration of the loan agreement with an owner buyout at the end of the performance period.

The effect of a managed utilities service agreement is to allow owners to pass the new operating expense on to tenants without renegotiating the existing lease. Assuming a cash-flow-positive project, the increase in shared operating expense that tenants are obligated to pay under managed utilities is exactly offset by guaranteed reductions in utilities expense, which reduction is likewise passed along to tenants by lease. Accordingly, tenant payments remain at or occasionally below their original levels until the loan is repaid at which point tenants experience a significant drop in rent and ongoing savings from that point forward. Under the EPC agreement, ESCOs are obligated to make cash payments to the SPE whenever energy savings fall below guaranteed levels in amounts that effectively offset the shortfalls.

Open Issues and Next Steps. The ability to work with existing leases and the budget-neutral nature of cash flows makes the model scalable to very large, multi-tenant commercial projects; but setup costs can be steep for an individual project. The model was piloted a decade ago by the multinational ESCO, TAC Schneider Electric, but eventually abandoned because high costs

and lack of sufficient project scale made it unattractive to potential customers (TAC, personal communication, 2008). More recently, some VC-backed startups, small project developers, and financial intermediaries have promoted the model, but market acceptance has been elusive and companies are seeking buyers or cutting back their efforts after brief forays into the market.

In addition to achieving economic scale, the model might also have to contend with emerging accounting standards resulting from the merger of U.S. (FASB) and international (IASB) accounting standards, particularly off-balance-sheet accounting treatment. More on this issue is discussed under the tax-exempt equipment leasing model below.

A possible next step is to develop a much larger shared-service entity as SPE organization and operating expenses might then be spread across many projects. Financial institutions would be an obvious choice to create such an entity as they now do with community development banks, though any third party is eligible who is not also a principal to the performance contract.

Municipal Leasing

For public sector owners, municipal leases are an underutilized source of financing for energy management projects, due for the most part to unfamiliarity with its advantages. Advising some big-city budget directors in particular uncovered two erroneous assumptions – that energy efficiency retrofit projects can only be funded through the capital budgeting process (financed with city bonding) and that municipal leasing was more costly than bonding in any case. Neither city had master lease agreements in place at the time.

The first assumption may have arisen because cities have traditionally financed new building construction and major renovations with bonds, as that is the only means by which most jurisdictions can legally assume multiyear debt obligations. However, cities normally adopt special language (known as non-appropriation) in multiyear municipal leases that allows them to safely exit a lease if budgets are not appropriated in the out years. Such language effectively converts municipal leases of any term to current-year obligations. As a result, cities may treat them as current expenses and not include them in their long-term debt with attendant borrowing caps and rating issues. Banks participating in the municipal market agree to the language.

The second assumption arises perhaps because budget directors understand that the bonding rate is their city's lowest borrowing rate and intuition suggested that other financing vehicles must therefore be more costly. At the scale of a major infrastructure project or wholesale renovation that may be true, but retrofit projects by their nature are considerably smaller. Issuing bonds entails considerable transaction costs, not required by municipal leasing, because of such requirements as an opinion of legal counsel and underwriting fees. Considerably lower transaction costs on municipal leases are offset by somewhat higher cost of funds, but budget directors are usually surprised at how small the premium can be. One budget director was prepared to pay up to 200 basis points more for a lease to avoid the transaction costs of bonding and was surprised to learn that the municipal leasing premium was only 50 to 75 basis points. (Department of Finance, City of Chicago, personal communication, 2008.) Once confirmed, the city approved municipal lease financing for a backlog of energy efficiency projects that would have otherwise taken seven years to fund with traditional capital budgeting.

Bonding has another drawback – that is, the entire amount must be taken down at the outset whereas retrofit projects on a city scale involve implementing thousands of measures in hundreds of occupied buildings without interrupting daily operations. That can take many years,

and the amount of funding needed in any given period is not always easy to predict. Municipal leasing has more flexible takedown provisions, so cities can access funds only as they are needed. Avoiding interest until funds are needed lowers financing costs even further.

A variety of municipal-lease payment structures effectively allow borrowers to match repayment schedules to energy efficiency project cash flows. That in turn ensures that project savings always cover debt service and that projects have a positive impact on operating budgets. Matching costs with benefits in this way is ideally suited to energy efficiency projects and makes ongoing investment sustainable because all but the most ambitious projects are budget neutral.

Municipal leases are available for virtually any size project, large or small. One advisory client identified a citywide portfolio of energy conservation measures whose combined hard and soft costs add up to $1.5 billion. (Office of Long-term Planning and Sustainability, City of New York, personal communication, 2011.) The entire amount can conceivably be financed under a master lease agreement to which individual project schedules can be added over time. Master agreements can be re-negotiated periodically to ensure the best available terms.

Open issues and next steps. In jurisdictions without one, setting up a master agreement is clearly a good next step as there is no cost involved. At the same time, additional professional education may be needed to prompt public finance professionals to take such action and to authorize more extensive use of the municipal leasing structure. Greater familiarity with negotiating the best terms and available repayment and prepayment options should naturally lead to more widespread adoption. Especially during difficult economic times when voter approval for new bond issues is challenging and public budgets make servicing new debt from operations almost impossible, a carefully structured self-funding approach to energy efficiency projects would appear to be sound public policy.

Tax-exempt Equipment Leasing

Tax-exempt equipment leasing is a programmatic approach to reducing energy costs and emissions by helping owners invest in energy efficiency improvements such as lighting, heating, and air conditioning upgrades financed under terms of their state's tax-exempt leasing program for tax-exempt institutions. Under an equipment lease, a lender's security interest is an essential-use asset; and in a typical transaction, the institution, a lender, and the state authority enter into a capital lease where: (i) the lender finances the purchase of equipment; (ii) title to the financed equipment is transferred to the institution; (iii) the institution grants a security interest to secure the institution's obligation to make sublease payments to the state authority; and (iv) the state authority assigns both its rights to receive the sublease payments and its security interest in the equipment to the lender. The lease payments required to be made by the institution reflect the principal and interest due to the lender under the tax-exempt loan made to finance the equipment. The institution's obligations under the sublease are deemed to be debt of the institution for accounting purposes, burdening its balance sheet and limiting further borrowing.

While institutions undertake lease transactions for capital improvements on a routine basis, borrowing limits and credit-rating pressures present difficulties under certain circumstances. A new way of thinking about financing capital improvements without regard for debt caps and credit ratings involves a different lease financing structure to finance the proposed energy efficiency projects that will not constitute capital obligations by the institution. Under

this structure, the state authority would (a) finance the cost of energy efficiency equipment pursuant to a lease financing agreement with a lender, (b) contract with a properly vetted energy services company to design and install the purchased equipment at the institution under a conforming energy performance contract, and (c) provide the equipment to the institution pursuant to a savings guarantee under which the institution agrees to make payments that are funded by a combination of (1) energy savings forecast by the energy services contractor and if necessary (2) cash payments from said contractor paid as liquidated damages for any shortfalls in energy savings that might occur.

Outside accountants have in some cases approved the structure for off-balance-sheet treatment because of the energy savings the projects deliver and agency willingness to hold title to the project during the performance period. Using this alternative structure does not require institutions to incur balance sheet debt to fund conservation measures with capital budgets and is operating-budget neutral because energy savings accrued by the institution under the agreement, backed by a credible performance guarantee from the energy services contractor, are expected to be sufficient to cover annual debt service payments plus certain fees payable to the contractor for measurement and verification services.

Open issues and next steps. The Dormitory Authority of the State of New York (DASNY) piloted the referenced model in 2008 on behalf of a Long Island hospital chain, and continues to do so at the request of their clients in healthcare and higher education; but without additional facilitation, the model is likely to be picked up only slowly if at all, by other jurisdictions. No additional legislative or regulatory action is required to implement a tax-exempt lease, and an agency can make its own policy subject to review by legal counsel and the consent of each client's outside accountants (DASNY, personal communication, 2008). A possible next step is to partner with an association of U.S. state finance agencies to educate agency professionals and demonstrate the value to their institutional constituents.

As with the managed utilities service model above, off-balance-sheet financing might be affected by new accounting rules under development by the FASB/IASB task force. However, DASNY experience suggests that continued use hinges on how assets are dealt with at the end of the lease and that a properly structured agreement will receive a favorable opinion.

Outside the U.S., regional development banks play a role similar to state finance agencies in funding important health and education infrastructure. There appears to be no technical reason why the model would not work equally well in Asia, Latin America, Africa, and Europe were the right participants engaged, subject to local conditions.

Conclusion

The models described are not the last word in energy efficiency finance, but a beginning. In some cases, they are little more than prototypes. Experience suggests that many challenges remain to attracting large amounts of capital. On the other hand, success to date also suggests that some potentially sturdy solutions are emerging which do not rely on a specific regulatory regime or special incentives, meaning they can scale in many places at once. Confirming their value will require greater familiarity and experience with the models, and that will entail a broad reeducation of professionals engaged in budgeting, finance, legal counsel, and procurement.

Necessary pilots and professional education do not currently exist, and someone must develop them. Trusted leaders in civil-society, philanthropic and international institutions, and an engaged global banking industry are all needed. At scale, such cooperation might create broad investor appetite for efficiency retrofit debt; and thereby turn the financial services industry into efficiency's greatest promoter. At the same time, banking regulators might analyze financing models that reduce credit risk by improving the quality of underlying security. Together, upgrading building systems and lowering operating costs make property more valuable in ways that ought to be quantifiable in a risk model. Finally, policy makers might consider the advantages of frameworks that deliver a widely acknowledged public good through market mechanisms. Should something of the sort emerge, it could be transformative indeed.

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