Global Power Best Practice Series

10

Strategies for Energy Efficiency Finance

RAP

Energy solutions for a changing world

December 2014

Strategies for Energy Efficiency Finance

Authors

John C. MacLean, *Energy Efficiency Finance Corp.*

David H. Purcell Jr., *contractor to RAP*

Acknowledgements

The authors would like to thank Dilip R. Limaye, President, SRC Global Inc., Paoli, PA, USA; and Dr. Steven Fawkes, Chairman, Day One Energy, London, UK for their research contributions.

How to Cite This Paper

MacLean, J., and Purcell, D. (2014). *Strategies for Energy Efficiency Finance.* Montpelier, VT: Regulatory Assistance Project. Retrieved from http://www.raponline.org/document/download/id/7451.

Table of Contents

List of Figures

List of Tables

Acronyms

ARRA	American Recovery and Reinvestment Act (U.S.)
C&I	Commercial and Industrial
CD	Certificate of Deposit
CDM	Clean Development Mechanism
CDFI	Community Development Financial Institution
CRA	Community Reinvestment Act (U.S.)
DG	Distributed Generation
DHW	Domestic Hot Water
DOE	Department of Energy (U.S.)
DSM	Demand Side Management
EE	Energy Efficiency
EEO	Energy Efficiency Obligation
EM&V	Evaluation, Measurement, and Verification
EU ETS	European Union Emissions Trading Scheme
ESCO	Energy Services Company
ESPA	Energy Savings Purchase Agreement
EU ETS	European Union Emissions Trading Scheme

FCM	Forward Capacity Market
FEMP	Federal Energy Management Program (U.S.)
FHFA	Federal Housing Finance Authority (U.S.)
FI	Financial Institution
FiT	Feed-in Tariff
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GRF	Green Revolving Fund
HELP	Home Energy Loan Program (PA, U.S.)
HVAC	Heating, Ventilation, and Air Conditioning
IRP	Integrated Resource Plan
KW	Kilowatt
M&V	Measurement &Verification
MW	Megawatt
NPV	Net Present Value
OBR	On-Bill Recovery
PA	Program Administrator
PACE	Property Assessed Clean Energy Loan Program (U.S).
PPA	Power Purchase Agreement
PRC	People's Republic of China
PUC	Public Utilities Commission
R&D	Research and Development
RE	Renewable Energy
RFQ	Request for Qualification
RGGI	Regional Greenhouse Gas Initiative
ROI	Return on Investment
RTO	Regional Transmission Operator
SBC/PBF	System Benefit Charge; Public Benefit Fund (Interchangeable)
TRC/SRC	Total/Societal Resource Cost Test
USD	United States dollar (currency unit)
UN	United Nations
VSD	Variable Speed Drive

Executive Summary

Increasing the scale of energy efficiency (EE) deployment has long been an important and highly valuable policy objective. Unlike all other capacity resources, EE offers a valuable combination of economic and social benefits typically at least cost, and is accessible to virtually all market segments, consumers, and market participants. In the US economy alone, the value of energy savings from cost-effective EE opportunities was estimated at USD1.2 trillion at a cost of only USD520 billion by McKinsey and Co. in 2009, excluding the substantial value of avoided environmental externalities. Yet the story of EE remains the substantial gap between its strong economic and environmental potential and its more limited commercial realization. While primary and secondary market financing groups are building interest and experience in investing in EE projects, they face an inadequate project pipeline for doing so that results in elevated transaction costs and ultimately increases risks. For many, the EE investment market is simply not ripe.

Still, EE is one of the lowest-cost energy capacity resources and offers tremendous near- and long-term economic, environmental, and social benefits. Further deployment is important for realizing these substantial benefits, and has a major role to play in supporting reliable, affordable, and efficient power delivery.

This report examines the primary transaction structures used to originate and finance EE projects as part of an analysis of the challenges and needs faced by development programs seeking to build EE project portfolios. In doing so, the report offers important lessons and actionable recommendations to support both the supply and demand side of EE project development. The emphasis is on building from existing EE program capacities, filling gaps, leveraging a variety of transaction points, and properly structuring financial products to help realize the primary prerequisite to scaling up EE financing: *project pipeline development.*

The following primary findings serve as a guide to policymakers and advocates of effective reform and identify many of the main opportunity areas in EE finance development.

Report Conclusions

Pipeline, Pipeline, Pipeline! Build Primary EE Finance Markets

Though many mainstream capital sources are interested in EE finance, they are often constrained by a lack of projects that are well-prepared for investment. Potential investors often ask: "Where's the pipeline?" This concern underscores one of the main conclusions of this report: Finance must be combined with project development programs that prepare projects for investment.

Finance Is Necessary, But Not Independently Sufficient

Availability of finance can drive development of EE projects, but financing alone, or simply the existence of available investment capital, is not sufficient to move the market. In addition to organizing finance, EE finance programs must also reach back further into the project development cycle and promote systematic project origination by capable market actors in order to generate a pipeline of investment-ready and creditworthy projects. Ultimately, successful EE finance programming must support both the supply and demand sides of the EE investment market by matching a robust project pipeline with capable market participants who can engage these projects with appropriate financial products and programs. Successful EE finance programs must combine:

- Source(s) of investment capital;
- Financial mechanisms tailored to the target market;
- Marketing, project development, and project delivery mechanisms that generate a steady pipeline of investment-ready projects;
- Ability to leverage the capacity of market actors to create scale and sustainability through commercial opportunities.

Fundamental EE Finance Scale-Up Challenges

1. Lack of coordinated EE project demand (i.e., *well-prepared projects ready for investment*), and;
2. Lack of financial products that are properly structured, adapted, and aimed at this market, as well as being creditworthy and scalable from the perspective of mainline capital sources.

Primary Barriers to EE Finance Scale-Up

While barriers to EE deployment at scale have been well studied for decades, the barriers to EE *finance* at scale are also numerous across all stakeholder groups. These and other characteristics of EE finance increase development risks and costs, reduce the interest of financial institutions (FIs) in this sector, create marketing barriers, and contribute to the gap between EE's economic potential and its commercial realization. Typical barriers to EE finance scale-up include:

- **The large number of small, dispersed projects** that characterize EE investment markets;
- **High pre-investment development and transaction costs** for EE projects relative to total capital deployed;
- **Lack of customer awareness**, complicated technical information requirements, and long marketing cycles associated with the customer sales and decision-making process;
- **The multi-step EE sales cycle**, which produces challenges particularly from the customer perspective;
- **The inadequacy of the project-by-project approach to project financing and development**, and the need instead for programmatic approaches to market aggregation, such as specialized EE finance companies that can package, originate, and warehouse EE finance transactions for mainstream capital sources;
- **Lack of EE finance experience within financial institutions (FIs)** and a lack of specifically adapted EE financial products offered by FI (though this is increasingly less of a barrier);
- **Real and perceived credit risks**, lack of collateral offered by EE equipment, and difficulties creating creditworthy financing structures; and
- **The sheer range of financing structures** applicable and needed to address the EE financing needs of various market segments.

Build Institutional Capacity to Deliver EE Financing and a Project Pipeline

The scale-up of EE finance is an institutional capacity-building challenge, not just a financing challenge.

Recommended Actions

This report recommends the following actions in an effort to overcome the primary barriers outlined above and encourage consistent EE project origination and development of EE finance strategies and EE development programs.

Develop an EE Finance Best Practices Network, Toolkit, and Service
Establish and strengthen the network of EE finance best practices by building on and further coalescing existing networks, and by promoting the creation of an EE finance best practices information service to design, set up, and implement EE finance programs.

Promote Replication and Scale-Up of Working Models and Promising New Models
Utilize Energy Savings Purchase Agreements (ESPAs) or EE feed-in tariffs (FiTs) to acquire EE savings directly.

Promote EE Project Development and Finance Program Funding, and Best Uses of Funds
A core recommendation of this report is that EE project development and finance programs are needed in many markets, accompanied by financing mechanisms, as a means to generate a pipeline of well-prepared EE project investments that those mechanisms can fund.

Leverage Market Intermediaries and Common Transaction Points
Many market intermediaries and common transaction points can be very useful for integrating EE financing incentives and mechanisms, particularly in the residential market. Among others, these include:

- Lending institutions, including during mortgage financing and refinancing transactions;
- Equipment suppliers and energy service companies (ESCOs) during equipment replacement or overhaul; and
- Building contractors during construction and renovation projects.

Promote Energy Consumption Reporting Standards, Benchmarks, Mandates, and Codes
In many countries this has been done in both the commercial and industrial (C&I) and residential markets (including rental markets) with success, and it can drive support for EE financing mechanisms and bolster project pipeline development.

Utilize Marketing to Foster a Culture of EE Investment
Effective EE programming should include social marketing, social media, and communication with political and community leaders. Successful EE financing mechanisms and programs can leverage EE's social capital benefits through marketing and successfully communicating EE's broad benefits, and can make it easier for customers to purchase EE and programs to develop.

Recommended Uses of Public Funds

- **To support "one-stop shopping" programs** that provide EE project development services to customers in their target market, covering the full project development cycle.
- **To provide various forms of co-financing** for risk sharing and credit enhancement to mobilize and leverage commercial financing.

Utilize Pooled Procurement

Pooled procurement can be particularly effective in the governmental and institutional markets. These programs can simplify the EE sales cycle and bring decision-ready consumers to financing mechanisms.

1. Purpose and Objectives

1.1 Introduction

Investment in energy efficiency (EE) produces significant near and long-term economic, environmental, and social benefits. EE investments offer a number of strong advantages, including that they often pay for themselves through energy cost savings while simultaneously improving economic competitiveness and creating value for energy consumers. In the US economy alone, the value of energy savings from cost-effective EE opportunities was estimated at USD1.2 trillion at a cost of only USD520 billion by McKinsey and Co. in 2009,[1] excluding the substantial value of avoided environmental externalities. Yet, there remains a substantial gap between the strong economic and environmental potential of EE and its more limited commercial realization with barriers to further EE market growth existing on both the supply and demand sides of the market., Insufficient project aggregation and the lack of project delivery and financing mechanisms adapted to specific market characteristics and conditions are two of the most substantial causes of this gap identified in this report.

This report—part of the Global Power Best Practices series prepared by the Regulatory Assistance Project (RAP)—contributes to current best practices in EE finance and outlines strategies and recommendations to accelerate EE investment commensurate with its vast potential. It was prepared based on the authors' experience, research, and interviews and contributions from many EE finance practitioners working around the world. (Because of time limits, many outstanding practitioners could not be interviewed for this work.)

For the purposes of this study, EE financing encompasses all EE investments in the primary end-user sectors. It often also includes small-scale, customer-sited renewable energy (RE) and distributed generation (DG) systems, as these investments have financing characteristics similar to EE (e.g., large numbers of relatively small projects). Small-scale RE projects are defined as those sited at an energy consumer's facility that are usually less than 15 MW in capacity. These projects typically include solar photovoltaic (PV), solar thermal, wind, geothermal, and biomass technologies.

1.2 Scope and Objectives

The primary objectives of this report are:

1. To summarize the current state of knowledge and practice in EE finance with attention to international developments and an emphasis on experience from the United States;
2. To assess the various financing mechanisms and programs for scale-up potential, and;
3. To provide recommendations on strategies and future programs to promote EE finance market development at scale.

This report focuses on financing scaled-up deployment of existing and proven EE technologies that can pay for themselves through energy savings; that is, they are economically viable at or below current energy prices.[2] EE projects discussed at large in this report are typically retrofits or replacements at existing facilities and encompass a full range of end-use equipment—boilers, thermal plants, lighting,

[1] These estimates are based on 2008–2009 research of energy cost savings from EE and do not include the value of avoided environmental externalities or carbon pricing. See Granade, Creyts et al., 2009.

[2] Such as those measures shown in the McKinsey & Co. carbon abatement cost curve. See Enkvist, 2007.

motors, controls, HVAC, industrial process systems, waste heat recovery, cogeneration, refrigeration, compressors, and other energy-consuming technologies—and investments in building performance. These projects are typically pure end-use EE and energy management (including load shifting) projects, though programs and mechanisms covered in this report may also apply to small-scale renewable energy (RE) and distributed generation (DG) installations that can often be financed in a manner similar to EE or as part of a broader package of services. The primary end-user market segments addressed in this report are residential, commercial, industrial, and public/institutional; the transportation sector has been excluded. Financing mechanisms for promoting EE in new construction are not examined in this report; these are particularly relevant for China, India, and nations experiencing rapid population growth and strong economic development.[3]

The primary audience for this report includes governmental, national, and international agencies, NGOs, and other entities concerned with the development of the EE investment market. A range of interviews was conducted to identify the cutting edge of EE finance thinking and current initiatives under consideration. This report is intended to identify actions that can be implemented by policymakers interested in advancing a more ambitious path for EE—a path that relies heavily on commercial capital for the funds necessary to bring EE investment up to the scale consistent with its existing cost-effective potential.

It is a fundamental tenet of this paper that aggressive public investment to realize the significant economic, environmental, and public interest benefits of EE is necessary and appropriate. EE investments:

- Create value and improve economic competitiveness;
- Lower the cost of delivering energy services;
- Support economic resiliency in the face of fossil fuel price variability and resource constraints;
- Improve energy security by reducing reliance on imported fuel sources;
- Promote economic development through direct job creation, improving the productivity of energy and increasing disposable income, and;
- Reduce emissions of greenhouse gases and improve local air quality, among other benefits.[4]

Public capital is limited, and public investment in EE should therefore be undertaken strategically by working with commercial finance institutions and market actors to mobilize and leverage primary and secondary commercial financing and capital from other private sources. Ultimately, a healthy EE investment market can be independently sustainable and not require major public investment. This report highlights experience and lessons learned with EE development finance structures and programs involving public and/or concessional funding, and provides policy and advocacy recommendations regarding the use of public funds to support EE investment. It also serves as a primer on EE financing mechanisms and EE finance program models.

1.3 Definitions

This report's scope and main theses are premised on the following definitions.

[3] RAP estimates that of the projected building stock in India as of 2030, more than 70% has not yet been built, which makes addressing EE in new construction of key importance.

[4] The benefits of EE are numerous. This report covers these benefits broadly; for a detailed investigation see, e.g., Lazar, J. and Colburn, K., 2013.

1.3.1 Financing Mechanisms and Finance Programs

This report distinguishes between EE *financing mechanisms* or *transaction structures* and EE *finance programs* and *project development.*

EE financing mechanisms systematically market and develop a series of EE investments in target market sectors, working programmatically with market aggregators. Typical EE financing mechanisms include a bank loan, on-bill financing by an energy utility, or a shared savings arrangement compensating an ESCO for its upfront investment.

EE finance programs and project development feed the pipeline of well-prepared projects to the financing mechanisms. They are essential for this purpose, to drive the market and address the demand side of EE finance. EE finance programs identify and organize resources to make financing (e.g., loans) available as needed for individual applications and to establish systems and procedures that facilitate financing arrangements for individual end users (e.g., technologies for meshing EE project development information with end-user credit score information). EE development programs recruit end users of energy, screen them for suitable EE measures (lighting retrofits, insulation upgrades, etc.) and connect them with finance programs and implementation providers. EE program development and EE implementation may also be part of a single, unified program. Development programs are often supported or run by interested agencies working with the commercial actors.

This report addresses both the (i) structure of and scale up strategies for financing mechanisms, and (ii) design of funding sources for EE finance programs and project development.

1.3.2 Public Funds

For this report, the term “public funds” refers to funds appropriated by governments at all levels, including international/multi-lateral bodies as well as national, state and local government entities. Governments make direct appropriations and can levy dedicated taxes, matching tax/revenue sources with EE investment purposes.

Public funds also include (i) funds from foundations, nonprofit agencies, community development finance institutions and publicly owned financial institutions all of which have an interest in promoting and investing in EE finance market development for public reasons, and, in the case of EE, (ii) funds provided by utilities (i.e., their ratepayers) through system benefit charges or public-benefit funds or energy supplier obligations (as in Europe) as well as (iii) revenues from carbon finance sources such as emission allowance auction revenues (e.g., the Regional Greenhouse Gas Initiative covering several US Northeast and Mid-Atlantic states) and white certificates.

Section 3.2 discusses recommended uses of various types of public funds.

1.3.3 Development Finance

Development finance can be broadly defined as using public/government or “publicly minded” funds in innovative ways to meet public economic development goals. Representative goals of development finance include capital organization for small and minority-owned businesses; job creation; affordable housing; investment in energy, water, and transportation infrastructure; and investment in clean energy and energy efficiency.

Public funds can be used to mobilize and leverage commercial finance and promote EE investment market development, building on existing commercial capacities. Public funds can be also be used to capitalize revolving loan funds (such as the Texas LoanStar program in the United States) or development finance institutions, such as state-owned banks (e.g., the Bank of North Dakota or the newly created Connecticut Clean Energy Finance and Investment Authority in the United States, or the India Renewable Energy Development Authority in India) or international development banks (e.g., the Asian Development Bank and the World Bank Group), all of which are owned ultimately by governments and which make direct investments in public priority economic sectors.

Development finance uses a range of investment modalities—including equity and quasi-equity investments, loans, loan guarantees, and other credit enhancements—and technical assistance to achieve its public goals. This report contends that there are proper and productive roles for EE development finance and further elaborates on EE development finance investment and program models.

1.3.4 Market Aggregation and Aggregators

Because EE investment markets consist of large numbers of small, dispersed projects, they are best approached programmatically, in partnership with market actors who can aggregate projects and demand for financing. Market actors who can participate as aggregators include energy utilities, EE companies (e.g., equipment companies and distributors, mechanical and HVAC contractors) and ESCOs, energy users owning/managing multiple facilities and their relevant industry associations, and local government or other agencies that work with energy users to develop and prepare the EE project investments.

1.3.5 Scalable

A “scalable” financing mechanism is one that (i) generates steady and sufficiently large volumes of creditworthy, well-structured investment portfolios, that (ii) can be originated with relatively low transaction costs, so as to be (iii) attractive and cost-effective for the customer, and (iv) on track to be a profitable line of business for mainstream capital sources. Eventually, these criteria may also include (v) suitable for packaging and resale to capital markets. The definition of “sufficiently large” is likely (vii) investment portfolios of a minimum USD25 million each, and (viii) potential to generate a series of such portfolios that aggregate into the hundreds of millions of dollars of total financing per year. Credit criteria and structures for EE financing mechanisms are addressed in the report, as are strategies to reduce and manage transaction costs.

A key thesis of this report is that financing mechanisms and capital must be accompanied by finance programs that will generate deal flow; thus, scalability must address both the supply side and demand side of EE finance.

1.4 Report Structure

The remainder of this report is organized as follows:

- **Section 2** discusses the core principles of successful EE financing mechanisms and programs, based on the authors' research, interviews, and experience.
- **Section 3** identifies basic EE finance transaction structures and describes the characteristics, strengths, and weaknesses of several types of EE finance programs.
- **Section 4** discusses the challenges of customer decision-making in the EE sales cycle, and provides strategies for accelerating this process.
- **Section 5** identifies additional barriers to the scale-up of EE finance, and details the steps involved in designing and implementing scalable programs and mechanisms.
- **Section 6** describes ESPAs and several emerging EE financing models that are generally at relatively low levels of market penetration and offer scale-up opportunities. These successful models provide valuable ideas for replication.
- **Section 7** provides actionable recommendations and identifies areas that would benefit from additional research.

2. Key Principles of Successful EE Financing

Design and implementation of successful EE finance programs entails a range of factors, including recruiting and engaging FIs, structuring financing mechanisms to leverage commercial financing by meeting credit and security requirements, implementing strategies and methods to generate deal flow, and creating stable funding sources for program operations. Of these many factors, the most important principles of successful EE financing as identified by this report include the following:

- Finance Is Necessary, But Not Independently Sufficient
- Build Institutional Capacity to Deliver EE Financing and a Project Pipeline
- Build on Existing Capacities: Identify and Fill Market Gaps
- EE Financing Mechanisms must match Target Market Characteristics
- Pipeline, Pipeline, Pipeline! Build Primary EE Finance Markets
- Mobilize and Leverage Commercial Finance
- Leverage Social Capital Benefits

2.1 Finance Is Necessary, But Not Independently Sufficient

Availability of finance can drive development of EE projects, but financing alone, or simply the existence of available investment capital, is not sufficient to move the market. In addition to organizing finance, EE finance programs must also reach back further into the project development cycle and promote systematic project origination by capable market actors in order to generate a pipeline of investment-ready and creditworthy projects. Ultimately, successful EE finance programming must support both the supply and demand sides of the EE investment market by matching a robust project pipeline with capable market participants able to engage these projects with appropriate financial products and programs. Successful EE finance programs must combine:

- Sources of investment capital;
- Financial mechanisms tailored to the target market;[5]
- Marketing, project development, and project delivery mechanisms that generate a steady pipeline of investment-ready projects, and;
- Ability to leverage the capacity of market actors to create scale and sustainability through commercial opportunities.

The idea that finance alone is not sufficient points to the need to address both EE financing *mechanisms* and EE finance *programs* in scale-up strategies.

2.2 Build Institutional Capacity to Deliver EE Financing and a Project Pipeline

Scale-up of EE finance is an institutional capacity-building challenge, not just a financing challenge. In a recent EE financing study, the World Bank found:

[5] A target market may be either a particular market segment, e.g., residential, commercial, industrial; a measure-specific market, e.g., lighting retrofits; a market identified geographically as a function of integrated resource planning (IRP) and forecasted or existing infrastructure constraints; or any combination thereof.

> Development and operation of energy efficiency investment delivery mechanisms is an *institutional development issue*… Lack of domestic sources of capital is rarely the true barrier; inadequate organizational and institutional systems for developing projects and accessing funds are actually the main problem. Therefore, mechanisms to capture the opportunities for energy efficiency investment need to be created and strengthened. This entails sustained effort over years …[6]

Building institutional capacity requires, in turn, stable sources of program funding. Sources of funding appropriate to support EE project development and finance programs include government appropriations, tax mechanisms, white certificates, revenues from the public auction of emissions allowances, a host of private capital resources, or utility system benefit funds and other energy company savings obligations. Programs may have diverse funding sources.

2.3 Build on Existing Capacities: Identify and Fill Market Gaps

In designing EE finance programs, it is essential to identify market actors with purposes and capacities related to the EE investment effort, understand what they can deliver, and understand both the needs and constraints they face for growth. Market actors can be partners in program implementation, and programs can be designed to address their constraints with resources and coordination. For many EE businesses, the constraint is lack of effective demand. As demand accelerates, they may face other constraints, including a shortage of trained workers.

Thus the most common gaps in the EE investment market are:

1. Lack of coordinated EE project demand (i.e., *well-prepared projects ready for investment*), and;
2. Lack of financial products that are properly structured, adapted, aimed at this market, and creditworthy and scalable from the perspective of mainline capital sources.

2.4 EE Financing Mechanisms Must Match Target Market Characteristics

Broad realization of EE's substantial existing potential means EE finance must operate in a diverse set of market segments, geographic regions, and policy climates. The best financing mechanisms will vary appropriately across market characteristics and conditions. Different market segments also have varying credit features, investment sizes, and access to finance, so the appropriate financial product and mechanism must be matched to the characteristics of the given sector. Multiple financial products may also be appropriate for a given market segment, though some have greater potential for scale-up and market penetration.

Just as target markets and conditions vary, financial mechanisms offer different costs of capital. For EE investments in facilities owned by public and nonprofit entities, tax-exempt financing will offer a lower cost of capital than, for example, financing by an energy service company (ESCO)[7] that relies on profit-

---

6 Taylor et al., 2008.

7 ESCOs are businesses that develop, engineer, install, provide or arrange financing, and provide operations services for projects designed to improve the efficiency with which facilities use energy and cut maintenance costs under long-term contracts of typically five to 10 years. ESCOs operate with a range of business models and generally act as project developers for a wide range of tasks, offering a complete set of project services for their customers and assuming the technical and performance risks associated with the project.

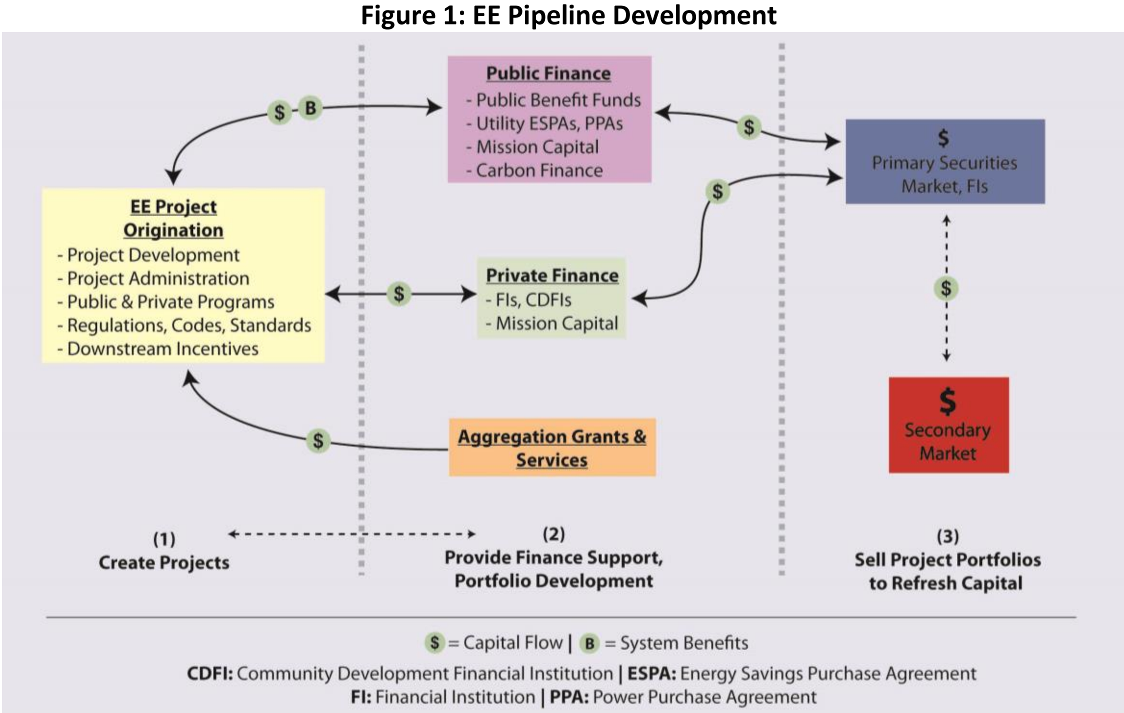
making and, typically, taxable sources of capital. ESCOs typically assume all technical and performance risk associated with EE projects, and financing available to these companies therefore bears a risk premium and ultimately must be drawn from a shallower capital market, resulting in a commensurately higher cost of capital. These characteristics have recently proved a painful reality for many ESCOs in China, which face a number of challenges, including undercapitalization (for more on this, see Section 3.2.3).

2.5 Pipeline, Pipeline, Pipeline! Build Primary EE Finance Markets

While finance institutions, governmental bodies, utilities, ESCOs, and other entities have gained considerable experience delivering successful EE financing mechanisms and finance programs, the question of how to scale up these successful models remains a key challenge.

Though many mainstream capital sources are interested in EE finance, they are often constrained by a lack of well-prepared projects for investment. Potential investors often ask: "Where's the pipeline?"[8] This concern underscores one of the main conclusions of this report: Finance must be combined with project development programs that prepare projects for investment. It also points to the need for specialized EE program administrators and project investment funds to originate EE investments and aggregate them in sufficient sizes for reinvestment by mainstream capital. While much attention has focused on creating secondary markets for portfolios of EE finance transactions, there first must be a healthy primary market, comprising entities that can originate and fund the transactions that build portfolios, before a secondary market can develop.

Figure 1: EE Pipeline Development



[8] Kaupr et al., 2011.

2.6 Mobilize and Leverage Commercial Finance

There is a strong rationale for public investment in EE for a host of reasons, including public interest in advancing long-term investments with economic, social, and environmental benefits; the role public investment plays in driving the marketplace (the absence of public investment would likely translate into either absent investment, or underinvestment); and, as described above, the fact that public sources of capital are typically less expensive and can play an important role in leveraging private capital resources. At the same time, the overall scale of investment—and the diversity, breadth, and geographic range of financial products required—dictate that commercial financial resources and delivery capacities must provide the vast majority of capital required. Thus, public policy and EE investment market development initiatives should focus on mobilizing and leveraging commercial finance resources to deliver well-structured and adapted financial products to specific EE finance markets.

2.7 Leverage Social Capital Benefits

Social capital refers primarily to the benefits—economic and non-economic—realized by both individuals and groups from cooperation and relationships. EE offers numerous and significant benefits for energy users, and because *everyone* is an energy user, nearly unlimited opportunity exists to establish these benefits as a social capital resource. Successful EE financing mechanisms and finance programs leverage social capital through marketing and successfully communicating EE's broad benefits and can make it easier for customers to purchase EE and programs to develop. Because energy consumption is individually and culturally influenced, it is important to frame EE as a social capital resource to encourage buy-in and development at scale.

3. EE Financing Models and Types of Finance Programs

This report distinguishes between individual EE financing mechanisms or transaction structures and EE finance programs and project development (see section 1.3.1 for definitions of these terms). It discusses EE finance transaction structures in Section 3.1 as a foundation for understanding strengths and weaknesses that may be inherent in EE financing mechanisms. Types of EE project finance programs are discussed in Section 3.2.

3.1 EE Financing Transaction Structures

There are two basic models for EE financing:

- Model 1: End-Use Consumer as Borrower;
- Model 2: Implementer as Borrower.

3.1.1. Model 1: End-Use Consumer as Borrower

Under this model, the end-use consumer procures financing either for complete turnkey services from a qualified entity or for purchase of these services individually. Model 1 structures require an energy consumer who is capable and willing to borrow, because EE investments under this model create a balance sheet obligation.

- <u>Financing:</u> Direct to the energy consumer via loans, leases, bonds, or similar financing structures.
- <u>Transaction Structure:</u> Financial relationship is between the end user and the EE financing source.
- <u>Implementer:</u> Private contractor, ESCO, or other installer procured either independently, through an EE project development program, finance provider, or government EE program administrator (typically a utility, third party, or hybrid).

3.1.2. Model 2: Implementer as Borrower

Under this model, the EE implementer packages the financing together with a turnkey project combining installation and other services into a single transaction with the energy consumer. In Model 2, the energy user often pays for EE measures through energy savings, delivered energy, or some other payment formula. Model 2 structures are more complicated, but have many clear advantages for marketing.

1. <u>Financing:</u> Provided midstream to the entity implementing EE measures via loans, leases, bonds, or other financing structures.
2. <u>Transaction Structure:</u> Financial relationship is between installing entity and the EE financing source.
3. <u>Implementer:</u> Private contractor, ESCO, government EE program–sponsored installer (typically a utility, third party, or hybrid), other EE program–sponsored installer, or installer procured through a financing provider.

Table 1 on the next page summarizes key differences between these two basic models.

Table 1: Advantages and Disadvantages of EE Financing Models: End User as Borrower vs. Implementer		
Issue	**Model 1: End User as Borrower**	**Model 2: Implementer as Borrower**
Distribution of End-User Credit Risk	FI exposed to borrower credit risk and must have or arrange credit analysis capacity.	Implementer is exposed to end-user credit risk, and FI is primarily exposed to implementer credit risk. Risk will vary depending on the implementing party's transaction structure and whether debt payments are tied directly to energy cost savings.
Consumer Payment Structure	Payments to FI are typically fixed and not subject to project performance variability; end user must get savings guarantees (if any) from implementer.	Payments may be based on energy savings (pay-for-performance model), fixed payments, or other arrangement. Savings-based payments create significantly more risk for FI in financing the implementer.
FI Exposure to Project Performance Risk	FI not exposed to project performance risk, reducing due diligence burden and enabling easier market entry.	FI exposed via implementer to all risks that implementer assumes, including project performance risk given that implementer's ability to make debt payments may depend on performance.
End-User Balance Sheet Treatment	On balance sheet, as financing counts as debt. For end users who face limits on their borrowing capacity this could be a barrier.	May be off balance sheet, with end-user payments treated as an operating expense; preserves end user's borrowing capacity for other core purposes.
Equity Requirements	Variable based on sum borrowed and end-user credit profile; 100% debt may be possible.	Typically requires implementer equity of 10–30% or more of project cost.
FI Due Diligence Burden	Lower; FI takes end-user credit risk only.	Higher; FI ultimately exposed to implementer credit risk, project performance risk, and end-user credit risk.
Finance Aggregation	FI makes more but smaller loans, but perhaps under a finance facility agreement with implementer; aggregation still possible.	Implementer aggregates demand for project debt finance for FI; increased loan sizes makes financing more attractive to FI.
Cost of Debt	May be lower, all else equal, due to FI's more traditional risk exposure.	May be higher, all else equal, due to higher FI risk exposure.

3.2 Types of EE Finance Programs

This section catalogues and briefly describes the characteristics, strengths, and weaknesses of different types of EE finance programs. This is not meant to be an exhaustive list; rather, it includes only those types of programs deemed by the authors to be of greatest interest to the question of how to scale up EE finance. Because this field is fast developing, the shelf life of this analysis may be very short, and other relevant developments may be missing.

Sources of funding for EE may include government appropriations, utility public/system benefit charges, tax mechanisms, white certificates, capital from private sources and community development financial institutions (CDFIs), and revenues from the public auction of emissions allowances. Government appropriations and utility system benefits charges (SBCs) are among the most common sources of funds for EE (see Section 3.2.8).

Though not financing mechanisms themselves, energy efficiency obligations (EEOs)[9] levied on energy utilities can also drive demand for financing. Obligated parties can either meet their energy savings targets through their own programs and activities, or through purchasing energy savings from others that specialize in this area.

Governments have also levied targeted fees to create dedicated revenues for EE programs (e.g., through existing waste disposal service levies, which collect funds through an existing mechanism).

The following EE finance programs are outlined in this section:

- Commercial financing supported by public co-finance or credit enhancements
- Utility-based or utility-related programs
- ESCO-financed programs
- Property Assessed Clean Energy (PACE) programs
- Public sector procurement programs
- Local government programs
- Private and CDFI mission-related capital
- Program funding with public benefit funds
- Public and mission-driven EE investment funds
- Organizations aiming to transform markets
- Carbon finance

[9] Crossley et al, 2012.

3.2.1 Public Co-Finance and Credit Enhancement Strategies

Transaction Structure

Public entity supports FI or CDFI to lend to end user, ESCO, or other group.

Description

Governments and communities can support private FIs by leveraging public capital to provide various levels and forms of co-finance or credit enhancement support. This can encourage lending, reduce capital costs for borrowers, and efficiently utilize public financial resources to drive EE project origination and pipeline development. Public co-finance is utilized in different forms in all target market segments covered in this report. Examples of strategies include:

- Credit enhancement: A private FI issues unsecured loans backed by a publicly funded loan loss reserve (loss protection) to reduce lending risk and enable private FIs to offer consumers more attractive terms.
- Reduced interest rates: Public finance is used to subsidize or "buy down" interest rates to offer consumers more attractive terms.
- Public co-financing: A public entity supports a private FI through various arrangements (e.g., the entity agrees to purchase loans after the FI provides interim financing).
- Senior debt co-financing: First-position debt, priority repayment, often at a below-market interest rate to reduce rates for borrowers.
- Subordinated debt co-financing: Second-position debt, below senior debt and possibly other defined debts; reduces risk for commercial senior lenders.

Strengths

- Uses public funds efficiently; enables public capital resources to support larger pools of projects than by funding projects on an individual basis.
- Supports private capital resources to expand program reach by providing loan security and reducing acquisition costs, as well as providing these groups with important experience managing EE lending; and
- Enables public funds to be used to support a variety of EE measures and market needs, unlike targeted rebates that apply to a narrower band of measures and markets.

Weaknesses/Challenges to Scale-Up

- Limited by available public capital resources, programs may be first-come, first-serve;
- Limited geographically if state or regional funding is utilized;
- May not drive demand for EE as successfully as traditional measure rebate programs;[10]
- Subsidizing finance for those that already have access to low-cost sources may not promote additionally[11] (i.e., the EE investments may have occurred anyway in the absence of the finance program).

[10] Borgenson, Zimring et al., 2012.

[11] Ibid.

Example: Residential Lending Programs Using Loan Loss Reserves

Residential EE lending programs have blossomed in the United States in dozens of cities with many FIs such as commercial banks or credit unions offering EE retrofit loan products to the single-family market segment. These products can be secured (with a mortgage or deed of trust) or unsecured (no mortgage on the real estate, but often with Uniform Commercial Code [UCC] liens on equipment). In many cases, these programs have been led and initiated by state and local governments. Marketing is typically contractor-driven, so the programs operate like vendor finance programs in line with the strategies described in Section 4.2.

A leading example of this type of program is the Home Energy Loan Program (HELP), implemented in Pennsylvania with AFC First Financial Corporation. AFC is a specialized EE lender that operates EE loan programs, originates and funds EE loans, and sells EE loan portfolios to replenish its capital. In Pennsylvania, the State Treasurer's Office purchases the loans in an example of a public co-finance program. AFC operates programs around the United States, and it reports a strong payment performance track record.[12]

Another example was programs funded by the American Recovery and Reinvestment Act (ARRA).[13] Numerous residential EE finance programs have been initiated with ARRA funds, frequently using grant funds for both credit enhancement in the form of loan loss reserves and for program operations. These programs have partnered with credit unions and commercial banks and take a portfolio approach to credit structuring. Interest rates have been as low as 5–7 percent fixed for ten-year terms; lower rates are provided by some programs by using interest rate buy-downs. A detailed guidebook on designing and structuring ARRA-funded programs, prepared with support by the U.S. Department of Energy (DOE), is the kind of best practices guide that would be valuable in preparing for other markets. The guidebook addresses program design, finance structure, use of grant funds for credit enhancement, recruitment and procurement of financial institution partners (including sample request for proposal or RFP documents), and negotiating implementing agreements (including sample agreements).[14]

In general, ARRA-funded programs have offered attractive financing terms. However, the main challenge they have faced is effective demand for loans. Many residential EE programs have loan uptake (i.e., the portion of the project implemented using loans) of just 20–30 percent. This reflects reluctance to lend, and is problematic because very often the availability of loans helps overcome a customer objection early in the sales process. Once this objection is overcome, though, consumers often decide to implement the project with their own funds instead of using the loan offer. This is also a common dynamic in ESCO marketing, where an ESCO convinces the customer of the merits of the EE investment and the customer implements the investment itself as its own general contractor with its own funds.

Now that ARRA grants have expired, a range of solutions and diverse revenue sources are being investigated and developed to sustain these programs. Options under consideration include: creating dedicated tax revenues for EE programs through the development of local improvement districts that can collect voter-approved levies; utility system benefits charges; government appropriations based on fiscal impact analysis; grant funds from clean air agencies and carbon revenues; and fee-for-service methods, such as small project development charges capitalized in the projects and paid by the contractors.

[12] Krasja & Welks, 2010.

[13] The ARRA was an economic stimulus package enacted in 2009 worth more than USD800 billion and intended to stimulate economic and employment growth through public spending on infrastructure, education, health, energy and more. It was used in part to fund EE programs, research, and financing mechanisms.

[14] Resource materials can be found online at the DOE Office of Energy Efficiency and Renewable Energy's State and Local Solution Center (http://www1.eere.energy.gov/wip/solutioncenter/).

3.2.2 Utility-Based Programs

Transaction Structure

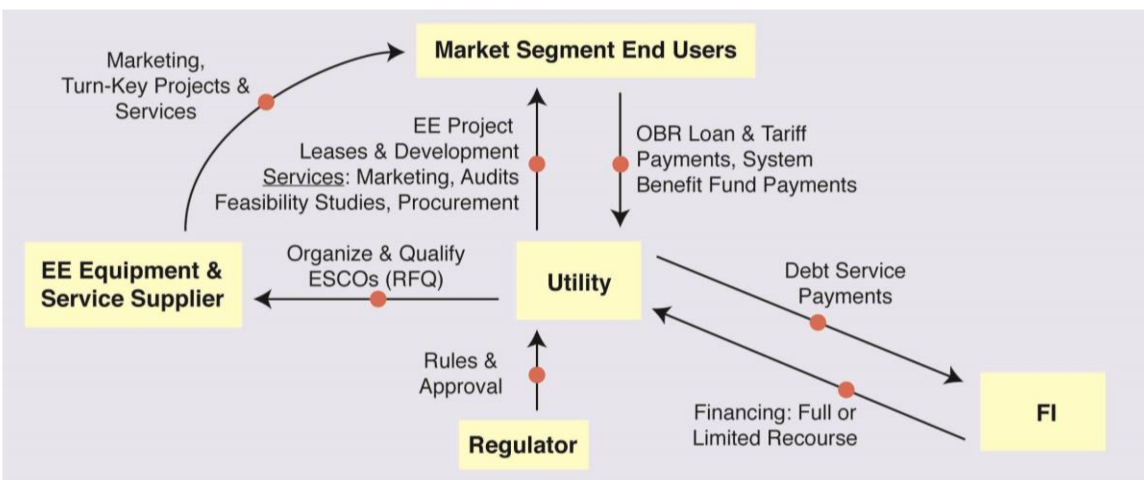
- End user, utility, or ESCO may be borrower.
- Utility may also act as purchaser under an ESPA, standard offer, or other arrangement.

Description

Utilities can be effective agents and aggregators for purchasing, marketing, financing, and delivering EE and customer-sited RE projects. Utility-based EE programs can take numerous forms and utilize a variety of transaction structures, including direct purchase[15] of saved energy and capacity through various agreements (e.g., kW and kWh). In some US states, utilities are also partnering with commercial FIs to deliver financing for EE measures to end users through their existing billing and collections infrastructure, often known as On-Bill Repayment (OBR). In an OBR program, the utility acts as collections agent via the utility bill on behalf of a third-party lender or financier; in an on-bill finance program, the utility also provides the financing. – These methods can enhance credit structure and debt payment performance, and reduce collection costs, which is especially useful for reaching smaller end users and more stratified market segments such as residential consumers. OBR programs in the United States typically take two forms:

- Loan programs: Travel with the borrower; typically non-transferable at time of property sale.
- Tariff programs: Travel with the meter and property; payments are made by the party responsible for the property's utility bill and thus may be transferred among varying property owners and tenants, etc.

Figure 2: Utility as a Financial Intermediary



Strengths

- Typically familiar with EE and RE technologies.
- Established and trusted connection with large groups of end users.
- Access to customer account data.

[15] Such savings may be driven by an open "standard offer" solicitation, energy savings purchase agreements or a request for proposals process, or an EE FiT, among others. Savings may also be sought for purchase from EE projects located in a specific geographical location as a means to address infrastructure constraints.

- Efficient use of utility funds; net present value (NPV) of avoided energy delivery cost is greater than the NPV of the total measure installation cost. (This is usually determined in the United States via the total resource cost or societal resource cost tests.)

In the case of U.S. OBR programs, OBR can enhance collections performance and reduce cost, especially for smaller end users and stratified market segments. OBR is also particularly well suited to access hard-to-reach end-user groups that generally do not have independent financing abilities. Certain on-bill tariff programs are also capable of overcoming the split-incentive problem in the residential market segment.

Weaknesses/Challenges to Scale-Up

- In countries with more than one utility, geographical limitations for individual utilities may make multi-program bundling difficult or impossible outside of defined service territories.
- Particularly in the United States, regulatory oversight, rules, and required approvals may delay program development and add to implementation cost; utilities and their investors and customers ultimately bear business risk and are typically risk-averse, challenging their ability to engage in EE programing that may be untested.

Example: Sacramento Municipal Utility District (SMUD) Residential Loan Program

The Sacramento Municipal Utility District Residential Loan Program began in 1977 and has one of the highest participation rates and the largest number of loans of any program in the United States.

It is a contractor-driven, point-of-sale finance program, and contact is often initiated when residents want to replace aging systems and equipment with more efficient alternatives. A SMUD-approved contractor must perform installation.

Unsecured loans cover building insulation, duct testing, duct sealing, and other envelope improvements, with a maximum term of three years, at a 10.75 percent interest rate. Secured loans cover improvements related to HVAC, windows, and renewable energy projects; the term for those is a maximum of 10 years, with an average interest rate of 6.99 percent. Secured loans are offered for up to USD30,000, while unsecured loans are limited to USD5,000. The average loan size, including both types, is USD9,100. Unsecured loans are primarily for envelope insulation investments and other lower-cost measures while secured loans are available for heat pumps, solar DHW, window retrofits, and central air-conditioning.[16]

Applicant creditworthiness is based on both a SMUD account payment record and an outside credit report. There is a maximum debt-to-income ratio of 0.4 unless the applicant's income is very large. Where appropriate, SMUD may require additional financial statements or records for the loan evaluation process.

Since October 1990, more than 84,000 loans have closed under the program, with a participation rate of approximately 16 percent among the utility's residential customers. Marketing revolves around directing customers to contractors vetted by SMUD and trained to assess home energy performance at a subsidized rate of $99 per inspection. During whole house energy inspections customers are informed of any possible upgrades and presented with options for both implementation and financing. Once contractors have collected information and made specific recommendations, they work through the application process with the homeowner; turnaround on loan applications is typically only a few days.

[16] For a detailed list of program stipulations, see SMUD, *Residential Loan Program and Eligibility*.

3.2.3 ESCO Finance

Transaction Structure

ESCO as borrower.

Description

ESCOs are typically private businesses that develop, engineer, install, provide or arrange financing, and provide operations services for projects designed to improve the energy efficiency and maintenance costs for facilities on behalf of customers in various market segments. Often ESCOs operate on a pay-for-performance basis and link investment repayment and financing to project performance. In these arrangements, they typically assume all performance and technical risk associated with the project. ESCOs operate worldwide and are an extremely high-growth area in China and India, both in terms of revenue and market participants.

Strengths

- Technical and administrative experience with EE.
- Familiarity with private financing, ESCOs may receive but do not inherently require public funding.
- Possess the experience and ability needed to manage projects in more technical market segments (e.g., C&I).
- Capable of bundling large portfolios of EE projects.

Weaknesses/Challenges to Scale-Up

- EE installations typically lack significant collateral value because of their integration into building systems (e.g., thermal envelope investments, HVAC equipment, hard-wired VSDs) and the fact that these systems directly affect the wellbeing of building occupants. This lack of collateral can discourage FIs from engaging with ESCOs and has been a particular challenge recently in China,[17] despite significant growth in ESCO development aided by generous incentives including elimination of income tax requirements during the first one to three years for applicable projects.[18]
- ESCOs in China are often undercapitalized and lack the marketing experience and capabilities necessary to effectively build EE project demand.[19]
- The primary focus on market segments of sufficient size to enable a performance-based payment structure and create appropriate project scale economy; may constrain ESCO participation in the residential market.
- The incentive is to focus on EE measures that offer the highest return rather than a whole-building approach that may achieve higher energy savings.[20]

---

[17] Zhu, 2013.

[18] D'Addario, 2013.

[19] Crossley, 2013.

[20] Noting, however, that the lowest-cost, highest-yielding investments are typically the most critical from an energy use and carbon reduction standpoint (e.g., thermal envelope investments).

Example: China, Industrial EE, and ESCO Markets

In China, an ESCO development program has been underway since 1998, with instrumental support from the World Bank. In 2003, the Chinese government adopted its medium and long-term energy conservation strategy focused on large industry, including many state-owned enterprises. For the 11th Five Year Plan (2006–2010), the government set a target of reducing the energy intensity of GDP by 20 percent. This target devolved to provincial and local governments and state-owned enterprises. EE investments focused on heavy industry, with a common type being waste-heat recovery co-generation projects ranging from 2–10 MW, some larger. Many such projects have been implemented and financed with the industry's own resources and direct bank loans. Some developers finance these projects on an individual basis and sell power to the host and utility. The national and provincial governments have created energy savings incentive funds to pay for a portion of project costs with direct incentive payments. These funds are geared to tons-of-coal equivalent savings and are paid at project completion. Incentives typically pay for 12–20 percent of project capital costs. Extended targets to achieve another 16 percent reduction in energy intensity for the 12th Five Year Plan were recently adopted.

The original World Bank energy conservation programs included support to form new ESCOs and an ESCO association (the Energy Management Company Association, or EMCA). EMCA is a vital organization with more than 560 members (as of 2010) that reported total annual EE project investments of USD6.8 billion in 2011.[21]

ESCOs meeting certain requirements that are registered with China's National Development and Reform Commission (NDRC) are eligible for government funding across a broad range of standard EE measures for qualified projects,[22] though financing is still a limiting factor for many private ESCOs in China that face unmet capital needs. In addition, highlighting one of the key principles of this report, ESCOs in China often lack access to properly adapted financial products and project-based lending structures that allow the projects themselves—their revenues, equipment assets, and contract assets—to provide security for lending and thus enable ESCOs to finance projects on a more scalable basis. Today, most lending is still based on an ESCO's balance sheet, independent of the projects, which severely constrains the ESCO's financing capability. New accounting and bank regulatory legislation issued by the China Bank Regulatory Commission concerning ESCOs will allow banks to treat projects as legitimate security for lending risk by weighting assessments for regulatory capital adequacy compliance. This policy is part of China's budding "Green Credit" policies. Capital needs are being addressed by development finance institutions and some entrepreneurs, but the market need is very large and represents a good opportunity for equity, new debt financing, development finance, and sharing of best practices.

With the 12th Five Year Plan targets, China has an opportunity to go deeper into industrial EE investments and take advantage of a great volume of low-hanging fruit. For example, a 2005 study commissioned by the Natural Resources Defense Council together with the Jiangsu (Provincial Government) Economic and Trade Commission identified 3.5 GW of EE measures for industrial motor/drive systems alone that could be obtained at a cost on the order of USD 250/kW, or less than 20 fen (about 3 US cents) per kWh.[23] This market can also be tapped using utility-based structures, where the utility purchases delivered savings. From January 2011, the central government placed an energy efficiency obligation on electricity utilities in China and the utilities have established ESCOs as subsidiaries to undertake energy efficiency projects to meet their energy savings targets under the obligation.[24]

[21] Crossley, 2013.
[22] Crossley, 2013.
[23] Finamore, Moskovitz et al., 2006.
[24] Crossley, 2013.

3.2.4 Property Assessed Clean Energy (PACE) Programs

Transaction Structure

Energy user as borrower.

Description

PACE is a voluntary mechanism developed in the United States that leverages property tax assessments as a transaction point for EE financing. Establishing a PACE program is a multi-step process, requiring enabling legislation at the state level followed typically by local municipality/district-level buy-in and program development. Essentially, PACE programs give end users who are unable to afford or finance the first cost of EE & RE investments access to inexpensive financing, sometimes coupled with state interest rate buy-downs, provided by a municipality over generally up to a 20-year term. Local governments fund these programs through municipal borrowing and sales of payment-secured bonds. Because the obligation to pay is connected directly to real property, PACE loans are transferred in full to a subsequent owner should a property be sold prior to repayment, leaving the lien ultimately on the property instead of the borrower. Though not all have created actual PACE programs, 29 US states and the District of Columbia have legally authorized program development. Most of these states offer these programs to both residential and commercial market segments, though a select few exclude one or the other. Because PACE program establishment requires local buy-in, penetration is limited to select areas within states that have approved the development of PACE programs.

Under most programs,[25] PACE loans carry a first lien on the property—over existing mortgages—providing FI underwriters with significantly reduced credit risk and promote low capital costs. While a significant driver for PACE program development and underwriter procurement, this became a serious issue in 2010 for the Federal Housing Finance Authority (FHFA), the governmental agency that regulates and oversees the operation of the United States' largest mortgage finance banks that together guarantee more than half of all US residential mortgages: Freddie Mac, Fannie Mae, and the Federal Home Loan Banks. After initial skepticism,[26] the FHFA banned the continued participation of these mortgage banks in PACE programs, sparking litigation that was effectively ended in March 2013, when the U.S. Court of Appeals for the 9th Circuit ruled that the FHFA did not need to issue a rule to ban the federal mortgage banks from participating in PACE because, the court held, the FHFA was ultimately acting as conservator of government finances. This ruling effectively supported the FHFA ban, and it dealt a significant blow to PACE financing, particularly for residential programs. In late 2014, however, the FHFA and several mid-size lenders reached an agreement that will allow Freddie Mac and Fannie Mae to purchase mortgages that carry PACE liens on the condition that the lenders agree to buy any loans that default.[27] The policy reversal is not yet official, but is a promising sign for the future of the program.

Strengths

- PACE leverages a familiar and secure transaction point.
- The program procures low-cost capital for participants and offers low risk to FI underwriters.
- Initial investment from property owners is not required, encouraging participation and avoiding certain split-incentive problems.

[25] As of September 2013, only two US states, Vermont and Maine, are known to have "sub-lien" PACE programs that do not subordinate first mortgage debt or municipal liens in the event of a mortgage default.

[26] FHFA, 2010.

[27] Asset-Backed Alert, 2014.

Weaknesses/Challenges to Scale-Up

- PACE programs requires state and local enabling legislation prior to program development.
- The appellate court's ruling significantly limited program development in the residential market segment for which it is most suitable.
- A lack of M&V requirements fuels uncertainty regarding program effectiveness.

3.2.5 Public Sector Procurement Programs

Transaction Structure

- If utilizing a performance contracting model, an ESCO is borrower.
- If self-contracted by the public end-user, the end user may either borrow or fund directly.

Description

National governments are often the single largest energy consumers in many nations,[28] maintain a strong interest in promoting economic development, and are key law and policy players that can shape EE and RE markets. In addition to these important roles, national governments have substantial impacts on EE and RE markets through procurement alone—typically 12–20 percent of a country's GDP passes through its public procurement systems.[29] National governments also have a responsibility to conserve public fiscal resources, and EE investments can help optimize spending efficiency while often returning positive cash flow.

In the United States, the Federal Energy Management Program (FEMP) has been operating successfully since the mid-1990s and enables federal agencies to contract with ESCOs and pay from savings. The FEMP can also provide audit services, operations assessments, M&V support, expertise, and other tools to federal agencies in effort to promote electricity demand reduction and resource conservation (particularly for water). These services assist agencies in meeting consumption goals, standards, and compliance with the Energy Policy Act of 2005 which mandates that federal agencies procure Energy Star or FEMP-designated products. In Canada, the equivalent Federal Buildings Initiative has generated more than 43 billion Canadian dollars (USD38.2 billion) in energy cost savings to date.[30] And a similar policy in China established EE procurement standards in 2004 that were mandated to all levels of government by 2006 and reached USD2.3 billion in spending by 2009.[31]

Strengths

- Governments are uniquely placed to achieve substantial reductions in energy and resource consumption.
- Can encourage best practices in private sector industries through leadership and trendsetting in this area and also drive development of similar policies at other levels of government.
- Promotes efficient utilization of taxpayer funds.
- Drives market share and support for private sector companies delivering EE and RE goods and services.
- Can utilize pooling across agencies or industries to maximize investment efficiency.

[28] Nationwide public sector energy consumption is typically 2–5 percent of total energy consumption, though this range can be higher in countries with poor energy access (Singh et al, 2012).

[29] Singh et al., 2012.

[30] Natural Resources Canada, 2014.

[31] Singh et al, 2012.

Weaknesses/Challenges to Scale-Up

- Most governments have not established explicit enforcement mechanisms to support EE procurement policies.[32]
- Few governments track the policy impacts of EE procurement programs (i.e. market effects, energy and CO_2 savings).[33]
- Public procurement programs may be limited to most cost-effective measures.
- Use of taxpayer funding encourages risk-averse behavior and may reduce the scope of EE procurement activities where not mandated.

Example: US Public Sector EE Markets

Public sector EE investment and procurement programs in the United States are working well at the federal level and for many state and local governments. In Washington state, the Energy Savings & Performance Contracting program operated by the Department of Enterprise Services claims greater than 75 percent market penetration/participation among State government agencies.[34] Two US organizations, the National Association of State Energy Officials and the Energy Services Coalition,[35] have promoted best practices in public sector procurement.

These markets are working because they combine two elements that are essential for success: access to capital on attractive terms and project development/procurement assistance. Government agencies are organized to define contracting methods, conduct procurements, and prepare energy consumers to make purchasing decisions. Government facilities typically have stable and predictable energy loads, and the agencies generally have reasonable creditworthiness and access to financing. In the United States, financing is available to government agencies at relatively low interest rates and long terms thanks to the tax-exempt bond and leasing markets. For these reasons, the public sector has been a market mainstay for US ESCOs.

Pooled procurements can also work effectively in the public sector. One example is the Iowa Schools Program, which organized financing and project development assistance for school districts in Iowa. Similar models and initiatives can be implemented in the institutional sector, with private nonprofit institutions such as hospitals and colleges.

In Hungary, the International Finance Corporation (IFC) implemented a pooled procurement program for public schools nationwide, working in cooperation with the National Ministry of Education and OTP Bank. IFC provided credit enhancement for the pooled finance program and organizational assistance.
Even in light of these successes, many market opportunities exist to scale up these programs in many state and local governments and extend their reach to more (if not all) public agencies.

---

32 Regulatory Assistance Project, *International Experience with Public Benefits Funds.*

33 Ibid.

34 Interview with Roger Wigfield, director of the ESPC program, 2011.

35 For the Energy Services Coalition's detailed best practices and tools, see: http://www.energyservicescoalition.org/espc/tools/index.html

3.2.6 Local Government Programs

Transaction Structure

Borrower could be a local government, consumer, or, depending on program type, an ESCO.

Description

Local governments at all levels are increasingly involved in developing and implementing EE finance programs, and numerous successful examples now exist.
Local governments often develop and implement energy efficiency programs internally, provide or arrange financing, and establish delivery mechanisms for property owners. Cities can use their offices to promote these programs and support higher and faster levels of market penetration with the advantage of forming local partnerships for outreach and education, and can deliver marketing from a familiar and trusted source. Local governments can also participate at a policy level and play a large role in driving demand for EE services through ordinances that include local EE codes/standards and building consumption benchmarking.

Many methods are used for program implementation; local governments can implement programs directly, create a new government-owned entity to do so, partner with a local nonprofit, or otherwise outsource implementation and administration to a new breed of for-profit business: the EE finance program administrator. Local governments are key actors for scale-up because EE finance has inherently local dimensions.

Strengths

- Local programs encourage “ownership” of local EE performance, goals, and energy consumption patterns. May help spur awareness and complementary EE market benefits.
- EE investment programs are integrative—i.e., they serve multiple objectives of local economic development, supporting jobs, economic resilience, and property values.
- Can mobilize support for similar programs at higher levels of government and provide FIs with experience and data at a lower risk level.

Weaknesses/Challenges to Scale-Up

- Small programs face inherently weak scale economy.
- Because they can be administered and developed with minimal experience, certain best practices could be lacking.
- At the most effective scale, these programs would require a municipality with broad resources to be fully developed.

Example: Berlin EE Financing[36]

In 1997, the City of Berlin established a program in partnership with Berlin Energy Agency (BEA), an energy consultancy partly owned by the government of Berlin, to improve energy efficiency in public and private buildings.

Through the Senate Administration for Urban Development, the city initiates energy-saving partnerships between building owners and ESCOs and the Berlin Energy Agency, then acts as the independent project manager, moderating and managing the process from baseline to contract negotiation.

To take part in a partnership, buildings need to have a minimum energy bill of approximately €200,000 annually. Typically, BEA will group a number of buildings together (from four to as many as 400) and then issue a request for proposals for a pooled retrofit.

CO_2 reductions of an average of 26 percent are written into the public retrofit bids to require the ESCOs deliver sustainable EE solutions and the winning ESCOs must guarantee energy savings without any initial investment from building owners. The ESCO pays for the retrofit up front and building owners pay them back over an agreed period, typically eight to 12 years in annual installments from the energy savings.

ESCOs bidding for the work—such as Siemens, Honeywell, and others—install measures such as insulation, CHP, lighting, self-ballasted lamps, heating control systems, energy consumption regulators, and insulation/envelope measures, among others, to reduce building energy consumption.

As of 2009, ESCOs had invested €43,125,882 in 1,400 buildings, achieving a total guaranteed savings of €10,164,848 or 24 percent of the building's energy bills, and delivering CO_2 reductions of more than 60,400 tons per year.

This model has since been successfully implemented beyond Berlin, and its success can be collectively attributed to:

- Good communication;
- Political will;
- Transparent procedures;
- Enforceable standards;
- Marketplace competition; and
- Independent experts.

3.2.7 Private and CDFI Mission-Related Capital

Transaction Structure

CDFIs, private foundations, and institutions can act as both borrowers and investors.

Description

Private mission-related or purpose-driven capital can play a critical role in facilitating EE and RE investments for underserved market segments, communities, and entities and end-users with poor access to traditional credit markets.

36 Berlin Energy Agency.

CDFIs are nonprofit, mission-driven lenders and are increasingly offering EE financial products to address a variety of market segments. In the United States, a range of structures are being used, including energy services agreements and OBR schemes, as well as more traditional direct loans to target markets. This experience is somewhat nascent, and the extent of market penetration of EE finance among CDFIs is still relatively low. To raise funds, some CDFIs and credit unions are considering issuing clean-energy certificates of deposit (a financial deposit product often known as a CD that is typically offered over a fixed term and often at a fixed interest rate) to investors in amounts as small as USD5,000 at a market-rate yield with the knowledge that their funds are being reinvested in local EE projects. Investment in CDFIs may often also come from traditional FIs through low-cost loans and grants, as well as from the US federal government through the CDFI fund managed by the Treasury Department.

Private capital for EE investments is also an increasingly important source of project financing, which is offered from a range of US private foundations investing both domestically and internationally. At an institutional level, private and public colleges and universities are utilizing endowments and student fees to invest in EE and RE projects on their own campuses through contributions to internal clean-energy funds, with returns accruing back for reinvestment. There are also examples of university endowments investing in broader EE project investment funds,[37] and this is recommended by this report as a natural extension of campus-based funds.

Strengths

- EE investments can both meet CDFI/private foundation mission objectives and generate secure and reasonable yields, which is highly attractive to these groups and has developed substantial interest.
- CDFIs typically seek to invest in underserved market segments and communities to fill critically important market gaps traditional FIs are typically not capable of financing, of which EE is a perfect example.
- CDFIs and other private foundations and capital sources may also be capable of organizing or providing technical assistance with EE investments that mainline FIs and capital sources generally do not provide.

Weaknesses/Challenges to Scale-Up

- CDFI loans may have higher transaction costs and require continued technical assistance from lenders.
- CDFI and private foundation programs may be of limited scope or timescale due to funding constraints.

[37] In the mid-1990s, Harvard University's endowment invested in Energy Capital Partners (Boston), which financed EE projects implemented on an ESCO basis.

Example: Higher Education Revolving Loans: The Billion Dollar Green Challenge[38]

The Billion Dollar Green Challenge in the United States seeks to engage signatory institutions in higher education to invest a combined USD1 billion in revolving EE funds. The objective of this investment is to harness the primary advantage of EE: Institutions can earn an above-market return and realize substantial environmental benefits at the same time.

Savings generated by reducing operating costs are tracked and used to repay the fund thus providing capital for future projects. The Sustainable Endowments Institute, which coordinates the challenge, has also conducted a survey of existing green revolving funds (GRFs) at 52 institutions with at least USD66 million invested in the United States and Canada, finding GRFs to be highly adaptable to budget goals while still beneficial in a variety of ways including: advancing other goals such as academic, co-curricular, and campus community sustainability issues, reductions in energy consumption, increased tracking of energy and water use, and consistent annual returns ranging from 29 percent to 47 percent, with a median project payback period of only four years. This suggests that GRFs can significantly outperform average endowment investment returns and maintain strong returns over longer periods of time while significantly reducing natural resource use, energy consumption, and emission of greenhouse gases.

3.2.8 Public Benefit Funds as EE Program Funding

Transaction Structure

Collection of surcharge or other fees fund EE programs/measures.

Description

Public or "system" benefit charges are commonly used in the United States as a means of funding EE programs, RE, R&D, low-income energy assistance, meeting EEOs, and other important functions. These charges are typically levied through a small charge (often based on kWh consumption) on the consumer's electric utility bill and termed primarily as either a Public Benefit Charge or System Benefit Charge that amounts to below 2 percent of total revenue, with few exceptions in the United States.[39] Some US states have separate RE charges in addition to EE charges, and half the states have no PBF charges for either.[40] PBF mechanisms are much less common outside the United States.[41]

Strengths

- PBFs offer an equity approach: Customers who utilize the system more pay more and ultimately receive a greater share of the benefits.
- PBFs offer substantial ROI for energy consumers with lasting economic and environmental benefits.[42]
- PBF charges provide dedicated funding for EE programs and research.

---

[38] Billion Dollar Green Challenge.

[39] Wiser, Murray et al., 2003.

[40] Ibid.

[41] Regulatory Assistance Project, *International Experience with Public Benefits Funds.*

[42] Efficiency programs have been regularly identified to offer returns approaching and exceeding 2:1. For example, the US state of Vermont's independently administered EE program, Efficiency Vermont, funded primarily through PBF charges, has delivered a 2.5:1 return, with more than USD109.4 million in net benefits to the state from 2000–2012.

Weaknesses & Challenges to Scale-Up

- "Stranded efficiency": PBF charges do not cover all cost-effective EE, and establishment of charges below cost-effective potential may thus effectively limit maximizing EE benefits in the near term.
- PBF charges in the United States are set at durations determined politically[43] and must typically be extended by the state PUC prior to the expiration of their term. Though it is unlikely these charges would be suspended due to their substantial public benefit and high ROI, this is still some level of risk exposure.
- Despite the well-documented and substantial net public benefits of state EE programs, implementing PBF charges in states or countries without existing PBF programs could be challenging amid public opposition to a surcharge levy.

***Example:* New York State Energy Research and Development Authority (NYSERDA)**[44]

NYSERDA is a public benefit corporation created in 1975 through the reconstitution of the New York State Atomic and Space Development Authority. The authority's earliest efforts focused solely on research and development with the goal of reducing the State's petroleum consumption. Today, NYSERDA's aim is to help New York meet its energy goals: reducing energy consumption, promoting the use of renewable energy sources, and protecting the environment.

NYSERDA, which is governed by a nine-member board of state officials and technical experts, is primarily funded by state ratepayers through a System Benefits Charge that first took effect in 1996 and has been extended most recently until the end of 2016. Some key programs include:

Green Jobs-Green New York: This program provides access to performance assessments and loans for EE improvements in residential single-family and multifamily homes, as well as for small businesses and nonprofits. It also offers job training programs and partnerships across the state. It eventually replaced the previous Residential Loan Fund program, which ended in 2012.

New York Energy $mart: This program, aimed at residents within specific utility service areas, began in July 1998 and is ongoing. The program offers participating lenders subsidies so they can reduce their normal interest rates. Loans can be for terms of up to 10 years and USD20,000. Owners of existing family homes of one to four units can borrow to cover the cost of new or upgraded heating, insulation, windows, and appliances. Lending to other sectors can fund renovation or new construction projects to install energy-efficient lighting, air conditioning, and motors, as well as renewable technologies.

3.2.9 Public, Mission-Driven EE/RE Investment Funds

Transaction Structure

Various; public investment funds may be used directly through a government-sponsored initiative, or may be borrowed by an ESCO or other organization delivering EE goods or services to the organization's target market.

43 See note 54.

44 NYSERDA.

Description

Public mission capital, often designated for matters of specific public interest, can also play a role in creating and supporting EE investments. Just as with various private capital structures, public capital can be used to fund EE and RE investments directly via specific investment funds, or indirectly through partnerships with nonprofit and for-profit entities (including ESCOs) capable of delivering EE services or products. These funds may also be used to support public co-finance schemes for credit enhancement, interest rate buy-downs, and more.

Strengths

- Specific designation for EE/RE;
- May pose fewer access barriers and lower costs than private capital resources;
- Ability to fill gaps left by other, typically private, mission capital interests.

Weaknesses/Challenges to Scale-Up

- Public investment funds may have limited financial resources and a narrow individual investment bandwidth.
- Certain public investment programs may require matching private funds that eliminate penetration into markets with minimal capital and credit access.
- Public spending is subject to scrutiny and oversight from the general public and political actors that may not be experts. As such, public investment capital will almost always face some risk of becoming cut, reduced, or diverted.

3.2.10 Organizations Aiming to Transform Markets

Transaction Structure

Market transformation programs may be driven or supported by public, private, or mission-related capital; borrowing; or law and policy.

Description

Market transformation in the context of EE is the effort to assimilate EE technologies and practices into the marketplace by effectively removing recognized barriers. As this report outlines in Section 4, the EE sales cycle presents a number of challenges that ultimately make it a difficult venue in which to achieve broad diffusion of EE technology at a pace required to meet economic and environmental objectives. Market transformation efforts, on the other hand, have demonstrated success in fundamentally integrating EE into the marketplace permanently, such that consumers don't *choose* to purchase EE specifically, but rather *receive* it while engaging in normal procurement and business practices as a result of the respective market having been effectively transformed. Early stages of transformation may include education campaigns, audits, consumption disclosure requirements, and product labeling requirements.

Utility programs can also be an important element of transformation by overcoming customer and commercial barriers. Often the last stage in market transformation is established by rules, standards, or codes issued by a government or governmental agency. The phase-out of certain incandescent bulbs in favor of more efficient technologies that started first in Cuba and Australia and has now been implemented in the United States, Britain, EU, Brazil, Russia, and other countries is a simple example of this late stage of market transformation; customers don't need to *choose* to purchase new technologies because the market has been transformed to provide them as a default.

Strengths

- Eliminates the majority of the EE sales cycle and associated challenges (see Section 4);
- Fully transformed markets ensure nearly complete EE diffusion into the product and service marketplaces, a feat otherwise nearly impossible;
- Encourages further EE technology and best practices evolution in transformed markets by elevating the status quo.

Weaknesses/Challenges to Scale-Up

- Effectively altering a market can be significantly challenging in the face of complex market dynamics that may not be fully understood, as well as social factors and the globalized nature of the marketplace. As a result, not all programs will see success, and some may ultimately prove to be imprudent investments of public or private mission-related capital.
- Market transformation for certain products and services may not be completely possible without regulatory, legal, or policy action to counteract certain advantages that sustain environmentally undesirable products or services in the marketplace, such as various subsidies that are provided to fossil fuels.
- Accelerated phase-out of environmentally undesirable technologies via successful market transformation runs the risk of producing perverse incentives and making these technologies *more* accessible in other markets without similar policy objectives as manufacturers and suppliers move their products to jurisdictions where they can still be legally sold, particularly developing economies.

***Example:* C40 Cities**[45]

The C40 Cities Climate Leadership Group (C40), founded in 2005 by then-London mayor Ken Livingstone, is a network of cities committed to implementing climate change mitigation actions. Its field staff, supported by technical experts, works with city governments to share best practices in transportation, waste management, water, energy supply, outdoor lighting, planning and urban land use, and food and agriculture. It has partnered with the Clinton Climate Initiative's Cities Program and received funding from Bloomberg Philanthropies. In 2014, it published the second edition of its *Climate Action in Megacities* report, including an ongoing assessment of which mechanisms cities are using to finance and promote EE retrofitting of existing buildings.

3.2.11 Carbon Finance

Transaction Structure

Various; allowances or avoided emissions may be monetized according to different protocols and utilized to originate EE investments or support EE programs.

Description

By monetizing or otherwise assigning value to carbon emissions—and often other GHG emissions, often by CO_2 equivalent—markets can more accurately account for external environmental effects that have long been ignored in traditional accounting. Currently, mechanisms utilized to account for carbon emissions values vary by both design and regulatory structure, however it is clear that carbon emissions

[45] C40 Cities Climate Leadership Group.

values can and are utilized to fund EE programs and investments. Among other methods, value extracted from carbon emissions trading or avoidance may both directly and indirectly finance EE investments: directly by utilizing, for instance, allowance proceeds to fund EE and conservation (e.g. RGGI, US) or indirectly as a means of "reducing" net carbon emissions from a facility by investing in EE or other projects elsewhere (e.g. UN CDM, Joint Implementation Program, EU ETS).

Strengths

- May improve the economics of certain EE investments.
- May drive support for investment in underserved markets with high-yielding existing EE potential.
- May require redirection of auction proceeds to conservation and EE.

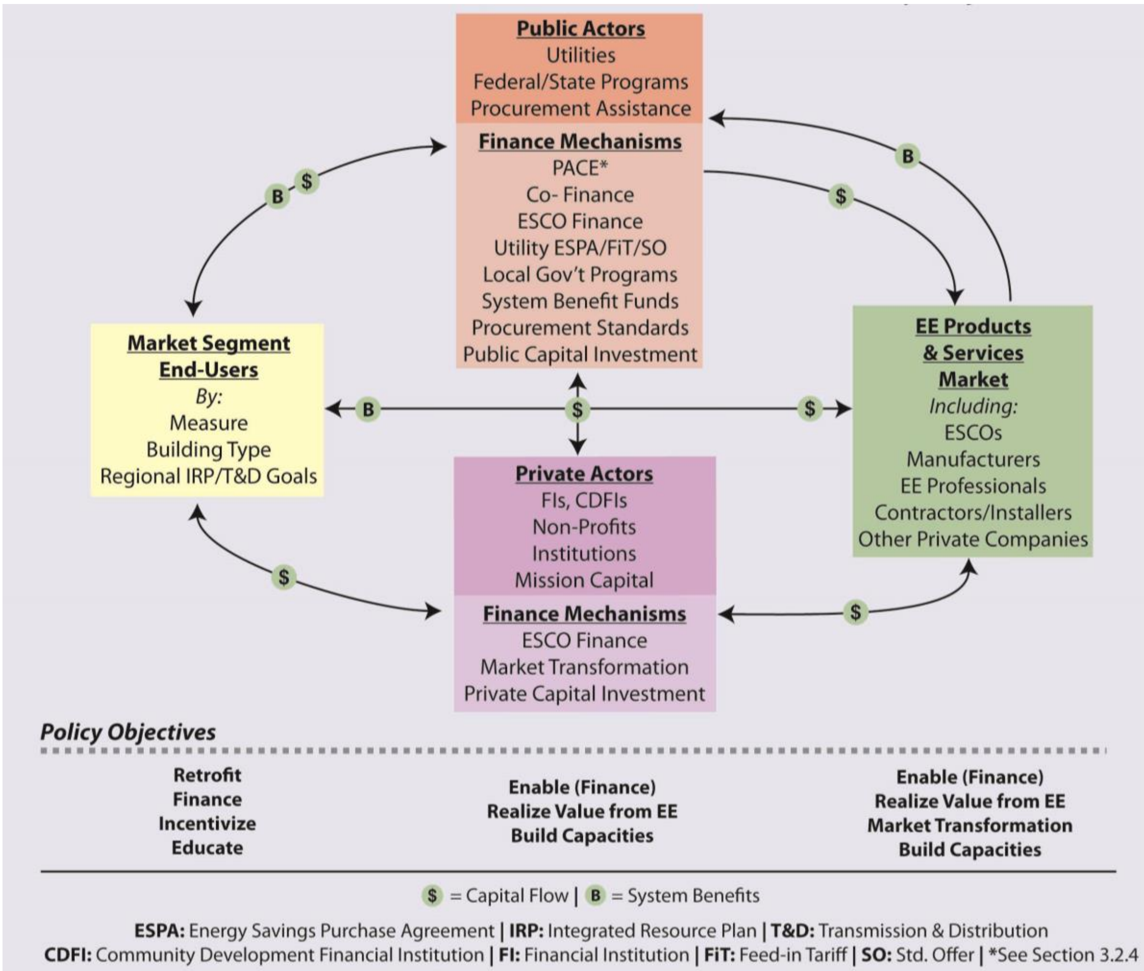
Weaknesses

- Carbon emissions trading programs have reached only limited international development to date outside the EU and northeastern United States (the latter home to the Regional Greenhouse Gas Initiative, or RGGI).
- Where GHG equivalent emissions reductions may be utilized (e.g. CDM) and EE investment is not mandatory, it may not be a least-cost resource for achieving CO_2 equivalent GHG reduction.

3.3 EE Financing Models Summary

Individual EE financing mechanisms each have somewhat different policy objectives and interface with different market actors and elements of the sales cycle. Figure 3 on the following page attempts to roughly delineate the interactions between the EE finance strategies described above, the market actors that define and affect the EE market, and the policy objectives relevant for each group. While many similar or like policy objectives can be pursued by different market participants and at different transaction points, this diagram demonstrates the primary mechanisms market participants are using to increase EE technology diffusion and foster development of the project pipeline. As this report outlines, finance is a necessary component of enhanced EE deployment, but is not an independently sufficient driver for market maturation and development. Recognition of the interplay among market participants, finance strategies, transaction points, policy objectives, and, particularly, the remaining and emerging opportunities within this continuum can help create a market better enabled to receive EE technologies and produce an adequate project pipeline.

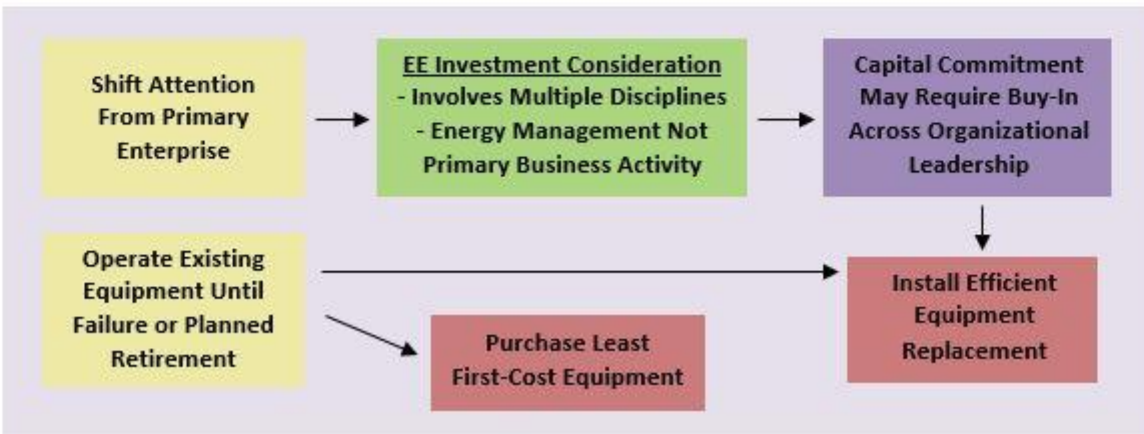
Figure 3: EE Finance Models: Actors, Finance Mechanisms, and Policy Objectives



4. End-User Decision-Making and the EE Sales Cycle

One of the most difficult aspects of EE investment scale-up is overcoming the lengthy process of sales and customer decision-making. For residential and small commercial customers, the complexity of major energy choices often presents enough of a challenge. In larger commercial enterprises, energy investment decisions typically reach across departments and affect different levels of the organization. Frequently, the limiting factor to implementing EE investments is simply the time and attention needed from senior management, financial officers, facilities managers, and other primary decision makers whose job it is to decide whether to move forward with these investments (see Figure 4). Even for many large industrial corporations, energy use is often below 5 percent of total operating costs and thus is often a secondary priority.

Figure 4: Commercial End-User Decision-Making and the EE Sales Cycle*



** Diagram does not fully apply to building envelope investments.*

Purchasing EE can be complex and difficult for many energy consumers. EE investment decisions involve a broad range of technical, financial, and contracting details that require multiple disciplines and cross organizational boundaries. Developing and initiating EE investments often requires participation by various primary decision-makers for whom energy management is typically not a central concern or high priority. In addition to these challenges, EE investment choices can also trigger special sensitivities. In industrial settings, for example, EE decisions can affect finely tuned manufacturing processes and may require the support and approval of quality control, product managers, and engineers. Furthermore, capital structure and balance sheet considerations can influence the willingness to take on debt or debt-like obligations in most large enterprises regardless of the merits of the EE project.

In economist's terms, energy is an intermediate good; energy delivers services such as heating, transportation, and lighting that are used in turn to create and deliver various goods and services. As a result of this intermediate nature, energy services tend to be easily ignored; if an energy-consuming system is working effectively, it's rational in the context of other business decisions to focus on more pressing needs. Indeed, this is why one of the primary transaction points for efficient products is to replace failed or retired equipment. In this case, the customer motivation is high, and there is a natural driver of the sales process. Unsurprisingly, the replacement market is a substantial component of the EE market.[46]

[46] See note 18.

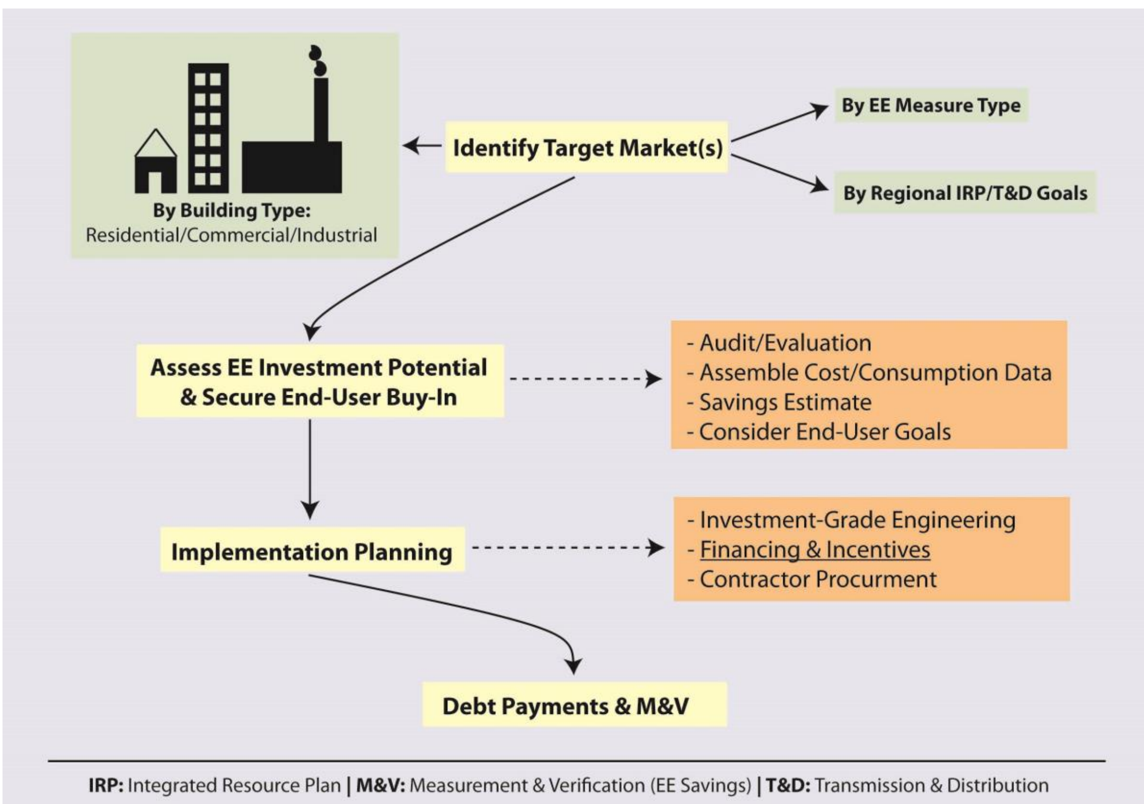
Further complicating the EE sales cycle is the simple fact that management attention and financial resources available for capital investments tend to be focused on projects that are core to the organization's mission: expanding production for an industry, improving the customer experience at a hotel, or providing excellent care for a hospital. End users often find it easier to simply purchase energy than to choose to purchase EE, making the sales cycle long and potentially complicated by delay. As a result, even when attractive EE investments are identified, they are easily postponed.

For these reasons, many EE experts express strong skepticism about relying on end users and property owners to drive investment scale-up. Further impetus must be utilized to drive the market. This is precisely the role that EE project development and finance programs are intended to fill.

4.1 Steps in the EE Sales/Project Development Cycle

Managing the sales cycle is critical to the success of EE finance programs and financing mechanisms. Failure to account for individual steps in this cycle may significantly impair the effectiveness of EE programs, and each is important to ensure successful project origination and delivery to financing. Figure 5 presents a construct for when many of the individual components are often considered; this order may vary by project and include additional steps to meet individual EE project requirements and customer needs.

Figure 5: EE Sales/Project Development Cycle



For EE programs and financing mechanisms, one of the first steps in the project development cycle is to define a target market; this is often decided according to building type, market (e.g., C&I, residential), individual EE measure, or other specific goals related to infrastructure planning or special public interest. In many cases, a number of these market parameters are considered together.

From a sales perspective, implementing entities and policy planners may utilize individual approaches to originating projects (or categories and groups of projects) as tailored by the characteristics described above, among others, but will typically include all or most of the steps shown in Figure 5, depending upon measure cost, savings, and customer requirements. Financing, though listed in the implementation planning phase, may be an important consideration at all phases of the sales/project development cycle.

4.2 Ways to Accelerate the EE Sales Cycle: Selling Concepts & Strategies

Overcoming the challenges of end-user decision-making is necessary in order to develop and implement EE investments at scale. EE investment programs must seek and find ways to engage and sell to decision makers and facility owners programmatically, drive demand, and accelerate the project sales cycle. The following concepts and strategies to accelerate the sales and customer decision-making processes discussed in this section are described below:

- “One-stop shopping”: Simplify the EE sales cycle
- Pooled procurement
- High-level selling on a financial basis
- Leverage other transaction points and use vendor finance programs
- Provide direct incentives from public and utility funds
- Directly acquire EE savings
- Utilize energy consumption reporting, benchmarks, mandates, and codes/standards
- Avoid landlord/tenant split incentives in the C&I markets through energy-aligned leases.

4.2.1 “One-Stop Shopping”: Simplify the EE Sales Cycle

A main goal of this approach is to make purchasing EE easy for customers.[47] Many EE programs provide one-stop shopping for EE project development services to customers in their target market, covering the full project development cycle (see Figure 5). While such a system is notably more feasible for less complex EE measures, integrating as many steps of the EE sales cycle as possible will increase program effectiveness and promote smooth project pipeline development.

Purchasing EE, particularly in tandem with financing or incentives, can be a multi-step process and successful EE programs should utilize extra handholding to help guide consumers. Many EE programs targeting single-family residential projects take this approach, with methods adapted to those types of projects. Financing is integrated as one of several services to customers, with terms and procedures that are simplified and ideally attractive. A “one-stop shop” can also act as an honest broker by building trust and educating its target customers as part of a marketing effort.

4.2.2 Pooled Procurement

In addition to potential scale economy benefits, pooled procurement can be useful in developing an EE project pipeline. Here, an organization representing a group of energy users (e.g., an end-user association) provides EE project development services and brings decision-ready customers to the market for project implementation contracting and financing. Pooled procurement programs address a

[47] Hayes, Nadel et al., 2011.

select, targeted market with one-stop shopping services and can be especially effective with public and institutional entities.

These types of programs can also earn a project development fee for the EE program, and therefore have the potential to be largely self-supporting. For the EE implementation contractor, these programs get the customer ready to buy and greatly reduce sales cost and risk.

4.2.3 High-Level Selling on a Financial Basis

Undertaking EE investments in many organizations often requires buy-in and decision-making from senior management. In these cases, sales efforts should be targeted at the highest levels of an organization early on to pursue top management buy-in. Cash flow projections are often used to sell at this level, and efforts should be made to acquire organizational mandates that seek to implement all EE projects that meet defined financial criteria. Examples of this include projects that achieve a certain simple payback window, demonstrate a positive NPV, or meet other enterprise-specific criteria that make EE investments cost-effective for an organization. Savings in maintenance costs, other business benefits realized from newer efficient equipment, and avoidance of environmental externalities including CO_2 emissions may also be factored into this equation.

An EE investment decision is similar to restructuring an annuity stream. The customer must pay for the energy operating cost of the facility one way or another, and amortization of the EE investment can be offset by decreased operating and energy costs. This offset may often provide a net benefit both during the investment period and after, as the useful life of new EE equipment is typically many years longer than the financing term. Customers with a replacement need may additionally choose to implement projects that do not achieve break-even savings or positive cash flow to take advantage of other business benefits in addition to EE. Once financial criteria are defined by senior management, an EE investment plan can be prepared that meets the criteria, and the availability of adapted EE financing products on defined terms supports this process.

This strategy may be best suited for targeting decision-makers who control or manage multiple facilities. In order to be successful, it must be undertaken with proper communication and deference to the consumer's own departmental imperatives (e.g., physical plant, facilities engineering, etc.). It's furthermore important that effective communication between the senior governance and financial levels of an organization and the facilities department personnel be established to maintain organizational integrity.

4.2.4 Leverage Other Transaction Points and Use Vendor Finance Programs

EE finance can also be marketed at the point of sale with an EE equipment/project vendor or contractor. These are the companies that drive the market, and they need financing to support their sales. In the single-family residential market, in particular, scale-up strategies are being explored that link EE financing mechanisms to other transaction points (e.g., to the residential home improvement contractor and loan market, and to mortgage refinancing and new mortgages). With proper organization, EE investments and financial products can be introduced systematically at these transaction points to assist in simplifying the customer decision-making process and generate deal flow for these mechanisms.

By putting EE finance tools into the hands of the contractor community and other midstream groups, financing can be offered at the point of sale, where a contractor can market and sell broader efficiency packages, ideally also combined with EE incentives. Bringing EE investments closer to this transaction point is convenient for consumers and leverages both a contractor's unique relationship with the consumer and incentive to upsell. Capital cost buy-downs or low-interest loans are examples of financial incentives that may be successful at this transaction point. Individual measure incentives and other EE incentive programs can also be leveraged from utilities or other public funding sources at this transaction point.

Similar programs also might be undertaken in connection with mortgage refinancing transactions when a mortgage banker is able to offer EE investment packages to the refinancing borrower, perhaps coupled with utility incentives. Under this type of program, the homeowner would be allowed to incorporate the EE investment into the use of proceeds for the new mortgage. (This may also reduce FI risk exposure by ensuring that the EE loan bears first position with the mortgage.)

4.2.5 Provide Direct Incentives from Public and Utility Funds

Public and (particularly in the United States) utility funds are often used to provide incentives directly to target markets or target EE measure types and can be particularly useful in developing demand for certain EE measures. Direct incentives are typically utilized to address the highest-yielding measures or those with particular public interest benefits. This direct approach may ultimately be more successful in driving demand for targeted measures than other public co-finance strategies,[48] but is a limited-use mechanism that typically faces budget limitations[49] and may be less useful for incentivizing higher-cost measures or deep retrofits. Direct incentives should be tested in order to determine the level and types of incentives that are most effective at achieving the desired market response.

4.2.6 Directly Acquire EE Savings

Utilities may also pay directly for delivered energy savings; this is typically achieved under an ESPA established between a utility and ESCO or an ESCO working directly with an end-use consumer. The utility can grant a concession or otherwise qualify multiple ESCOs to develop the EE projects and deliver energy savings to the utility. This can also be accomplished through an EE FiT, which operates similarly but with some fundamental differences from an ESPA. The structure of utility ESPAs and the EE FiT is discussed in detail in Section 6.1, below.

Another angle on direct acquisition of energy savings is the concept of ESCOs paying customers for the right to tap their "savings resource." As with the ESPA approach detailed further in Section 6.1, some agreement with the customer to be on their premises will still be required, and the need for a customer decision process remains.

4.2.7 Utilize Energy Consumption Reporting, Benchmarks, Mandates, and Codes/Standards

Consumption reporting, and codes/standards can be important market drivers that create demand for EE financing mechanisms. Governments can adopt EE benchmarking programs that require energy consumers to monitor and report their energy consumption and express it in standard units, such as

48 U.S. DoE.

49 As a result, direct incentive programs may be offered on a first-come, first-serve basis to encourage faster decision-making by customers. This may also be viewed as a strength of this strategy.

energy consumption per square foot of space or production unit. This form of compulsory benchmark reporting is considerably better suited to the C&I market for scale economy reasons (largely due to M&V costs), and is seeing increased use in major metropolitan markets in the United States and elsewhere.[50] Energy consumption reporting requirements are a critical first step in the planning and implementation of minimum efficiency performance standards that can be developed for standardized usage types (e.g., office space, multi-family residential). In China, the government has implemented EE standards prescribing a maximum energy unit input/output ratio for heavy industries such as steel, coke, petrochemical, and cement. New construction EE standards, which have been very successful in the United States, are common in China but often not enforced.

While mandates of this type are being utilized or planned more commonly in the C&I markets, these standards are also being considered for rental housing markets in the United Kingdom and United States. There are multiple models in use to address the efficiency of existing building stock that use different strategies to address this market including a long term phase-in of EE regulations combined with incentives or standards that are activated at time of sale.

Reporting requirements, standards, and other mandates across various market segments are uniquely capable of avoiding certain aspects of the consumer decision-making process and the EE sales cycle and can help generate deal flow for a financing mechanism that can be designed in tandem to be scalable.

4.2.8 Avoid Landlord/Tenant Split Incentives in C&I Markets through Energy-Aligned Leases

Following from the mechanisms described above, implementing policy to avoid the split-incentive problem can drive demand for EE and generate deal flow for a financing mechanism used in tandem. Split incentives arise when a tenant pays for the energy consumption cost of major building equipment (e.g., HVAC, DHW) that exists in a facility owned by a principal with exclusive authority to upgrade or retrofit this major energy-using equipment. Here, the incentive to invest in efficient equipment is split between tenant and landlord, and the landlord has minimal incentive to upgrade existing equipment. This problem is particularly acute for the small commercial and residential rental markets, as well as markets with low vacancy rates. In larger commercial buildings, this can be addressed with arrangements made through “energy-aligned” amendments to the property lease that allow an owner to pass along to the tenant the cost of making the EE investments, subject to certain conditions, including typically that the tenant’s realized energy cost savings will exceed these pass-through costs and provide an investment performance buffer. Model energy-aligned lease provisions of this type have been developed by PLANYC, a multi-stakeholder city government group in New York City, and are being used in the large commercial market with success.[51] This solution, however, is not entirely suitable for smaller commercial and residential customers because the scale economies of projects at that level cannot practically cover M&V costs. Even simply integrating these provisions into the lease agreement can be a barrier at this level and is effectively untested in the marketplace.

A related means for marketing EE investments to commercial building owners is for tenants to recommend such investments to their landlords. This strategy is being tested in some markets by public-sector and local government agencies that rent offices and other facilities. Here, the public-sector tenants ask their landlords to make EE investments and indicate that they are willing to accept energy-

[50] This has been required in New York City since 2009. See: City of New York Administrative Code 3 § 28-309.3.

[51] LANYC, 2014.

aligned lease provisions. This strategy can be combined with a program that offers services and financing solutions to develop and implement tenant-requested projects.

Utility on-bill repayment (OBR) is also being tested in the United States to address the split incentive issue. In the case of certain specific on-bill tariff programs, the payment obligation for the EE investment stays with the utility meter, so that tenants may fund the cost of the investment from which they benefit and the obligation can be seamlessly transferred to subsequent tenants after move-out. The fairness of this arrangement is maintained provided that the energy cost savings exceed the EE investment charge collected on the utility bill. Despite the promise of this concept, on-bill repayment programs have seen minimal penetration in the United States thus far and bring up a series of challenging problems that do not yet have adequate solutions, such as the question of how depreciation and capital costs can be recovered in the case of a long-term property vacancy or if a customer defaults on utility bills. Furthermore, individual state PUCs may have statutory requirements that complicate establishment of these programs.

5. Scaling Up EE Financing

EE finance is a field that is ripe for development and scale-up. As defined in this report, a scalable financing mechanism is one that generates steady and sufficiently large[52] volumes of creditworthy, well-structured financings that can be originated with relatively low transaction costs. Financing mechanisms that meet these criteria are more attractive and cost-effective for customers, and are on track to be profitable lines of business for mainstream capital sources. Eventually, as the EE finance market continues to develop, the criteria for scalable financing mechanisms should also include suitability for packaging and resale to capital markets.

At present, a large array of organizations are converging on the topic of EE finance scale-up. These organizations include, among others:

- Governments at all levels;
- Utility regulators;
- Commercial FIs;
- CDFIs, including public and mission-related investment institutions;
- Economic development agencies;
- End-user associations representing sectors such as commercial real estate, industry, hospitals, etc.;
- Consultants and financial advisers serving all the above; and
- A new breed of business: both for-profit and nonprofit EE project development and finance program administrators, among others.

5.1 Primary Barriers to EE Finance Scale-Up

While barriers to EE deployment at scale have been discussed and studied for decades, the barriers to EE *finance* at scale are also numerous across all stakeholder groups. These and other characteristics of EE finance increase development risks and costs, reduce financial institution interest in this sector, create marketing barriers, and contribute to the gap between EE's economic potential and its commercial realization. Typical barriers to EE finance scale-up include:

- **The large number of small, dispersed projects** that characterize EE investment markets.
- **High pre-investment development and transaction costs** for EE projects relative to total capital deployed, which results in a lack of well-prepared, investment-ready projects.
- **Lack of customer awareness**, complicated technical information requirements, and long marketing cycles associated with the customer sales and decision-making process—all of which likewise limit project pipeline development.
- **The challenges of the multi-step EE sales cycle**, particularly from the customer/purchaser perspective.
- **The inadequacy of the project-by-project approach to project financing and development** and the need for programmatic market aggregation approaches, including specialized EE finance

[52] For the purposes of this report, "sufficiently large" refers to investment portfolios of at least USD25 million each. To be scalable, a financial product must have the potential to generate a series of such portfolios that aggregate into the hundreds of millions of dollars of total financing per year.

companies that can package, originate, and warehouse finance transactions for mainstream capital sources.

- **Lack of EE finance experience within FIs**, and/or a lack of specifically adapted EE financial products they offer (this is increasingly less of a barrier).
- **Real and perceived credit risks**, lack of collateral offered by EE equipment, and difficulties creating creditworthy financing structures.
- **The sheer range of financing structures** applicable and needed to address the EE financing needs of various market segments.

5.2 Criteria for Scale-Up

While many effective EE financing business models exist in the United States and elsewhere, all of these models face scale-up challenges regarding the supply and demand for EE finance. This section details the steps involved in designing and implementing scalable EE finance programs and mechanisms. Scale-up requires:

- **Increases in properly structured capital and financial products** available for EE investments.
- **Enhancement of institutional capacities** for organizations implementing EE finance programs that develop projects and prepare for sale in large volumes.
- **Consistency in funding** from private and public sources, aided by loan delinquency and collections performance data.
- **Marketing and education programs** to drive demand for EE products and services and leverage social capital benefits.
- **Supportive regulatory policy,** including benchmarking requirements, minimum efficiency standards, and building efficiency codes.

5.3 Scale-Up Strategies

The following strategies highlight some important opportunities and strategies for improving the effectiveness of parties interested in scaling EE financing mechanisms.

5.3.1 Gap Analysis

A strategic approach begins with analysis of barriers and gaps in the market. As outlined in Section 2, the most common gaps in the EE investment market are 1) lack of project demand (i.e., well-prepared EE projects ready for investment), and 2) lack of financial products that are structured, adapted, aimed at this market, and creditworthy and scalable from the point of view of mainline capital sources. Addressing these gaps is a main function of EE project development and finance programs. Program administrators (PAs), therefore, play a critical role in overcoming market barriers by acting as facilitators and bringing parties together in EE investment transactions.

Ultimately, three main elements are required to drive development and implementation of projects:

1. Compelling project economics
2. Motivated project participants
3. Well-developed EE programming capable of delivering as many elements of the EE sales cycle as possible, including financial products and public incentives

Together, these elements can overcome many existing market barriers when combined with implementation contractors and a clear contract and financing arrangement that links all parties for successful project implementation. Project participants must all have clear financial incentives.

5.3.2 Conduct Market Research to Identify Economic EE Applications with Scale-Up Potential

Strong project economics distribute economic benefits to participants and motivate end users to act. Properly financed, EE projects can pay for themselves out of energy cost savings and generate immediate positive cash flow for the end user. Projects with average simple payback periods of two to five-plus years can meet this positive cash flow criterion, sometimes called “bill neutrality,” with financing of three to ten years at reasonable rates. Longer terms are appropriate for energy output, cogeneration, and many renewable energy and distributed generation projects. Market research must identify the most compelling EE investment opportunities as a prelude to prioritizing end-use markets for finance programs. Cost/benefit analysis needs to be conducted from the perspective of various parties, including end-users, utilities, EE businesses, and investors/lenders. Market research of a given market must also identify the market actors and develop an understanding of their business objectives, capacities, and financial interests.

This analysis should also take into account governmental and utility public policy objectives that can also influence project economics, costs, and prices at the micro/market level through means that include trade and macroeconomic policy, utility restructuring, regulatory policy and price reform, and placing value on environmental externalities. Utilities as supply systems and governments as promoters of the public interest can experience economic, ecological, and reliability benefits beyond the end user’s cost savings—because those do not fully reflect all systems cost savings, including the ability to avoid increased long-run marginal costs of new energy generation and delivery systems and externalities from fossil energy generation and consumption. Utilities may reflect these values by promoting and funding EE/DSM programs, and governments can do so through similar programs, tax mechanisms, and other fiscal policy decisions.

5.3.3 Conduct a Role and Risk Analysis of EE Market Participants

Once compelling EE project economics and the target market segments for a finance program have been identified, the next task is to assemble the parties to the proposed transaction(s), catalyze decisions, and conduct the financial engineering to create a complete, creditworthy, and commercially viable arrangement. Each transaction requires descriptions of the participants and a number of important details, including: roles, objectives, financial incentives, the project development cycle (including who initiates the project) and financing structure, contract terms, and flow of funds. A preliminary project finance risk analysis is also needed to evaluate all risks, distribute them among the parties, and define methods (technical, contractual, financial, etc.) for managing and mitigating these risks.

The individual EE sales/project development cycle provides a useful framework for approaching design of finance programs. A typical project development cycle includes the steps detailed in Figure 5 in Section 4.1.

The roles analysis must also evaluate and develop a plan to satisfy the incentives under which each program participant operates, taking care to understand the perspective and financial interest of each participant. If the interests of the various parties cannot be effectively tapped or reconciled, project development will suffer. Where this analysis identifies a gap—a role no party is prepared to play, a cost no party is prepared to incur, a risk that no party will accept, a mismatch between cost and benefits for projects that have strong but poorly distributed economics and incentives—an EE finance program can seek to fill the gap through targeted efforts such as incentives, credit enhancement/co-finance, financial and technical support, organizational skill, and other mechanisms. Under this model, these efforts can be designed with the full project cycle in mind; otherwise, failure to adequately address any one stage could cause efforts at other stages to be unsuccessful. In a broader context, regulatory support can also play a role in properly aligning and shaping incentives at this stage.

5.3.4 Drive Demand by Designing Financial Products for Specific EE Applications that are Attractive to Customers

An EE financial product should be designed as much as possible to achieve positive cash flow for the customer. This is achieved through longer terms, lower interest rates, and financing structures that match savings with payments—including energy service agreements. For projects that meet energy system replacement needs (i.e., when existing equipment fails), the positive cash flow criterion is less critical. Therefore, it is important that criteria for eligible EE measures and investments properly incentivize EE investments during equipment replacement.

One motivating concern for policy makers and EE finance program designers is consumer protection. Some EE finance programs have definitions of eligible measures that are too restrictive, allowing only EE measures that generate positive cash flow for the customers. Many residential EE investments have long payback periods, in excess of seven to ten years, and cannot achieve this positive cash flow effect. At the same time, when customers need to replace their energy system, they are willing to pay more than the energy cost savings. Programs should consider eligibility tests that incorporate this value to the customer.

5.3.5 Meet Lender Criteria and Use Existing Financing Capacities

FIs want and will respond to sufficiently large, steady, creditworthy demand for capital with manageable transaction costs. The transaction size required to interest financial institutions will vary, and is typically much higher for commercial banks than for leasing companies, which may be able to consider one-off transactions as low as USD50,000 to USD100,000. In general, programs that can initially generate several million dollars in capital demand, with prospects for an ongoing flow of similar business, should be able to attract interest from qualified FIs.

Critically, an EE finance program must address FI credit criteria. Because EE equipment often lacks collateral value, the credit structure of financing is primarily based on the strength of end-user credit. Poor credit is a major barrier, especially in market segments that typically lack sufficient access to credit. In some cases, large numbers of small projects aggregated together can allow finance programs to take a portfolio approach to credit structure. Strategies to consider include interposing ESCOs, utilities, government agencies, and other strong-credit entities into a financing structure, as well as pursuing credit enhancement programs.

5.3.6 Scale-Up Criteria from the Point of View of Capital Resources and Investors

From the point of view of capital investors, a scalable financing mechanism is one that:

- Generates steady and sufficiently large volumes of financings that are creditworthy, well structured, and secured, with a common credit structure preferred.
- Originates transactions with relatively low, manageable, and compensable transaction costs, using standardized financial products.
- Is both attractive to and cost-effective for the customer.

In general, because the EE investment market involves large numbers of small projects, specialized EE finance intermediaries are needed to originate and fund transactions for refinancing or sale to mainstream capital sources. Support is needed to build this capacity, including mission-related investment and co-financing from public/concessional sources.

Achieving a common credit structure is an ongoing challenge. One means is to use the portfolio approach, combined with first loss reserves. Another is using recovery mechanisms such as PACE and OBR, though these mechanisms have varied and significant regional limitations. Some utility credit support can be very useful to create a common credit structure and achieve attractive financing terms. In the public sector, aid intercept programs have been used whereby local governments and schools can pledge a portion of their state government revenue, sharing resources as security to amortize EE investments.

Ultimately, the primary EE finance market still needs to be built, eventually opening up opportunities for secondary market capital. In some cases, the availability of a secondary market capital provider, based on defined terms and underwriting guidelines, can help drive development of the primary market.

6. Other EE Finance Opportunities

This section describes ESPAs and several emerging EE financing models that are generally at relatively low levels of market penetration and offer valuable ideas for replication and scale-up opportunities. Challenges and opportunities are noted where applicable.

6.1 Energy Savings Purchase Agreements (ESPAs) and the EE Feed-in Tariff (FiT) [53]

One effective and strongly recommended approach is for utilities to participate in EE financing by contracting to purchase delivered energy savings. No standard name for this structure has yet been adopted in the industry; it is variously referred to as DSM contracting, EE Power Purchase Agreements (EEPPAs), efficiency power plant (EPP), standard offer (both in South Africa and in the United States), and pay-for-performance, among others. In this paper we will refer to this arrangement as an ESPA, because it is analogous to a utility's purchase of delivered energy through PPAs. In the United States in the late 1980s through the mid-1990s, a number of utilities developed programs to procure saved energy by utilizing ESPAs.[54] These programs worked for both electric utilities purchasing kW and kWh savings, and for gas utilities purchasing therms of gas savings. This experience also contributed to the development of the International Performance Monitoring & Verification Protocol (IPMVP)[55] for energy savings. ESPA contracting diminished in the late 1990s in the United States as industry restructuring took priority among utility regulators.

6.1.1 Program Design

The typical ESPA model consists of a contract between a utility and either a customer or an ESCO working with the customer. The utility agrees to purchase delivered energy and/or capacity savings. The price (typically offered on a time-variable price schedule) for delivered kWh or kW savings is established over the contract term, and careful provision is made for M&V of savings. The price the utility pays is typically not sufficient to pay for all the costs of the EE project, but will cover up to 50–60 percent; in such cases the customer shares in the costs, contracting also with the ESCO. Even without covering total project costs however, including direct utility payments for EE savings can greatly improve project economics and cash flow for the customer, thereby accelerating the sales process. Furthermore, the ESPA model has the advantage that the utility only pays for the savings it receives; should the EE project save less than estimated or fail altogether (e.g., a customer goes out of business), then payments are reduced or terminated accordingly.

The EE FiT is a similar mechanism, though bearing fundamental differences with ESPAs as detailed further below, that establishes a set price to be paid for EE savings.

The EE FiT concept is designed to procure EE savings in a very similar fashion to the ESPA, though at a broader scale to allow for more competitive procurement from all varieties of qualified third-party entities. Where the mechanisms fundamentally differ is in how they are designed to be utilized and the signals they send to the marketplace. The EE FiT, like FiTs designed for RE, is a mechanism conceived to be offered over a long time scale and as a primary policy mechanism for procuring EE. That is, unlike an

[53] The EE FiT is a relatively new concept about which this report provides merely a summary. For a fuller description, see Neme & Cowart, 2013.

[54] Utilities included Central Maine Power, Public Service Electric and Gas, Pacific Gas & Electric, Texas Utilities, Public Service of Colorado, Commonwealth Electric (Massachusetts), and others.

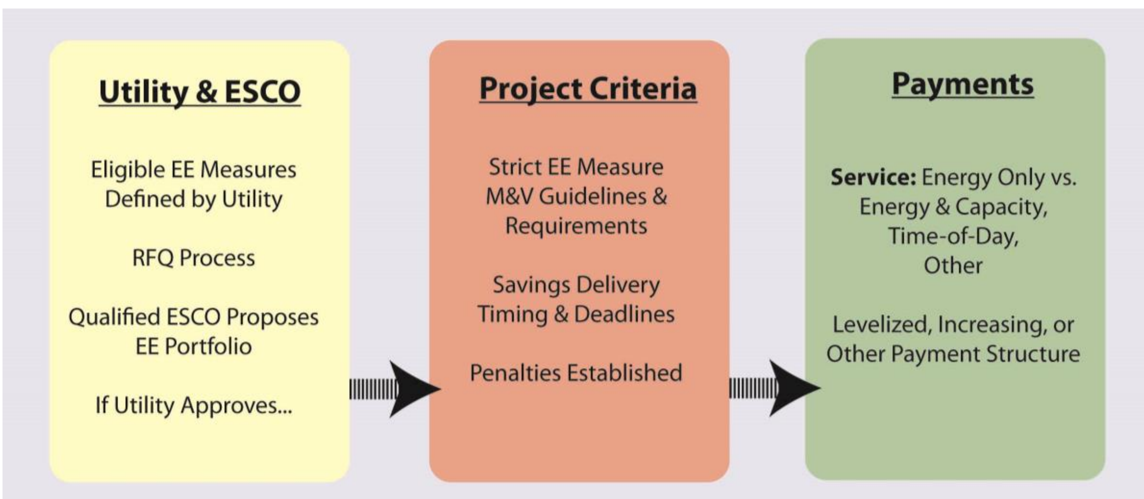
[55] Efficiency Valuation Organization, 2014.

ESPA, the EE FiT is designed to procure all available EE at a particular price, from a wide range of third-party providers, and subject to clear requirements and terms over a long, dependable time scale. Under the ESPA model, EE procurement is based on a contract term and may be combined with other programs to meet EEOs or procure EE without a long-term commitment to provide payment under an EE FiT model. This time scale difference may ultimately send different signals to the marketplace in terms of which measures are procured, a lesson demonstrated by the US utility PSE&G when it received, and ultimately overpaid for, primarily lighting retrofits via an ESPA program (this example is detailed at the end of this section). Certainly, however, EE FiT programs would not be immune to a “cream-skimming” EE procurement effect, particularly over the short run, and could also be combined with other incentives and programs to maximize EE uptake.

6.1.2 Structure and Term Sheet for Utility ESPAs

An ESPA will typically include terms and provisions similar to the following items,[56] which are outlined in Figure 6 and detailed thereafter. The typical contract is between an ESCO and the utility.

Figure 6: Energy Savings Purchase Agreement (ESPA) Outline



1. **Eligible measures are defined.** As is typical of utility-funded EE rebates, the ESCO proposes the measures using a standard proposal format, which is reviewed and accepted by the utility. The ESCO is responsible for turnkey installation of the agreed-upon measures, and there is a utility commissioning or acceptance protocol to verify the installation at completion. Protocols and provisions are made for savings M&V, including utility rights to review calculations. In many cases, this savings verification is done independently, and the utility may also charge M&V or other administrative fees to the ESCO to perform their own validations.

2. **Eligibility and qualification criteria for ESCOs are defined.** A request for qualification (RFQ) process is typically used to qualify ESCOs in advance to participate.

[56] These terms derive in large part from a standard-offer ESPA promulgated by PSE&G (which is an affiliate of PJM) in 1993.

3. **The ESCO commits to a minimum savings amount** from the given individual project or for the ESCO contract as a whole. There are also opportunities for ESCOs to aggregate savings from multiple facilities that would deliver smaller savings on their own. Thus, an ESCO may contract for 20 MW of capacity savings to be brought online within a certain time period, and achieve this through a series of small projects. The time of day during which capacity savings must be delivered is defined, and deadlines for bringing the savings online are set. Because the utility then will rely on this committed savings to meet future resource needs, penalties (liquidated damages) are established for failure to deliver the committed savings amount by the deadline. ESCOs may design and build the EE project or portfolio to over-deliver savings, and/or conservatively estimate savings, in order to avoid penalties and to protect the integrity of the ESPA payment stream over the contract term. This is a common strategy and can be deployed to create committed capacity savings similar to those delivered in the forward capacity auction markets discussed below. The ESPA also typically defines a maximum savings amount; delivered savings over this amount would be uncompensated or compensated at a lower rate.

4. **A payment schedule, per delivered kW and kWh (or therm), is established.** In some cases, the ESCO may have payment options. Variations include: energy-only vs. energy and capacity, time of day (peak/off-peak), and levelized (front-end-loaded) vs. increasing payments over the contract term. In South Africa's standard offer model[57] administered by the national utility, Eskom, which is willing to purchase delivered energy savings, 40 percent of the total payment to the ESCO is made at project commissioning, and the balance is paid for delivered kWh over the contract term, typically three years, with payments made annually in arrears. The payment amounts are based on the utility's estimate of the savings value, or some portion thereof, and are approved by regulators. The term of the ESPA and the payment stream are typically based on a conservative estimate of the useful life of the measures.

5. **Standard contract provisions** include representations and warranties, insurance, indemnification, assignment for financing purposes, and force majeure.

6.1.3 Strengths of Utility ESPAs

There are several important strengths of ESPA contracts that make the mechanism worthy of promotion.

- First, the utility pays for delivered savings only, as strict M&V is used. Recent experience in the PJM and New England markets confirm that these M&V systems can work.
- By paying for the savings received, the risk for the utility and its non-participant ratepayers is lowered. This makes the program scalable, so that as the EE industry grows, ESPAs have the potential to deliver utility-scale resources. A lower risk, with dependable delivery, is a good buy for the utility.
- As it will pay only for savings actually achieved, the utility can afford to pay more for the delivered savings. This creates an enlarged revenue stream for the ESCO and reduces the portion of the EE investment that must be paid by the customer. This arrangement has strong potential to accelerate the sales cycle with the customer. Both ESPAs and the EE FiT can also accelerate EE project development time in the same ways that standard FiTs for RE projects

[57] ESMAP, 2011.

reduce project development time and risk, though an EE FiT, described above in this section, is ultimately a slightly different and more comprehensive policy mechanism.

- The ESPA arrangement can reinforce accounting treatment of ESCO customer contracts as service agreements. If the customer is buying EE as a service (as opposed to making a capital investment), the customer's internal decision process can potentially be further accelerated. The utility confirmation of savings via the ESPA can add further validity to the arrangement with the customer.
- An intriguing arrangement is to combine an ESPA with an OBR arrangement to pay for the customer's share of the project costs, which can be structured as an Energy Services Agreement with an ESCO with savings-based payments.

6.1.4 Challenges of a Flat Payment Scheme

- **Savings Overpayment[58]:** In the 1990s, Public Service Electric & Gas of New Jersey (PSE&G) invested more than USD1 billion in a standard offer program that functioned as detailed above and offered a fixed price (with seasonal and time-of-day variation) per kWh for delivered EE savings. A review of this program determined 83 percent of the savings achieved were from EE lighting measures, and an average price of 3.9 US cents per kWh was paid for these lighting retrofits. While this price is competitive with—though still above—the average US cost of EE of 3.5 cents per kWh (as of 2010),[59] lighting measures are some of the least expensive, and it is substantially above the average price utilities have paid for the same type of savings through rebate programs, which has averaged 2 cents per kWh or less.[60]
- **"Lost" EE Opportunities[61]:** This problem is seen when an EE services provider sells a customer many of the highest-yielding EE measures but neglects other likely profitable opportunities in favor of finding high-yielding opportunities at other customer locations. EE FiT or ESPA/standard offer arrangements are vulnerable to this problem. An EE FiT or ESPA program capable of funding savings from a variety of resources—including indirect education/marketing programs[62]—is difficult to closely monitor and regulate. As a result, it is recommended that policymakers use care in setting price and incentive structures to minimize this effect.[63]

6.1.5 Conclusions

Today, the ESPA model is judged to have strong potential for scale-up. The purchase of delivered power from independent power producers is a common utility supply procurement strategy driven increasingly in the United States by wholesale electricity markets, open access to electric transmission, risk hedging, and increased competition and deregulation in the marketplace. From a contractual standpoint, utilities are very comfortable with this model. Further, the development of M&V methods, with traditional costs increasingly brought down by wireless controls, ensure savings can be verified at a reasonable cost with high confidence using methods that are widely known and deployed. Finally, the price for delivered savings can compete with supply, particularly in forward-capacity markets, even with strong coverage and margins built into the project financing plans for all parties.

---

58 For greater detail, see Neme & Cowart, 2013.
59 Wood, 2012.
60 For greater detail, see Neme & Cowart, 2013.
61 Ibid.
62 Ibid.
63 For further recommendations on this topic, particularly with regard to the EE FiT, see Neme & Cowart, 2013.

6.2 Emerging Models

6.2.1 EE Sales into RTO-Sponsored Forward Capacity Markets[64]

A special case for ESPAs exists when the utility is a participant in a power pool that conducts an auction-based wholesale market for forward capacity. Two such auctions are currently conducted in the United States by regional transmission operators (RTOs); one in New England (ISO-NE) and one in the Mid-Atlantic/Midwest (PJM Interconnection).[65] These markets allow EE resources to effectively compete directly with traditional generation capacity and supply resources. With the first generations of EE projects now online, EE has demonstrated success in participating in these markets. FCMs are, however, relatively new and are not created exactly alike. In ISO-NE, EE resources can bid capacity savings from the full life of EE measures into the forward capacity auction, whereas PJM limits EE resources to four delivery years—a significant restriction.

In general, EE can compete very handsomely against traditional supply-side resources on price. EE has contributed about 4 percent of total resources in the PJM auctions (e.g.: 632 MW out of 15 GW for the period 2007–2013), and has been found to lower the clearing price for capacity. Auctions are held three years in advance of the first delivery, allowing time for an ESCO to plan, finance, and implement an EE portfolio. EE must meet strict rules for capacity, availability, M&V, and hours for dispatch/performance or face penalties (liquidated damages) for failure to meet these obligations and standards. Despite the increased complexity and added cost of these strict market rules, EE's contribution to the FCMs has been significant; in PJM the amount of EE bid into the FC market in 2014 was approximately double that of 2012, at 822 MW of capacity.[66]

Sample prices in the PJM system are in the range of USD100 per MW-day for capacity only, which translates to USD36,500 per year per MW, or a present value of approximately USD120,000 per MW over the four delivery years. Prices are as much as 150 percent of that amount in the ISO-NE system. This capacity value is sufficient to cover full EE measure and project development, implementation, management, and operations costs for only some types of measures, particularly controls. For other types of typical EE measures, such as certain HVAC upgrades, the forward market value is likely to pay for 30–50 percent of measure costs and would have to be combined with revenues from the customer to make the project economics work for an ESCO. Combining revenue streams from an RTO with revenues from the customer can work well, but requires a longer sales cycle. This can also function as an entry barrier for ESCOs that must plan and maintain responsibility for their EE portfolios in advance of deployment when bid into an FCM.

Nonetheless, the value proposition for the utility system is clear, and there is ample room for finding the price for delivered EE resources that can meet the objectives of all parties. Recommended approaches include:

1. Alternative contract provisions and arrangements for the build-out of EE portfolios and for managing risk.

64 Gottstein & Schwartz, 2010.

65 PJM is the world's largest competitive power market and covers all or part of 13 US states and the District of Columbia, with a capacity of more than 160 GW.

66 Fetter, Thomas et al., 2012.

2. Pricing of the resource to include full measure life.[67]
3. Energy payments for addressing special circumstances in specific customer markets (e.g., large commercial).

6.2.2 Comparison: Solar Photovoltaic (PV) PPA Model

A number of US companies (e.g., Sun Edison, Solar City, SunRun, and others) offer to install solar PV systems in the residential, institutional, and commercial market segments at no cost to the householder or the facility owner and have developed access to financing and successfully built their balance sheets. These companies have developed state-by-state—in California, Arizona, New Jersey, Colorado, Vermont, and others—following the implementation of state renewable energy incentives and net metering legislation as well as the federal investment tax credit and other incentives. The net project cost to finance is low enough that a solar company can sell power to the customer, pursuant to a long-term contract often of 20 years, at a small discount off the retail rate.[68] Certain advantages exist compared with EE investments developed within an ESCO framework: Power production and sales are easier to measure and verify than energy savings; the useful life and warranties on solar PV panels often exceed 20 years; and the economics of these projects have been driven significantly by the 30 percent US federal investment tax credit[69] and US state government incentives. Many examples exist of large institutional sector projects in the USD5–20 million investment range. Despite certain advantages, it is important to note that the economics of EE investments are still most often superior to solar PV projects even after factoring in these incentives.

The success of this market is a result of a business model where energy users pay for delivered energy and savings, on a service or PPA basis, with no upfront capital investment. This is exactly the ESCO formula for EE that has strong potential for scale-up, especially for commercial buildings, provided that accounting and tax treatment issues are resolved.

---

[67] As noted, PJM limits FCM EE resources to four years of payment and ISO-NE offers payments for full-measure life. While this is a result of PJM using modified load estimates (inclusive of EE savings) as opposed to ISO-NE, which does not, failure to price EE capacity resources inclusive of full measure life has been shown to less strongly support demand for EE project participation. See, e.g. statement of John Moore, the Sustainable FERC Project, submitted to FERC on Sept. 9, 2013.

[68] Rahus Institute, 2008.

[69] This is currently set to expire Dec. 31, 2016. Qualifying properties include principal and secondary homes in the residential market; rental properties do not qualify.

7. Conclusions and Recommendations

7.1 Conclusions

While finance institutions, governmental bodies, utilities, ESCOs, and other entities have gained considerable experience delivering successful EE financing mechanisms and programs, the question of how to scale-up these successful models remains a key challenge. This report has examined the scale-up challenge in detail and offers the following major conclusions:

- The most common gaps in the EE investment market are:
  1. Lack of coordinated EE project demand that are linked to financing options (i.e., *well-prepared projects ready for investment*), and;
  2. Lack of financial products that are structured, adapted, and aimed at this market, and are creditworthy and scalable from the perspective of mainline capital sources.
- Availability of finance can drive development of EE projects, but *financing alone is not sufficient* to move these markets. EE finance programs must also reach back further into the project development cycle and promote systematic project development by capable market actors in order to generate a pipeline of investment-ready and creditworthy projects. This principle points to the need to address both EE financing *strategies* and EE finance *programs* in scale-up strategies.
- Scale-up of EE finance is a challenge not just of financing, but also of institutional capacity-building. Building this capacity requires, in turn, stable sources of program funding.
- Scale-up does not imply blind replication, but rather adaptation and application of good transaction structuring and program design principles for given markets and locales, consistent with the characteristics of local institutions.
- The best financing mechanisms will vary for different market segments and regions.
- Public policy and EE investment market development initiatives should focus on mobilizing and leveraging commercial finance resources to deliver well-structured and adapted financial products to specific EE finance markets.
- Overcoming the challenges of end-user decision-making is necessary in order to develop and implement EE investments at scale. EE investment programs must seek and find ways to engage and sell to facility owners programmatically, drive demand, and accelerate the EE project sales cycle. Concepts and strategies to accelerate the sales and customer decision-making processes are described in Chapter 4.
- There are several important steps involved in designing and implementing scalable EE finance programs and mechanisms. These steps are described in Chapter 5.

7.2 Recommendations

The following recommendations are based on the conclusions above, and are intended to be actionable by advocates of effective reform.

7.2.1 Develop an EE Finance Best Practices Network, Toolkit, and Service

One recommendation of this report is to establish and strengthen the network of EE finance best practices by building on and further coalescing existing networks, and by promoting the creation of a best practices information service to design, set up, and implement EE finance programs. A new service of this type could support a broad range of practitioners and market participants—governments, development agencies, utilities, financial institutions, ESCOs, and end users and their associations—to promote EE financing through compilation and promotion of effective models. Because of the size and recent growth of this field, further work to identify and interview practitioners to build the community of practice is recommended.

This service concept begins with an EE finance "toolkit" of resource materials and thorough case studies of best practices made accessible to practitioners through a web-based service. The compilation would document in meaningful, deep, and practical detail a range of EE financing mechanisms and transactions; that is, the structures of individual deals between commercial parties and EE project development and finance programs of the type that government, development banks, and other agencies undertake to organize and deliver EE project development services and financing to implement project transactions in a range of market segments.

In addition, the service would provide a forum for development of scale-up strategies. This is especially topical in the face of new EE funding being organized in the United States and elsewhere.

7.2.2 Promote Replication and Scale-Up of Working Models

A logical initiative is to promote replication and scale-up of working models. Those identified in Chapter 3 are a good place to start, especially for EE investment in the public sector. Public-sector facilities are good prospects for EE investment as a result of typically stable energy loads and sound credit. A number of organizations provide this service already (such as the National Association of State Energy Officials in the United States), but new initiatives building on these capacities are still needed. Further, many of the project development and procurement methods, including pooled procurements and pooled finance programs, can be extended to local governments and the institutional and non-profit sectors via associations (e.g., for healthcare, higher education, primary and secondary private education, YMCAs, and others). This is an opportunity for new EE project development and finance program administrators working with state-chartered bond authorities.

7.2.3 Promote Development of Promising New Models

Another logical initiative is to promote the development of promising new models. Three noteworthy ones are:

- Utility purchase of delivered energy savings through both ESPAs and the EE FiT model. These models have a number of strengths summarized in Chapter 6 and further interested utility practitioners are needed. New opportunities may exist in US states that are planning to rebid implementation of their EE programs. Opportunities in China may also be available; this is an opportunity for further research.
- Business models for commercial buildings to sell EE as a service. This includes the model whereby consumers pay for delivered energy and savings on a service or PPA basis with no up-front capital investment (see, e.g., the solar PV PPA model outlined in Section 6.2). A number of organizations are implementing EE projects on this basis but the level of achievement is far below potential. If parties are willing to share via a neutral convener these business models could be accelerated. Initiatives to clarify accounting and tax treatment are also important to this market.
- Leveraging new transaction points to upsell EE investments and deeper EE retrofits. This can occur at many transaction points when property owners interact with parties including general

contractors, mortgage bankers, and HVAC/equipment contractors, among others. With proper organization—implemented with partner vendors, contractors, and financial institutions—these transaction points can be captured as an opportunity to market EE investments and initiate project development. This model is discussed in Section 4.2.

7.2.4 Promote EE Project Development & Finance Program Funding, and Best Uses of Funds

A core recommendation of this report is that EE project development and finance programs are needed in many markets, accompanied by financing mechanisms, as a means to generate a pipeline of well-prepared EE project investments that financing mechanisms can fund. This need underscores one of the fundamental dilemmas of EE financing: Funding stability is essential in order to build the institutional capacity needed for effective EE project development programs, but at the same time these programs must develop an effective pipeline of projects in order to access stable funding.
Recommended uses of public EE funds are twofold:

1. **To support "one-stop-shop" style programs** that provide EE project development services to customers in their target market, covering the full project development cycle. Public funds can be used to operate the EE programs, provide marketing support, and deliver the project development services to interested customers.

2. **To provide various forms of co-financing** to mobilize and leverage commercial financing. Co-financing can take many forms, including:
    - Senior debt co-financing, often at a below-market interest rate to reduce rates for borrowers.
    - Subordinated debt co-financing to reduce risk for commercial senior lenders.
    - Interest rate buy-downs (i.e., directly expending public funds to reduce rates to borrowers).
    - Credit enhancements, such as partial credit guarantees, loan loss reserves, and debt service reserves, where public funding is used to reduce commercial lender risks.

Another special-case use is to capitalize public investment funds. These funds can also leverage commercial finance at the individual project level through the means listed above, or on their own balance sheets.

Further recommendations concerning various types of public funding for EE project development programs include the following:

- Advocate for the importance of program funding and continue to make the case for public investment.
- Compile and catalogue further information on sources of funding for EE project development programs and assist interested agencies in applying for these sources of funding.

Many advocates of strategic public EE funding wish to reduce public investment over time on the basis that development programs can eventually become self-sustaining. This goal is important to assure that programs are delivering value and are organized on sound business practices, but a case can be made for sustained public investment at a level that is more than matched by the numerous benefits of sustained EE investment, and to continue building institutional capacities for EE investment programs that are needed for a long-term clean energy transition.

7.2.5 Tapping New Sources of Capital & Capital Market Development

Secondary Market Development Strategies

Development of secondary market financing for portfolios of EE investments is a major goal of those aiming to scale, though there has been fairly limited progress to date toward this goal. Development of the secondary market depends on a healthy primary market of FIs that originate loans, assemble portfolios of those loans, and then seek to refinance or sell the portfolios to secondary market capital sources. Availability of financing from the secondary market can drive development of the primary market and cut capital costs. Credit enhancement support provided from public funds can be made assignable to the secondary market capital source, and financing can include underwriting that will make the level of risk acceptable to secondary sources. A typical target portfolio size for a secondary market transaction would be approximately USD20–25 million each, with a plan and demonstrated potential to finance USD100–200 million or more over a period of 12 to 24 months to justify transaction costs. Thus, there is a need for EE finance market aggregators who can originate and fund the many small transactions and assemble portfolios for resale. The EE investment market needs more active primary market sources, and the premium is on building a pipeline capable of delivering a consistent and consolidated portfolio of EE projects.

Equity for the Primary EE Finance Markets

To mobilize large-scale capital, the EE finance market needs to fund and build capacity for the specialized EE financial institutions that can create EE investments for sale or refinancing by larger-scale capital sources. For this purpose, this report recommends an equity-first strategy, coupled with sound project finance and credit structuring principles. This is similar to the approach taken by Green Campus Partners, a portfolio company of Hudson Clean Energy.

Another reason for an equity-first strategy is the fact that the EE market consists of many small projects; initial projects can be funded with 100 percent equity, with debt leveraged into the financing after a portfolio of projects has been assembled and is performing appropriately.

Mission-Related Capital

Mission-related capital has a strong role to play in EE investment. Recommendations include the following:

- Convene mission-related capital sources to strengthen their EE investment identity and practices. Investigate their respective investment appetites and capacities, yield and security requirements, the extent and structure of possible concessionality they may be able to offer, and the terms and structure of the investment instruments that can meet their objectives and match the financing needs of the EE market. Such investors are well suited for both CDFIs and specialized EE finance funds. This could be a fruitful domain for applying a best practices network, including further resource materials.
- Convene CDFIs with experience and interest in this field. Assist in exchange of best practices, including structure of financing products and mechanisms suitable for various target markets. Assist CDFIs in developing new EE finance products. Assist CDFIs in accessing additional wholesale funds, especially from public and mission-driven sources.
- Investigate the willingness of mission-related capital sources (e.g., foundations) to provide grants that can be used for credit enhancements, such as loan loss reserves, to support and leverage commercial financing.

- Investigate the possibility of getting college and university foundations to invest in specialized EE finance funds as an extension of their current on-campus EE investment fund initiatives, similar to what was done by Harvard University in the 1990s.

7.2.6 Policy Recommendations

Policies and Legislation Supporting Utility Roles in EE Finance

Legislation is one means to initiate EE finance programs that involve roles for utilities. OBR and ESPA structures can be promoted through legislation as they have been in New York, Illinois, and California. Legislation can also be used to establish EE FiTs.

Benchmarking Requirements and Standards

Benchmarking rules at local, state, and federal levels stimulate the EE investment market by promoting transparency and bringing information to market, promoting awareness, and enabling building owners and customers alike to compare relative property efficiencies, thereby encouraging development of EE projects.

Link EE Investment to Financial System Reform

EE investment can be linked to and incorporated in financial system reform policies. Examples include:

- Allowing loan loss reserves and other forms of concessional credit enhancements that are provided to and used by a commercial FI to be recognized by financial regulators as counting toward the FI's capital adequacy and required loss provisioning. This will help the FI increase lending capacities and ease equity constraints.
- Institute Green CRA policies or portfolio standards that require regulated financial institutions to develop clean energy finance products as a target percentage of their portfolio.

Tax Policy and Accounting Treatment of EE Finance Transactions

Accounting treatment supportive of EE investment, which allows for accelerated depreciation, and clarifying EE ESCO contracts as service agreements could greatly serve to unlock investment in commercial buildings and other EE investment markets.

7.3 Research Agenda

Areas that may benefit from additional research include the following:

7.3.1 EE Investment Economic Development and Macroeconomic Planning

The concept of EE investment as a means to advance economic development has strong appeal and resonance. Further research can be done at the macroeconomic level to flesh out this potential and could include: calculating the investment potential in various markets, detailing the methods by which this investment can be captured for these specific markets, and analyzing the macroeconomic, fiscal, and job creation benefits. This research could help make the case for sustained public investment.

7.3.2 Fiscal Impact Analysis

EE investment generates tax revenues. This fiscal impact is important to study and quantify in making the case for sustained public investment.

7.3.3 Financial Sustainability for EE Project Development and Finance Programs

Many EE finance programs and project development are initiated and supported with grants and government appropriations. These programs are frequently run by local government agencies and nonprofit organizations partnering or contracting with them. Such programs aim to become increasingly self-sustaining. Business plans, revenue models, and related methods to achieve this sustainability can be studied as part of peer information exchange among successful practitioners.

7.3.4 Database and Case Studies on Energy Savings and EE Finance Payment Performance

As participating FIs gain experience with new EE financial products and finance programs, collections payment performance track records will be established. Because EE equipment is essential to the physical operation of a home, commercial building, factory or other facility, the borrower's willingness to pay is often enhanced. With proper collections practices, this can translate into lower default and loss rates compared to non-EE debt. It is important to collect this information. One element of the U.S. DOE's work on best practices in clean energy finance is to compile data on collections payment performance for various types of clean energy financial products (e.g., unsecured residential EE loans, LRF programs, and PACE transactions). Over time, the availability of this critical data will help lenders and investors assess risk and price their financing accurately. The DOE is planning to compile this data into a form that is accessible and appropriate to share industry-wide.

However, additional information gaps exist for FIs interested in this market and lack of information inhibits the scaling up of EE investments. In particular, information is needed compiling case studies on energy savings achieved by EE projects. This will help FIs conduct appropriate due diligence assessments. This information is available, in depth, but it needs to be compiled in ways that are readily accessible to the financial community. Also needed is further research and information on how EE investments improve the appraised and market value of buildings,[70] though this effect will vary by market.

[70] Friedrich, 2012.

References

Asset-Backed Alert (2014). Agencies Stop Opposing Clean-Energy Loans, 7 November 2014. Retrieved 15 December 2014 from https://www.abalert.com/search.pl?ARTICLE=160844

Berlin Energy Agency. *Energy Saving Partnerships in Berlin.* Retrieved 15 December 2014 from http://www.berliner-e-agentur.de/en/consulting-information/energy-saving-partnerships-berlin

Billion Dollar Green Challenge. *The Challenge.* Boston, MA: Sustainable Endowments Institute. Retrieved 15 December 2014 from http://greenbillion.org/the-challenge

Borgeson, M. Zimring, M., et al. (2012). The Limits of Financing for Energy Efficiency. In *ACEEE Summer Study on EE in Buildings*. Retrieved 15 December 2014 from www.aceee.org/files/proceedings/2012/data/papers/0193-000155.pdf

C40 Cities Climate Leadership Group. *About C40.* Retrieved 15 December 2014 from http://www.c40.org/about

Crossley, D. (2013). ESCOs as a Delivery Mechanism for Grid Company DSM in China: Lessons from International Experience. Montpelier, VT: The Regulatory Assistance Project. Retrieved 15 December 2014 from http://www.raponline.org/document/download/id/6443

Crossley, D., Gerhard, J., Kadoch, C., Lees, E., Pike-Biegunska, E., Sommer, A., Wang, X., Wasserman, N., and Watson, E. (2012). Best Practices in Designing and Implementing Energy Efficiency Obligation Schemes. Montpelier, VT: The Regulatory Assistance Project and International Energy Agency Demand Side Management Programme. Task XXII Research Report. Retrieved 15 December 2014 from http://www.raponline.org/document/download/id/5003

D'Addario, Patrick (2013). *The Future of Industrial EE Finance in China* [Webinar]. Washington, DC: Institute for Industrial Productivity. Retrieved 15 December 2014 from https://cleanenergysolutions.org/training/industrial-energy-efficiency-finance-china.

Efficiency Valuation Organization (2014). *IPMVP Core Concepts.* Retrieved 15 December 2014 from http://www.evo-world.org

Energy Sector Management Assistance Program (2011). *Implementing Energy Efficiency and Demand Side Management: South Africa's Standard Offer Model.* Briefing Note 007/11. Washington, DC: ESMAP. Retrieved 15 December 2014 from http://www.esmap.org/node/1260

Enkvist, P. (2007). A cost curve for greenhouse gas reduction. *McKinsey Quarterly*, (1), 38. Retrieved 15 December 2014 from http://www.epa.gov/oar/caaac/coaltech/2007_05_mckinsey.pdf

Federal Housing Finance Authority (2010). FHFA Statement on Certain Energy Retrofit Loan Programs [Press release]. Retrieved 15 December 2014 from http://www.fhfa.gov/Media/PublicAffairs/Pages/FHFA-Statement-on-Certain-Energy-Retrofit-Loan-Programs.aspx

Fetter, J., Thomas, S., et al. (2012). *Energy Efficiency in the Forward Capacity Market: Evaluating the Business Case for Building Energy Efficiency as a Resource for the Electric Grid.* Booz Allen Hamilton, ACEEE Summer Study on Energy Efficiency in Buildings. Retrieved 15 December 2014 from http://www.aceee.org/files/proceedings/2012/data/papers/0193-000167.pdf

Finamore, B. and D. Moskovitz et al. (2006). Demand-Side Management Strategic Plan for Jiangsu Province, China: Economic, Electric and Environmental Returns from an End-Use Efficiency Investment Portfolio in the Jiangsu Power Sector. In *ACEEE Summer Study on EE in Buildings*. Retrieved 15 December 2014 from http://www.greenenergyeconomics.com/wp-content/uploads/2006/08/DSM-Plan-for-Jiangsu.pdf

Friedrich, K. (2012). Critical Need for Energy Savings and Loan Performance Data Remains Unmet. *Clean Energy Finance Source*, April 27, 2012. Retrieved 15 December 2014 from http://www.cleanenergyfinancecenter.org/2012/04/critical-need-for-energy-savings-and-loan-performance-data-remains-unmet

Gottstein, M., and Schwartz, L., (2010, May). *The Role of Forward Capacity Markets in Increasing Demand-Side and Other Low-Carbon Resources: Experience and Prospects* [policy brief]. Montpelier, VT: Regulatory Assistance Project. Retrieved 15 December 2014 from http://www.raponline.org/docs/RAP_Gottstein_Schwartz_RoleofFCM_ExperienceandProspects2_2010_05_04.pdf

Granade, H.C., Creyts, J. et al. (2009). *Unlocking Energy Efficiency in the U.S. Economy.* McKinsey & Co. Retrieved 15 December 2014 from http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/unlocking_energy_efficiency_in_the_us_economy.

Hayes, S., Nadel, S. et al. (2011). *What Have We Learned From Energy Efficiency Financing Programs?* Washington, DC: American Council for an Energy-Efficient Economy. Retrieved 15 December 2014 from http://aceee.org/research-report/u115

Kaupr, N., et al. (2011). *Show me the Money: Energy Efficiency Financing Barriers and Opportunities.* Washington, DC: Environmental Defense Fund. Retrieved 15 December 2014 from www.edf.org/content/show-me-money

Krasja, P., and Welks, K., (2010). *Pennsylvania's Keystone HELP* [PDF document]. Retrieved 15 December 2014 from http://www1.eere.energy.gov/wip/solutioncenter/pdfs/doe_webcast_presentation_012810.pdf

Lazar, J. and Colburn, K. (2013). Recognizing the Full Value of Energy Efficiency. Montpelier, VT: Regulatory Assistance Project. Retrieved 15 December 2014 from http://raponline.org/document/download/id/6739

Natural Resources Canada (2014). *Federal Buildings Initiative.* Retrieved 15 December 2014 from http://www.nrcan.gc.ca/energy/efficiency/communities-infrastructure/buildings/federal/4481

Neme, C., and Cowart, R. (2013, June). EE Feed-in Tariffs: Key Policy and Design Considerations. In *ECEEE Summer Study Proceedings*. Retrieved 15 December 2014 from http://raponline.org/document/download/id/6638

New York State Energy Research and Development Authority. *About NYSERDA.* Retrieved 15 December 2014 from http://www.nyserda.ny.gov/About.aspx

PLANYC (2014). *GBEE – Other Initiatives – Energy Aligned Clause.* Retrieved 15 December 2014 from http://www.nyc.gov/html/gbee/html/initiatives/clause.shtml.

Rahus Institute (2008, Oct.). *The Customer's Guide to Solar Power Purchase Agreements.* Retrieved 15 December 2014 from http://www4.eere.energy.gov/solar/sunshot/resource_center/resources/customers_guide_solar_power_purchase_agreements

Regulatory Assistance Project. *International Experience with Public Benefits Funds: A Focus on Renewable Energy and Energy Efficiency* [PDF document]. Montpelier, VT: RAP. Retrieved 15 December 2014 from http://www.raponline.org/docs/CRS_PBFInternationalExperience.pdf

Singh, J., et al. (2012). Public Procurement of Energy Efficient Products: Lessons From around the world. Washington, DC: World Bank Energy Sector Management Assistance Program. Retrieved 15 December 2014 from: https://openknowledge.worldbank.org/handle/10986/17485

SMUD. *Residential Loan Program and Eligibility*. Retrieved 15 December 2014 from https://www.smud.org/en/residential/save-energy/rebates-incentives-financing/documents/Residential%20Financing%20Fact%20Sheet.pdf.

Taylor, R., et al. (2008). Financing Energy Efficiency; Lessons from Brazil, China, India, and Beyond. Washington, DC: World Bank. Retrieved 15 December 2014 from http://documents.worldbank.org/curated/en/2008/01/9014995/financing-energy-efficiency-lessons-brazil-china-india-beyond

U.S. Department of Energy. *State and Local Solution Center.* Washington, DC: DoE Office of Energy Efficiency and Renewable Energy. Retrieved 15 December 2014 from http://www1.eere.energy.gov/wip/solutioncenter/

Wiser R., Murray, C. et al. (2003). International Experience with Public Benefit Funds: A Focus on Renewable Energy and Energy Efficiency. Montpelier, VT: Regulatory Assistance Project. Retrieved 15 December 2014 from http://raponline.org/document/download/id/467

Wood, L. (2012, April). Energy efficiency savings, budgets, and spending. *Electric Perspectives*, 37(2), 70.

Zhu, C. (2013). Credit Crunch Stifles Chinese Energy Savings Sector. *Reuters,* March 14, 2013. Retrieved 15 December 2014 from http://www.reuters.com/article/2013/03/14/china-energy-saving-idUSL3N0C51NL20130314