The Future of Financing Advanced Energy Efficient Building Equipment

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Cover: The Cambridge Public Library in Cambridge, MA is LEED Silver Certified and features energy efficient design and technology.

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Study Purpose

Improving building energy efficiency represents both a major financial investment opportunity as well as a means of advancing the low carbon economy in the United States. And yet, much of this potential remains untapped. Due to a range of barriers, institutional investors – investment banks, mutual funds, local banks, national entities – have been hesitant to take part in the market to date. This report defines investment in energy efficiency as the investments needed to implement energy efficiency retrofits and upgrades. Historically, energy efficiency financing has focused on public sector buildings, comprising federal, state and local government occupied buildings, and universities and hospitals. Yet, the commercial built environment represents a significant portion of existing building stock and energy consumption, and now the efficiency equipment and services market is turning its focus towards this building sector to try to take advantage of this large and growing opportunity.

Financing, and the participation of institutional investors, has been identified as a core element of unlocking the potential of energy efficiency in the commercial sector, but the landscape of tools available to financiers, property owners, and service providers has remained stagnant until recently. This paper is intended to serve as an introduction to this emerging financing opportunity. To this end, the paper will define the growing building energy efficiency market, specifically focusing on project finance for retrofits in commercial buildings; outline the major drivers and barriers of the industry; examine the latest financing mechanisms; and review the newest technologies that are moving the building sector towards a more efficient future. Navigating the energy efficiency market is complex due to factors including: complicated accounting structures including on- and off-balance sheet treatments, uncertainty of savings (due to lack of uniform methods for calculation and verification of savings), and perceptions of risk from investors regarding repayment structures and risk allocation, among others. This report, which was developed through primary interviews of industry experts in efficiency financing and technologies, acts as an initial guide for financial institutions and investors looking to participate in the evolving energy efficiency financing market.

Executive Summary

While building energy efficiency has always been viewed as a significant opportunity to reduce energy consumption in the U.S., investors have recently begun to recognize the tremendous financial opportunity this sector represents for the equipment leasing and finance industry. Kick-started during the energy crisis of the 1970s, the building energy efficiency solutions market has focused for thirty or more years largely on the public and educational building segments. Over the past 10 years the market has begun to shift in recognition of the large potential efficiency gains represented in the commercial buildings sector. This report is intended to provide the reader with an overview of the emerging financing opportunity in providing private capital for commercial building energy efficiency projects. To do so, the report reviews the building energy efficiency market, applicable building technologies, the drivers and barriers influencing growth of the market, and the emerging financing mechanisms that can be employed to catalyze the commercial building efficiency market.

For the purpose of this report, we define building energy efficiency solutions as products and/or services that use less energy to condition and maintain the environment within and around a building. Building efficiency measures fall into three categories:

- **Building Envelope Upgrades:** retrofits to static, non-energy consuming building components such as windows and insulation, which impact energy transfer between the built and external environments
- **Equipment Upgrades:** retrofits to energy-consuming components, such as boilers, chillers and lighting, and associated controls to meet building operational needs with lower energy consumption
- **Operational Efficiency:** services, such as building analytics, to tune, maintain and verify the performance of building envelope and equipment

This report focuses on the real estate sector in which the most tangible energy efficiency opportunity is emerging: the commercial buildings sector, which includes office, retail, and multi-tenant buildings. The paper begins by discussing the commercial energy efficiency market, and the opportunity identified in a recent report by McKinsey, which identified the need for $520 billion in upfront investment in efficiency measures through 2020 to achieve the resulting $1.2 trillion in energy savings.[i] Investment in energy efficiency, for the purpose of this report, refers to money lent or invested upfront to enable retrofit projects to scale in the commercial buildings sector. For over three decades, the existing market has consisted largely of established companies called Energy Service Companies (ESCOs) providing a completely financed set of equipment and energy management services to the Municipalities, Universities, Schools and Hospitals (MUSH) real estate segment. While the commercial buildings sector represents significant energy spend, it lacks a similar, established energy efficiency model, leaving the opportunity ripe for new entrants willing to be part of a growing market.

The industrial real estate sector is characterized by facilities utilized for production, manufacturing, assembly, warehouses or distribution centers. Efficiency projects in the industrial sector have historically been high cost and technically complex due to unique, process-dependent energy consumption patterns, and irregular energy usage patterns that render predicting energy savings challenging. Given that the immediate opportunity for scalable technologies, services, and financing tools lies in commercial buildings, this report will focus only on the commercial sector.

As an introduction to the representative technologies that underlie the financing opportunity, this report defines and reviews four major building technology segments. These segments include: Heating, Ventilation, and Air Conditioning (HVAC); Lighting; Building Analytics and Controls; and Envelope. The paper reviews innovative new, lower cost technologies that contribute to a more diverse landscape of vendors offering greater absolute energy savings potential or savings at lower lifetime cost. Trends including decreases in sensor size and costs, widespread adoption of smart meters, and the rise of big data analytics have transformed seemingly static equipment into dynamically integrated building components.

The paper then discusses five key drivers that underpin the commercial buildings energy efficiency opportunity, including: volatile energy prices, increasingly stringent federal and state regulations for energy efficiency, carbon reduction targets, increasing social awareness of green branding, and rising concern over climate change and energy independence.

Lastly, the paper outlines the response to this financial opportunity: the development of new financing structures to enable investment in the sector by new, third party players. The three financing models outlined in this paper are:

- **Energy Service Agreements (ESA) and Managed Energy Service Agreement (MESA):** Energy efficiency projects that are financed and installed by a third party provider and repaid by the customer based on realized energy savings
- **On-Bill Financing (OBF):** Efficiency improvements that are serviced by or in partnership with a utility company, which provides the initial capital required to implement the project and is repaid through the customer's monthly utility bill
- **Property Assessed Clean Energy (PACE):** Energy efficiency upgrades provided to property owners at no upfront cost through municipal bonds that are repaid in long-term annual property tax assessments and secured by a property lien

Traditional secured lending has been the prevailing model in the equipment leasing industry for implementing energy efficiency retrofits without incurring large capital expenditures from the outset of the project by spreading the cost of payments across the life of the contract. Secured lending can either take place in the form of a capital lease or operating lease, which are differentiated by accounting treatments and tax allowances. While the new financing models outlined above have been created to address the barriers hindering the commercial building market from wide-scale efficiency adoption, traditional secured financing continues to be the most widely accepted financial model for the equipment leasing industry to date.

Although new financial models have been created to encourage more private investment in the market, investors and building owners/operators alike remain reluctant to engage with project financing characterized by unfamiliar contract and repayment structures, uncertain energy savings, unproven credit quality, longer contract terms, and new technology types. At present, a mixture of public and private debt and equity investments is being used to catalyze the industry and make way for more private investment. Yet, as the market realizes the potential opportunity, efforts to educate and address investors' and building owners' uncertainties are gaining steam, and we predict that these markets will soon turn a corner and grow rapidly.

Definition of Terms

Building Energy Efficiency: Using less energy to operate, condition, and maintain the environment within and around a building. Traditional suite of services supporting this industry includes building retrofits, facilities management, and operations and maintenance.

Building Energy Management Systems (BEMS): Software-based systems that analyze, monitor and optimize energy performance of building equipment such as envelope, lighting, and HVAC. BEMS (Building Energy Management Systems) provide greater insight into a buildings energy use through real-time information gathered from smart meter data, weather data, occupancy use and/or sensors.

Building Control Systems: Centralized systems consisting of hardware and software which monitor and control the environment within commercial, industrial and institutional facilities. They control mechanical and electrical systems within a building, including heating, ventilation, and air-conditioning (HVAC) systems, lighting systems, and other power equipment. Building Control Systems inclusion of hardware controls, such as sensors, is the key differentiator from a BEMS.

Building Envelope: Static, typically non-energy consuming building components including insulation, air sealing, roofs, walls, windows and doors.

Commissioning & Recommissioning: An intensive quality assurance test is performed to ensure a building's systems and equipment are operating as intended throughout the design, construction and occupancy phases of a building. Commissioning occurs upon installation while recommissioning takes place at regular intervals to fine tune equipment throughout the building lifecycle.

Continuous Commissioning: An ongoing process to ensure efficiency by collecting and analyzing energy data in order to make necessary operational changes to keep building systems at optimal performance levels. Measures for improvements are identified and implemented based on established baseline energy and comfort levels, and continuously tracked and verified throughout the life of a building.

Demand Response: The ability for residential, commercial and industrial consumers to reduce electricity usage at specific times of the day, typically during peak hours, in response to power grid needs, economic signals, or special retail rates to reduce strain on the electricity grid.

Energy Services Companies (ESCOs): National or regional companies that provide a range of energy services, from retrofits to ongoing maintenance, and financing and guarantees via performance contracts.

Fault Detection: Identification of failures within hardware or software equipment inside a building through the use of manual or automated tests.

HVAC: Heating, Ventilation, and Air Conditioning technologies that ensure indoor comfort and safety within a building.

LED (Light-Emitting Diode): A highly efficient semiconductor diode that emits light; used in lamps and digital displays.

Measurement & Verification: The process of quantifying energy savings from retrofit projects, typically via industry-standardized protocols, to ensure equipment is operating efficiently and to validate cost savings for energy performance contracts.

Retrofit: Improvement(s) made to existing building stock to improve overall operation and maintenance for continued energy efficiency.

Remote Building Auditing: The use of smart meter interval data and other factors (e.g., weather, occupancy data, location) to predict energy savings opportunities and inefficiencies from various building loads without requiring on-site engineering inspections.

Special Purpose Entity: A legal entity created by the project developer of an efficiency project to finance an ESA or MESA through equity and debt investment.

Split Incentives: Leases are structured such that tenants pay energy costs while improvements to major energy consuming equipment are paid for by building owners. As a result, (1) building owners are unable to directly recoup energy cost savings and are not incentivized to make efficiency upgrades, and (2) tenants are incentivized against major upgrades as they may anticipate the owners' costs to be passed on through a rent increase, and given typically short lease terms, that they would not have enough time to recoup the full cost savings.

Smart Meters: Advanced electricity meters that measure energy consumption in shorter time intervals, typically every hour or more frequently. Smart meters enable two-way communication between the electricity meter and the central location of the utility provider. The ability to securely and reliably relay information to a central location is enabled through communication networks, such as wireless mesh networks, often supported by WiFi, ZigBee, and other protocols.

INTRODUCTION AND MARKET SIZING

Investment in energy efficiency in US buildings overall totaled $18 to $20 billion in 2011, with that number expected to scale to $28 to $30 billion annually by 2020 from private debt financing.[ii] The investment opportunity in energy efficiency building retrofits is indisputably large, and the market is growing steadily. Yet, unlocking the full potential of the opportunity remains difficult.

Energy Efficiency by the Numbers

- The entire building sector consumes 49% of all energy used in the US and 73% of US electricity consumption[iii]
- Investment in energy efficient US buildings stood between $18 to $20 billion in 2011, with potential to scale to $28 to $30 billion by 2020[iv]
- Scaling building energy efficiency retrofits represents a $279 billion dollar investment opportunity[v]
- Scaling building retrofits could mitigate more than 600 million metric tons of CO2/year and yield $1 trillion in energy cost savings over the next 10 years[vi]
- The market can be broken down by (1) building sector, including Residential, Commercial, Institutional and Industrial, or (2) buyer type. Figure 1.1 shows market size by building sector.

Figure 1.1 Energy Consumption by Sector in the United States[1]

	Residential				Commercial									Institutional				Industrial[2]		
	Single Family	2-4 Unit Building	5+ Unit Building	Mobile House	Food Sales	Food Service	Lodging	Mercantile	Office	Public Assembly	Service (other than retail & food)	Warehouse/ storage	Other	Education	Healthcare	Public Order & Safety	Worship	Manufacturing	Warehouse/ Distribution	Power Plant
Energy Consumption (Quadrillion BTU)	10.6				4.8									1.7				*		
Total Investment Opportunity ($Bn)	$182B				$72B									$25B				*		

Source: Deutsche Bank Climate Change Advisors and the Rockefeller Foundation. *United States Building Energy Retrofits: Market Sizing and Financing Models*. 2012; DOE's Building Energy Data Book.

Notes: (1) * Energy consumption is measured by site energy consumption ("delivered energy"); excluding off-site consumption. Breaking out energy consumption by the 'MUSH' (Municipal, University, Schools and Health) category proved infeasible due to lack of publicly available data; additionally, government owned buildings span across various building segments, including residential, office and public assembly, and so the 'MUSH' segment has not been called out explicitly. Sub-segments are not exhaustive, rather illustrative, to demonstrate building types. (2) Energy consumption data across the Industrial building sector has not been included because these building types are characterized by irregular energy usage; existing data sources and studies have not been consistent and comprehensive, and thus estimates would be misleading.

While Industrial buildings comprise a major energy consuming real estate sector, we have not included energy consumption estimates for this building type as existing data sources and studies have not used consistent methodologies across all building types, and thus estimates would be misleading. The building energy efficiency market can be broken down by (1) building type and (2) buyer type. To characterize the market size for building energy efficiency, we have broken down energy consumption by *building type*. For the remainder of this paper, we will address *buyer type*, which includes the labels MUSH (an acronym standing for Municipal, University, Schools, and Hospitals, which represent the state and local buyers that have similar buying considerations due to tax structures) and Federal as buyer considerations are core to the issues of financing drivers, barriers, and overall market traction.

Over the past 30 years, Energy Service Companies, or ESCOs, have provided a significant portion of building energy efficiency services and solutions, largely by deploying financing structures that remove customers' upfront cost barriers for equipment and installation services. During this time, ESCOs focused on the Public and Educational sectors, also referred to as the MUSH sector (for Municipal, University, School, and Hospital) and the Federal building sector. A similar opportunity exists to unlock the commercial building sector through financing. Yet, commercial building owners and operators have been reluctant to engage with the traditional financing solutions, ESCO contracts, due to availability of capital, split incentives, complex approval processes and a view that this financing is an expensive option. In response, a number of financing structures have emerged to capture the untapped efficiency savings in the commercial real estate market.

New emerging financial mechanisms comprising public and private capital facilitate the implementation and financing of efficiency projects. In addition to leveraging private capital within the commercial sector, these structures differ from the traditional ESCO structure by offering shorter terms and restructuring risk allocation. The following pages review three different financing structures that have emerged to enable the growth of this market:

- **Energy Service Agreements (ESA)/Managed Energy Service Agreements (MESA)**[1]
- **On-Bill Financing (OBF)**
- **Property Assessed Clean Energy (PACE)**

These mechanisms are used to finance three different methods of delivering building energy retrofits that vary in cost and savings potential. These methods can cover a full range of solutions (including both equipment and services) for optimizing Building Envelope, Equipment Upgrades and Operational Efficiency. See Figure 1.2 for a breakdown of building energy consumption by end device.

- **Building Envelope:** retrofits to static, non-energy consuming building components to lower energy demand, including insulation and air sealing, roofs, walls, windows and doors
- **Equipment Upgrades:** retrofits to energy-consuming components and controls to meet building operational needs with lower energy consumption, such as boilers, chillers, cooling towers and lighting.
- **Operational Efficiency:** services provided by building operators or third parties to tune, maintain and verify the performance of building envelope and equipment, such as commissioning, recommissioning, Measurement & Verification (M&V) and maintenance.

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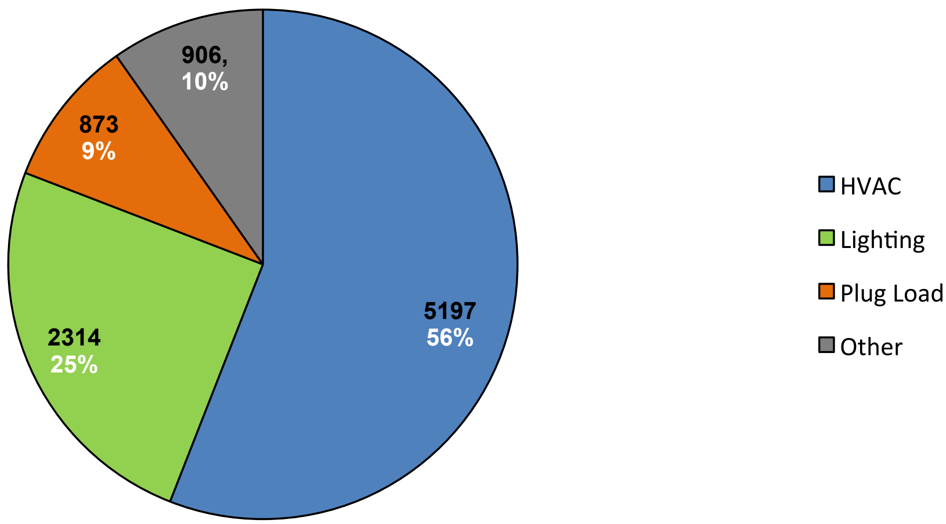
[1]The terms ESA and MESA are used interchangeably, and will be considered jointly as one of the three financial structures outlined in this paper. Many new individual project integrators have created their own deal nomenclature at this point, but we use the ESA, Energy Services Agreement, as the highest level framework for discussion. Both structures provide Energy Services, with investment by third parties, contractualized by energy service agreements with the building owner.

Figure 1.2 Annual Energy Consumption for 100,000 sq. ft. Office *(MMBTU)*



NOTE: "Other" category assumed to be critical or otherwise uniterruptible loads
Source: Cleantech Group analysis; EIA, DOE

Operational efficiency measures are what keep the equipment within the building operating efficiently. This process is becoming more effective due to better data collection and analysis, which allow for finer tuning of systems, preventative maintenance, and better decision making indicating when retrofits are needed. Greater access to data and the resultant new technologies have created greater potential for efficiency gains in the commercial sector, leading to even greater potential investment returns. The key technological advances underlying this momentum include:

- **Sensors:** A continuing reduction in sensor costs coupled with increased sensor capabilities have opened the door for diverse, more precise, and cost effective applications within buildings. Driven in particular by increased demand for embedded-control applications, annual revenue for advanced sensors will reach $3.7 billion with shipments exceeding 28 million units by 2020.[vii] In addition to becoming smaller and cheaper, sensors are getting more sophisticated communication capabilities. Dominant players in the market, including Panasonic, Melexis and ULIS, are deploying wireless sensors in place of hardwired devices to provide greater energy efficiency while using less power for data collection itself. With broader availability of sensors in the building comes the capability to monitor and impact consumption at a more detailed, device-specific level. In turn, sensors have helped new building efficiency technologies and applications proliferate, from remote auditing to more advanced building control systems. Deploying networked sensors within a building optimizes resource consumption by creating automated feedback mechanisms based on usage patterns for resources like energy and water. In addition to managing energy use, sensors also play a critical role in fault detection, enabling building operators to identify in advance when equipment will fail or need to be tuned. Advanced sensors are increasingly becoming the foundation for smart buildings to understand and respond to changing conditions.

- **Smart Meters,** or utility meters that are equipped with advanced communication, are replacing customers' analog electric meters and providing greater access to energy use information. Approximately 43 million smart meters have been deployed in the US to date, with 65 million smart meters total to be deployed by

2015.[viii] Smart Meters automatically capture real-time information in hourly or shorter intervals on building electricity consumption and digitally relay the data to utilities. This capability replaces "trucks rolls," or the practice of utilities driving from building to building to manually read meters. This data can also be relayed back to commercial building owners and managers through energy dashboards, which are used to better understand building energy consumption and performance Collecting continuous energy data allows utilities to deploy demand response systems to shift energy-intensive loads away from peak demand times, enable dynamic pricing based on network demand, and implement other advanced distribution and demand-side services.

There are four different real estate buyer types to consider when discussing building efficiency, comprising (1) Municipal, Universities, Schools, and Hospitals, or the MUSH segment (which will include Federal for the purposes of this paper given analogous buying considerations), (2) Residential, (3) Commercial, and (4) Industrial. While the MUSH and Federal real estate segments have been traditional customers of energy efficiency services thus far, the commercial and industrial real estate markets are increasingly poised for growth given the potential size of the markets and the resulting potential portion of the market that may be opened through new financing solutions.

- **Municipalities, University, Schools and Hospitals (MUSH):** Properties owned and operated by government entities and nonprofit institutions. The MUSH segment represents the majority of ESCO projects over the past three decades, accounting for 73 percent of ESCO revenues. Several aspects of the MUSH real estate sector make it particularly well suited for ESCO financing, including: the buildings are either owner occupied or have long leases and are generally large and/or exist within a portfolio of buildings; the owning organizations have tight operating and capital budgets, and are often able to make use of tax-exempt lease structures, and have high, stable credit ratings. All of these factors make them ideal partners to enter into the type of long-term contracts provided by ESCOs.[ix]

- **Residential:** Residential properties consist of single-family residences, two to four unit buildings or 5+ unit buildings. These are usually highly fragmented properties by ownership (either owned or rented) with varying occupancy lengths. Financing for energy efficiency upgrades is typically from traditional sources of funding including unsecured loans and home equity lines of credit. Utility or state-administered rebates and government funds are also used to finance low-tech projects such as simple appliance upgrades or window installments. Small project sizes and corresponding long payback periods have prevented robust financing from developing in the residential sector. The weak appetite among investors to engage in this space is also driven by split incentives and other complexities resulting from the inherent fragmentation of this market.

- **Commercial:** Commercial buildings represent office and retail buildings, warehouses, private educational and health-care buildings and hotels. The sector accounts for 19% of the energy consumed in the United States and comprises small to large businesses with varying occupancy lengths. Figure 1.3 details the distribution of energy consumption and floor space across commercial sub-sectors. In the past, financing within the commercial sector came from both traditional bank loans and self-funding (the latter usually only seen in large corporations). Innovative third party financing structures that harness private capital, such as PACE and On-Bill Financing, are becoming increasingly popular within the commercial sector.

- **Industrial:** The industrial sector, including manufacturing, production, processing and warehouse facilities, has undergone impressive technological advancement in energy efficient equipment to offer much needed energy reductions in the largest energy consuming sector in the United States. While estimates vary, this sector accounts for nearly a third of total energy consumption in the United States, representing a large potential opportunity for efficiency due to the sheer size and scale of its operations. Yet, industrial environments are much more diverse and complex compared to the commercial sector, often utilizing high-intensity advanced machinery with bespoke configurations and narrow operating constraints in terms of performance and reliability. Furthermore, unlike office environments, manufacturing processes often represent an industrial company's IP and competitive differentiation. While service providers and technologies exist to improve these processes, standardization to common best practices remains a low priority (and even a risk) for industrial operations managers. As a result, while a large portion of the market by energy consumption, the industrial sector is viewed as a very difficult market to address at scale and speed necessary.

Given these market sector characteristics, the commercial sector holds the greatest opportunity for efficiency upgrades. As a result, the market is well-suited for private capital to speed up the adoption of energy efficiency building technologies within this particular real estate segment.

Figure 1.3 Share of Buildings by Type and Primary Energy Consumption

Building Type	Total Floorspace	Total Buildings	Primary Energy Consumption
Office	18%	16%	22%
Warehouse/Storage	16%	13%	8%
Mercantile	15%	14%	15%
Education	13%	7%	10%
Public Assembly	7%	7%	6%
Lodging	7%	3%	7%
Service	5%	10%	6%
Health Care	4%	3%	8%
Food Service	3%	7%	7%
Public Order/Safety	2%	2%	1%
Food Sales	1%	4%	4%
Vacant	8%	12%	2%
Other	2%	2%	3%

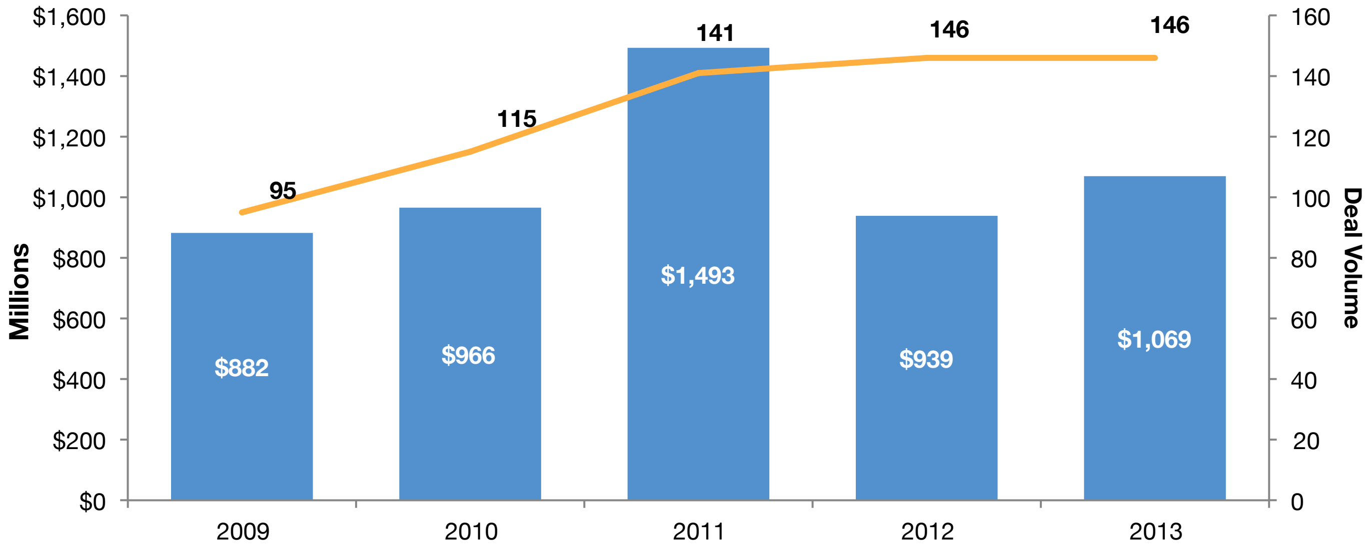
Source: DOE2005: Buildings Energy Databook, Table 2.2.2

TECHNOLOGY SEGMENTS

The four largest segments of building technologies are reviewed below, including a description of the technologies' role within the building, general level of energy consumption, and new technologies emerging within each technology type and associated levels of efficiency gains. Throughout the section, venture capital investment levels are used as a proxy to indicate amount of focus on innovation and highest potential companies in the space.

Overall, venture investors have shown a great deal of interest in the potential of the building energy efficiency space over the past 5 years. As depicted in Figure 2.1, investment for the past 5 years has totaled $5.3 billion dollars and grown at an annual rate of 4%.

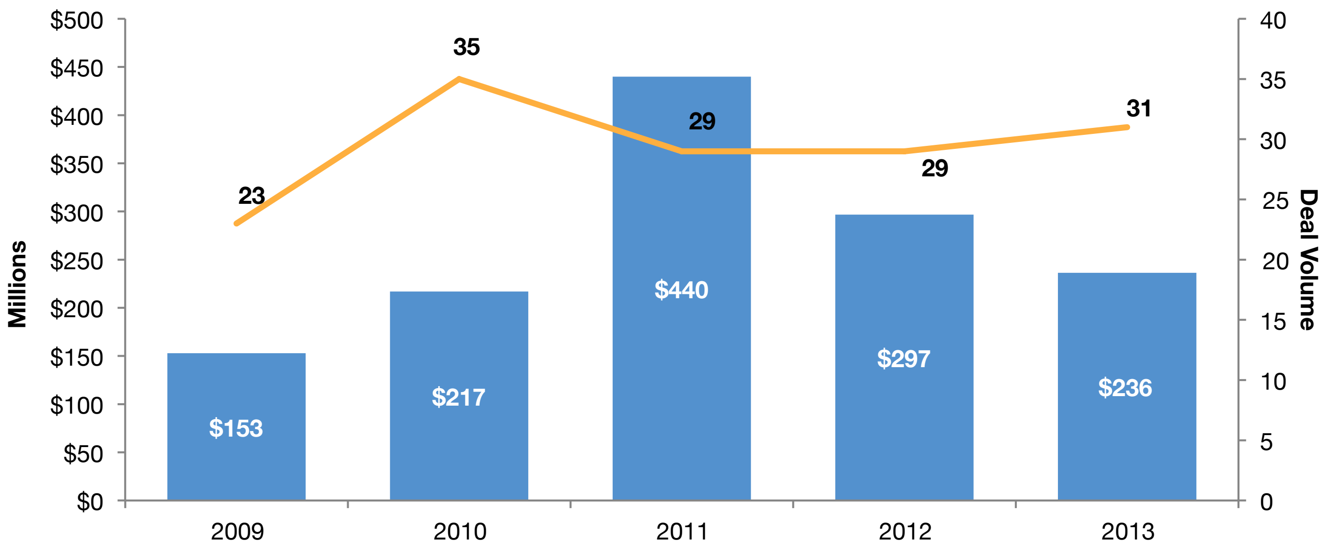
Figure 2.1 US Venture Investment in Energy Efficiency



Source: Cleantech Group analysis

Lighting

Figure 2.2 US Venture Investment in Lighting



Source: Cleantech Group analysis

Overview

In the United States alone, reducing lighting energy use by 40% would save $53 billion in annual energy costs, and reduce energy demand by the equivalent output of 198 mid-size power stations.

The market for commercial lighting is undergoing a major transformation as falling prices and improving quality for light-emitting diode (LED) lighting has begun to drive widespread adoption of this technology. Yet, due to the much longer lifespan of LED lamps, overall revenue from lamp sales will actually decrease in the coming decade, even as a greater portion of sales goes to more expensive lamp types[x].

To avoid this inevitable decline, companies are broadening their offerings to include lighting controls and lighting services. Revenue from LED lamp sales in commercial buildings is forecasted to rise to $8.7 billion by

Figure 2.3 Major Players in Lighting Segment

Company	Location	Founded	Date Funded	Amount Raised
Genesys Systems	United States	2009	10/22/2013	$8,128,400
Enlighted	United States	2009	10/8/2013	Undisclosed
LuxVue Technology	United States	2009	05/02/214	Acquired by Apple
Lucibel	France	2008	12/18/2013	$12,300,000
Glo	Sweden	2005	3/18/2014	$30,000,000
Lime Energy	United States	1997		
OSRAM (Siemens)	Germany	1906		
Solatube International	United States	1986		
WattStopper	United States	1984		
Schneider Electric	France	1836		

Source: Cleantech Group analysis

2021, growing at a compound annual growth rate of 23.2 percent[xi]. Overall, however, revenue from lamp sales will stay flat through 2017 before beginning a steady decline.

Picture 1: Cree LED Light Bulb

Source: Cree

Technology Characterization

LED

LEDs (light emitting diodes) are semiconductor-based devices that emit light when current flows through them. The color of the LED is dependent on the material it is made from and typically occupies a very narrow spectrum. LEDs have been around for decades, but generally have not been able to produce the quality and quantity of light suitable for use in general lighting. This is now changing, with total light output per device going up, efficiency improving, and cost of device coming down.

A LED lighting system is composed of chips and wafers, a package, a lighting module and a lamp and lighting system. A chip consists of:

- active layers that emit the light
- substrate that supports the structure upon which active layers are grown

As the chip, a semiconductor, is critical to the efficiency and performance of the light, it provides the key to LED lighting adoption: the more efficient the chip, the fewer LEDs are required in the module and the smaller and cheaper the heat sink can be.

The composition of the chip is central to its performance and cost. Currently, the majority of white LEDs use gallium nitride (GaN) as the active semiconductor material. This material offers several options of substrates, the most commonly used being a sapphire substrate (used in 90% of commercial LED devices). Yet, silicon could potentially lower the cost of LED manufacturing significantly because it is much cheaper as a material and also because of the supply chain infrastructure that is already in place for silicon-based devices. As a result, there has been significant desire for and investment in developing ways of growing GaN-on-silicon, even amidst recognized technical challenges. Because sapphire currently generates more lumens per watt than silicon-based devices, sapphire is projected to prevail in the short term, particularly in the price-sensitive, less performance-led residential market.

The market size for new installation LED light sources is currently $3.5 billion, but is expected to increase to $12.5 billion by 2020.[xii] This movement in value from replacement to new installation means that LED lighting companies will need to develop new service models in order to access the installation market. For a typical replacement light, an LED lamp will use 70% less energy than an incandescent lamp and 50% less than a fluorescent lamp. As an illustration, an incandescent lamp has an efficiency of 8-12 lumens per watt, a typical lifetime of 1,000 hours and a 40W power equivalent. LED lamps boast 52-67 lumens per watt, 25,000 hours of typical lifetime and 6W power equivalent.[xiii] LEDs are also evolving much faster than any other lighting technology: while fluorescent tubes have doubled in efficiency since 1950, white LED efficiency has increased by a factor of ten since 2000. Today, LEDs are among the most efficient lighting sources available, and are predicted to eventually surpass competitors' market share to become the lighting technology of choice for most applications – with energy savings reaching up to 90% compared to today's conventional technologies.

The costs of LEDs have decreased substantially over the past decade, and are expected to decline even further during the following decade. Market data from 2012 indicates that the price of 'cool white light' LEDs fell more than 50% from $13 to $6 per thousand lumens, from 2010 to 2011.[xiv] Yet, despite rapid price declines, the initial cost of LED lighting products is much higher than the equivalent incandescent replacement, up to 12 times more expensive. Economic payback of five years or less for total cost of ownership has been reported during the most recent LED trials, indicating the LED market is still a few years from mass adoption in commercial settings. Despite increased production and demand of LEDs, the cost of LED lighting components is not yet at parity with incumbent technology prices.

> *"Installation and commission varies by design because of the flexibility of product offerings (lighting, HVAC, plug loads, fans, and others) and customer needs. It comes down to how many points within a building you are trying to control."*
>
> VP of Marketing and Channel Partnerships,
> Lighting Controls Company

Low Ambient/Task lighting

Low Ambient/Task lighting is a lighting scheme that reduces the necessary overhead light level through the use of specific, individually controlled light fixtures designed to provide light directly where needed. Task-ambient lighting's designs consist of a general uniform lighting system supplemented with local task luminaires. Task-ambient design approaches save energy when compared with most general lighting strategies, because higher light levels are provided for the task areas only. For example, in a task-ambient design, lighting fixtures might be concentrated primarily over work areas, with an additional indirect lighting system providing relatively low levels of general (ambient) luminance. Thus, when compared to a more traditional design, which might rely on a uniform layout of direct lighting luminaires, task lighting reduces the average light level for the room, reducing the number of required light fixtures. This design strategy usually requires point calculations to insure that luminaires are correctly located to produce the lighting level and quality necessary for performing visual tasks at the needed locations. Low Ambient/Task lighting can achieve energy savings of 15% to 20% as compared to conventional overhead lighting while also providing cost-effective maintenance over time.

Daylighting

Daylighting is the practice of utilizing the outdoor ambient light in intelligent ways to reduce the lighting requirements inside a structure. Daylighting can be achieved or enhanced through skylights, windows, light shelves, and reflectors, as well as many other methods. Designing for daylighting has to be considered at the earliest stages of building design. The orientation of the building and glazing relative to the sun path is the single most important decision. This is followed by design of the facades and roof, selection of glazing systems, and daylight controls such as blinds and louvres. LEED and other comprehensive energy retrofit guidelines often include incentives for the use of daylight in building design.

Intelligent Lighting Control

Lighting control systems refer to an intelligent networked system of devices that communicate between various inputs and outputs related to lighting control. These devices may include relays, occupancy sensors, photocells, light control switches or touchscreens, and signals from other building systems, such as security or heating systems. Adjustment of the system occurs both at device locations and at central computer locations via software programs or other interface devices. Advanced controls and monitoring systems can allow unoccupied spaces to consume less light and, therefore, less energy.

The market for lighting controls in commercial buildings has transformed dramatically in recent years. Demand for local controls such as occupancy sensors and photo-sensors, as well as networked controls, is on the rise as adoption rates of LED lighting begin to climb and controls technology improves and becomes less expensive. Building owners and managers, many of whom have become accustomed to the idea of centrally monitoring and managing their HVAC systems, are beginning to expect the same level of control from their lighting systems.

Figure 2.4 Case Study of Lighting Installation

Digital Lumens

Developer of intelligent LED-based lighting systems for industrial facilities

Case Study: Stone Brewing Company, Escondido, CA

Project Characteristics

Retrofit Size	69,000 square feet
Building Operational Schedule	24 x 7
Service Type	Lighting
Specific Solution	Digital Lumen's Intelligent LED Lighting System over T8 Fluorescent Alternatives

Results*

Annual Energy Savings	86%
Cost Savings	79%
Payback	1.77 year project payback

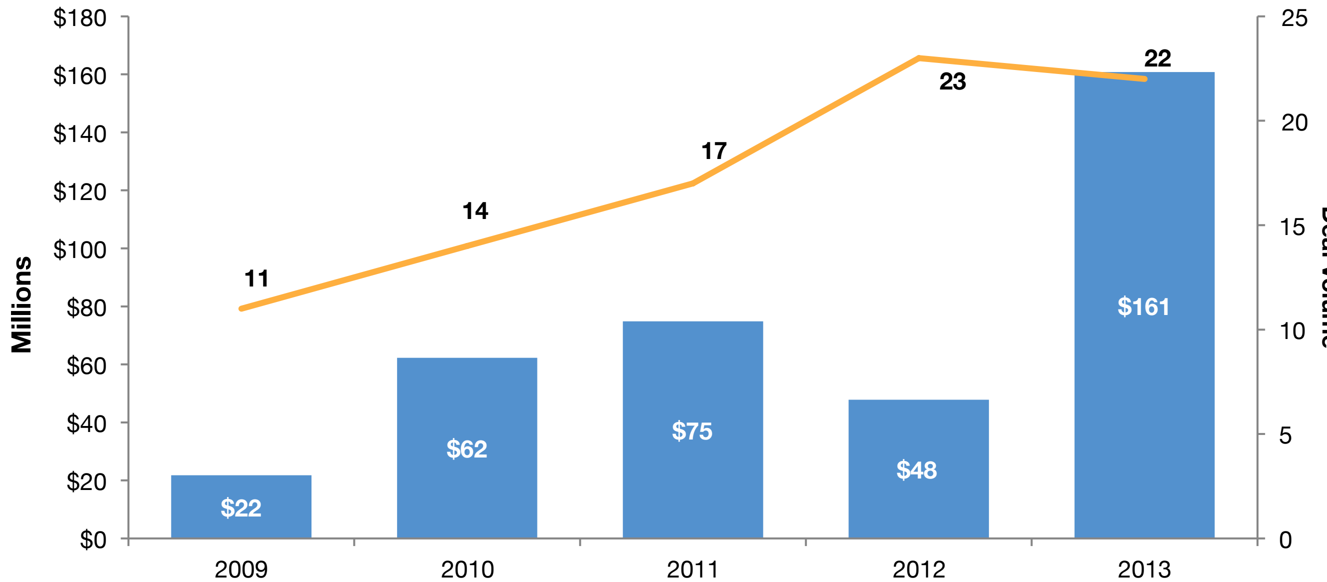
*compared to annual energy costs associated with basic LED alternatives

Select Retrofits Undertaken

- Wirelessly enabled every fixture to provide personal remote controlsIntegrated daylight harvesting sensors built into every lighting fixture
- Instantaneous dimming, between 0% and 100%, to adjust to changing light levels
- Daylight harvesting sensors that operate in conjunction

Heating, Ventilation and Air Conditioning

Figure 2.5 US Venture Investment in Heating, Ventilation, Air Conditioning & Cooling (HVAC)



Source: Cleantech Group analysis

Overview

Heating, Ventilation and Air Conditioning (HVAC) systems are one of the largest energy expenditures within a building, representing nearly 56% of a commercial building's total energy consumption.[xv] Efforts to improve the efficiency of heating and cooling technologies have been made over the last several decades through upgrades to thermal distribution systems and advanced component technologies. Air conditioning systems have increased in efficiency nearly 30 to 50 percent since the 1970s.

Even with this progress there are still substantial advances in both the design and efficiency of HVAC equipment being made through core technology improvements and information technology integration. The expected efficiency gains are correlated with an overall projected annual growth in energy efficient HVAC systems from $3.9 billion in 2013 to $9 billion in 2020.[xvi] Installing highly efficient HVAC equipment would tackle one of the largest items on a building's utility bill, while also realizing substantial energy reductions. Historically, implementing HVAC upgrades has been difficult because HVAC systems represent one of the most capital intensive retrofit projects, resulting in high first cost barriers to implementation and longer pay back periods. New technologies, paired with access to greater finance, are slowly tackling these barriers.

Figure 2.6 Major Players in HVAC Market Segment

Company	Location	Founded	Date Funded	Amount Raised
Aircuity	United States	2000	7/25/2013	$3,000,000
Efficient Energy	Germany	2006	5/13/2014	$19,500,000
SNTech	United States	2007	12/13/2013	$500,000
MicroStaq	United States	2001	10/1/2010	$10,200,000
Phononic Devices	United States	2008	3/28/2014	$26,000,000
Hitachi	Japan	1910		
Ingersoll-Rand	Ireland	1871		
JCI	United States	1885		
Trane	United States	1913		
Lennox	United States	1999		

Source: Cleantech Group analysis

Technology Characterization

Heating consists of boilers, furnaces and heat pumps that heat or burn fuel to produce hot air and water that is circulated through ductwork or piping within a building. Cooling applications consist of chillers and air conditioners that distribute cool air or water through pipes, ducts or condensed coils in a building. Ventilation is the process of replacing or exchanging air in a controlled temperature to remove contaminates to improve indoor air quality. This process can take place under either forced or mechanical ventilation or natural ventilation using dehumidification or humidification and air cleaning systems.

Most commercial and public buildings utilize similar heating and cooling technologies. Many of these technologies remain relatively similar from years past, but have been undergoing small efficiency improvements over time.

HVAC upgrades can be broken down by:

- Single technology improvements (e.g., heat pump installations)
- Modern ventilation systems (e.g., air units with energy recovery ventilators)
- Integrated systems (e.g., bundle of various technologies into one system)

Picture 2: Aircuity Sensor Suite used for Demand Control Ventilation (DCV)

Source: Aircuity

Heating

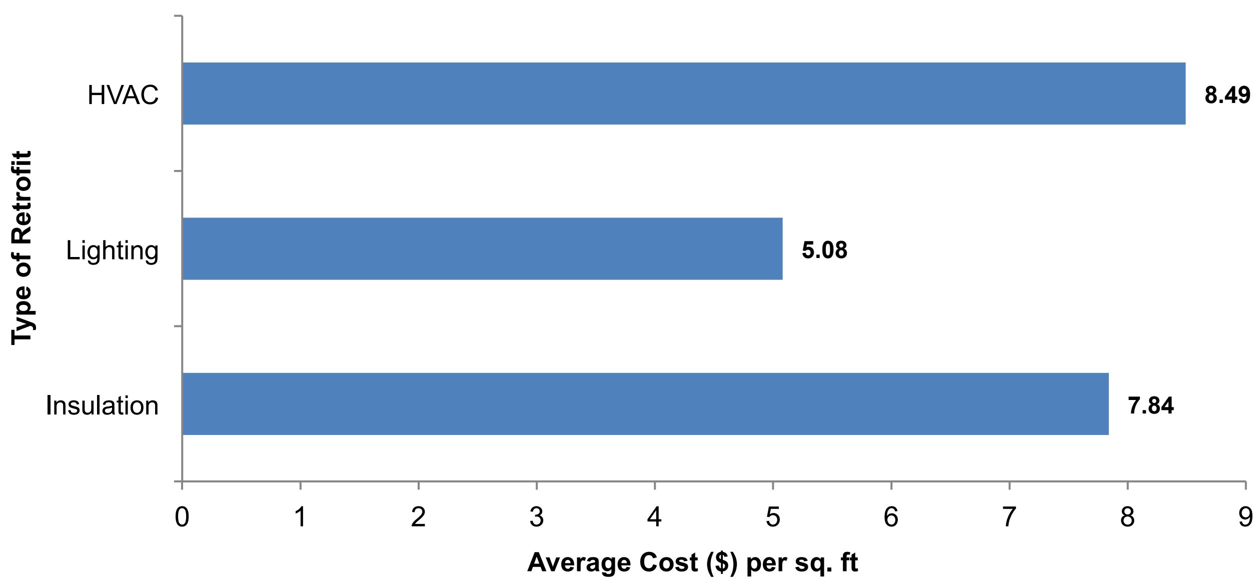
Most commercial and industrial buildings employ the same heating technologies that have been available for many years. Still, heating systems have undergone improvements in technologies that have created more compact and efficient systems, including boilers, furnaces and packaged heating units.

Boilers

Boilers, one of the most common technologies used in heating commercial buildings, have been rapidly evolving. Boilers produce hot water or steam that circulates heat through piping within a building. Usually, they are deployed in central heating systems within larger buildings such as universities and large medical or commercial campuses. Traditional boiler systems, consisting of centralized plants distributing heat across numerous buildings, have been replaced by more efficient technologies such as condensing boilers and renewable or all-electric fuel boilers.

Condensing boilers are much smaller, lighter and able to recover more latent heat than their predecessors. Condensed boilers achieve a thermal efficiency ranging from 84% to 96% and have a 3 to 6 year payback period.[xvii] Many other efficiency upgrades to HVAC units have payback periods up to 20 years, making condensing boilers a more attractive investment.

Figure 2.6.1 Average Cost of Select Technology Retrofits



Source: UCLA: Retrofitting Commercial Real Estate

Note: Average cost calculated through a survey of various building retrofits (including, but not limited to, lighting control systems, occupancy sensors, heat pumps, weather sealing within Lighting, HVAC, and Insulation)

Furnaces

Furnaces produce hot air through burning fuel, either oil or gas, then distribute this hot air through a building's ductwork. Furnaces are optimized for heating small areas in commercial buildings, such as small offices and banks, because forced air furnaces are less effective than boilers at distributing hot air. Modern furnace equipment has been upgraded using secondary heat exchangers, variable speed air blowers and sealed combustion to achieve fuel efficiency between 95% and 100%.[xviii]

Boilers and furnaces achieve efficiency scores above older technologies when upgraded with improved technologies, but newer technologies are often significantly more expensive than their older replacements. Condensed boilers may cost on average 70% more than conventional systems. Depending on the cost of fuel being used, the higher equipment cost may be recouped more quickly in lower energy bills.

Cooling

Cooling is especially critical for office and commercial buildings because of the latent heat given off by occupants and machines within a building. In order to retain comfort for occupants and reliability of the machines within a building, heat must be expelled efficiently. Cooling is done primarily with four different types of technologies: chillers, air conditioning, chilled beams, and heat pumps.

Chillers

A central chiller system is most often employed in large commercial buildings and Municipal, University, School, and Hospital (MUSH) segments. In these systems, a large sink of water is chilled and piped through terminal equipment including wall units and other small blowers throughout various areas of a building. More complex piping systems require extensive installation and typically only distribute cooling in one building, as opposed to multiple locations. Advances in component efficiency have improved the performance of chillers, for example:

- **Magnetic bearing compressors** reduce friction on terminal equipment components which increase the efficiency of chillers and provide a payback period of 4 to 10 years.
- **Variable speed chiller controls** optimize chiller systems by creating a network-based strategy for the entire system, instead of optimizing individual component elements.

Air Conditioning

Air conditioning provides cooling, ventilation and humidity control through the removal of heat. Air conditioning installations can be:

- Central units that use ductwork to transfer cooled air through various locations in a building
- Standalone appliances installed in different parts of a building

Advances in air conditioning technology have vastly increased the efficiency of these systems. Variable refrigerant flow (VRF) HVAC systems are ductless systems that use refrigerant as a heating and cooling medium in air conditioning units. Ductless cooling systems require significantly less energy than conventional cooling systems by avoiding duct-related losses that account for nearly 30% loss in system efficiency. Ductless systems are preferable to ducted systems because they are easier to install into older buildings and do not require detailed modifications to a building.

Ductless heating and cooling systems have been used for over 30 years and represent nearly a quarter of the global commercial air conditioning market. North America holds roughly 3% of global market share, having just entered the market in the early 2000s. Ductless systems in the US are expected to grow at a compound annual growth rate of more than 14 percent from 2013 and 2020. Yet, duct systems have a downside: the equipment is typically 30% more expensive than conventional systems. Despite the higher cost, global annual revenue from ductless cooling systems will grow from $3.9 billion in 2013 to $9 billion by 2020, representing nearly 30 percent of total energy efficiency HVAC systems revenue.[xx]

Chilled Beams

A chilled beam is a convection system used to either heat or cool large buildings. Water is used to condition an occupied space, which is then piped through a beam in the ceiling of a room until the space is cooled. Lower operating cost is the primary advantage of this solution. Chilled beams rely on cooling and heating air rather than forced air circulation, which is more costly to maintain through circulation fans. Cost savings between 10 to 30 percent compared to other chilled water systems are expected for chilled beam systems.

Heat Pumps

Heat pumps are an energy efficient alternative to both furnaces and air conditioning systems that provide space heating and cooling as well as hot water in buildings. Heat pumps use renewable energy from the environment (ambient air, water or ground) to generate heat. They can be used either in air conditioners, reversible air conditioners or chillers. Two types of heat pumps are used in commercial applications: air-source heat pumps and ground-source heat pumps. These systems are much more efficient than conventional air conditioning or cooling because they move, rather than create, heat.

Ventilation/Indoor Air Quality

Beyond heating and cooling technologies, ventilation is a key component required to maintain occupant comfort inside buildings. Ventilation equipment can be separated into forced ventilation and natural ventilation systems. Current HVAC systems are designed to supply ventilated air based on expected occupancy, which often results in over-ventilation.

> *"While it is clear that airside efficiency initiatives can save significant amounts of energy and money, there is no single standardized methodology for verifying the results of these projects."*
>
> VP of Marketing, HVAC Technology Vendor

Demand Control Ventilation (DCV) is a concept which has been on the market for over 20 years, but has just now become viable due to reductions in sensor costs. DCV consists of placing discrete sensors throughout a building and using the data from the sensors to regulate ventilation accordingly. Historically, conventional ventilation systems have underperformed due to prohibitive costs, sensor inaccuracy and maintenance requirements, but improvements in DCV technology have drastically reduced cost and improved performance of ventilation systems.

HVAC Networking and Controls

As consumer preferences shift, occupants are demanding greater control over their working and leisure spaces. In turn, a growing emphasis on occupant preferences has sparked a new trend in HVAC controls and networking, which focus less on equipment-specific upgrades and more on networking systems and distributing control.

Controls and diagnostics have vastly improved the efficiency of HVAC systems. Wireless communications driven by increasingly low cost sensors, as seen in other building equipment like lighting and building controls, promote localized and personalized control of indoor climates. Digitally integrated humidity and temperature sensors can provide an opportunity to get even more energy savings from upgraded equipment. For example, localized heating or cooling build-up from inefficient boilers or chillers can be diagnosed and controlled from temperature sensors equipped within an office or cubical. Additionally, temperature control shifting from one central point to multiple locations can be optimized through sensor installments.

Sensors can also be used to improve indoor air quality by using intelligent ventilation systems. Gas sensors can detect air contamination based on the presence of volatile organic compounds (VOCs) and adjust the duration and intensity of ventilation accordingly.

Figure 2.7 Case Study of HVAC Installation

Aircuity

Manufacturer of ventilation management systems for commercial buildings

Case Study: University of California Irvine

Project Characteristics

Retrofit Size	Avg. 100,000 sq. feet/lab building
Number of Buildings	10
Service Type	HVAC
Specific Solutions	Demand Control Ventilation

Results

Average kWh Savings	57% per building
Energy Reductions	Reduced airside energy use by ~50 %

Select Retrofits Undertaken

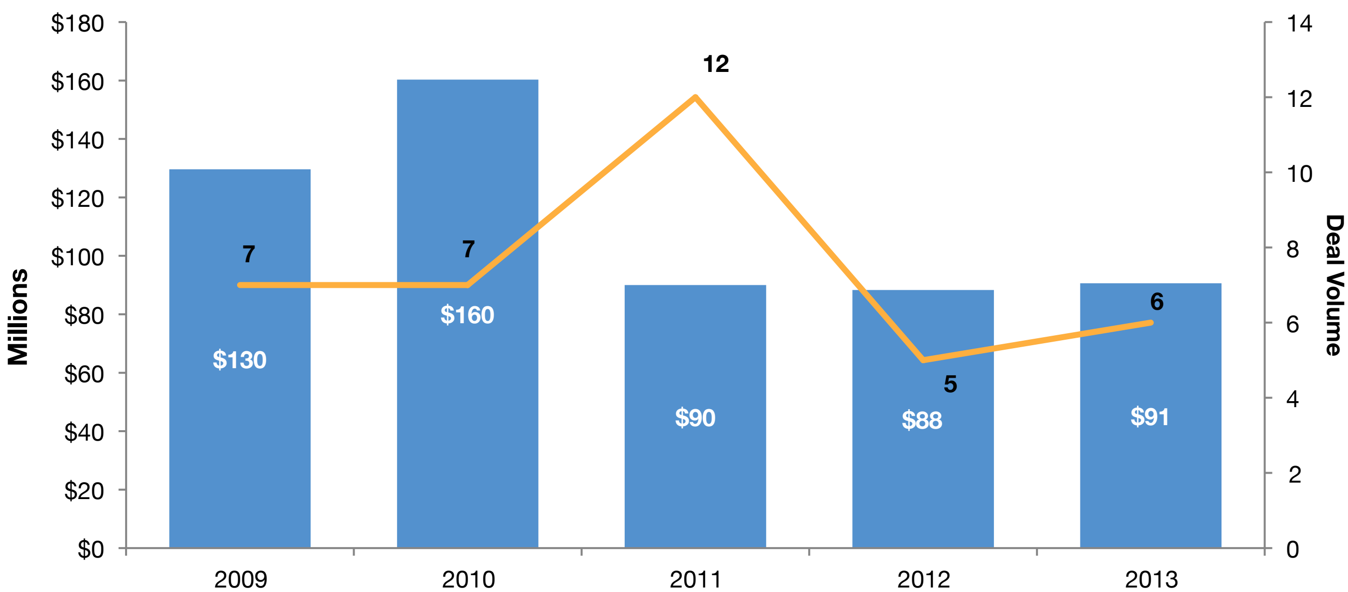
- Implemented Aircuity "Smart Lab solutions across campus laboratory buldings
- Installed Centralized Demand Control Ventilation (DC) systems
- Utilized Aircuity Advisor Services to provide continuous commissioning and monitoring to achieve maximum energy savings

Building Envelope

Overview

The building envelope is the interface between the interior of the building and the outdoor environment, and therefore plays a major role in regulating interior temperatures. Given that within the overall US building sector, space heating and cooling account for over one third of all energy consumed in buildings, rising to as much as 50% in cold climates[xxi], the building envelope's impact on energy consumption is a key part of building efficiency.

Figure 2.8 US Venture Investment in Building Envelope



Source: Cleantech Group analysis

Figure 2.9 Major Player in Buiding Envelope Segment

Company	Location	Founded	Date Funded	Amount Raised
View	United States	2006	1/17/2014	$296,300,000
Kinestral Technologies	United States	2010	2/26/2014	$23,000,000
Heliotrope Technologies	United States	2012	8/21/2013	$3,050,000
Project Frog	United States	2006	11/7/2013	$57,590,000
Datum Phase Change	United Kingdom	N/A	8/30/2012	$25,000
SAGE Electrochromics	United States	1989	11/11/2010	$133,500,000
SAINT GOBAIN	France	1885		
Velux Group	Denmark	1941		
Masonite	United States	1924		
The Atis Group	Canada	2004		

Source: Cleantech Group analysis

Technology Characterization

There are two dominant perspectives on the relative importance of the building envelope and heating and cooling equipment. The passive design approach supports high levels of energy efficiency in building envelope components, with any remaining need for heating or cooling met by basic, efficient mechanical equipment. The smart technology approach promotes high energy efficiency in mechanical equipment because it is routinely replaced and it is easier to install than retrofitting old, inefficient building envelopes. This paper incorporates both perspectives in our analysis of the building envelope segment.

Building envelope design

New buildings can be fitted with integrated facade systems that optimize daylight while minimizing energy requirements for heating, cooling, artificial lighting and peak electricity use. Exterior shading, proper orientation and dynamic solar control should become standard features globally in new buildings and can also be applied to existing buildings. In new buildings, window-to-wall ratios can also be optimized.

Pilot projects have demonstrated that such systems can enable energy savings of up to 60% for lighting, 20% for cooling and 26% for peak electricity.[xxii]

Insulation and air sealing

Many different types of insulation, from blown-in dense-pack cellulose to spray-in-place soy-based foam products, are prevalent in the market. Regardless of the product, the goal of the insulation is to create a resistance for heat or cold, moisture, and air from entering or exiting the building. In addition, buildings need properly sealed structures to ensure low air infiltration rates, with controlled ventilation for fresh air. Air sealing alone can reduce the need for heating by 20% to 30%.[xxiii]

Roofs

There are two dominant roof geometries: pitched (sloped) roofs and flat roofs. Sloped roofs with cathedral ceilings (pitched roofs without attics that are open to the living space) are probably the biggest challenge for insulation, because the primary location for insulation is within the depth of the structural members.

Cool roofs

Over the past decade, energy efficiency within the roofing market has been focused on cool roofing. Cool roofs are designed to reflect sunlight and heat. Conventional roofing materials reflect only 5 to 15%, which means they absorb 85 to 95% of the heat from the sun. The coolest roofing materials reflect more than 65%, absorbing 35% or less of the energy from the sun. Cool roofs utilize light-colored materials such as thermoplastic polyolefin (TPO) to reflect sunlight and solar energy away from a building to keep it cooler.

In 2007, TPO accounted for 29% of the US commercial roofing market. Other popular materials include dark-colored materials like EPDM and asphalt-based roofing, which accounted for 7% and 11% of the market, respectively[xxiv].

Green roofs

Green roofs provide similar benefits to cool roofs. Green roofs are gardens or mini-ecosystems that cover an existing roof with the aid of special planters. The greenery shades the roof, reducing heat transfer and thereby keeping the building cool. Green roofs also act as insulators in cold weather and have a host of other benefits, such as absorbing rainfall for better storm water management, reducing air pollution and providing garden space in densely populated areas where parkland is rare.

Advanced roofing systems

Innovative solutions to improve performance also include higher-performance foam insulation (interior side), above-deck insulation boards and radiant barriers (with low-emissivity surfaces) on the underside of roof decks that can help in both hot and cold climates, although they are generally more cost-effective in hot climates for cooling benefits.

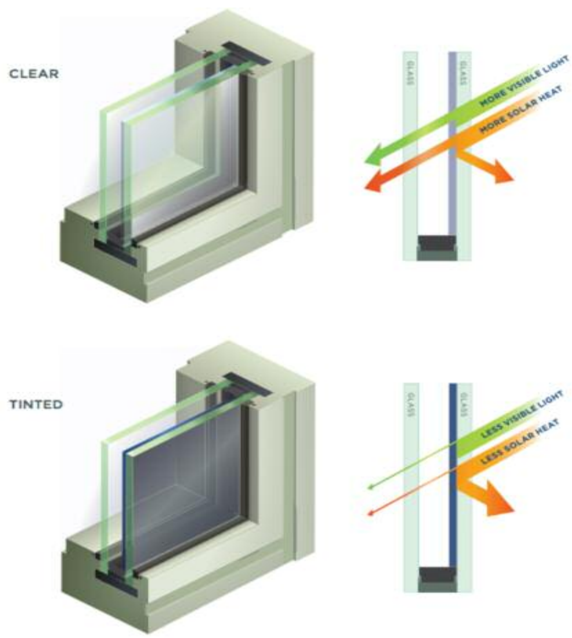
Integrated advanced roofing designs

Integrated advanced roofing designs have been developed by researchers at Oak Ridge National Laboratory (ORNL) using above-deck ventilation, insulation and radiant barriers that demonstrated a reduction of over 87% in peak heat flow through the roof surface. Expected energy usage is estimated at 50% less than conventional roofing designs, comprised of dark asphalt shingles fastened directly to the roof[xxv].

Windows

Window elements include framing materials, glazing, coatings, spacers between panes of glass, and low thermal conductivity inert gases to reduce heat transfer within cavities, thermal breaks and operating hardware. Traditionally, windows have been the weakest energy efficiency link in a building envelope.

Picture 3: View Dynamic Glass



Source: View

High-R windows

The standard today is a double-glazed low-E window with insulation between the panes. These windows can filter out 40% to 70% of the heat normally transmitted through clear glass.[xxvi] R-value is the measure of thermal resistance for a particular insulation material, and is used to determine the rate of heat flow. High-R window panels are pre-manufactured units designed to improve the insulating power of low-performing windows without costly retrofits or modifications to existing buildings. The panels use low emissivity coating and can be easily installed upon existing windows. When paired with a more integrated retrofit or in a new building, they can result in smaller, less expensive HVAC unit requirements, possibly offsetting the upfront capital cost.

Smart windows

Two types of windows dominate the smart window market: electrochromic windows and thermotropic organic polymer windows. Both dynamically change light transmission, transparency, and solar heat gain coefficients (the metric used to measure solar energy transmittance of a window or glass). Electrochromic windows achieve varied tinting values between 2% and 60% via electronic controls. Thermotropic organic polymer window filler darkens the window's surface as the temperature increases. Lawrence Berkeley National Laboratory estimates that advanced dynamic window technologies could save as much as 1 quadrillion BTUs of energy each year – more than 1 percent of the nation's annual energy consumption, or more than $10 billion in annual energy costs.[xxvii]

Though the savings potential for smart windows is massive, the cost for smart glass is steep, standing currently at $100 per square foot, and is a major barrier to mass adoption. The smart glass market is projected to reach US $700 million per year by 2020, with costs to fall 50 percent due to industrial-scale production and falling material prices.[xxvii i]

Exterior dynamic shade control

There has been significant interest in developing highly insulating windows with greater passive heating benefits. A mature market exists for exterior dynamic shade control (such as motorized blinds) that offers significant benefits for all buildings, regardless of their design, including the large stock of existing buildings.

A vacuum glazing combined with highly insulating frames whose edges have minimal thermal bridges, as well as dynamic solar control, can offer the best thermal performance with a wide range of solar control for all climatic conditions. Such a product can also optimize daylighting and minimize cooling in a variety of building applications.

Advanced frames and edges

Window edges usually conduct heat through solid material, so better edge design can significantly improve energy efficiency, particularly in conventional windows. Edge spacers, used in insulated glass with multiple layers of glazing, are often in aluminum with a desiccant and commonly have dual seals to increase structural performance and reduce moisture permeability.

Technological advances in advanced frames and edges include the use of lower conductivity materials such as very thin metals and polymers. Low-conductivity frame materials, such as vinyl with improved cavity configurations, perform significantly better than traditional materials such as aluminum. As a result, high-performance window framing systems have recently been developed that incorporate state-of-the-art thermal breaks, low-e interior frame coatings and advanced insulation within the frame cavity.

Walls

The majority of the world's wall construction involves a "stick built" framing structure (wood or metal studs) or a high thermal mass structure (stone, masonry or concrete). Framing structures allow for cavities to be filled with insulation, but the structural components remain as thermal bridges, with significantly higher heat transfer properties. High thermal mass structures were often built without any insulation but help conserve energy due to the inherent moderating properties of their thermal mass. Older framed structures often do not have insulation in cavities. Insulation strategies can make integrated solutions very complex if they involve a variety of insulation materials.

Structural Insulated Panels

A new approach to construction that has been growing in popularity includes structural insulated panels (SIPs). The high performance panels consist of an insulating foam core placed between two structural facings, typically oriented strand board (OSB).

Vapor retarder and moisture assessment software

Modern insulated walls, roofs and floors are susceptible to moisture damage because there is less energy loss to evaporate moisture. Solutions may include a vapor retarder, depending on the climate, and moisture assessment software, which is used in advanced building envelopes in Europe and North America.

Figure 2.10 Case Study of Buiding Envelope Installation

View

Developer of energy-efficient glass technologies for buildings

Case Study: View Dynamic Glass in Commercial Office Buildings

Project Characteristics

Building Type	20-story high-rise office building
Service Type	Envelope
Specific Solutions	View Dynamic glass

Results

Energy Savings*	20%
Cooling Peak Load Savings	23%

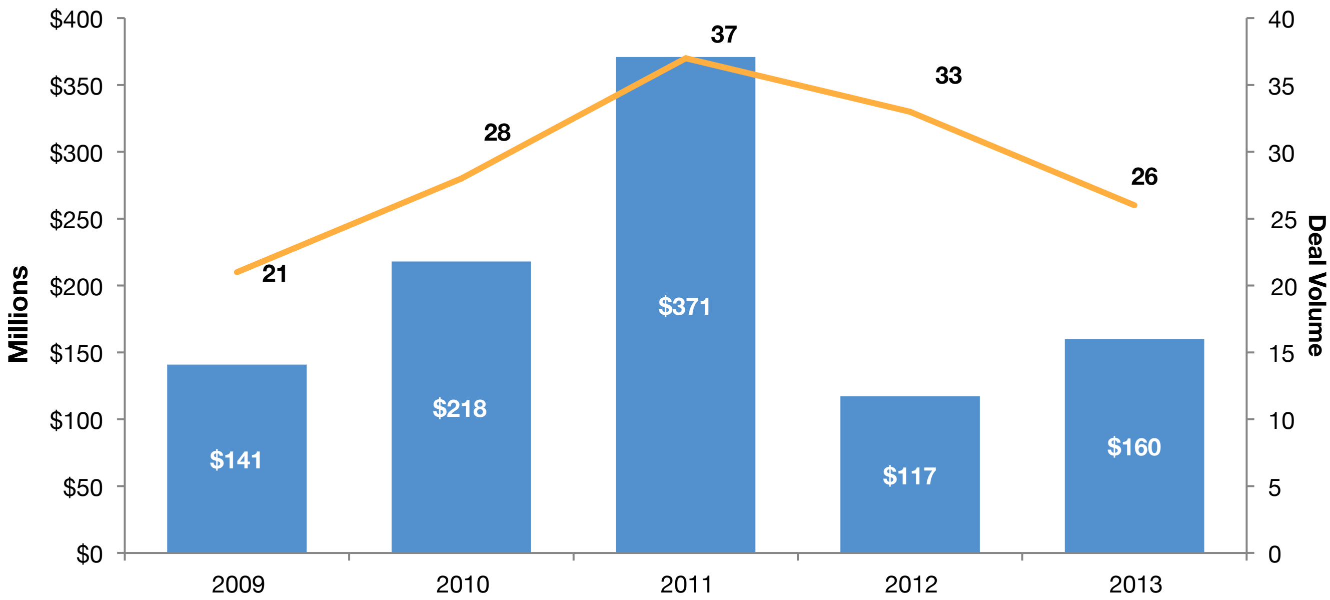
*use of View Dynamic glass contributes to reduced lighting and HVAC electricity consumption

Select Retrofits Undertaken

- A 20-story high-rise office building with high performance glass was modeled against a building with View dynamic glass, using the average building electrical energy across five climates to compare energy usage

Building Analytics and Controls

Figure 2.11 US Investment in Building Analytics and Controls



Source: Cleantech Group analysis

Overview

Ten years ago, building efficiency was defined as replacing outdated, low performing equipment with more efficient and advanced technologies. The same is still true for today's retrofits, except equipment efficiency and longevity has drastically improved. The integration of information technology within buildings and the nationwide deployment of smart meters have provided unprecedented control and insight into our buildings. Providing real time intelligence into once-static equipment assets allows buildings to be responsive to changes in occupancy, external weather environments and changes in energy supply systems – all of which influence expected savings and energy reductions.

Building Energy Management Systems (BEMS) (described in detail below), are software-based systems that

> *"Data access and data modeling present a challenge for building owners and integrators that are implementing analytics for building systems. The effort involved in this part of the process is the key variable when determining installation cost estimates for data analytics related efficiency projects."*
>
> CEO, Building Analytics Company

monitor a building's equipment performance, including lighting, energy use and heating and cooling systems. Cloud-based BEMS technology, enabled by hardware and enhanced with services, is disrupting the traditional efficiency marketplace by driving greater performance of existing building stock. In the past, traditional monitoring, analysis and controls required extensive manual oversight from facility managers. Yet, digital efficiency solutions are altering the energy efficiency value chain and replacing time consuming and expensive actions with relatively cheap technological fixes that play an integral piece in energy efficiency upgrades.

The rise of building analytics and controls is also driven by a growing demand for simple, digitally enabled tools. The emergence of "smart" devices, such as smart thermostat maker Nest, sparked a change amongst building owners and operators to recognize the potential of increased ease of control and insight into their energy usage.

A slew of energy management platforms are now utilizing vast streams of granular building data from equipment loads and on-site sensors to enable a continuous stream of insights and recommendations that optimize performance for maximized long-term savings.

Picture 4: Panoramic Power Wireless Sensor for Building Controls

Source: Panoramic Power

The overall BEMS market is expected to grow from $1.8 billion in annual revenue in 2012 to nearly $5.6 billion in 2020.[xxix] This fast-growing market segment will alter the delivery of traditional energy efficiency services, with utilities, contractors and ESCOs forced to comply with ever-changing products and technologies. The energy efficiency technology segments previously outlined in this report focus on capital equipment upgrades, such as new chillers and boilers to insulation and windows. With the added intelligence afforded by data driven energy management tools, digital efficiency solutions are bundled as part of larger retrofits to ensure maximum efficiency. Building controls and analytics represent not only a low capital expenditure for building owners and operators, but they also deliver greater energy savings and prolong the life of building equipment.

Figure 2.12 Major Players in Building Analytics & Controls Segment

Company	Location	Founded	Date Funded	Amount Raised
Gridium	United States	2011	3/12/2013	$750,000
SkyFoundry	United States	2009	5/13/2014	Undisclosed
Distech Controls	Canada	1995	6/13/2013	$37,000,000
Daintree Networks	United States	2003	3/26/2010	$8,000,000
BuildingIQ	United States	2009	1/22/2013	$9,000,000
Johnson Controls	United States	1885		
Honeywell	Ireland	1906		
Ista International	United States	1957		
IBM	United States	1911		
Schneider Electric	France	1836		

Source: Cleantech Group Analysis

Technology Characterization

Digital solutions stand to alter the traditional ESCO service offerings that focus on capital intensive projects and associated services. New solutions optimize performance by drawing data from and providing an analytical layer to control and manage systems – from lighting, to windows, to boilers and chillers, to generation assets. Energy visualization and energy analytics are the two primary functions of building energy management systems, with building controls and demand response gaining more traction. Divergent technical approaches in BEMS vary from high touch, complex analytics and controls to support deep savings to low touch, less complicated analytics to address low hanging efficiency gains. Other models include technology agnostic platforms to integrate with other systems and enable flexible data integration.

Visualization

Building Energy Management Systems increase operational efficiency by promoting energy saving behaviors through a combination of analytical layers. Visualization consists of monitoring and presenting energy use with relatively minimal data to perform trend analysis on monthly energy usage and cost data. Basic building performance is measured by monthly utility bills, weather data and basic information on the building structure and use. Visual analysis can identify extremes in energy usage and indicate where building systems are operating below optimum efficiency levels. Basic monitoring capabilities are also used for benchmarking, which is critical in establishing baseline energy usage. Benchmarking identifies potential efficiency improvements as well as a reference point to measure efficiency savings across a project life cycle.

Analytics

Analytics uses real-time information accessed through a variety of more complex inputs including more granular (weekly, hourly, or more detailed incremental data) utility data, maintenance schedules and electric power meters to process complex, large volumes of data into visual feedback and actionable recommendations. Analytics provide additional insight into a building's energy profile to provide on-going commissioning of building systems to save energy and extend equipment life. A building manager can identify specific energy efficiency projects within a building to address through deeper analysis.

At its most sophisticated, analytics systems can perform "fault detection" through the use of manual or automated tests. Fault detection is an important attribute of building analytics because it helps capture latent inefficiencies from the time of equipment installation to diagnosing sub-optimal performance throughout the equipment lifecycle. As buildings become increasingly complex with newly introduced devices and systems, consumption metrics and key performance indicators are of increasing importance to building operators. Inefficient equipment operation can waste an estimated 15 to 30 percent of energy use in commercial buildings due to inadequate (re)-commissioning, operational issues and real time performance degradation. Deeper building analytics provide insights into a building to guard against such energy inefficiencies and cost fluctuations.

Controls

Controls add an additional layer of functionality that actually enables oversight and control over individual end loads. A building equipped with optimization control utilizes advanced smart metering and advanced metering infrastructure (AMI) to isolate energy consumption of a specific sub-system or equipment. Real time data from sensory nodes is communicated to a central BMS and displayed through a customized dashboard or platform to display information to customers. Interval data supported by sensors and collected through a building management system allow users to respond to real-time changes in energy supply or demand.

> *With the cost of hardware and systems integration decreasing and new legislation allocating more funds for energy efficiency upgrades, the commercial building sector is increasingly poised for greater adoption of more approachable building analytics that drive greater efficiency savings.”*
>
> CEO, Building Technology Company

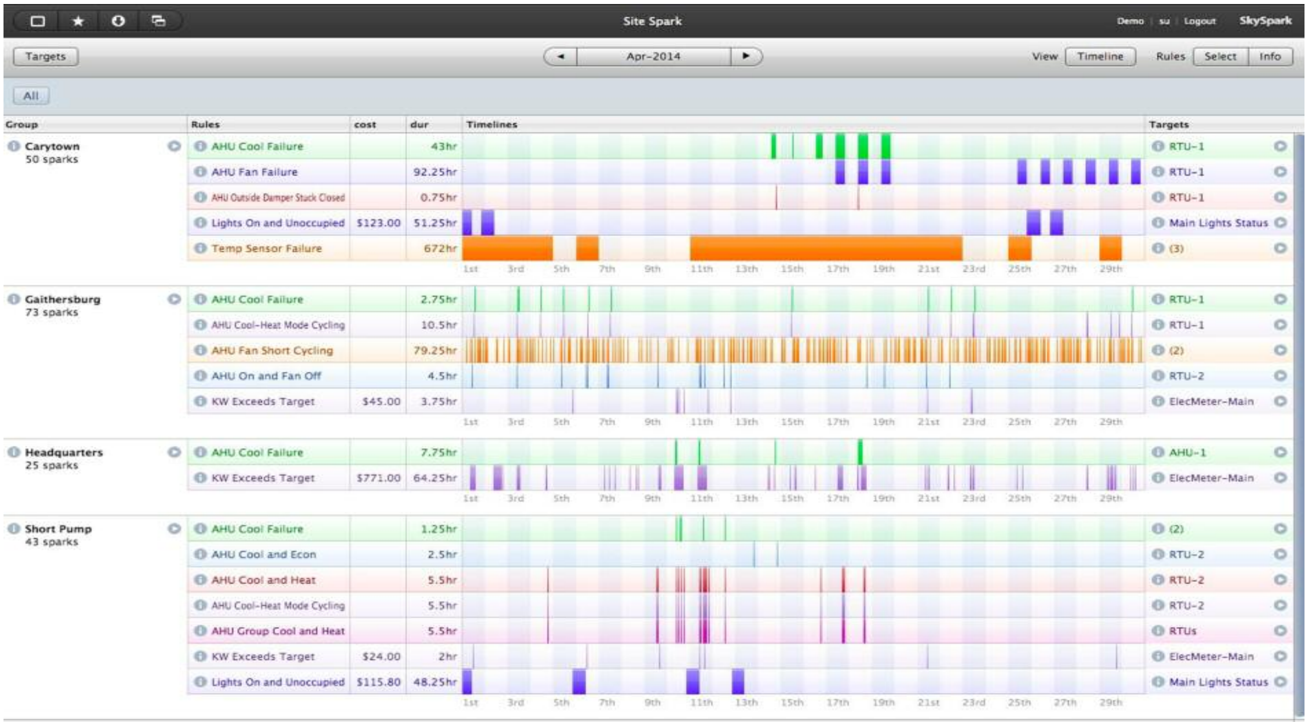
The transition from a static energy management system to an intelligent, cloud based application is heavily dependent on sensor technology. Sensors (nodes) are the connection point that send, receive and forward data across a communication network. Sensors can be attached to equipment which allow energy management systems to monitor and control various assets remotely. Sensors are becoming an integral part of buildings and enable demand-based control of systems including load shifting, cycling, and optimal start and run time. The hardware and installation costs of wireless sensors have dropped dramatically in price due to advances in technology and adoption rates. The broad sensor industry was valued at $65 billion in 2012, and the building automation sector represented about 2.7% of the total (accounting for $1.75 billion).[xxx]

Benefits

On-site analytics and controls provide granular data that enable optimized performance, from simple monitoring to advanced analytics. Energy management platforms defer the need for frequent large capital intensive upgrades, while continuous monitoring and recommissioning prolong equipment life and reduce maintenance costs by detecting faults throughout the equipment life cycle.

Energy analytics can also be seen as “lead generation” by energy service providers and ESCOs because these tools help identify areas for potential projects and efficiency upgrades. For example, some remote auditing software or building energy management systems can identify equipment that is running sub-optimally, signaling to

Picture 5: SkyFoundry Energy Analytics Dashboard



Source: SkyFoundry

a contractor which efficiency improvements to implement and prioritize. These solutions are efficient not only from an energy standpoint, but also from a capital and human resource aspect.

Another benefit is the flexibility of integration across a spectrum of building types, ages and existing installed BMS. While it does pose a problem for certain systems, many energy platforms have the ability to integrate with different load types and systems. Enterprise energy management also provides measurement and verification capabilities required in many energy efficiency retrofits.

Barriers

As security becomes a rising concern in other facets of public life, intelligent management systems are beginning to face the same scrutiny. Sensor enabled technology and other smart products that track building occupancy and optimize energy usage continue to create unease for building owners. Data and IT infrastructure risk is also a security consideration for buildings who pass off sensitive information, from their utility bill to their HR database, to third party service providers.

A technology barrier facing the building management market – as well as the efficiency market on a macro level – is the lack of standardized communication protocols. The market is flush with numerous solutions and applications that can be plugged into a building, but most are standalone solutions that don't integrate with one another. This prevents building owners from being able to compare costs across different loads – from lighting, to cooling to energy, while also creating confusion that reduce the adoption rate of these technologies all together.

Figure 2.13 Case Study of Building Analytics and Controls Installation

Daintree Networks

Provider of wireless building automation solutions for commecial and industrial buildings

Case Study: United Stationers, Sacramento, CA

Project Characteristics

Building Type	Office Building
Typical Facility Occupancy	100%
Service Type	Building Analytics and Controls
Specific Solution	ControlScope Wireless Smart Building Control System with LED fixtures

Results

Savings Attributed to ControlScope Control System	41%
Pre-project wattage (fluorescent fixtures)	21,672 watts
Post-project wattage (LED fixtures)	3,930 watts
Control adapter granularity	Per fixture

Select Retrofits Undertaken

- Daintree's ControlScope smart building system implemented in wholesale distributor's facility office
- Convert Fluorescent Fixtures to LED
- Automated and centralized lighting control including automated on/off switching, daylight sensing, and motion sensors
- Wirelessly enabled every fixture to provide personal remote controls

Aging building stock in the United States also poses a challenge to all of the new, advanced technology being installed into buildings. Building Energy Management Systems (BEMS) are a no-brainer in new construction, but technology vendors and providers run into compatibility limitations with legacy building systems. Commercial buildings also represent a fragmented customer market, and require flexibility in offering their own proprietary energy management suite compared to a customer's existing tool.

Software-enabled energy management systems are not viable as a standalone solution for direct third party funding, but rather as one (critical) element of a larger energy service contract. Building analytics and controls capture additional energy savings in real time, freeing up capital for other efficiency improvements with longer payback returns. Building analytics software do not guarantee savings, as would a more efficient lighting or cooling system, because action is required to make informed decisions based on the information provided. Rather, data driven energy management is a measuring and verification tool to ensure energy savings are being realized. But even with an added level of energy reduction certainty, building analytics and controls offer more risk and less quantifiable returns, and thus have failed to attract third party capital. Increasingly, however, ESCOs and other project developers are seeing these solutions as mission critical to an effective efficiency upgrade. As a result, building analytics are generally funded in two ways:

Bundled as part of an energy efficiency retrofit offering from a larger ESCO or ESP

- In an Energy Service Agreement (ESA) or Managed Energy Service Agreement (MESA), the provider arranges the financing to install and monitor the improvements, which are usually outsourced to ESCOs and ESPs, in addition to all of the typical efficiency upgrades (lighting, HVAC)

Installed as a stand-alone solution through the building owner

- In scenarios where private capital is not applicable, either because the real estate segment is not relevant or a customer has a large internal budget, building analytics and controls may be financed individually. This is similar to a traditional ESPC where the customer self-funds efficiency projects and contracts installment to an ESCO. In this case, an internal budget as well as increasing availability of government funds and subsidies has driven the adoption of building energy management systems.

MARKET DRIVERS

Five key drivers underpin the steady growth of demand in the overall building energy efficiency market.

Volatile Energy Costs

As energy costs continue to rise and fall with unpredictable frequency, energy consumption within the built environment has been targeted to reduce inefficiencies and latent energy use. The energy crisis in the 1970s made price volatility a core concern for building owners as operational costs spiked, and highlighted the opportunity to reduce the risk of these cost variances through efficiency. More recently, the shift to real time and variable energy pricing, characterized by pricing that reflects changing supply and demand conditions on the grid, also increases consumers' vulnerability to fluctuating energy prices. This shift has exposed building owners to higher peak pricing during high demand periods and thereby also increased their vulnerability to other factors that impact energy use, such as weather or occupant behavior.[xxxi]

Federal, State and Local Policy

Federal, State and Local policies have been used to drive the development of the market and adoption of efficiency measures. These fall into three categories: building codes for improved efficiency, incentive programs, and efficiency level mandates. The initial jolt behind energy efficiency was largely promoted by federal and state policies mandating more strict energy reductions and implementing new building codes. The most frequent policy levers used to promote energy-efficient building technologies include:

- Building codes that specify minimum efficiency standards for construction and operation
- Appliance performance standards
- Labels and other consumer education and awareness tools
- Incentives (both financial and non-financial) including tax credits and expedited permitting for efficient buildings
- Support for R&D on technologies needed to achieve cost-competitive low energy buildings

These policy efforts have made more efficient products available, increased awareness, and improved construction efficiency, yet large barriers still exist to adopting new technologies in a building retrofit. Policymakers are now targeting a number of new policy solutions that incentivize the creation and adoption of financing mechanisms to leverage private capital within the building efficiency sector.

Tax equity financing has been a critical component in leveraging private finance within the clean energy sector. Solar investment tax credits were a key enabler to the development of the US residential and commercial solar industry, and similar tax credits stand to fuel growth within the energy efficiency market. Many project developers are not eligible to benefit from the tax benefits themselves if they are unable to take on the full project debt. As a result, developers seek out tax equity investors, usually financial entities such as banks, to finance the project. These entities receive passive ownership interest in an asset or project and collect the benefits from the tax deductions and credits, in addition to the returns from the project. The federal Energy Policy Act of 2005 established a tax incentive program for new or existing building owners, providing a tax deduction for those that install lighting, envelope or HVAC systems that reduce the building's total energy cost by 50%. The tax credits expired at the end of 2013, and are currently under revision to be extended by Congress.

Another policy-backed incentive in the energy efficiency space is Property Assessed Clean Energy (PACE), a new initiative established in 2007 that allows home owners and building operators to receive 100% upfront financing to install energy efficiency retrofits that can be repaid as a property tax assessment at no risk to the federal government. State legislation is required to establish a local district to disburse local PACE funds. Due to support from state and local governments, PACE is gaining traction rapidly across the country. Commercial PACE financing is currently available in nine states including California, New York, Texas and Pennsylvania.

State mandates have also played a key role in incentivizing energy efficient building improvements. While new financing mechanisms are being structured to promote greater adoption of efficiency projects, state legislation is needed to encourage initial participation. Recent state legislation includes:

- **Illinois** mandated that utility companies provide On-Bill Financing options to residential customers.
- **Power NY Act** passed in 2011, allowing customers to repay energy efficiency project loans through On-Bill Financing.
- **NYSERDA (New York State Energy Research and Development Authority)** established a portfolio of funding opportunities to offset the cost of energy improvements in existing commercial facilities.

Programs initiated on the federal level, including LEED and Energy Star, have helped in standardizing the energy efficiency market. Other key federal mandates include:

- **Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance** established an integrated strategy and deadlines towards greenhouse gas reductions for Federal agencies.
- **Energy Efficiency Commercial Buildings Tax Deduction** provides a tax deduction for building owners who install efficient lighting, HVAC, or envelope measures.
- **House of Representatives 2126 "Energy Efficiency Improvement Act"** identifies opportunities for efficiency gains within tenant spaces of commercial buildings, creating a "Tenant Star" program similar to popular ENERGY STAR certification.
- **Green Button** is a government program that provides utility customers with easy access to their energy usage information. The availability of data has created a rush of new startups utilizing new information flows to intelligently analyze and control building energy use.
- **ASHRAE 90.1** has been the benchmark for commercial building energy standards for over 35 years, establishing minimum requirements for energy efficient design and building.

Carbon Reduction

Efforts towards mitigating the impacts of global climate change have focused on the development of renewable energy sources, carbon capture technologies and other high capital expenditure R&D projects. Over the past 5 to 10 years, energy efficiency has moved up the national agenda from being a peripheral strategy for energy reduction to one of the most cost-effective strategies for reducing carbon emissions.

Substantial reductions in energy intensity resulting from more efficient products and services from 1970 to 2007 have avoided the consumption of over 105 quadrillion BTUs.[xxxii] While some of the productivity increases can be attributed to changes in the industrial economy, energy efficiency improvements account for a 60 to 75 percent increase in energy productivity since 1970. Had the United States met the increased energy demand through energy generation, energy consumption would have accounted for an additional $1.65 trillion in additional costs. Energy efficiency is now seen as the "fifth fuel" (in addition to coal, petroleum, nuclear, and alternative energy): the fastest, least expensive, lowest risk resource to reduce carbon emissions, due to the enormous energy savings and subsequent technologies enabling these milestones.

The pressing issue of climate change has prompted federal regulators to establish mandatory and voluntary initiatives towards setting and increasing greenhouse gas (GHG) reduction targets. If executed at scale by 2020, energy efficiency could:

- Generate 9.1 quadrillion BTUs of annual end-use energy savings[xxxiv]
- Reduce end-use energy consumption by 23 percent of projected demand
- Abate 1.1 gigatons of annual GHG emissions[xxxv]

Green Branding and Employee Satisfaction

As consumer awareness increases around issues of sustainability and climate change, companies are using sustainability efforts to attract customers, inspire investors, and retain the best employees. As one of the most cost effective means of reducing GHGs, energy efficiency is quickly becoming a core focus of corporate sustainability and climate change efforts. Walmart, having established significant goals for energy efficiency, including reducing their building energy intensity on a per-square-foot basis by 20% by 2020, has recently begun to act. In 2013, they implemented over 3,500 efficiency projects, including opening a 100% LED-lit Walmart which consumes 34% less energy annually than a conventional store. In addition to consumer awareness, corporate employees are internally demanding an "environmentally aware or friendly workplace" to enhance the workplace atmosphere. Studies have recently shown that reduced air pollution and better indoor climate leads to better health outcomes, higher productivity and positive welfare.[xxxvi]

In addition to brand value driven by sustainability and engaged employees, green buildings improve asset value, and reduce operating costs. These improvements drive value for a company's bottom line, while commanding a price premium for real estate at the point of sale. As evidenced by a recent survey, the branding image of energy efficient buildings is driving increased value for building owners through higher occupancy and rental rates (Figure 3.1).

Figure 3.1 Financial Metrics for Green versus Conventional Buildings

Building Type	Occupancy Rate	Rental Rate per ft^2	Sale price per ft^2
ENERGY STAR Certified	91.5%	$30.55	$288
Non-ENERGY STAR peers	87.9%	$28.15	$227
LEED Certified	92.0%	$42.38	$438
Non-LEED peers	87.9%	$31.05	$257

Source: CoStar Group, "Commercial Real Estate and the Environment"

Energy Resiliency and Security

Rising concern over climate change and U.S. energy independence has created urgency around energy resiliency and security issues. The overwhelming majority (87%) of electricity sales growth between 1985 and 2006 was attributable to the building sector. Improving energy efficiency standards and achieving energy reductions decrease the need for investment in energy infrastructure, freeing up capital for research and development of clean technologies and renewable energy infrastructure.

Major Players

While the concept of a service provider installing and then maintaining energy efficient equipment is simple, the mix of stakeholders in the building energy efficiency ecosystem is more complex. There are nine key player archetypes that take part, including several core players to the ecosystem: Energy Service Companies, Original Equipment Manufacturers, Energy Service Providers, Financial Institutions (lenders as well as consultants), and Technology Vendors.

Energy Service Companies (ESCOs) are large, national companies that provide a range of integrated, technical energy services to improve energy performance. Typical services include: energy audits, in which a building is inspected to understand its patterns of energy consumption and level of efficiency; retrofits, in which new building equipment is installed; and, ongoing maintenance, in which the companies are contracted to maintain equipment for an extended period (often on a quarterly or biannual basis). Key to an ESCO is the ability to bundle these services and solutions and provide long term financing and guarantees of the savings to be achieved, typically formalized in agreements known as performance contracts. Performance subsequently resulting from retrofits or service plans is assessed through Measurement & Verification (M&V) services that the ESCO may also provide.

An Energy Services Performance Contract (ESPC) is a key component of the agreement between a client and an ESCO. Over a set duration of time, ESCOs guarantee a certain level of energy savings that will eventually accumulate and exceed the initial capital investment in equipment or other infrastructure upgrades. In an ESPC, the upfront investment is often self-funded through the client or paid for through a capital lease from a financial institution or the ESCO's balance sheet and is paid back out of the delivered energy savings. Some prominent ESCO players include *Johnson Controls, Honeywell*, and *Siemens*. Figure 3.1 and 3.2 represents the ESCO market penetration by market segment and retrofitted floor space, respectively.

Figure 3.2 Median ESCO market penetration estimates: % of total market floor area addressed by performance-based contracts since 2003

Market Segment	U.S. Census
K-12 Schools	42%
State/Local	30%
Federal	28%
Universities/Colleges	25%
Public Housing	18%
Health/Hospitals	10%
Private Commercial	9%

Source: LBNL, Current Size and Remaining Market Potential of the U.S. Energy Service Company Industry 2013

Since the 1970s, ESCOs have been a leader in the energy efficiency market. The majority of ESCO projects occur in the MUSH segment due to lower transaction costs given the larger project sizes (typically larger than $5 million), ability to engage with longer term financing structures (which are common among energy efficiency investments), and appetite for third party financing.

Figure 3.3 Estimated total floor area (million ft²) of buildings that have received performance-contracting retrofit projects since 2003

Market Segment	Floor Area Retrofitted: 2003-2012 (million ft²)	% of Total Floor Area Retrofitted: 2003-2012
K-12 Schools	2,147.6	43.3%
Federal	698.6	14.1%
State/Local	697.9	14.1%
Private Commercial	664.7	13.4%
Universities/Colleges	338.4	6.8%
Health/Hospitals	224.4	4.5%
Public Housing	190.2	3.7%

Source: LBNL, Current Size and Remaining Market Potential of the U.S. Energy Service Company Industry 2013

Original Equipment Manufacturers are manufacturers of large pieces of building infrastructure such as boilers, chillers, and lighting components. The equipment industry is largely consolidated, with 3 to 5 global firms per equipment vertical, which has limited the ability to innovate new technologies and deployment mechanisms. Pure play OEMs strictly supply equipment into the space (typically through ESCOs, contractors, vendors, or directly to customers), while hybrid OEMs include an ESCO line of business and are able to supply both technical solutions and associated services to their customers. Examples of pure play OEMs include *Carrier* and *Lennox*. Examples of hybrid companies include Johnson Controls and Honeywell.

Energy Service Providers are small to medium sized commercial firms, often regional or local companies, that provide more targeted retrofit services such as in HVAC or lighting. ESPs don't offer performance guarantees like in the ESCO model due to smaller size and scope of projects, but often work as a subcontractor with an ESCO to execute aspects of a broader project.

While ESPs have less robust balance sheets than ESCOs and thus aren't willing to take on as much risk, projects undertaken by ESPs have been gaining traction in the commercial and residential markets for targeted, single solution retrofit projects due to their quick return periods and lower capital expenditures.

Real Estate Management Companies provide sustainability services and develop strategies for buildings around energy efficiency, but generally do not provide many of the core technical services. As owners of large building stock, they are positioned to influence operations and components of property arrangements through leasing arrangements, building upgrades and tenant engagement.

General Contractors are responsible for designing, building, retrofitting or providing maintenance to mechanical systems. They are accountable for overseeing building construction, electricians and mechanics.

Commissioning Agents are dedicated to coordinating installation, inspecting installed systems, verifying performance, and identifying changes to system operation. They are typically third party consultants brought in during early stages of a retrofit to ensure the project is running to specification.

Technology Start Ups are new service providers often applying digital solutions and differentiated delivery models to building efficiency retrofits. Advances in sensors, communications, data analytics and software development have challenged traditional equipment vendors by offering data-centric service models at a lower cost than traditional ESCO service offerings. Software services, enabled by these technological advances, play a key role in offering additional value by providing customers on-going savings above and beyond the step change efficiencies that occur with each new hardware upgrade cycle. In addition, smart meters have unlocked troves of data that enable sensor-integrated hardware to conduct ongoing commissioning and remote optimization. Companies such as *Digital Lumens* and *Aircuity* provide systems that enable intelligent controls over previously static building components through hardware integration and software analytics.

Distributors are dedicated to distributing OEM equipment to contractors, service providers or directly to facility managers.

Financiers are responsible for providing the initial capital required to implement projects. Financial institutions are beginning to play a larger role in the energy efficiency market. Historically, leases – generally capital leases but also operational leases – have dominated much of the market. Capital leases are preferred vehicles because they carry less risk than other types of equity and debt-based investment, but now third party financing models are creating new structures to disrupt that model. Within the commercial market segment, third party financers, like *SCIenergy* and *Metrus Energy*, are providing the same services and solutions for customers without employing the prohibitive structures used in capital and operational leases that have slowed the commercial segment in entering the efficiency marketplace.

Figure 3.4 Partnerships in Building Energy Efficiency

Corporate	Partner/Acquisition	Relationship
PHILIPS	DaintreeNetworks	**Phillips** and **Daintree Networks** partnered to bring Daintree's ZigBee based wireless controls system to Phillip's product line
Honeywell	saia-burgess	**Honeywell** acquired **Saia Burgess Controls**, a provider of intelligence building controls and infrastructure automation solutions
Jones Lang LaSalle	PACIFIC CONTROLS	**Jones Lang LaSalle** and **Pacific Controls** partnered to develop IntelliCommand, JLL's building energy management service
Johnson Controls	OPTIMUM	**Johnson Controls** indirectly invested in **Optimum Energy**, a developer of highly efficient HVAC control systems, to improve the efficiency of JCI's cooling equipment

Source: Cleantech Group Analysis

KEY FINANCING CONSIDERATIONS AND MODELS

Overview of US Energy Efficiency Financing Marketplace

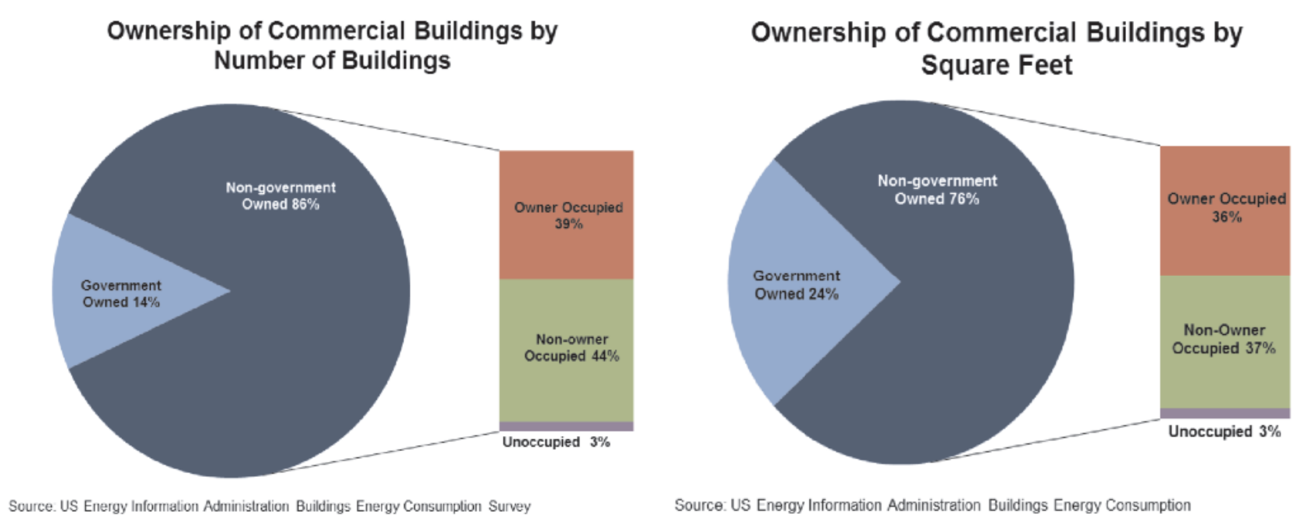
Stakeholders throughout the building ecosystem have sought to understand the barriers to uncovering the efficiency opportunity, given the size of the potential energy and cost reductions. Over the last decade, building energy efficiency experts identified a number of obstacles to implementation of energy efficiency projects ranging from complex payback incentive structures (“split incentives”), unclear business cases supporting efficiency projects, lack of technical expertise, and misaligned internal financial criteria. Yet, as indicated by 31% of participants in a Johnson Controls survey of building managers, lack of appropriate funding and financing mechanisms was by far the largest obstacle.[xxxviii] In response to this concern amongst stakeholders, a number of financing mechanisms emerged to accelerate adoption of efficiency measures. Financing, among other solutions, has been lauded as a major key to accelerating adoption of efficiency measures by addressing the high capital expenditures preventing the market from realizing its full potential. And, as innovative technologies have developed, the potential for efficiency (and the corresponding payback) has only increased. As outlined above, the opportunity is massive, representing a $279 billion investment opportunity which would result in over $1 trillion in energy savings over 10 years.[xxxix] (See Introduction and Market Sizing section for a full description of the market size and investment opportunity.)

Barriers to Scaling Energy Efficiency Financing

This paper focuses on commercial buildings as the highest potential building sectors for growth in efficiency financing. While upfront cost is a major barrier to growth, a range of others have been identified. The following five are commonly cited:

Split Incentives: Split incentives are common in multi-tenant or non–owner-occupied commercial building leases, which are structured such that tenants pay energy costs while improvements to major energy consuming appliances are paid for by building owners. As a result, (1) building owners are unable to directly recoup energy savings and are not incentivized to make efficiency upgrades, and (2) tenants, who usually have short term

Figure 3.4.1 Ownership of Commercial Buildings



leases, are incentivized against upgrades as their cost would be passed on through a rent increase, which due to a short term lease length results in their bearing the cost burden but only a portion of the benefits.

Certainty of Savings: Various parties including building owners and financiers have historically had trouble obtaining a clear and trustworthy picture of their savings. This results from a range of factors including (1) the reality that building owners may have not done much in the way of collecting data, and/or maintaining systems to collect accurate data on energy usage, and (2) proving that savings have been achieved due to an efficiency retrofit is difficult because of varying usage and weather patterns. Poor data collection of ongoing energy efficiency measures results from a number of issues, including the dynamic nature of building use (e.g., shifting occupancy rates or behaviors) and the lack of detailed baselines before implementation of measures.

Technical Expertise: Identifying the necessary upgrades within a building requires deep technical expertise in building systems. Gathering information on building, energy and financial performance to identify efficiency projects is a challenge due to the complexity of datasets, and is a task typically not aligned with the day-to-day priorities of building owners.

Long Payback and Associated Term Lengths: Energy efficiency upgrades within the commercial sector are characterized by longer payback and term lengths than other investments. While efficiency upgrades provide secure and reliable cost savings (though not always transparent, as explained above), they also necessitate large upfront capital that requires a number of years to pay off. In turn, this equipment is financed with longer-term lease lengths to make up for the cost of the equipment. Longer term leases are less attractive for both companies and investors that require a short return on investment. Equipment upgrades, especially, are larger capital investments that often fall out of scope for building managers with strict ROI requirements.

The lack of historical data on project performance limits performance benchmarking – a key data point needed to quantify energy efficiency savings – which ultimately limits investment. Players within the building efficiency market – from technology providers, financiers, and large building owners – have been making strides towards collaboration on this front. As an example, the *Investor Confidence Project* is a consortium of organizations working together to enable widespread participation in the energy efficiency marketplace. Members include equity and debt finance companies, building owners and managers, energy service providers and others who are working together to identify opportunities, reduce transaction costs and create standardized protocols for implementing efficiency projects.

While identifying the short-term savings and long-term economic benefits of energy efficiency improvements has become easier with advanced forecasting and measurement and verification technologies (M&V), ease of access to capital has traditionally been seen as a major hurdle for scaling adoption of building energy efficiency measures – until now.

Finance Mechanisms

To address the financing barrier, three structures have emerged over the last 10 years including: Energy Service Agreements (including Managed Energy Service Agreements)[2], On-Bill Financing and Property Assessed

[2]For the purpose of this report, Energy Service Agreements and Managed Energy Service Agreements are grouped together because the structure is fundamentally the same, with the exception that under a MESA, the project developer is responsible for utility bill payments on behalf of the building owner.

Clean Energy (PACE). These structures were predated by Energy Savings Performance Contracts (ESPCs), which were developed in the 1970s and are the major structure used by ESCOs in the MUSH sector today. The ESCO model provides a comprehensive suite of solutions through large contractors, leverages technical depth of subcontractors, and has had the most success bundling services to provide an end-to-end solution for its customers. According to a study conducted by the Lawrence Berkeley National Laboratory in 2013 (seen in Figure 4.0), only 16% of Commercial and Industrial customers use alternative forms of financing, including the mechanisms outlined below, to finance efficiency projects, indicating a large potential market opportunity for investors entering the commercial building market.

Figure 4.0 Financing Methods used by ESCO Customers (2009-2011)

Market Segment	Cash	Partial Cash	Term Loan	State/Local Bond	Lease	Other	Total
Federal	40%	7%	0%	3%	19%	31%	100%
State/Local	15%	14%	16%	31%	23%	0%	100%
K-12 Schools	7%	8%	18%	34%	28%	5%	100%
Univ/College	20%	16%	22%	22%	19%	0%	100%
Health/Hospital	33%	16%	28%	1%	21%	1%	100%
Public Housing	17%	3%	5%	4%	58%	13%	100%
C&I	50%	4%	23%	2%	5%	16%	100%

Source: LBNL, Current Size and Remaining Market Potential of the U.S. Energy Service Company Industry 2013

Traditional equipment upgrades paid for on the end user's balance sheet or through loans has been the primary source of financing for efficiency retrofits in the commercial building segment. Secured lending requires lenders to provide additional debt financing to the building owner, either through a capital lease or operating lease, while using the equipment as collateral. A capital lease is a fixed-term lease, similar to a loan agreement for purchase of a capital asset, which grants equipment usage rights to the lessee. From an accounting standpoint, the leased equipment appears on the lessor's balance sheet and the ownership of the asset transfers to the lessee at the end of the lease term. An operating lease transfers only the right to use the property to the lessee, and returns the equipment to the lessor at the end of the lease period. In the latter case, the lease expense is treated as an operating expense and appears on the end user's cash flow statement, rather than the balance sheet.

A capital lease is structured such that the term of the loan fully amortizes the equipment costs, and the user spreads out the cost of the energy efficiency project implementation and recognizes the energy savings on a monthly basis on the firm's cash flow statement.

A true lease, which may qualify as an operating lease, is accounted for as an operating expense on the income statement. A lesser known model through traditional equipment leasing is the ability to transform a capital expenditure from the user to an operating expense found on the income statement, which would allow the end user to match the reduction on their utility bill from the income statement with the cost of the project in the form of a lease payment. In this case, the utility savings is greater than the lease expense and the end user experiences an immediate payback.

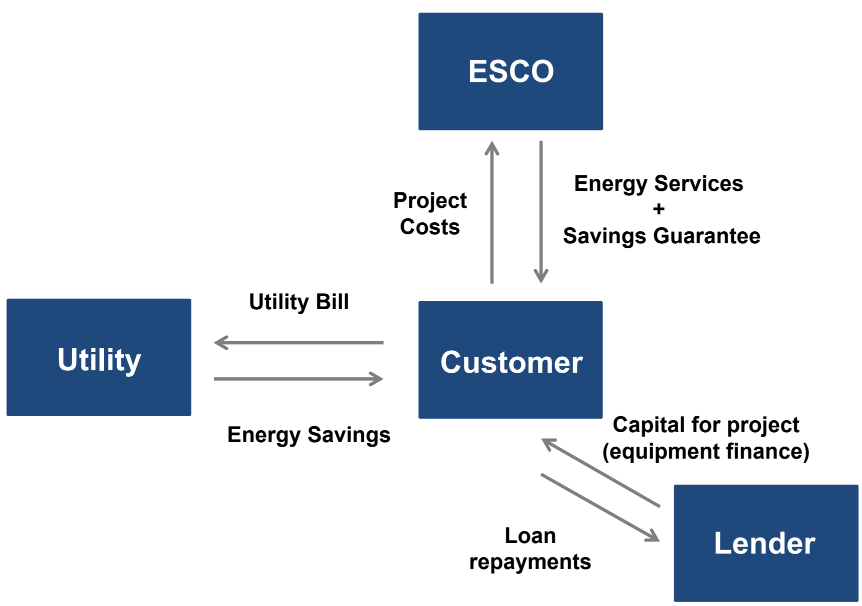
The capital lease structure is best understood by both contractors and customers due to its simple and straightforward payment structure; the model described above is less well known because customers are not accustomed to seeing infrastructure equipment on an income statement. True leases are not preferable for large multi-tenant or office buildings because they do not overcome the issue of split incentives and require the owner to assume additional levels of indebtedness, thus these models are seen mostly in owner occupied buildings.

As a result of volatile energy prices, a patchwork of regulatory drivers, and the structural barriers within the real estate industry that prevent energy efficiency projects from being widely adopted, the ESCO model and traditional secured lending have not been scalable models in the commercial market, and have thus made room for new entrants. The emergence of third party financers and new energy service providers – which lower the cost of services and increase potential efficiency gains – is disrupting the traditional ESCO model. Meanwhile, the traditional equipment finance model has not been able to overcome many of the barriers facing building owners, such as the split incentive between tenants and landlords and lack of data about potential energy savings. Below, the ESPC structure is reviewed as background, and then each of the three new structures is described in detail.

Energy Service Performance Contract[3]

Overview:
An ESPC is a turnkey service that provides a full range of services required to complete an energy efficiency retrofit typically delivered by an Energy Service Company (ESCO). In an ESPC, an ESCO installs energy efficient equipment in a customer's building at no or limited upfront cost to the customer, provides project finance, and offers a project savings guarantee to ensure the savings produced by the project will cover the cost of the project financing for the life of the project. The customer repays the ESCO for the efficiency upgrade throughout the contract term.

Figure 4.1 Energy Savings Performance Contract



[3]Example of an Energy Performance Contract structure attached in the Appendix

Key Features

In the ESPC arrangement, efficiency improvements, including equipment, are owned by the customer and the ESCOs are repaid for their services by the customer over the course of the contract term. These payments are structured to ensure that the sum of payments over the duration of the contract, which is usually 10-20 years, is less than the overall savings. After the term ends, all remaining energy savings stay with the customer.

In this model, ESCOs serve as a single point of contact for the client while playing a range of roles throughout the project including: developer, financier, project manager, contractor, and consultant on measurement and verification (M&V). ESCOs can finance projects either through their own balance sheets or from external third party financiers, but are expected to be able to coordinate and supply financing. Because established, multinational ESCOs are extremely experienced using the ESPC model and generally have large balance sheets, ESPCs are viewed as a secure, low risk project finance option.

ESPCs have largely dominated the energy efficiency services market, especially within the MUSH segment, since their development in the 1970s.[xl] Both customers and lenders in the MUSH market have traditionally preferred this model because ESCOs assume all of the financial risk and operate as the single point of contact during the contract (a convenient structure for projects that often may include multiple parties). Because efficiency improvements are owned by the customer, the service appears as an on-balance sheet expense. This often increases the internal approval process time as organizations scrutinize and plan around their long term debt-to-equity ratio. As a result, it is organizations with either large internal budgets, or excellent credit looking to implement a large scale efficiency project, which tend to utilize ESPCs.

Financial Structure

In an ESPC, the customer can implement an efficiency upgrade using either their own balance sheet or a mixture of debt and equity provided by the ESCO's balance sheet and other outside banks or lenders. The customer uses energy savings from the upgrade for performance payments to the ESCO in return for developing and installing the efficiency upgrade. ESCOs can offer savings guarantees to the customer, but the customer collects all of the energy savings on their energy bill.

Project finance for energy efficiency equipment and improvements come from a variety of public and private capital, including debt, equipment leasing, tax equity, government incentives, rebates and grants. Loans are granted based on a customer's creditworthiness, rather than the potential energy efficiency performance of the project as seen in models described below such as On-Bill Financing and Energy Service Agreements.

Benefits

- Performance guarantees ensure energy and cost savings
- Secure, low risk source of capital (if not self-funded)
- Ease of implementation for customer because ESCO provides comprehensive set of services

Challenges

- Long contract terms render the structure unfavorable by real estate segments other than MUSH sector
- ESCOs encouraged to implement more low-risk, high-cost energy efficiency retrofits that result in smaller savings because energy savings stay with the customer beyond term contract
- Newer, unproven technologies increase the risk profile of an ESPC in the event that expected savings are not achieved and ESCOs are unable to recoup their investment or repay third party investors. As a result, newer technologies are not commonly implemented by ESCOs
- High transaction costs due to generally complex portfolios of projects which require long lead time to develop and complex contract structure

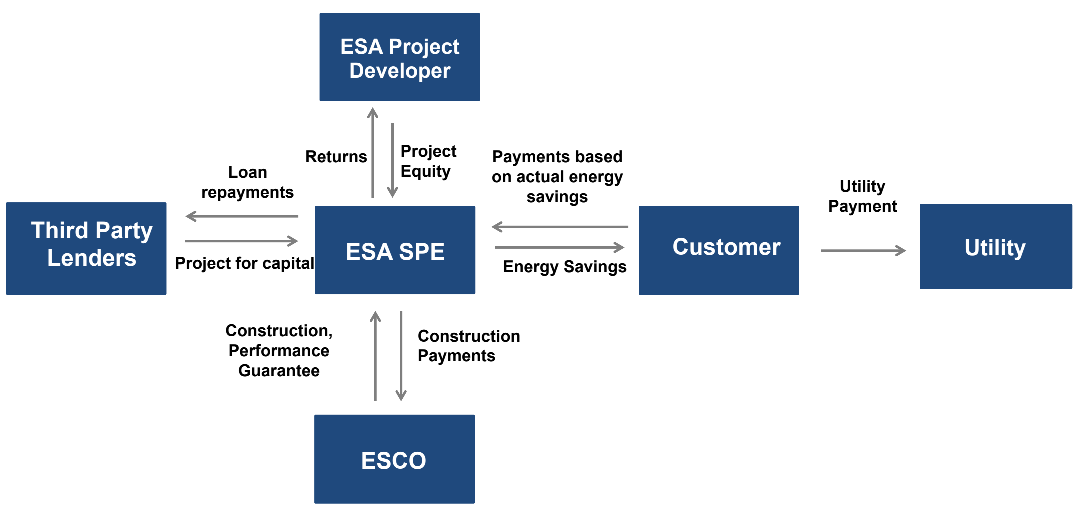
Energy Service Agreements / Managed Energy Service Agreements

Overview

Energy Service Agreements (ESA) address the high initial capital expenditures of an energy efficiency retrofit by delivering energy efficiency as a service with little to no upfront cost to the consumer. With the ESA model, project developers pay for 100% of the design, engineering and construction costs, which are repaid by the customer based on realized energy savings, similar to a power purchase agreement for solar installations. The building owner outsources the energy services and signs a contract assuming responsibility for performance payments back to the project developer based on realized energy savings.

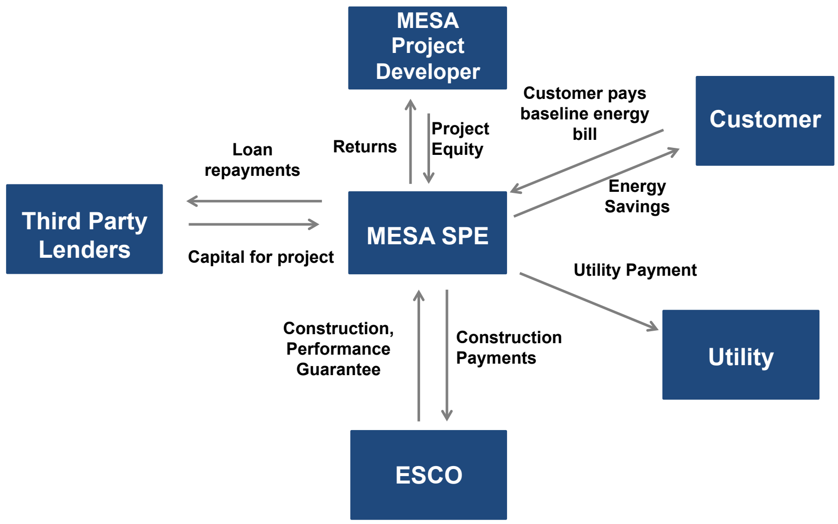
In both an ESA and MESA, the project developer and third party financier assume financial risk and the energy contractor (either an ESCO or ESP) is responsible for the performance risk of the project (whether the project delivers the promised savings). The efficiency upgrade is able to remain an off-balance sheet charge with contract terms ranging from 5 to 20 years, depending on the ESA/MESA provider and investor preference.

Figure 4.2 Energy Services Agreement Structure



> *"Managed Energy Services Agreements differ from other ESAs because they assume energy savings risk much more directly. Landlords are billed on their baseline energy usage for the entire meter and the MESA developer pays the energy bill via a paying agent. There is no guarantee to argue over — if there are no savings, the MESA developer makes no money"*
>
> Managing Director, Building Energy Management Company

Figure 4.3 Managed Energy Services Agreement Structure



Key Features

The ESA provider is a project developer in charge of helping to identify and define the project, secure financing, and oversee contractors to implement efficiency upgrades. The ESA provider enters into two separate agreements: (1) an Energy Service Agreement directly with a building owner and (2) an Energy Service Performance Contract (ESPC) with a service provider, typically an ESCO or ESP. The Energy Service Agreement is a contractual agreement between the developer and the building owner establishing responsibility on behalf of the developer to provide upfront capital for a project through a special purpose entity. In return, the building owner agrees to pay a fixed service charge to the fund until the initial capital investment is repaid.

In an ESA, the project developer pays the ESCO to implement the upgrades, who then bears the responsibility for engineering, implementing, and maintaining the project while providing a savings guarantee either to the developer or customer. The customer repays the project developer based on actual energy savings realized. Service payments to the ESA provider are based on cost per unit of avoided energy, either as a percentage of the customer's utility rate or as a fixed dollar amount per kilowatt-hour saved set at or below existing utility prices. These stipulations ensure a building owner does not pay more per month for energy than prior to entering into the agreement. After the ESA term expires, the customer has the option to purchase the equipment at fair market value and keep all ongoing savings.

A Managed Energy Service Agreement (MESA) is similar in structure and function to an ESA, except the MESA provider also acts as an intermediary between the local utility and the building owner. The MESA provider assumes the role of paying the building owner's utility bill and captures the energy savings resulting from the building owner's reduced energy costs. The MESA provider relies on the difference between the historical and current utility bill to repay debt and equity providers, and to make its profit. MESAs are preferable for multi-tenant commercial buildings because this structure allows landlords the ability to "pass-through" MESA sub-charges to tenants on their energy bill. This also alleviates the risk of non-repayment because tenants are incentivized to pay their utility bill in order to keep their electricity on, which is a lot easier than the building owner servicing the debt through individual service charges.

Figure 4.4 MESA Case Study

Case Study: SCIenergy & Drexel University

Program Overview

SCIenergy, provider of financing services for commercial buildings, established one of the largest energy-efficiency-as-a-service projects to date with Drexel University in March of 2014. Drexel worked with a consortium of partners, including Mitsui USA, Pennsylvania Treasury Department, and Blue Hill Partners to implement a $6.6 million energy retrofit to numerous campus buildings.

Financing came from Mitsui USA and the Campus Energy Efficiency Fund ("CEEF"), a program under the Pennsylvania Treasury Department managed by Blue Hill Partners. The project was structured using SCIenergy's Managed Energy Service Agreement (MESA). Using the MESA structure, SCIenergy was able to fund major efficiency upgrades for Drexel University without greatly impacting the university's balance sheet.

Just the Numbers

Project expected to reduce energy consumption by over 25% in three science and two mixed-use buildings

Building controls upgrades in lab spaces will save over 46% of energy

Reducing HVAC load by 35% through mechanical upgrade across 101,000 square feet

Upgrades will reduce consumption by 19.4 billion BTUs per year across 430,000 square feet of building space

Source: SCIenergy website

Similar to an ESA structure, MESA providers (1) secure external funding from a mixture of capital partners and lenders and provide all upfront costs, (2) own all of the equipment through a special purpose entity and (3) contract a service provider to install and manage the project.

Financial Structure

In an ESA/MESA, the project developer establishes a special purpose entity (SPE) to create a distinct legal ownership structure for the energy efficiency project. Debt and equity investors finance ESA projects through investments in the SPE. The project developer assumes the risk of an Energy Service Agreement by purchasing the equipment with the expectation that the return on energy savings will be sufficient to justify the upfront capital investment. Capital investments through an ESA are determined by the creditworthiness of the customer and the participating ESCO. Depending on the project developer, some prefer to work exclusively with ESCOs who can provide a performance guarantee as to assure investors of the security of their investment.

Traction to date

Energy Service Agreements and Managed Energy Service Agreements have begun to gain traction in the commercial real estate market. ESA and MESA providers have implemented sizeable efficiency projects in the commercial sector, but access to feasible projects and corresponding capital are still in short supply. For investors, becoming comfortable with lower credit grade projects and longer contract term lengths from energy efficiency projects remain a hurdle. For building owners, the value of energy efficiency on a company's bottom line is not yet embedded in their long-term business objectives.

Noesis, an efficiency software and financier based in Texas, recently raised $30 million for energy efficiency improvements using their shared savings model. The fund will support mid-sized efficiency projects in the

$500,000 to $3 million range installed by Noesis-approved project developers. A Noesis Shared Savings Agreement (SSA) will fund 100% of the projects costs and is repaid based on percentage of energy savings by the customer. Unlike traditional ESPCs, the performance risk is shared by the project developer and Noesis Energy, capping the developer's risk at 10% of the project costs, which is earned back from the delivered energy savings over the contract term.

> *"As a result of the perceived limited resale market of the equipment, financial institutions such as banks tend to provide long term debt or lease financing for alternative energy equipment to investment grade or near investment grade prospects and clients."*
>
> Senior Vice President, Financial Services Company

Benefits:
- Outsourcing upfront project costs to a third party developer reduces need for upfront capital expenditures on behalf of the customer
- Customer eliminates operation and maintenance responsibilities
- Classifying the service as an operating lease allows for off-balance sheet accounting
- Primary funding through private capital reduces need for additional policy support
- Addresses split incentive concern for multi-tenant commercial buildings (MESA only)

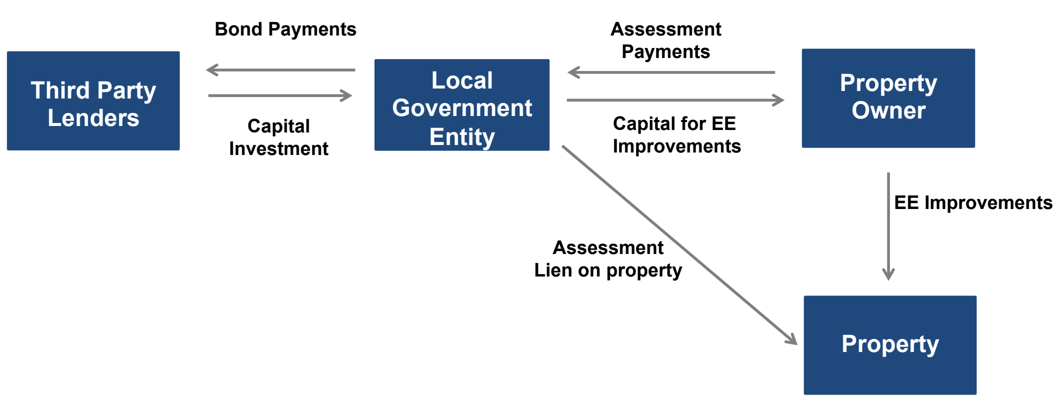
Challenges:
- Financial structure is relatively new, and requires significant education of customers and investors
- Exposure to utility rate fluctuations exposes project developer to additional risk (MESA only)

Property Assessed Clean Energy

Overview

Established in 2007, Property Assessed Clean Energy (PACE) enables local governments to finance energy efficiency improvements by issuing bonds from local government municipalities and using third party entities to

Figure 4.5 Property Assessed Clean Energy Structure



service, originate and administer the upgrade. Projects are implemented through long-term loans that are repaid by an annual property tax assessment of terms up to 20 years secured by a property lien, without any upfront capital from the property owner.

Key Features
PACE enables loans to be distributed to building owners by an established municipal improvement district authority for energy efficiency projects and secured through a lien on the loan recipient's property. Critically, this lien is senior to the existing mortgage and repayment obligation is tied to the property. This increases security for investors and allows local governments to issue low interest rate financing for PACE programs. In 2010, the Federal Housing Financing Agency warned against the seniority of PACE liens in residential homes, concerned that property liens for efficiency improvements would exacerbate the mortgage crisis. As a result, PACE financing has been concentrated in the commercial sector.

Financial Structure
PACE improvements are implemented through the issuance of bonds from municipalities in exchange for third party capital. The local government provides the capital to a property owner which is paid back through annual property tax assessment payments. The loan terms are tied to the payback period, which can be up to up to 20 years, lowering the risk for both lenders and owners wishing to participate in the energy efficiency market. Longer loan periods represent both a more steady investment for lenders and manageable repayment terms for building owners.

Traction to date
PACE financing has begun to take hold across the country, with nearly $60 million invested across 200 commercial projects as of December 2013. Projects completed have ranged in size from $5,000 to $7,000,000. Yet, the marketplace is still nascent. Commercial PACE financing is currently implemented in nine states, while twelve new programs and over $215 million in PACE project applications are under development. Enabling legislation at the state and local government levels to create the operational framework that facilitates PACE financing has been challenging, especially when paired with overcoming resistance from existing real estate stakeholders.

Figure 4.6 PACE Case Study

Case Study: C-Pace

Program Overview

Established in 2012, Connecticut Property Assessed Clean Energy (C-PACE) provides financing to commercial, industrial and multi-family property owners to access efficiency and clean energy improvements. Connecticut boasts one of the most progressive PACE programs in the country, and established the country's first Green Bank, CEFIA (Connecticut Energy Finance Investment Authority), which leverages public and private funds to drive and scale energy investments throughout the state.

In May of 2014, CEFIA sold a package of their C-PACE loan portfolio to Clean Fund, a speciality PACE investor, worth $30 million. Clean Fund purchased $24 million of the commercial bond issuance, with CEFIA holding on to the remaining $6 million. The projects were initially funded through a $40 million warehouse facility supported by CEFIA, and CEFIA will use the latest injection to underwrite new PACE transactions throughout Connecticut. This deal marks one of the first-ever securitization of commercial energy-efficiency portfolios, setting a precedent for the private sector that the efficiency market can be a viable opportunity to scale investment from institutional investors.

Just the Numbers

Active across 80 municipalities in CT

$30 million invested across 23 projects

Qualified 8 capital providers, including Citibank, Wells Fargo and Ameresco

Projects include energy efficiency, clean distributed energy generation and hybrid projects

Source: CEFIA website, Cleantech Group analysis

Benefits

- Secure investment due to assessment lien provision
- Enables competitive interest rates due to low default risk

Challenges

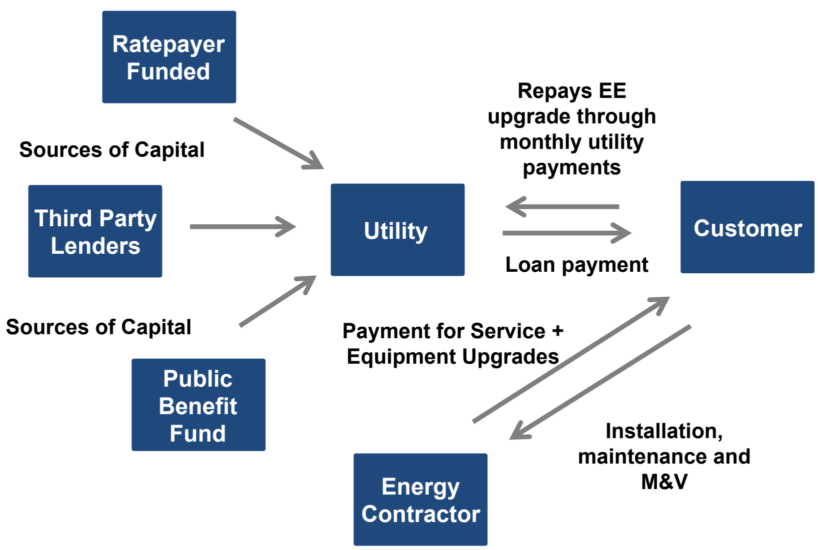
- Requires implementation of local regulatory infrastructure, which may result in delayed market maturity
- Ongoing uncertainty surrounding the structure as the Federal government is challenging property lien status in residential sector

On-Bill Financing & On Bill Repayment

Overview

On-Bill Financing (OBF) leverages the existing relationship between utilities and their energy customers to provide easy access to capital for energy efficiency improvements. OBF employs utility capital, either collected from ratepayers or from public benefit funds (funds established by states to support energy efficiency and renewable energy projects), to provide the upfront installation and purchasing fees of efficiency measures. Key to the structure, these loans are then repaid through a customer's monthly energy bill. While default rates are low (ranging from 0-3 percent), uncertainty still remains surrounding who bears the risk in the event of non-payment.

Figure 4.7 On-Bill Finance Structure



Key Features

On-bill programs are designed by states and, as a result, vary depending on both the state's utility and regulatory structures that set the loan terms and criteria. Utilities administer the loans through a revolving loan fund and collect repayments through a customer's utility bill until all costs are repaid. These are typically low or no interest loans that ensure the energy savings afforded by the efficiency improvements recover the costs of the total monthly financing payments. Some on-bill programs guarantee bill neutrality so the customer's total monthly charges will be equal or less than the pre-investment amount.

There are two forms of repayment through On-Bill Financing which vary by transferability of payment obligation: On-Bill Tariffs and On-Bill Loans. On-Bill Tariffs tie repayment of the service to the property or utility meter, and all subsequent owners or occupants, rather than to an individual or company. The key feature of a tariff-based system is that the obligation to repay the loan is transferable from one building owner/occupant to another. Thus, when an owner sells a building, the subsequent new tenant or owner inherits the loan repayment responsibility. Tying the financial terms of the loan with the payback period allows for low monthly payments, regardless of who owns the property. The tariff system overcomes the split incentive issue for short term renters because they are only responsible for the payment as long as they are living on the property, while allowing successive renters to benefit from lower monthly utility bills without the property owner paying a large upfront cost. On-bill tariffs work in both residential and small commercial properties, but are more common in the residential sector. The drawbacks of tariffs are borne largely by utilities. Because tariffs are packaged as an energy efficiency service, rather than a loan, tariffs are often subject to different laws and regulatory approval which can be costly for utilities to comply with.

In an On-Bill Loan structure, the loan is tied to an individual or company, and payment is non-transferable. On-Bill Loans are mostly administered to small commercial and industrial customers and are less common among residential customers. Loans are preferable for utilities because they are subject to less regulatory approval and are thus easier to distribute and implement. A loan-based system can be financed through either public benefit funds or a third party lender, similar to the tariff model, but has shorter financing terms of up to 5 years in some states, which disincentivizes higher cost measures.

> *"On-Bill Repayment programs will provide customers the convenience of being on the utility bill, encouraging a direct link between energy savings and energy use, while allowing investors more security. Coordination of the utility billing systems with traditional lending products will be tricky, but the ultimate goal is for private capital to create new solutions for energy customers."*
>
> California utility

Financial Structure

On-bill programs rely on public, utility and private capital to finance efficiency upgrades. On-Bill Finance was initially capitalized by American Recovery and Reinvestment Act (ARRA) funds, but is now primarily funded using a combination of ratepayer funds, revolving loan funds and public benefit funds. The financial structure of OBF programs varies based on types of entities distributing capital (utilities, government agencies or other third parties) and target customers and buildings. Accordingly, loan payments can go to the customer to reimburse them for funds paid to the energy contractor or directly to the energy contractor while the utility provides the mechanism to collect the loan.

Although OBF program finance varies by state, default rates as low as 2% across the country are beginning to attract more private capital. Sources of private capital come from Community Development Financial Institutions (CDFIs), local banks, credit unions, large commercial banks and capital markets. Scaling private capital involvement will enable greater participation among utilities and customers within OBF programs.

Traction to date

Efficiency projects implemented through On-Bill Finance programs are restricted by maximum loan amounts, term lengths and retrofit types. A new iteration of OBF, On-Bill Repayment, is being created to alleviate those constraints. On-Bill Repayment (OBR) enables third party capital, including banks, lenders and alternative energy organizations to administer loans on the bill. The customer enters into a contract with a bank, and the utility acts as the middleman that distributes funds between the two parties. The new structure attracts more private sector capital by removing the cap on loan amounts and number of loan disbursements per customer. Unlike traditional on-bill financing, however, there is no requirement for bill neutrality. The benefit to On-Bill Repayment is an open-sourced financial mechanism in which banks and lenders can shop around for projects with no restrictions on what types of projects to fund. The required legislation and regulation to establish OBR are currently under development in states including California and Texas.

The limits of OBF lie in the loan criteria set up by state utility and regulatory structures, which often set restrictions on the maximum allowable loan amount and loan repayment terms. The OBR method is preferable to OBF because banks, rather than the utility or customer, will bear 100% of the project risk. As On-Bill Repayment gains traction, it could eventually be a channel for other financial mechanisms to be bundled onto a consumer's utility bill. For example, an ESA provider that independently finances efficiency upgrades for a commercial building is exposed to risk of default or foreclosure on the payment or building. If an ESA were channeled through On-Bill Repayment, all payments due to the provider would be paid through the utility bill and reduce the risk of nonpayment.

Figure 4.8 On-Bill Finance Case Study

Case Study: PG&E On-Bill Finance

Program Overview

PG&E's On-Bill Financing Program administers capital through a revolving loan fund which is supported by California utility customers and repaid through PG&E utility bills, similar to how rebates and incentives are collected. PG&E offers secure, zero interest loans to non-residential customers, including commercial, municipal or federal buildings. The projected energy savings determine a customer's loan terms and must be sufficient to repay the loan during the maximum allowable payment term, which is 5 years for businesses and 10 years for government agencies. PG&E underwrites projects between $5,000 and $100,000, but does not assume any of the risk associated with the project. Instead, the customer enters into a contract with a contractor that is eligible under PG&E's on-bill program to purchase and install the energy efficiency equipment. Once the project has been complete, it must undergo a quality assurance process in order to receive the funds from PG&E. In this program, the utility does not guarantee any of the work and the customer assumes 100% of the risk.

Just the Numbers

$29 million distributed out of dedicated $50.5 million

Issued 500 loans and reserved fund for another 274 projects underway

$9 million in loan collections already paid back to the utility

Projects typically consist of lighting and building controls chosen from existing PG&E partners

Source: PG&E On-Bill Financing Handbook, Cleantech Group analysis

Benefits:

- Efficiency payments are bundled onto a customer's utility bill
- Threat of utility disconnection ensures on-bill payments are serviced because customers place a high priority on utility bill payments
- Customer adoption rates for OBF are higher due to transparent link between energy savings and reduced utility bill
- OBF provides additional ease of operation and installation because all payments are made through one bill
- On-bill programs reduce time and effort in financing and implementation efforts by utilizing existing relationships between customers and their utility. Utilities can also leverage access to customer data to assess creditworthiness, as well as other key financial considerations

Challenges:

- Misperception among customers that energy retrofits are costly; lack of awareness of large potential savings available from energy efficiency improvements
- Information gaps persist on availability of financing and how to secure financing
- Reluctance amongst utilities to adopt OBF due to responsibility of behaving like a lending institution
- Modifying utility billing systems to incorporate non-energy billing is expensive and not always compatible for some utilities
- Regulatory approval for on-bill programs is cumbersome for utilities

Figure 4.9 Financial Model Comparison Chart

	ESA/MESA	Property Assessed Clean Energy	On-Bill Financing
Target Market Segment	MUSH, Commercial and Industrial	Residential, Commercial	Residential, Commercial, Industrial
Project Size	>$2 million	$2,000 - $2.5 million	$5,000-$350,000
Term Length	7-10 years	<20 years	<5 years
Source of Capital	Private	Private/Public	Private/Public
Security/Collateral	Equipment	Assessment Lien	Equipment; Service Termination
Risk Allocation (Financial)	Project Developer	Municipalities	Customer
Repayment Method	Service Charge to Project Developer	Property Tax Assessment	Utilily Bill Payments
Market Penetration	Low	Medium	Low-Medium

Secondary Markets and the Future of Energy Efficiency Financing

The financing mechanisms discussed throughout this paper have emerged over the past decade to attract private investment and encourage participation in the market. As discussed, each mechanism is gaining support and traction. Energy Service Agreements and Managed Energy Service Agreements facilitated through third party financers have shown promise for scaling efficiency investments due to minimal regulatory requirements. Property Assessed Clean Energy (PACE) financing is gaining support from state and local governments, but requires much more political and legal infrastructure than most other financing structures. On-Bill Financing, delivered by utilities, has also been successful in implementing energy efficiency upgrades, but faces similar hurdles in establishing the necessary utility partnerships needed to enable private financing. On-Bill Repayment, however, will be a viable mechanism that encourages greater participation from institutional investors. On-Bill Repayment allows for the entrance of private capital by placing the loan contract between the bank and customer, with the utility acting as a repayment vehicle rather than the financier.

In order for the efficiency market to truly realize the nearly $300 billion market potential referenced throughout this paper, more private capital is needed in place of public funding. Investors are reticent to participate in the market largely due to the unfamiliarity with these new financial structures. Investing in a project with returns based on energy savings is a relatively new concept for most investors. Traditional debt and equity investments in energy efficiency (and beyond) have largely been through the ESPC model used in the MUSH segment, where investors would lend money to either ESCOs with large balance sheets or customers with investment grade credit. As a result, private investors cite hesitation with these new structures in large part because customers in the commercial market have lower quality credit ratings. Working directly with ESCOs (as opposed to a project developer using an ESA or MESA) allows risk to be clearly delineated amongst the involved parties: the ESCO assumes performance risk based on the performance guarantee and the investor is consigned to the financial risk based off the creditworthiness of the customer. The risk delineation is not as straightforward for these new financing structures. Uncertainty surrounding these details, including who gets paid, repayment structures, and what happens in the event of non-payment, is still a key barrier for large banks entering the commercial building efficiency market whose chief concern lies in secure financial returns.

As financial structures like the three described above begin to take hold, one question emerges: what is the next step to widespread adoption of and investment in these structures? To many, the answer is securitization. Securitization is the process of combining and repackaging like financial assets and offering them on a secondary market. This step is critical to attract investors who require greater security and liquidity. In the case of energy efficiency, securitization could be what the market has needed to stimulate demand and attract private capital. Yet, larger packages of pooled portfolio projects are needed to develop a mature secondary market and project volume remains low.

The hurdle facing the development of this market is two-fold: first, project demand is stagnant due to historical issues like split incentives and high upfront costs, and as a result, the market is currently too small to efficiently create robust pools of loans; second, the lack of loan standards and historical energy performance data has prevented instituitonal investors, including mutual funds, pension funds and large banks, from particpating in the creation of a seconadary market for energy efficiency. In order for secondary markets to develop within the efficiency sector, greater activity in the market is needed to (1) stimulate large, investment-ready project portfolios and (2) get investors comfortable with project finance loans which are characterized by lower credit quality and longer term lengths.

Though the market is nascent, recent deals have created a few sizeable funds within the efficiency market, indicating that the time for a secondary market may be near. For example, Connecticut's green bank, the Clean Energy and Finance Authority (CEFIA), sold off a $30 million PACE loan portfolio to third party financer, *Clean Fund*. This deal – one of the first known securitization deals within the commercial energy efficiency market – comes after recent efforts from *Hannon Armstrong, Joule Assets* and Deutsche Bank to catalyze the industry through established asset-backed bonds and funds.

CONCLUSION

The opportunity to put capital to work improving commercial building energy efficiency is large, standing at almost $300 billion. And, given the increasingly efficient technologies in development – from lighting and HVAC hardware, to smart networks for improved analytics and controls – this opportunity is only growing. Yet, the current size of the commercial building energy efficiency market remains small due to a range of barriers. On the consumer side, buyers face a range of constraints surrounding financing efficiency improvements in their buildings and find the traditional financing models difficult to engage with. On the capital market side, lenders face high educational hurdles in understanding these structures and the underlying technologies and associated risks, which must be overcome before they will be comfortable putting significant money to work. As an example, investors cite hesitation with ESAs and MESAs due to the repayment structure that utilizes a special purpose entity to distribute funds to the end user. Despite these concerns, interest in this opportunity is growing tremendously. Though still nascent, the range of new models that are developing across the US – from Energy Service Agreements (ESAs), Managed Energy Service Agreements (MESAs), and On-Bill Finance (OBF) and Repayment (OBR), to Property Assessed Clean Energy (PACE) – show significant promise in enabling access to new capital. With each completed commercial energy efficiency project that is financed, the track record grows, investor confidence builds, and the path towards grasping the $1 trillion opportunity becomes clearer.

About the Study Authors

Founded in 2002, Cleantech Group's (CTG) mission is to accelerate sustainable innovation. Serving clients across five focus industries including Utilities, Industrials, Oil & Gas, Chemicals, and Transportation, CTG helps clients understand and engage with emerging technology landscapes. The company does so through three offerings including Advisory consulting, which supports corporations and investors as they develop technology innovation strategies and invest in new companies to drive growth; the i3 platform, an online marketplace that connects corporates with innovation by allowing them to find, vet, and connect with start-ups; and, our global events, which convene corporates and start-ups along with other players shaping the future of sustainable innovation.

CTG is headquartered in San Francisco, and has offices in London and New York.

Kerry Cebul, Principal
As co-lead of CTG's Advisory team, Kerry guides the development and execution of engagements focused on the Utility, Energy Management, and Oil & Gas industries.

Kerry's work in the Utility and Energy Management spaces includes engagements identifying new, high value markets, developing Go-To-Market strategies, and creating venture investment strategies for some of the world's largest utilities, facility management companies, and equipment Manufacturers. From the emergence of digital energy efficiency solutions to the potential impact of financing in accelerating the deployment of new technologies, Kerry has helped global corporations understand and act upon the opportunities that the shifting energy landscape is creating.

Prior to joining the Cleantech Group, Kerry spent 4 years as a consultant with ICF International developing and scaling national sustainability and energy programs for public sector Federal, State, and local organizations including the Department of Energy, Environmental Protection Agency, and the National Park Service.
Kerry has a B.A. in Environmental Studies from Middlebury College.

Yakov Berenshteyn, Engagement Manager
Yakov advises clients in the utilities, energy, and industrial technology sectors on innovation scouting strategy and investigates the opportunities created by the convergence of these fields in sectors like intelligent buildings and manufacturing.

At Cleantech Group and GreenOrder, Yakov has helped business leaders develop corporate growth platforms founded in corporate sustainability and innovation sourcing. He has worked with major industrial manufacturers on sustainable product portfolios, environmental lifecycle management, and M&A strategy in energy-related target sectors. Yakov has also advised numerous utilities on marketing, sales, corporate venturing, and demand-side services, and has written about the smart grid for GreenBiz.com. He helped develop sustainability programs and management tools for community health clinics and facilitated the development of a flagship partnership between a major utility and a regional medical campus.

Natalie Volpe, Research Analyst
Natalie comes to Cleantech Group with a background in sustainable development, energy, and international relations.

At Cleantech Group, Natalie works on the Research team helping clients connect with innovative start-ups through the i3 online marketplace. She has worked with major utilities to evaluate business models and vet companies to facilitate corporate partnerships and investments. Focusing on the energy efficiency and smart grid sectors, she produces reports on investment trends and industry developments within Cleantech.

Natalie holds a B.A. in Environmental Studies from the University of Pennsylvania with a focus in Sustainability and Environmental Management. She worked at the Wharton School of Business to publish a paper on the global adoption of electric vehicles and wrote her senior thesis on the impacts of global markets on agriculture in rural India.

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Energy Efficiency Steering Committee

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Ivory Consulting Corporation

Michael Rinaldi
Graduate Student
Duke University

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Appendix

ENERGY PERFORMANCE CONTRACT

This Energy Performance Contract ("Contract") is made and entered into as of ***<date>***, by and between ***<name of energy service company>*** ("ESCO"), having its principal offices at ***<ESCO's physical address>***, and the State of Idaho, Department of Administration, Division of Public Works ("DPW") for ***<name of agency>*** ("Agency").

RECITALS

Agency owns and operates facilities, and wishes to acquire equipment and services to reduce energy costs and related expenses in the facilities.

ESCO has experience and technical management capabilities to identify and evaluate energy cost saving opportunities, and provide for engineering, packaging, procurement, installation, financing, maintenance and measurement of cost effective energy and water cost saving measures ("CSMs").

ESCO has delivered to Agency a response to DPW's and Agency's Request for Qualifications ("RFQ") pertaining to the engineering, design, packaging, procurement, installation, financing and measurement of cost effective CSMs at Agency's facilities.

In accordance with the provisions of the RFQ, ESCO was selected to perform a technical energy audit and pursuant to the Technical Energy Audit and Project Development Plan Agreement, dated __________________, has delivered to DPW and Agency a Technical Energy Audit Report and Project Development Plan ("Audit Report") which includes an assessment of the energy consumption characteristics of Agency's facilities and the identification and evaluation of viable CSMs, as well as estimates of expected energy and operational savings and associated project costs for each recommended CSM.

Agency desires to contract with ESCO for the design, installation, financing, maintenance and measurement of the CSMs all as set forth herein. ***<Note: If there will be no financing under the Contract, reference to "financing" should be removed here and in other appropriate parts of the Contract.>***

ESCO, DPW and Agency all acknowledge and agree that the purpose of this Contract is to achieve the Cost Saving Measures contemplated by this Contract to the benefit of Agency and all agree to cooperate to achieve the purpose of this Contract.

NOW, THEREFORE, the parties agree as follows:

SECTION 1. ENERGY MANAGEMENT PLAN

Section 1.1. Plan Details. ESCO has prepared the final Audit Report, dated __________________, which is set forth in Appendix A and incorporated by reference. The Audit Report has been approved and accepted by DPW and Agency. The Audit Report includes all identified CSMs .

<Note: The Audit Report must be completed before executing this Energy Performance Contract. This section records Agency's approval and acceptance of the Audit Report and makes the Audit Report part of the Contract . If the list of CSMs is not completely finalized prior to signing this contract, include language to that effect.>

<Note: If you anticipate using a lease-purchase agreement to finance CSMs under this contract, do not accept an Audit Report unless ESCO has included an estimate of the acquisition-cost weighted average useful service life of the recommended CSMs.>

Section 1.2. Schedules, Exhibits and Appendices. ESCO has prepared and DPW and Agency have approved and accepted the Schedules and Exhibits as set forth below, copies of which are attached hereto (or will be as provided for in this Contract) and are made a part of this Contract by reference.

Schedules:

Schedule A	Equipment to be Installed by ESCO
Schedule B	Description of Premises; Pre-Existing Equipment Inventory
Schedule C	Energy Savings Guarantee
Schedule D	Compensation to ESCO
Schedule E	Baseline Energy Consumption
Schedule F	Savings Measurement & Calculation Formulae; Methodology to Adjust Baseline
Schedule G	Construction and Installation Schedule
Schedule H	Systems Start-Up and Commissioning; Operating Parameters of Installed Equipment
Schedule I	Standards of Comfort
Schedule J	ESCO's Maintenance Responsibilities
Schedule K	Agency's Maintenance Responsibilities
Schedule L	Facility Maintenance Checklist
Schedule M	ESCO's Training Responsibilities
Schedule N	General Conditions
Schedule O	Annual Installment Payment Schedule ***<Or may be titled "Financing Amortization Schedule", "Debt Service Payment Schedule", etc.>***
Schedule P	Pre-existing Service Agreements
Schedule Q	Current and Known Capital Projects at Facility
Schedule R	Projected Financial Performance

<Note: Schedules P, Q and R are not yet specifically listed in the body of the Contract. If they are used, reference as to their function should be made in the body of the Contract.>

Exhibits:

Exhibit I	Certificate of Acceptance — Installed Equipment
Exhibit II	Operations and Maintenance Manuals (to be provided)
Exhibit III	Equipment Warranties (to be provided)

Appendices:

Appendix A	Technical Energy Audit Report and Project Development Plan
Appendix B	RFQ
Appendix C	ESCO Proposal
Appendix D	Lease Agreements and Documents, if applicable

<Note: The contract schedules detail the substantive technical parameters of the projects negotiated and agreed to by the parties. These schedules are referenced throughout the Contract. Their titles can be included here for easy reference or at the end of the Contract. If any schedules need to be completed after contract execution, include language to that effect.>

<Note: For Schedule N: General Conditions – If this schedule is used, specify which articles and paragraphs apply to this contract.>

<Note: Descriptions for each schedule, exhibit and appendix are provided at the end of this sample contract in Attachment I.>

Section 1.3. Other Documents. The RFQ and ESCO Proposal for this Project, Appendix B **(RFQ)** and Appendix C **(ESCO Proposal)** respectively are attached and incorporated by reference. The provisions of this Contract and the attached Schedules shall govern in the event of any inconsistencies between the RFQ, ESCO proposal or Audit Report and the provisions of this Contract.

<Note: This section makes the original RFQ and ESCO response a part of the contract. If there is any future discrepancy between the RFQ, ESCO proposal or Audit Report and in this Contract, the terms of this Contract apply. Thus, be sure the Contract and Schedules are complete and accurate.>

SECTION 2. ENERGY USAGE RECORDS AND DATA

Agency has furnished or shall furnish (or cause its energy suppliers to furnish if reasonably possible) to ESCO, upon request, all of its records and complete data concerning energy usage and energy-related maintenance for the Premises described in Schedule B **(Description of Premises; Pre-Existing Equipment Inventory)**, including the following data for the most current twenty-four (24) month period; utility records; occupancy information; descriptions of any changes in the building structure or its heating, cooling, lighting or other systems or energy requirements; descriptions of all energy consuming or saving equipment used in the Premises; bills and records relating to maintenance of energy-related equipment, and a description of energy management procedures presently utilized. If requested, Agency shall also provide any prior energy audits of the Premises and shall make employees who are familiar with such records available for consultations and discussions with ESCO.

By the _____________ day after receipt, Agency shall provide ESCO with copies (hard or electronic) of all energy bills for the Premises that it shall have received for the preceding month. Upon receipt of the required information, ESCO shall calculate the savings in accordance with the agreed-upon calculation formulae in Schedule F **(Savings Calculation Formulae; Methodology to Adjust Baseline)**.

<Note: This section ensures that ESCO has access to historical energy consumption, facility operations records and occupancy data necessary to formulate baseline utility consumption. At a minimum, there should be twenty-four (24) months of data, however, thirty-six (36) months is recommended. Existing facility conditions, operations and equipment need to be carefully documented to establish an accurate baseline. This will serve as a record of the state of your buildings before project installation and will be critical to establishing and adjusting the baseline and measurement of savings. Any prior technical studies and energy audits should also be made available for ESCO's review and information. This Section also requires that Agency provide copies of energy bills for the Premises and requires that ESCO calculate the savings based on those bills. >

SECTION 3. <u>COMMENCEMENT DATE AND TERMS; INTERIM PERIOD</u>

Section 3.1. <u>Commencement Date</u>. The Commencement Date shall be the first day of the month after the month in which all of the following have occurred: (i) all schedules are in final form and accepted by Agency; (ii) ESCO has delivered a Notice to Agency that it has installed and commenced operating all of the Equipment specified in Schedule A **(Equipment to be Installed by ESCO)** and in accordance with the provisions of Section 8 **(Construction Schedule and Equipment Installation; Approval)** and Schedule H **(Systems Start-Up and Commissioning; Operating Parameters of Installed Equipment)**; and (iii) Agency has inspected and accepted said installation and operation as evidenced by the Certificate of Acceptance as set forth in Exhibit I **(Certificate of Acceptance—Installed Equipment)**. Compensation payments due to ESCO for service and maintenance under this Contract as set forth in Schedule D **(Compensation to ESCO)** shall begin no earlier than thirty (30) days from the Commencement Date as defined herein.

<Note: This section determines the Commencement Date when the savings guarantee period begins. This date is usually the first month AFTER ESCO has completed construction and delivered a notice that all equipment is installed and operating, and Agency has signed the Certificate of Acceptance. The Certificate of Acceptance should be attached to the Contract. It also states that no payment for ESCO service and maintenance will be made prior to the Commencement Date. If applicable, the repayment obligation for project financing should be arranged to coincide with the Commencement Date. The Commencement Date may also need to accommodate Agency's fiscal year for the purpose of appropriations and budgeting. Also, be sure to specify "fiscal year" if that is necessary. See section 23.30 and change if not needed. >

Section 3.2. <u>Term of Contract; Interim Period</u>. Subject to the following sentence, the term of this Contract shall be ***<contract term in years>*** years measured beginning with the Commencement Date. Nonetheless, the Contract shall be effective and binding upon the parties immediately upon its execution, and the period from contract execution until the Commencement Date shall be known as the

"Interim Period". All energy savings achieved during the interim period will be fully credited to Agency.

<Note: Idaho Code § 65-5711D(8)(b) provides that a performance contract term may not exceed twenty-five (25) years. It is DPW policy that such contracts not exceed ten (10) years. Prior to the Commencement Date (Section 3.1) the final contract and schedules are negotiated and executed by signature. At that time ESCO typically begins final project design and construction. The "Interim Period" is the design and construction period. Some savings will be realized during this period. The savings can be credited to ESCO's guarantee or credited to Agency. If these savings are credited to ESCO's guarantee, the credit should be extended for a maximum one to two year period. If ESCO is credited, ESCO will need to develop an approach to measure these savings.>

SECTION 4. PAYMENTS TO ESCO

Section 4.1. Energy Savings Guarantee. ESCO has formulated and, subject to the adjustments provided for in Section 14, **(Material Changes)** has guaranteed the annual level of energy and operations savings to be achieved as a result of the installation and operation of the Equipment and provision of services provided for in this Contract as specified in Schedule J **(ESCO's Maintenance Responsibilities)** and in accordance with the Savings Calculation Formula as set forth in Schedule F **(Savings Calculation Formulae; Methodology to Adjust Baseline)**. The Energy Savings Guarantee is set forth in annual increments for the term of the Contract as specified in Schedule C **(Energy Savings Guarantee)**.

<Note: This section establishes the term of the energy savings guarantee to be on an annual basis.>

Section 4.2. Review and Reimbursement/Reconciliation. If at the end of any ***<Note: insert "fiscal" if applicable>*** year during the guarantee period as specified in Schedule C **(Energy Savings Guarantee**) ESCO has failed to achieve the annual Energy Savings Guarantee specified in Schedule C (Energy Savings Guarantee), upon written request by Agency, which shall be given no earlier than the end of such year and no later than thirty (30) days thereafter, ESCO will pay Agency the difference between the annual amount guaranteed and the amount of actual energy and operations savings achieved at the Premises in accordance with the provisions of Schedule C **(Energy Savings Guarantee)**. ESCO shall remit such payments to Agency within thirty (30) days of written notice by Agency of such monies due. When the total energy savings in any one year during the guarantee period exceed the Energy Savings Guarantee as set forth in Schedule C **(Energy Savings Guarantee)** and are in addition to those monies due ESCO for compensation for services as set forth in Schedule D **(Compensation to ESCO)**, such excess savings shall be the property of Agency. ESCO shall annually prepare and provide a report to the Administrator of DPW and to Agency documenting the performance of the CSMs.

<Note: This section is drafted to provide for the review and potential reimbursement annually. If the Agency does not want to wait until the conclusion of an entire year for potential reimbursement, Agency may consider doing this more frequent, for example, semi-annually. Agency may also want to consider making the review more frequent during the first few years of the contract only or during the years that measurement and verification will be done by ESCO.>

Open book pricing will be required, such that ESCO will fully disclose all costs, including all subcontractor and vendor costs. ESCO will maintain cost accounting records on authorized work performed under actual costs for labor and material, or other basis requiring records. ESCO will afford DPW access to these records and preserve them for a period of three (3) years after final payment. Costs will be evaluated through price analysis to compare costs with reasonable criteria such as established catalog and market prices or historical prices.

ESCO, Agency and DPW agree to work in good faith to resolve any disagreement over the calculation of the energy savings. Should an irresolvable disagreement arise as to the calculation of energy savings, an independent public accounting firm may be engaged by either party to conduct a review and give an opinion on whether the calculation of savings or deficiencies as prepared by ESCO is fairly stated in accordance with this Contract. The independent public accounting firm shall be mutually agreed upon by the parties (if the parties cannot agree upon an accounting firm, then each shall designate a firm; and the two designated firms shall identify a mutually agreeable third firm). The independent public accounting firm shall include in its report any exceptions determined by its review. Exercise of the right to request a review shall in no way affect Agency's obligation to make current payments pursuant to this Contract unless otherwise described herein. Any payments between the parties necessary to resolve any irregularities identified in the review will be made within sixty (60) days after submission of the review to the parties. If ESCO calls the review, ESCO shall pay the cost of the review. If the review is called by Agency, the following structure will be applied to paying for the review:

If the review determines that ESCO's preparation of the Energy Savings Guarantee was more than ten percent (10%) in error, ESCO shall pay the entire cost of the review; however if ESCO's determination of the Energy Savings Guarantee are in error of ten percent (10%) or less than the amounts as determined by the independent public accounting firm, Agency shall pay for the entire cost of the review. In any case, the ___________________________ shall be changed to reflect the findings of the review and the calculations of savings relating to the guarantee will be modified if necessary.

<Note: At the end of each contract year, usually within a specified 45-60 days, there will be a review and reconciliation of the actual achieved savings (subject to any adjustments made for weather, occupancy, operations etc.) vs. ESCO's guaranteed savings projections. If there is a savings shortfall, ESCO is contractually liable to reimburse Agency for the difference between what was actually achieved and the guaranteed amount. If in any year, the achieved savings exceed the guarantee, Agency shall retain excess savings. As an incentive for ESCO to look even deeper for additional savings, a shared savings arrangement could be part of this agreement.>

Section 4.3. ESCO Compensation and Fees: ESCO has structured the Energy Savings Guarantee referred to in Section 4.1 above, so as to be sufficient to equal or exceed the sum of any and all annual payments required to be made by Agency in connection with the acquisition of Equipment to be installed by ESCO under this Contract as set forth in Schedule O **(Annual Installment Payment Schedule)** and any and all annual fees to be paid by Agency to ESCO for the provision of services as set forth and in accordance with the provisions of Schedule D **(Compensation to ESCO)** and Schedule J **(ESCO's Maintenance Responsibilities)**.

<Note: This section ensures that ESCO's savings guarantee will at least cover annual project financing costs (principal and interest) and all annual ESCO service fees for maintenance and measurement and verification .>

Section 4.4. Billing Information Procedure. Payments due to ESCO under this Section 4 shall be calculated in accordance with the provisions of Schedule D. ESCO shall provide Agency with an invoice of the total amount due.

Section 4.5. Effective Date of Payment Obligation. Notwithstanding the above provisions in Section 4, Agency shall not be required to begin any payments to ESCO under this Contract unless and until all equipment installation is completed by ESCO in accordance with the provisions of Section 8 **(Construction and Equipment Installation; Approval)** and Schedule H **(Systems Start-Up and Commissioning; Operating Parameters of Installed Equipment)**, and accepted by Agency as evidenced by the signed Certificate of Acceptance as set forth in Exhibit I **(Certificate of Acceptance — Installed Equipment)**, and unless and until said equipment is fully and properly functioning.

<Note: This section states that no ESCO fees shall be paid until all equipment is installed and operating in accordance with the agreed upon Construction Schedule and until Agency has accepted the completed installation and signed the required Certificate of Acceptance — Installed Equipment.>

SECTION 5. PERMITS AND APPROVALS; COORDINATION

Section 5.1. Permits and Approvals. Agency shall use its best efforts to assist ESCO in obtaining all necessary permits and approvals for installation of the Equipment. In no event shall Agency be responsible for payment of any permits fees. The Equipment and the operation of the Equipment by ESCO shall at all times conform to all federal, state and local code requirements. ESCO shall furnish copies of each permit or license, which is required to perform the work to Agency, before ESCO commences the portion of the work requiring such permit or license.

ESCO shall pay for plumbing and electrical permits required by the Idaho Division of Building Safety. ESCO shall obtain and pay for all licenses and permits and shall pay all fees and charges for connections to outside services and for the use of municipal or private property for storage of materials, parking, utility services, temporary obstructions, enclosures, opening and patching of streets, etc., arising from the construction and completion of the installation and maintenance contemplated by this Contract.

<Note: This standard construction provision requires ESCO comply with all code requirements, pay all associated permit fees and provide Agency with copies of each permit and license required to do the work. Agency agrees to assist ESCO to the best of its ability to obtain required permits and approvals.>

Section 5.2. Coordination During Installation. Agency and ESCO shall coordinate the activities of ESCO's equipment installers with Agency employees, and agents. ESCO shall not commit or permit any act that will interfere with the performance of business activities conducted by Agency or its employees without prior written approval of Agency.

<Note: This standard provision directs both Agency and ESCO to coordinate equipment installation to avoid interference with Agency's business activities. If an installation requires interference, ESCO must first obtain Agency's written approval to proceed. If a facility generates revenue for Agency

(e.g. civic center, theater, arena etc.) and scheduled revenue-producing activities are interrupted due to the fault of ESCO, either during project installation or operation, then a provision for the collection of damages may be negotiated.>

SECTION 6. LOCATION AND ACCESS

Agency shall provide sufficient space on the Premises for the installation and operation of the Equipment and shall take reasonable steps to protect such Equipment from harm, theft and misuse. Agency shall provide access to the Premises for ESCO to perform any function related to this Contract during regular business hours, or such other reasonable hours as may be requested by ESCO and acceptable to Agency. Agency shall not unreasonably restrict ESCO's access to Premises to make emergency repairs or corrections as ESCO may determine are needed.

<Note: This provision states Agency's responsibility for providing adequate space and protection for the installed equipment and authorizes ESCO's access to the facility to perform routine and emergency operations.>

SECTION 7. PERFORMANCE BY ESCO

ESCO shall perform all tasks/phases under the Contract, including construction, and install the Equipment in such a manner so as not to harm the structural integrity of the buildings or their operating systems and so as to conform to the standards set forth in Schedule I **(Standards of Comfort)** and the construction schedule specified in Schedule G **(Construction and Installation Schedule)**. ESCO shall repair and restore to its original condition any area of damage caused by ESCO's performance under this Contract. Agency reserves the right to review the work performed by ESCO and to direct ESCO to take certain corrective action if, in the opinion of Agency, the structural integrity of the Premises or its operating system is or will be harmed. All costs associated with such corrective action to damage caused by ESCO's performance of the work shall be borne by ESCO.

ESCO shall remain responsible for the professional and technical accuracy of all services performed, whether by ESCO or its subcontractors or others on its behalf, throughout the term of this Contract.

<Note: This section directs ESCO to protect the premises and its contents and repair and restore to the original condition any damage caused by ESCO in connection with this contract. Any costs incurred to correct such damage will be paid by ESCO. ESCO is solely responsible for the technical professional accuracy of all work performed under this Contract including work done by subcontractors or others.>

SECTION 8. CONSTRUCTION SCHEDULE AND EQUIPMENT INSTALLATION; APPROVAL

Section 8.1. Construction and equipment installation shall proceed in accordance with the construction schedule approved by Agency and attached hereto as Schedule G **(Construction and Installation Schedule)**.

<Note: The construction/installation phase of the project must be managed in compliance with Agency's requirements and governing statutes. Since construction is just one component of the overall project, a separate construction contract may be desirable and in some cases may be necessary. The construction contract would be referenced in the body of the contract and attached, or the appropriate construction language could be incorporated into the body of the contract.>

Section 8.2. Systems Startup and Equipment Commissioning: ESCO shall conduct a thorough and systematic performance test of each element and total system of the installed Equipment in accordance with the procedures specified in Schedule H **(Systems Start-Up and Commissioning; Operating Parameters of Installed Equipment)** and prior to acceptance by Agency. ESCO shall provide notice to Agency of the scheduled test(s) and Agency and/or its designees shall have the right to be present at any or all such tests conducted by ESCO and/or manufacturers of the Equipment. ESCO shall be responsible for correcting and/or adjusting all deficiencies in systems and Equipment operations that may be observed during system commissioning procedures.

Section 8.3. Inspection and Final Approval: DPW and Agency have the right to inspect, test and approve the work conducted in the facilities during construction and operation. DPW shall have the right and access to the account books, records, and other compilations of data that pertain to the performance of the provisions and requirements of this Contract. Records shall be kept on a generally recognized accounting basis, and calculations will be kept on file in legible form and retained for three (3) years after close-out.

<Note: This section requires ESCO to do commissioning to ensure the system is functioning properly, testing equipment performance and verifying the specified operating parameters. Commissioning typically occurs before the owner's final project acceptance, however, language can be included here to provide for testing after project acceptance. It also requires ESCO notify Agency when testing will take place and gives Agency (or its designee) the right to be present during all tests. Have the commissioning report include manufacturer's startup and performance sheets.>

SECTION 9. STANDARDS OF COMFORT

ESCO will maintain and operate the Equipment in a manner that will provide the standards of heating, cooling, hot water, and lighting as described in Schedule I **(Standards of Comfort)**.

<Note: This section references the standards of comfort contained in Schedule I that ESCO is contractually liable to maintain throughout the contract term. These standards are negotiated between ESCO and Agency to reflect realistic ranges of heating, cooling and hot water temperatures, lighting levels, chilled water requirements, and other specified comfort and operating parameters to be maintained.>

SECTION 10. EQUIPMENT WARRANTIES AND COMPATIBILITY

ESCO covenants and agrees that all equipment installed, as part of this Contract, is new, in good and proper working condition and protected by appropriate written warranties covering all parts and equipment performance. Demonstrators, previously rented, refurbished, or reconditioned items are not considered "new" except as specifically provided in this section. "New" means items that have not been used previously and that are being actively marketed by the manufacturer. Equipment may contain new or minimal amounts of recycled or recovered parts that have been reprocessed to meet the manufacturer's new product standards. Equipment must have the State of Idaho as their first customer and must not have been previously sold, installed, demonstrated, or used in any manner (such as rentals, demonstrators, trial units, etc.). Equipment offered must be provided with a full, unadulterated, and undiminished new item warranty against defects in workmanship and materials. The warranty is to include replacement, repair, and any labor for the warranty period. ESCO further agrees to deliver to Agency for inspection and approval all such written warranties, which shall be attached and set forth as Exhibit II **(Equipment Warranties)**; to transfer warranties to Agency; to pursue rights and remedies against the manufacturer of the equipment under the warranties in the event of equipment malfunction or improper or defective function, and defects in parts, workmanship and performance; and to notify Agency whenever defects in equipment parts or performance occur or when warranty rights and remedies are exercised by ESCO. The cost of any risk of damage or damage to the equipment and its performance, including damage to property and equipment of Agency or the Premises, due to ESCO's failure to exercise its warranty rights shall be borne solely by ESCO.

All warranties shall specify that only new, and not reconditioned parts, may be used and installed when repair is necessitated by malfunction. All warranties required hereunder shall be in force for a minimum of one (1) year from the Commencement Date.

Notwithstanding the above, nothing in this Section shall be construed to alleviate/relieve ESCO from complying with its obligations to perform under all terms and conditions of this Contract and as set forth in all attached Schedules.

<Note: This warranty provision ensures all installed equipment is new and protected by appropriate written manufacturers warranties for parts and performance for a minimum of one (1) year. It requires that warranties provide for replacement with new parts (not used or reconditioned) during the warranty period. While equipment warranties will be transferred to Agency after completed project installation, ESCO is responsible for pursuing any necessary remedies during the warranty period. If ESCO fails to exercise the warranty and damages occur, ESCO is responsible for all costs of repair and any lost savings. Manufacturer warrantees can not supersede Sections 3.1>

SECTION 11. <u>TRAINING BY ESCO</u>

ESCO shall conduct the training program described in Schedule M **(ESCO's Training Responsibilities)** hereto. The training specified in Schedule M **(ESCO's Training Responsibilities)** must be completed prior to acceptance of the Equipment installation. ESCO shall provide ongoing training whenever needed with respect to updated or altered Equipment, including upgraded software, and including newly hired maintenance personnel during the term of the Contract. Such training shall be provided at no charge to the Agency.

<Note: In many performance contracts training of facility personnel is conducted before acceptance of the completed installation. If it is necessary to conduct training after project acceptance, note this in the appropriate schedule. If there are charges for unscheduled training, it should be noted in this section.>

SECTION 12. EQUIPMENT SERVICE

Section 12.1. Actions by ESCO. ESCO shall provide all service, repairs, and adjustments to the Equipment installed under terms of this Contract pursuant to Schedule J **(ESCO's Maintenance Responsibilities)**. Agency shall incur no cost for Equipment service, repairs, and adjustments, except as set forth in Schedule D **(Compensation to ESCO)**, provided, however, that when the need for maintenance or repairs principally arises due to the negligence or willful misconduct of Agency or any employee or other agent of Agency, and ESCO can so demonstrate such causal connection, ESCO may charge Agency for the actual cost of the maintenance or repair insofar as such cost is not covered by any warranty or insurance proceeds.

<Note: This section refers to the maintenance and service responsibilities of each party as specified in Schedules J and D. It also states that if Agency is at fault for causing additional maintenance or repair to the equipment, Agency will be charged by ESCO for maintenance or repair costs.>

Section 12.2. Malfunctions and Emergencies. Agency shall use its best efforts to notify ESCO or its designee(s) within twenty-four (24) hours after Agency's actual knowledge and occurrence of: (i) any malfunction in the operation of the Equipment or any preexisting energy related equipment that might materially impact upon the guaranteed energy savings, (ii) any interruption or alteration to the energy supply to the Premises, or (iii) any alteration or modification in any energy-related equipment or its operation.

Where Agency exercises due diligence in attempting to assess the existence of a malfunction, interruption, or alteration it shall be deemed not at fault in failing to correctly identify such conditions as having a material impact upon the guaranteed energy savings. Agency shall notify ESCO within twenty-four (24) hours upon its having actual knowledge of any emergency condition affecting the Equipment. ESCO, or its designee(s) shall respond within ____ hours and shall promptly proceed with corrective measures. Any telephonic notice of such conditions by Agency shall be followed within three (3) business days by written notice to ESCO from Agency. If Agency unreasonably delays in notifying ESCO of a malfunction or emergency, and the malfunction or emergency is not otherwise corrected or remedied, such conditions will be treated as a Material Change and the applicable provisions of Section 14 **(Material Changes)** shall be applied.

ESCO will provide a written record of all service work performed. This record will indicate the reason for the service, description of the problem and the corrective action performed.

<Note: This section requires Agency to notify ESCO within a specified number of hours of actually knowing about any situation that impacts the performance of the equipment. The impacts cover both pre-existing energy related equipment and the newly installed equipment including equipment malfunction or modification, interruption of power supply or any emergency situation which may affect the energy savings guarantee. If such an impact is known by Agency to have occurred and Agency delays notifying ESCO and doesn't correct the situation, it will be treated as a Material Change and the baseline will be adjusted accordingly. If Agency makes an effort to assess the situation and incorrectly determines it doesn't have an impact, then ESCO will not fault Agency, although an adjustment to the baseline may still be warranted.>

Section 12.3. Actions by Agency. Agency shall not move, remove, modify, alter, or change in any way the Equipment or any part thereof without the prior written approval of ESCO except as set forth in Schedule K **(Agency's Maintenance Responsibilities)**. Notwithstanding the foregoing, Agency may take reasonable steps to protect the Equipment if, due to an emergency, it is not possible or reasonable to notify ESCO before taking any such actions. In the event of such an emergency, Agency shall take reasonable steps to protect the Equipment from damage or injury and shall follow instructions for emergency action provided in advance by ESCO. Agency agrees to maintain the Premises in good repair and to protect and preserve all portions thereof, which may in any way affect the operation or maintenance of the Equipment.

<Note: This section states Agency may not make any changes to the operation and maintenance of the equipment without prior written approval of ESCO unless otherwise indicated in Schedule K or if there is an emergency and ESCO can't be reasonably notified. In the case of such emergency, Agency should follow instructions provided by ESCO for emergency action.>

SECTION 13. UPGRADING OR ALTERING THE EQUIPMENT

ESCO shall at all times have the right, subject to Agency's prior written approval, which approval shall not be unreasonably withheld, to change the Equipment, revise any procedures for the operation of the equipment or implement other energy saving actions in the Premises, provided that:

(i) ESCO complies with the standards of comfort and services set forth in Schedule I **(Standards of Comfort)** herein;

(ii) such modifications or additions to, or replacement of the Equipment, and any operational changes, or new procedures are necessary to enable ESCO to achieve the energy savings at the Premises and;

(iii) any cost incurred relative to such modifications, additions or replacement of the Equipment, or operational changes or new procedures shall be the responsibility of ESCO.

All modifications, additions or replacements of the Equipment or revisions to operating or other procedures shall be described in a supplemental Schedule(s) to be provided to Agency for approval, which shall not be unreasonable withheld, provided that any replacement of the Equipment shall be new as set forth in Section 10 and have equal or better potential to reduce energy consumption at the Premises than the Equipment being replaced. ESCO shall update any and all software to be used in connection with the Equipment in accordance with the provisions of Section 18.1 **(Ownership of Certain Proprietary Rights)**. All replacements of and alterations or additions to the Equipment shall become part the Equipment described in Schedule A **(Equipment to be Installed by ESCO)** and shall be covered by the provisions and terms of Section 8 **(Construction Schedule and Equipment Installation; Approval)**.

<Note: This section describes the terms and conditions under which ESCO may make changes to the equipment, operating procedures or take other energy savings actions. If such changes are implemented during any time during the Contract they must be described in a supplemental schedule and be approved by Agency. Any equipment replaced is required to be new and have the potential to

produce at least as much or more savings. If computer software is updated, the licensing provisions of Section 18.1 still apply.>

SECTION 14. MATERIAL CHANGES

<Note: It is typical for the percent of deviation to be negotiated as a value ranging between two percent (2%) and five percent (5%) based on aggregate consumption costs. The lower value (2%) may be appropriate for large facilities (over $20,000/month utility bills) and the higher value (5%) may be appropriate for small facilities (less than $5,000/month utility bills).>

Section 14.1. Material Change Defined: A Material Change shall include any change in or to the Premises, whether structural, operational or otherwise in nature which reasonably could be expected, in the judgment of Agency, to increase or decrease annual energy consumption in accordance with the provisions and procedures set forth in Schedule E **(Baseline Energy Consumption)** and Schedule F **(Savings Measurement and Calculation Formulae; Methodology to Adjust Baseline)** by at least _____ percent (___%) after adjustments for climatic variations. Actions by Agency, which may result in, a Material Change include but are not limited to the following:

(i) manner of use of the Premises by Agency; or

(ii) hours of operation for the Premises or for any equipment or energy using systems operating at the Premises; or

(iii) permanent changes in the comfort and service parameters set forth in Schedule I **(Standards of Comfort)**; or

(iv) occupancy of the Premises; or

(v) structure of the Premises; or

(vi) types and quantities of equipment used at the Premises or

(vii) modification, renovation or construction at the Premises; or

(viii) Agency's failure to provide maintenance of and repairs to the Equipment in accordance with Schedule K **(Agency's Maintenance Responsibilities)**; or

(ix) any other conditions other than climate affecting energy use at the Premises.

<Note: This section defines the term "Material Change" which covers any condition, other than weather, that affects building energy use by more than the negotiated percentage (see above discussion).>

Section 14.2. Reported Material Changes; Notice by Agency: Agency shall use its best efforts to deliver to ESCO a written notice describing all actual or proposed Material Changes in the Premises or in the operations of the Premises at least __ (___) days before any actual or proposed Material

Change is implemented or as soon as is practicable after an emergency or other unplanned event. Notice to ESCO of Material Changes which result because of a bona fide emergency or other situation which precludes advance notification shall be deemed sufficient if given by Agency within ______ (___) hours after having actual knowledge that the event constituting the Material Change occurred or was discovered by Agency to have occurred.

<Note: This section requires Agency to notify ESCO in writing if there are any actual or planned changes to the facility which would affect energy consumption by more than the negotiated percentage (see above discussion). In the event of an emergency or situation that would prevent advance notification, Agency has a specified number of hours to inform ESCO that a Material Change has occurred.>

Section 14.3. Unreported Material Change. In the absence of any Material Changes in the Premises or in their operations, the baseline energy consumption as set forth in Schedule E **(Baseline Energy Consumption)** should not change more than percent (___%) during any month from the projected energy usage for that month, after adjustments for changes in climatic conditions. Therefore, if energy consumption for any month as set forth in Schedule E **(Baseline Energy Consumption)** deviates by more than ____ percent (%) from the energy consumption for the same month of the preceding contract year after adjustments for changes to climactic conditions, then such deviation shall be timely reviewed by ESCO to ascertain the cause of deviation. ESCO shall report its findings to Agency in a timely manner and ESCO and Agency shall determine what, if any, adjustments to the baseline will be made in accordance with the provisions set forth in Schedule F **(Savings Measurement and Calculation Formulae; Methodology to Adjust Baseline)** and Schedule E **(Baseline Energy Consumption)**.

<Note: This section states that if all building conditions and operations stay the same, then energy consumption will not vary more than the negotiated percentage (see above discussion) during any month when compared to the baseline use for that month and after adjustments for weather are made. In the event such a variation occurs, ESCO will try to determine the cause of the deviation and report its findings to Agency. ESCO and Agency will then determine what adjustments will be made to the baseline as described in Schedule F. Disputes may need to be addressed here.>

SECTION 15. REPRESENTATIONS AND WARRANTIES

Each party warrants and represents to the other that:

(i) it has all requisite power, authority, licenses, permits, and franchises, corporate or otherwise, to execute and deliver this Contract and perform its obligations hereunder;

(ii) its execution, delivery, and performance of this Contract have been duly authorized by, or are in accordance with, its organic instruments, and this Contract has been duly executed and delivered for it by the signatories so authorized, and it constitutes its legal, valid, and binding obligation;

(iii) its execution, delivery, and performance of this Contract will not breach or violate, or constitute a default under any Contract, lease or instrument to which it is a party or by which it or its properties may be bound or affected; or

(iv) it has not received any notice, nor to the best of its knowledge is there pending or threatened any notice, of any violation of any applicable laws, ordinances, regulations, rules, decrees, awards, permits or orders which would materially and adversely affect its ability to perform hereunder.

<Note: This boilerplate provision states that each party has the requisite authority and ability to enter into this contract.>

SECTION 16. ADDITIONAL REPRESENTATIONS OF THE PARTIES.

Agency hereby warrants, represents and promises that it has not entered into any undisclosed leases, or contracts with other persons or entities regarding the leasing of energy efficiency equipment or the provision of energy management services for the Premises or with regard to servicing any of the energy related equipment located in the Premises. Agency shall provide ESCO with copies of any successor or additional leases of energy efficiency equipment and contracts for management or servicing of preexisting equipment at Premises that may be executed from time to time hereafter within sixty (60) days after execution thereof.

Agency agrees that it shall adhere to, follow and implement the energy conservation procedures and methods of operation to be set forth on Schedule K **(Agency's Maintenance Responsibilities)**, to be attached hereto and made a part hereof after Agency's approval.

Agency agrees that ESCO shall have the right once a month, with prior notice, to inspect Premises to determine if Agency is complying, and shall have complied with such obligations. For the purpose of determining Agency's said compliance, the checklist to be set forth at Schedule L (Facility Maintenance Checklist) as completed and recorded by ESCO during its monthly inspections, shall be used to measure and record Agency's said compliance. Agency shall make the Premises available to ESCO for and during each monthly inspection, and shall have the right to witness each inspection and the recordation on the checklist.

ESCO hereby warrants, represents and promises that:

(i) before commencing performance of this Contract:

(a) it shall have become licensed or otherwise permitted to do business in the State of Idaho.

(b) it shall have provided proof and documentation of required insurance pursuant to Section 17 **(Insurance Requirements)**;

(c) it shall submit a properly executed Contractor’s Affidavit Concerning Taxes.

(ii) it shall make available, upon reasonable request, all documents relating to its performance under this Contract, including but not limited to all contracts and subcontracts entered into;

(iii) it shall use qualified subcontractors and delegates, licensed and bonded in this state to perform the work so subcontracted or delegated pursuant to the terms hereof;

(iv) it is financially solvent, able to pay its debts as they mature and possessed of sufficient working capital to complete and perform its obligations under this Contract.

The parties acknowledge and agree that ESCO has entered into this Contract in reliance upon the prospect of earning compensation based on guaranteed energy savings in energy used at Premises, as set forth on Schedules C **(Energy Saving Guarantee)** and D **(Compensation to ESCO)**, attached hereto and made a part hereof. The parties further acknowledge and agree that the said guaranteed energy savings would not likely be obtained unless certain procedures and methods of operation designed for energy conservation shall be implemented, and followed by Agency on a regular and continuous basis.

<Note: This provision protects both ESCO and Agency by establishing a method for ESCO to supervise Agency's compliance with the scheduled routine and preventative maintenance activities to be performed by Agency (either by in-house personnel or existing maintenance contract). This checklist should be developed for both the newly installed and pre-existing energy-related equipment.>

<Note: These additional representations address several areas specific to the performance contract. Agency declares it has not entered into any leases or service contracts relating to energy equipment or servicing of pre-existing equipment and will notify ESCO within a specified period of time if it does so.

ESCO certifies that before beginning work under this contract it will: have become licensed to business in the state of Idaho; provide proof of required insurance; give Agency access to all document relating to the project (including all contracts and subcontracts) upon request; use Idaho-licensed and qualified subcontractors; and is financially able to complete the project and perform under the terms of this contract.>

SECTION 17. PROPERTY/CASUALTY/INSURANCE; INDEMNIFICATION

Prior to commencement of any work and for the duration of this Agreement, ESCO must provide and maintain insurance as set forth below. ESCO shall require all subcontractors to maintain the same insurance required herein of ESCO. All such insurance shall be written on a Comprehensive Form of Policy. Failure to provide satisfactory evidence of coverage may result in rejection of a submission and/or contract cancellation. Insurance required by this section shall name the State of Idaho as an additional named insured and shall be with insurers rated A-VII or better in the latest *Bests Rating Guide* and in good standing and authorized to transact business in Idaho. The coverage provided by such policy shall be primary to any coverage of the State on or related to the Contract and shall provide that the insurance afforded applies separately to each insured against whom a claim is made, except with respect to the limitation of liability. Any “other insurance” provisions contained in any policy including the state of Idaho as an additional insured shall not apply. All required policies shall evidence that the policies have been endorsed to require sixty (60) days’ notice to the State, by certified or registered mail, return receipt requested, prior to any cancellation, potential reduction in aggregate limits, refusal to renew or any material change in the nature or extent of the coverage provided. All policies shall contain waivers of subrogation. ESCO waives all rights against the State and its agents, officers, directors and employees for recovery of damages to the extent these damages are covered by the required policies.

Policies may contain deductibles but such deductibles shall not be reduced from any damages due to the State.

By requiring insurance herein, the State does not represent that coverage and limits will necessarily be adequate to protect ESCO and such coverage and limits shall not be deemed a limitation on ESCO's indemnity liabilities under the Contract.

The following are required:

a. Workers' Compensation Insurance with statutory limits as required by statute, and Employer's Liability Insurance with limits of not less than One Hundred Thousand and 00/100 Dollars ($100,000.00) per Accident, Five Hundred Thousand and 00/100 Dollars ($500,000.00) Disease, Policy Limit and One Hundred Thousand and 00/100 Dollars ($100,000.00) Disease, Each Employee.

b. Automobile Liability, including non-owned and hired with a limit not less than One Million and 00/100 Dollars ($1,000,000.00).

c. Commercial General Liability and Umbrellas Liability Insurance including premises, operation, owners and contractors protective liability, products and completed operations liability, personal injury liability (including employee acts), broad form property damage liability and blanket contractual liability in amounts of not less than Five Million and 00/100 Dollars ($5,000,000.00). ESCO shall maintain Commercial General Liability (CGL) and, if necessary, commercial umbrella or excess liability with a limit of not less than Five Million and 00/100 Dollars ($5,000,000.00) each occurrence/Annual Aggregate and the Annual Aggregate shall be endorsed to apply separately to each job site or location. The Schedule of Underlying Insurance in the Umbrella Policy shall include the CGL, the auto policy and the Employer's Liability Policy. In the event any of the hazards of explosion, collapse and underground, normally referred to as XCU, exist, then such hazards shall be covered and protection afforded under the policy and such exclusions must be removed from the policy.

d. ESCO shall maintain in full force and effect, at ESCO's expense, an Errors and Omissions or Professional Liability Insurance Policy in the amount of $2,000,000 minimum coverage. Such coverage may be on a "claims made" basis. If such insurance is on a "claims made" basis, it shall remain in effect for the duration of the applicable statute of limitations for claims against professionals such as ESCO. ESCO shall be responsible for all claims, damages, losses or expenses, including attorneys' fees, arising out of or resulting from the performance of professional services contemplated by this Agreement, provided that any such claim is attributable to bodily injury or death, or injury to or destruction of tangible personal property or to failures of the work, including the loss of use resulting there from, and is caused, in whole or in part, by any negligent act, error or omission of ESCO, or any consultant or associate thereof, anyone directly or indirectly employed by ESCO. ESCO shall submit a Certificate of Insurance verifying said coverage upon execution of this Agreement and also any notices of renewals of such policy as they occur.

e. ESCO shall maintain in full force and effect, at ESCO's expense, an Installation Floater, with limits of not less than One Million and 00/100 Dollars ($1,000,000.00), for coverage of the ESCO's labor, materials, and any equipment to be used for completion of work under this contract. Coverage is to be on an all risk of physical damage form, including earthquake and flood. This insurance shall include the State of Idaho, DPW, Agency, the contractor and its subcontractors as their interests may appear.

ESCO shall be responsible for (i) any damage to the Equipment or other property on the Premises and (ii) any personal injury where such damage or injury occurs as a result of ESCO's performance under this Contract.

ESCO shall save and hold harmless DPW and Agency and their officers, agents and employees or any of them from any and all claims, demands, actions or liability of any nature based upon or arising out of any services performed by ESCO, its agents or employees under this Contract.

<Note: This section needs to reflect Agency's requirements with regard to insurance and indemnification.>

SECTION 18. OWNERSHIP

Section 18.1. Ownership of Certain Proprietary Property Rights. Agency shall not, by virtue of this Contract, acquire any interest in any formulas, patterns, secret inventions or processes, copyrights, patents, or other intellectual or proprietary rights that are or may be used in connection with the Equipment. ESCO shall grant to Agency a perpetual, irrevocable royalty-free license for any and all software or other intellectual property rights necessary for Agency to continue to operate, maintain, and repair the Equipment in a manner that will yield maximal energy consumption reductions.

<Note: In most cases, this provision addresses ESCO's proprietary rights over customized (or exclusive) software used in an energy management system which may control, manage and perform other functions in conjunction with the project (there may be other technical designs, processes, formulas etc., which this provision would cover). Of particular importance is the stipulation that grants Agency a continuing license (at no charge) to use and operate the project without violating ESCO's proprietary rights.>

Section 18.2. Ownership of Existing Equipment. The equipment and materials at the Premises at the time of execution of this Contract shall remain the property of Agency even if it is replaced or its operation made unnecessary by work performed by ESCO pursuant to this Contract. If applicable, ESCO shall advise Agency in writing of all equipment and materials to be replaced at the Premises and Agency shall within thirty (30) days designate in writing to ESCO which equipment and materials should not be disposed of off-site by ESCO. It is understood and agreed to by both Parties that Agency shall be responsible for and designate the storage location for any equipment and materials that should not be disposed of off-site. ESCO shall be responsible for the disposal of all equipment and materials designated by Agency as disposable off-site in accordance with all applicable laws and regulations regarding such disposal.

<Note: This provision states that Agency has ownership of all existing equipment and ESCO shall notify Agency in writing of what equipment and materials are to be replaced. If Agency chooses to keep the equipment to be replaced, ESCO will be notified and Agency will be responsible for identifying the location of where the property is to be stored or relocated. ESCO is responsible for all equipment and materials to be disposed>

Section 18.3 Ownership of Drawings. All drawings, reports and materials prepared by ESCO specifically in performance of this Contract shall become the property of Agency and will be delivered to Agency no later than forty-five (45) days after completion.

SECTION 19. EVENTS OF DEFAULT

Section 19.1. Events of Default by Agency. Each of the following events or conditions shall constitute an "Event of Default" by Agency:

(i) any failure by Agency to pay ESCO any sum due for a service and maintenance period of more than sixty (60) days after written notification by ESCO that Agency is delinquent in making payment and provided that ESCO is not in default in its performance under the terms of this Contract;

(ii) any other material failure by Agency to perform or comply with the terms and conditions of this Contract, including breach of any covenant contained herein, provided that such failure continues for sixty (60) days after notice to Agency demanding that such failures to perform be cured or if such cure cannot be effected in sixty (60) days, Agency shall be deemed to have cured default upon the commencement of a cure within sixty (60) days and diligent subsequent completion thereof; or

(iii) any representation or warranty furnished by Agency in this Contract, which was false, or misleading in any material respect when made.

Section 19.2. Events of Default by ESCO. Each of the following events or conditions shall constitute an "Event of Default" by ESCO:

(i) the standards of comfort and service set forth in Schedule I (Standards of Comfort) are not provided due to failure of ESCO to properly design, install, maintain, repair or adjust the Equipment except that such failure, if corrected or cured within thirty (30) days after written notice by Customer to ESCO demanding that such failure be cured, shall be deemed cured for purposed of this Contract;

(ii) any representation or warranty furnished by ESCO in this Contract is false or misleading in any material respect when made;

(iii) failure to furnish and install the Equipment and make it ready for use within the time specified by this Contract as set forth in Schedules A **(Equipment to be Installed by ESCO)** and G **(Construction and Installation Schedule)**;

(iv) provided that the operation of the facility is not adversely affected and provided that the standards of comfort in Schedule I **(Standards of Comfort)** are maintained, any failure by ESCO to perform or comply with the terms and conditions of this Contract, including breach of any covenant contained herein except that such failure, if corrected or cured within thirty (30) days after written notice by the Customer to ESCO demanding that such failure to perform be cured, shall be deemed cured for purposes of this Contract;

(v) any lien or encumbrance is placed upon the Equipment by any subcontractor, laborer, supplier or lender of ESCO;

(vi) the filing of a bankruptcy petition whether by ESCO or its creditors against ESCO which proceeding shall not have been dismissed within ninety (90) days of its filing, or an involuntary assignment for the benefit of all creditors or the liquidation of ESCO;

(vii) Any change in ownership or control of ESCO without the prior approval of Agency, which shall not be unreasonably withheld; or

(viii) failure by ESCO to pay any amount due Agency or perform any obligation under the terms of this Contract or the Energy Savings Guarantee as set forth in Schedule C **(Energy Savings Guarantee)**.

SECTION 20. REMEDIES UPON DEFAULT

Section 20.1. Remedies upon Default by Agency. If an Event of Default by Agency occurs, ESCO may exercise all remedies available at law or in equity or other appropriate proceedings including bringing an action or actions from time to time for recovery of amounts due and unpaid by Agency, and/or for damages which shall include all costs and expenses reasonably incurred in exercise of its remedy. Election of one (1) remedy is not a waiver of other available remedies.

Section 20.2. Remedies Upon Default by ESCO. In the Event of Default by ESCO, Agency may exercise and any all remedies at law or equity, or institute other proceedings, including, without limitation, bringing an action or actions from time to time for specific performance, and/or for the recovery of amounts due and unpaid and/or for damages, which shall include all costs and expenses reasonably incurred, including attorney's fees. Election of one (1) remedy is not a waiver of other available remedies.

SECTION 21. CONDITIONS BEYOND CONTROL OF THE PARTIES

If a party ("performing party") shall be unable to reasonably perform any of its obligations under this Contract due to acts of God, insurrections or riots, or other event beyond its control, this Contract shall at the other party's option (i) remain in effect but said performing party's obligations shall be suspended until the said events shall have ended; or, (ii) be terminated upon ten (10) days' notice to the performing party, in which event neither party shall have any further liability to the other.

SECTION 22. ASSIGNMENT

Section 22.1. Assignment by ESCO. ESCO acknowledges that Agency is induced to enter into this Contract by, among other things, the professional qualifications of ESCO. ESCO agrees that neither this Contract nor any right or obligations hereunder may be assigned in whole or in part to another firm, without the prior written approval of the State. Notwithstanding the provisions of this paragraph, ESCO shall remain jointly and severally liable with its assignees(s), or transferee(s) for all of its obligations under this Contract.

<Note: This assignment provision acknowledges that Agency selected ESCO for its unique expertise and qualifications to perform the services specified in the contract. ESCO may not assign this contract to another ESCO without the written approval of DPW and Agency and any ESCO assigned this contract must fully comply with all terms and conditions. ESCO and any assignee remain contractually liable for fulfilling all of ESCO's obligations as specified in the contract.>

Section 22.2. Assignment by Agency. Agency may transfer or assign this Contract and its rights and obligations herein to a successor or purchaser of the facility(ies) subject to this Contract or an interest therein.

<Note: This provision allows Agency to transfer or assign this contract to a new building owner or occupant. >

SECTION 23. MISCELLANEOUS PROVISIONS

Section 23.1 Nonappropriation of Funds. It is understood and agreed that DPW and Agency are Idaho state government entities and this Agreement shall in no way or manner be construed so as to bind or obligate DPW or Agency beyond the term of any particular appropriation of funds by the State's Legislature as may exist from time to time. DPW reserves the right to terminate this Agreement in whole or in part if, in its judgment, the Legislature of the State of Idaho fails, neglects, or refuses to appropriate sufficient funds as may be required for Agency to continue any payments required under this Agreement. All affected future rights and liabilities of the parties hereto shall thereupon cease within ten (10) days after notice to ESCO. It is understood and agreed that Agency's payments herein provided for shall be paid from Idaho State Legislative appropriations and, in some instances, direct federal funding.

Section 23.2. Waiver of Claims/Liens. ESCO shall obtain and furnish to Agency a Waiver of Claims or Liens from each vendor, material manufacturer and laborer in the supply, installation and servicing of each piece of Equipment.

Section 23.3. Compliance with Law and Standard Practices. ESCO shall perform its obligations hereunder in compliance with any and all applicable federal, state, and local laws, rules, and regulations, in accordance with sound engineering and safety practices and in compliance with any and all reasonable rules of relative to the Premises. ESCO shall be responsible for obtaining all governmental permits, consents, and authorizations as may be required to perform its obligations hereunder. Failure in this Contract to specifically identify any applicable law does not affect its applicability.

Section 23.4. Independent Capacity of the Contractor. It is distinctly and particularly understood and agreed between the parties hereto that the state of Idaho is in no way associated or otherwise connected with the performance of any service under this Contract on the part of ESCO or with the employment of labor or the incurring of expenses by ESCO. Said ESCO is an independent contractor in the performance of each and every part of this Contract, and solely and personally liable for all labor, taxes, insurance, required bonding and other expenses, and for any and all damages in connection with the operation of this Contract, whether it may be for personal injuries or damages of any other kind.

Section 23.5. Severability. In the event that any clause or provision of this Contract or any part thereof shall be declared invalid, void, or unenforceable by any court having jurisdiction, such invalidity shall not affect the validity or enforceability of the remaining portions of this Contract unless the result would be manifestly inequitable or unconscionable.

Section 23.6. Complete Contract. This Contract, when executed, together with all Schedules attached hereto or to be attached hereto, as provided for by this Contract shall constitute the entire Contract between both parties and this Contract may not be amended, modified, or terminated except by a written amendment signed by the parties hereto.

Section 23.7. Further Documents. The parties shall execute and deliver all documents and perform all further acts that may be reasonably necessary to effectuate the provisions of this Contract.

Section 23.8. Applicable Law. This Agreement shall be construed in accordance with, and governed by the laws of the state of Idaho. Any action to enforce the provisions of this Agreement shall be brought in state district court in [__________] County, Idaho. In the event any term of this Agreement is held to be invalid or unenforceable by a court, the remaining terms of this Agreement will remain in force. ***<Note: May consider using county where Agency is located. Consult counsel.>***

Section 23.9. Notice. Any notice required or permitted hereunder shall be deemed sufficient if given in writing and delivered personally or sent by registered or certified mail, return receipt requested, postage prepaid, or delivered to a nationally recognized express mail service, charges prepaid, receipt obtained, to the address shown below or to such other persons or addresses as are specified by similar notice.

TO ESCO: ***<ESCO Name, Attention:, Mailing address.>***
< Include COPY TO: information for ESCO, if applicable.>

TO AGENCY: **<Agency Name, Attention:, Mailing address.>**
< Include COPY TO: information for Agency, if applicable. >

Section 23.10. Headings. Headings and subtitles used throughout this Contract are for the purpose of convenience only, and no heading or subtitle shall modify or be used to interpret the text of any section.

Section 23.11. Handling of Hazardous Materials: All work completed under this Contract must be in compliance with all applicable federal, state and local laws, rules and regulations regarding waste disposal and treatment/disposal of any hazardous materials that could result from this project. In the event ESCO encounters any such materials, ESCO shall immediately notify the project manager and stop work pending further direction from the project manager. DPW may, in its sole discretion, suspend work on the project pending removal of such materials or terminate this Agreement.

Section 23.12. Public Works Contractor's State License Law: ESCO and its subcontractors and sub-subcontractors shall comply with Idaho Code with specific reference to Public Works Contractor's State License Law, Title 54, Chapter 19.

Section 23.13. Construction Manager: If construction management is used, the Construction Manager shall be licensed as a Public Works Construction Manager, and all construction management shall comply with Idaho Code, Title 54, Chapter 45.

Section 23.14. Architects: If applicable, construction work done under this Contract must have plans and specifications approved by an architect licensed in Idaho.

Section 23.15. Permanent Building Fund Advisory Council: ESCO shall make presentations as required related to this Contract to the Permanent Building Fund Advisory Council.

Section 23.16. Employment of Idaho Residents: Pursuant to Sections 44-1001 and 44-1002, Idaho Code, it is provided that each ESCO must employ ninety-five percent (95%) bona fide Idaho residents as employees, except where under such contracts fifty (50) or less persons are employed, ESCO may employ ten percent (10%) non-residents, provided, however, in all cases employers must give preference to the employment of bona fide residents in the performance of said work, and no contract shall be let to any person, firm, association or corporation refusing to execute an agreement with the above-mentioned provisions in it; provided that in contracts involving the expenditure of Federal Aid Funds, this act shall not be enforced in such a manner as to conflict with or be contrary to the federal statutes prescribing a labor preference to honorable discharged soldiers, sailors, or marines, prohibiting as unlawful any other preference or discrimination among citizens of the United States.

Section 23.17. Subcontractor Approval: DPW retains the right to reasonably reject any ESCO-selected subcontractor prior to its commencement of work under this Contract. If not previously provided, names and qualifications must be submitted at least two (2) weeks in advance.

Section 23.18. Bonding Requirements: ESCO will provide to DPW separate performance and labor and material payment bonds, each in the sum of one hundred percent (100%) of the cost of the construction work. Bonds shall be issued by a surety rated A-VII or better in the latest *Bests Rating Guide* and in good standing and authorized to transact business in Idaho.

Section 23.19. As-Built Drawings: Where applicable, ESCO must provide durable, reproducible record drawings (and such CADD documents as may be agreed to by DPW and Agency) from the "as-built drawings" of all existing and modified conditions associated with the project, conforming to typical engineering standards. These should include architectural, mechanical, electrical, structural, and control drawings and operating manuals and will be delivered prior to acceptance. Drawing format should be in an electronic format as per AIA standard CAD layering AutoCAD version 2000.

Section 23.20. Follow-up Monitoring/Measurement and Maintenance Services: Following the installation and implementation of improvements, ESCO will be responsible for maintaining and measuring to ensure optimal performance, however, Agency has the option to decline these services or negotiate for a reduced term of services. All maintenance and measurement fees will be paid through guaranteed savings.

Section 23.21. Operation and Maintenance Manuals: At least three (3) maintenance manuals for each site will be provided for all equipment replacements and/or upgrades at each location. Manuals are subject to approval of DPW and Agency.

Section 23.22. Continuing Activities: DPW and Agency reserve the right to make energy and water improvements to the work sites and to monitor the performance of the installations independently of ESCO. Additionally, DPW or Agency may wish to integrate other identified capital needs with ESCO projects, which may or may not contain energy and water savings opportunities.

Section 23.23. Non-Discrimination: ESCO shall comply with all applicable state and federal laws, rules and regulations involving non-discrimination on the basis of race, color, religion, national origin, age or sex.

Section 23.24. Taxes: ESCO, in consideration of securing the business of erecting or constructing public works in this state, recognizing that the business in which it is engaged is of a transitory character, and that in the pursuit thereof, its property used therein may be without the state when taxes, excises, or license fees to which it is liable become payable, agrees:

(i) To pay promptly when due all taxes (other than on real property), excises and license fees due to the state, its sub-divisions, and municipal and quasi-municipal corporations therein, accrued or accruing during the term of this Contract, whether or not the same shall be payable at the end of such term;

(ii) That if the said taxes, excises, and license fees are not payable at the end of said term, but liability for the payment thereof exists even though the same constitute liens upon its property, to secure the same to the satisfaction of the respective officers charged with the collection thereof; and

(iii) That, in the event of its default in the payment or securing of such taxes, excises, and license fees, to consent that the department, officer, board, or taxing unit entering into this Contract may withhold from any payment due it hereunder the estimated amount of such accrued and accruing taxes, excises, and license fees for the benefit of all taxing units to which said ESCO is liable.

Section 23.25. Contract Re-Negotiation: DPW and Agency reserve the right to renegotiate the terms of the Contract due to changes in the regulatory or utility climates or Agency's non-discretionary use of energy, or if DPW and Agency desire to add sites as identified in the RFQ.

Section 23.26. Preventive Maintenance Schedule: Upon completion of measurement and verification by ESCO, ESCO shall provide to Agency a single comprehensive schedule of necessary preventive maintenance for all installations for the five (5) years following Contract expiration or termination.

Section 23.27. State of Idaho Minimum Wage Law: It will be the responsibility of ESCO to fully comply with Idaho law regarding the minimum wage law for residents hired to help on projects and jobs in Idaho.

Section 23.28. Use of Agency's Name: ESCO agrees that it will not, prior to, in the course of, or after performance under this Agreement use Agency's name in any advertising or promotional media as a customer or client of ESCO without the prior written consent of Agency.

Section 23.29. Officials, Agents and Employees of the State Not Personally Liable: It is agreed by and between the parties hereto that in no event shall any official, officer, employee or agent of the State of Idaho be in any way personally liable or responsible for any covenant or agreement contained in this Contract whether express or implied, nor for any statement, representation or warranty made herein or in any way connected with this Contract.

Section 23.30. Drafting Not to be Construed Against any Party: All parties acknowledge and agree that each has had a full opportunity to review and have input into this Contract and that any ambiguity found shall not be construed against any party as drafter. Reference to "year" shall mean calendar year unless a fiscal year is specified. If a fiscal year is specified that year is July 1 through June 30.

IN WITNESS WHEREOF, and intending to be legally bound, the parties hereto subscribe their names to this Contract by their duly authorized officers on the date first above written.

____
<Name of ESCO>

By: _______________________
(Signature)

____
(Name and Title)

____
<Name of Agency>

By: ____________________________
(Signature)

____
(Name and Title)

DIVISION OF PUBLIC WORKS

By: _______________________________
Larry V. Osgood, Administrator

ATTACHMENT I: Schedules, Exhibits, Appendices

SCHEDULE A. EQUIPMENT TO BE INSTALLED BY ESCO

<Note: Schedule A: This schedule will be furnished by ESCO based on the final Audit Report. It should specify all of the newly installed equipment including manufacturer, quantity, location and warranties (you can also have a separate schedule for warranties). This schedule should also describe any modifications that may have been made to existing equipment, if applicable.>

SCHEDULE B. DESCRIPTION OF PREMISES; PRE-EXISTING EQUIPMENT INVENTORY

<Note: Schedule B: This schedule is based on the final Audit Report. It contains basic information about the condition of the premises at the time of contract execution. Such information would include facility square footage, building construction, use, occupancy, hours of operation etc., and any special conditions that may exist.

The inventory is important to include for the purpose of identifying what equipment was in place and how it was configured at the time of contract execution. This schedule is important to the accurate establishment of baseline, savings measurement and may need to be referred to in the later years of the contract.>

SCHEDULE C: ENERGY SAVINGS GUARANTEE

<Note: Schedule C: This schedule should fully describe all provisions and conditions of the energy saving guarantee provided by ESCO. The guarantee should be defined in units of energy to be saved for the duration of the contract term and provide a mechanism to calculate dollar savings. Reference to the annual reconciliation of achieved vs. guaranteed savings should be included (there is also language in the body of the contract regarding annual reconciliation See Section 4.2).>

<Note: Actual savings of energy costs attributable to all measures for each year of the contract should be more than the calculated savings for that year.>

<Note: This schedule should contain the projected energy savings in units for each year of the contract. Often these projections are broken down on a measure by measure basis, although some measures may be aggregated into general categories such as lighting or HVAC. If there are several buildings involved in the project, this schedule should contain projections for each facility, even though they may all be covered under a single guarantee.>

SCHEDULE D: COMPENSATION TO ESCO

<Note: Schedule D: This should contain the amount and frequency of any payments that may be made to ESCO for maintenance, measurement and verification or other services negotiated as part of the contract. It should contain information about how the compensation is calculated (e.g. a percentage of savings above and beyond the guarantee, flat fee etc.), and if an annual inflation index is to be used to escalate fees over the duration of the contract term. An hourly fee structure can also be included to cover ESCO costs for any services provided beyond the scope agreed to at the time of contract execution. If ESCO is not the financing arm and will be paid for audit services previously performed, that could be included here.>

SCHEDULE E: BASELINE ENERGY CONSUMPTION

<Note: Schedule E: The baseline energy consumption is the "yardstick" by which all savings achieved by the installed project will be measured. The methodology and all supporting documentation used to calculate the baseline should be in this schedule including unit consumption and current utility rates for each fuel type. This schedule may also include baseline documentation regarding other cost savings such as material savings (e.g. bulbs, ballast, filters, chemicals etc.), and cost savings associated with the elimination of outside maintenance contracts. >

<For each site or project, the baseline and post-installation energy use will usually be defined using metering, billing analysis and/or engineering calculations (including computer simulations) either individually or in combination. In addition, values for certain factors that affect energy use and savings that are beyond ESCO's control may be stipulated using historical data, analyses and/or

results of spot or short-term metering. Agency or ESCO can define baseline conditions. If Agency defines the baseline, ESCO will have the opportunity to verify it. If the baseline is defined by ESCO, Agency will have the opportunity to verify.

<Baseline physical conditions (equipment inventory and conditions, occupancy, nameplate data, energy consumption rate, control strategies, etc.) are typically determined through well-documented audits, surveys, inspections and/or spot or short-term metering. This documentation will define the baseline for calculating savings and document baseline conditions in case future changes require baseline energy use adjustments.>

SCHEDULE F: SAVINGS CALCULATION FORMULAE; METHODOLOGY TO ADJUST BASELINE

<Note: Schedule F: This schedule contains a description of the energy savings measurement, monitoring and calculation procedures used to verify and compute the savings performance of the installed equipment. This calculation will include a method to compare the level of energy that would have been consumed without the project (referred to as the "Baseline") with what amount of energy actually consumed during a specific time period (monthly, quarterly, etc.). All methods of measuring savings including engineered calculations, metering, equipment run times, pre- and post-installation measurements, etc. should be explicitly described for all equipment that is installed.

Periodically (typically on an annual basis), the baseline will be adjusted to account for the prevailing conditions (e.g., weather, billing days, occupancy, etc.) during the measurement period. All methodologies used to account for any adjustments to the baseline needs to be clearly defined in this schedule.

Use FEMP Measurement and Verification Guidelines. You will need to incorporate these by reference. Be sure to identify by current year, edition or version.>

Examples of baseline adjustments include: change in the amount of space being air conditioned, changes in auxiliary systems (towers, pumps, etc.), and changes in occupancy or schedule. For example, if a chiller retrofit was completed in a building with 100,000 square feet of conditioned space and during the contract term the conditioned space is reduced to 75,000 square feet, post-installation energy use would be lower making savings higher. If there are no records of the amount of originally conditioned space, the baseline could not be adjusted. Baseline adjustments for issues such as changes in production shifts, facility closures, adding new wings or loads (such as computer labs) require a conceptual approach versus a method to cover each eventuality. Clearly predictable annual variations are usually handled through established procedures for each identified factor in the savings formulas. Permanent changes, such as changes in square footage, are handled through agreement clauses that allow predictable or expected changes and/or through a "re-open" clause that allows either party to renegotiate the baseline.>

<A Facility Changes Checklist or other method may be provided by ESCO for Agency to notify ESCO of any changes in the facility that could have an impact on energy use (occupancy, new equipment, hours of use, etc.). This checklist is generally submitted on a monthly or quarterly basis.>

SCHEDULE G: CONSTRUCTION AND INSTALLATION SCHEDULE

<Schedule G: The timetables and milestones for project construction and installation should be contained in this schedule. If so desired, documentation of required insurance, and subcontractor lists may be included in this schedule or broken out into a separate schedule. NOTE: It is important that the construction/installation phase of the project (for example bonds and insurance) be treated in compliance with individual institutional requirements and the appropriate governing statutes. Since construction is just one component of the overall project, a separate construction contract may be desirable and in some cases necessary. The construction contract would then be referred to in the body of the contract and attached as an exhibit, appendix or other type of attachment. Another approach would be to consolidate the appropriate construction language for inclusion in the body of the final contract. This will need to be decided as appropriate on a case-by-case basis.>

SCHEDULE H: SYSTEMS START-UP AND COMMISSIONING; OPERATING PARAMETERS OF INSTALLED EQUIPMENT

<Note: Schedule H: This section should specify the performance testing procedures that will be used to start-up and commission the installed equipment and total system. The schedule also provides for Agency to be notified of and have the right to be present during all commissioning procedures. This schedule should contain a provision for the documentation of Agency's attendance at the various tests and acceptance of ESCO's certification that the tests followed the specified procedures and met or exceed the expected results. Use of manufacturer's start up and performance sheets are required.

<The operating parameters should contain any specified parameters for the operation of the installed equipment such as temperature setbacks, equipment run times, load controlling specifications and other conditions for the operation of the equipment.>

SCHEDULE I: STANDARDS OF COMFORT

<Note: Schedule I: The standards of comfort to be maintained for heating, cooling, lighting levels, hot water temperatures, humidity levels and/or any special conditions for occupied and unoccupied areas of the facility should be explicitly described in this schedule.>

SCHEDULE J: ESCO'S MAINTENANCE RESPONSIBILITIES

<Note: Schedule J: A complete description of ESCO's specific operations and maintenance responsibilities should be included in this schedule along with the time intervals for their performance of the stated O&M activities.>

SCHEDULE K: AGENCY'S MAINTENANCE RESPONSIBILITIES

<Note: Schedule K: This schedule describes the operations and maintenance responsibilities that may be assigned to facility staff as agreed to by both parties. In some instances it will contain no more than a description of routine O&M currently being performed on existing energy consuming equipment in the facility. In other cases, facility staff may be used to provide some maintenance on

the new equipment installed under the performance contract, with ESCO providing any specialized services as needed.>

SCHEDULE L: FACILITY MAINTENANCE CHECKLIST

<Note: Schedule L: This checklist is a method by which ESCO may record and track compliance with operations and maintenance procedures performed by facility personnel. The checklist typically specifies simple list of tasks and the corresponding schedule for the performance of the prescribed procedures. Facility staff will complete the checklist and forward it to ESCO, usually on a monthly basis. (This checklist is a very useful tool for both ESCO and Agency to verify that the required maintenance activities are being performed at the scheduled intervals).>

SCHEDULE M: ESCO'S TRAINING RESPONSIBILITIES

<Note: Schedule M: The description of ESCO's training program or sessions for facility personnel should be contained in this schedule. The duration and frequency of the specified training should also be included. Any provisions for on-going training, commitments to train newly hired facility personnel, and training with respect to possible future equipment or software upgrades should also be described. Any fees associated with requests for training beyond what ESCO is contractually bound to provide should also be specified.>

SCHEDULE N: GENERAL CONDITIONS

<Note: Schedule N: Where applicable, insert standard GENERAL CONDITIONS. Where referenced in Section 1.2, describe which of the paragraphs of the general conditions apply to this contract.>

SCHEDULE O: ANNUAL INSTALLMENT PAYMENT SCHEDULE

<Schedule O: This schedule contains the amortized financing payments to be made to the financing institution for the total, itemized capitalized costs (principal and interest) of the project. This schedule will indicate the frequency (monthly, quarterly semi-annually) of payment, the specific amount due. The actual lease agreement and associated documents are located in Appendix D. This Schedule may identify the costs of the audit that the ESCO will expect to recover, if ESCO is the financing institution. If ESCO is not the financing institution, be sure to identify in some schedule the costs of the audit that ESCO will be paid for.>

SCHEDULE P: PRE-EXISTING SERVICE AGREEMENTS

<Note: Schedule P: Include information on the scope and cost of pre-existing equipment service contracts. This gives Agency and ESCO information about how and when existing equipment is being serviced. If ESCO is credited with any maintenance savings or is taking over any existing service contracts, the scopes and costs of these agreements will be useful in tracking the performance of ESCO in providing required services and documenting attributable cost savings.>

SCHEDULE Q: CURRENT AND KNOWN CAPITAL PROJECTS AT FACILITY

<Note: Schedule Q: Include a description or discussion of any current or planned capital projects to be implemented. This information could prove useful in the out-years of the contract to avoid potential disputes over long-term energy savings performance. An installment payment/amortization schedule may need to be included depending on the type of financing used.>

SCHEDULE R: PROJECTED FINANCIAL PERFORMANCE

<Note: Schedule R: This schedule should include a spreadsheet depiction of expected financial performance of the project for the entire contract term. It should clearly identify all financial components of the project including interest rates, current fuel prices, any escalation rates to be applied, guaranteed savings, ESCO compensation figures, cash-flow projections and projected Net Present Value of any cumulative positive cash flow benefits to the building owner.>

EXHIBITS

EXHIBIT I CERTIFICATE OF ACCEPTANCE — INSTALLED EQUIPMENT

APPENDICES

APPENDIX A: TECHNICAL ENERGY AUDIT REPORT AND PROJECT DEVELOPMENT

APPENDIX B: RFQ

APPENDIX C: ESCO PROPOSAL

APPENDIX D: LEASE AGREEMENTS AND DOCUMENTS (if applicable)

ADDITIONAL OPTIONAL SCHEDULES

<The following schedules can be included as optional and included or combined with others or may be contained in the audit report, as desired. If any of the following schedules are used, references to these schedules may need to be added to the contract body.>

ENERGY SAVINGS PROJECTIONS

<This schedule should contain the projected energy savings in units for each year of the contract. Oftentimes these projections are broken down on a measure by measure basis although some measures may be aggregated into general categories such as lighting or HVAC. If there are several buildings involved in the project, this schedule should contain projections for each facility, even though they may all be covered under a single guarantee.>

FACILITY CHANGES CHECKLIST

<A "Facility Changes Checklist" or other method may be provided by ESCO for the client to notify ESCO of any changes in the facility that could have an impact on energy consumption (e.g. occupancy, new equipment acquisition, hours of use etc.). This checklist is generally submitted on a monthly basis or quarterly basis.>

For further information about companies mentioned in the report:

Company	Website
Aircuity	http://www.aircuity.com/
Carrier	http://www.carrier.com/
Clean Fund	http://www.cleanfund.com/
Daintree Networks	http://www.daintree.net/
Digital Lumens	http://www.digitallumens.com/
Johnson Controls	http://www.johnsoncontrols.com/
Joule Assets	http://www.jouleassets.com/
Hannon Armstrong	http://www.hannonarmstrong.com
Honeywell	http://honeywell.com/
Lennox	http://www.lennoxcommercial.com/
Metrus Energy	http://metrusenergy.com/
Noesis Energy	https://www.noesisenergy.com/
Panoramic Power	http://www.panpwr.com/
SCIEnergy	http://scienergy.com/
Siemens	http://www.siemens.com/
SkyFoundry	http://skyfoundry.com/
View	http://viewglass.com/

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