ENERGY

Cost Savings For Facilities

Corey Lee Wilson

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by

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Author's Preface

The ***Energy Cost Savings For Facilities*** guidebook is designed with your busy day and heavy workload in mind. It's organized with subheadings that target the most critical energy issues your buildings and properties are likely to encounter. The content is to the point, with no lengthy explanations, because that's what the links are for in the Appendix.

If you're like me, there are times when you spend more time searching for the information you need "right now" than using it. When your time is of the essence, that's frustrating and non-productive. One of the benefits of an e-book is that you can control-click to the chapter or subheading from the table of contents in a few seconds or search by word.

Use the ***Energy Cost Savings For Facilities*** as a reliable source of energy saving tips, cost saving strategies, and introduction to the ENERGY STAR Portfolio Manager. This e-book is free, but your energy is not. Energy is a significant operations cost component and reduces net profit. Any costs you shift away from energy improve the bottom line.

Energy is a controllable cost. Don't let it control you, your facilities and properties, and most of all your profits. Your organization's leadership is counting on you to make the most of your limited operating budget and minimize costs. Don't let them down. Be the master of your sustainable energy building plan. You have nothing to lose and a lot to gain.

Acknowledgements

To my wife Natedao Arumsri, the love and rainbow of my life, thank you time and again for supporting my projects like this one. Without your unconditional support, this book would not be possible.

Thank you Ting Chang, EVP at MicroNOC Inc. for providing me the opportunity to benefit society by helping to reduce energy usage and balance the electrical grid using smart energy saving systems in California.

Thank you Jim Caldwell, California Statewide Director and Sector Navigator - Energy, Construction & Utilities System for giving me the opportunity to help reduce energy and greenhouse gas emissions.

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1 – ENERGY Savings Introduction

Credit: EPA

Energy! It's one of your major cost components. It's a hot topic and will continue to be so. For most facilities and properties, the cost of energy is not going down—only up. It's essential to reduce energy costs on your building(s) whether new or existing.

Energy management is an integral part of the day-to-day operations for facility managers and property owners. Rising energy costs and increasing interest in sustainability are driving the need to reduce energy consumption in buildings and develop strategies for better management.

How energy efficient is your property? How does a facility overall energy efficiency compare to a portfolio of buildings? Or, how does it compare to other similar buildings regionally, nationwide or internationally?

Doing more with less! That's an often heard catch-phrase for FM's and CFO's in managing costs. The purpose of this handy guide is much the same. Energy issues can drain your budget and consume valuable resources.

This guide is also essential for facility and property managers along with their financial officers who are serious about reducing energy usage and the cost of it to their organization's Triple Bottom Line.

How the United States Uses Energy

Electricity and natural gas have been, and continue to be, the two dominant energy sources in the commercial buildings sector. Together electricity and natural gas accounted for about 93% of total energy consumed in 2012. Along with the increase in total electricity consumption, electricity increased its share of total energy consumed from 38% in 1979 to 61% in 2012**.**

Americans use a lot of energy in homes, businesses, throughout industry, and to travel and transport goods. Thirty percent of energy consumed in the commercial and industrial buildings is wasted. There are five energy-use sectors:

- The industrial sector includes facilities and equipment used for manufacturing, agriculture, mining, and construction.

- The transportation sector includes vehicles that transport people or goods, such as cars, trucks, buses, motorcycles, trains, aircraft, boats, barges, and ships.

- The residential sector includes homes and apartments.

- The commercial sector includes offices, malls, stores, schools, hospitals, hotels, warehouses, restaurants, and places of worship and public assembly.

- The electric power sector consumes primary energy to generate most of the electricity to sell to the other four sectors.

In addition to primary energy use, the industrial, transportation, residential, and commercial sectors also purchase and use most of the electricity (a secondary energy source) the electric power sector produces and sells. These four sectors are called end-use sectors because they purchase or produce energy for their own consumption and not for resale.

As a result of advancements in technology, customer expectations, and state and federal policy goals, the electric power sector is evolving with increased deployment of Distributed Energy Resources (DERs). In late 2016, the Federal Energy Regulatory Commission (FERC) issued a Notice of Proposed Rulemaking (NOPR) requiring Regional Transmission Operators (RTOs) and Independent System Operators (ISOs) to facilitate the participation of electric storage resources and aggregated DERs in competitive wholesale markets.

The California Example

Distributed Energy Resources (DERs), which are defined as distribution-connected distributed generation resources, energy efficiency, energy storage, electric vehicles, and demand response technologies, are supported by a wide-ranging suite of California Public Utilities Commission (CPUC) policies.

The passage of the California Global Warming Solutions Act of 2006 (AB 32) has amplified the need for intensive energy efficiency efforts across California. The California Air Resources Board's (CARB) Draft Scoping Plan for AB 32 implementation states that while "California has a long history of success in implementing regulations and programs to encourage energy efficiency… [it] will need to greatly expand those efforts to meet our greenhouse gas emission reduction goals."

On average, 30 percent of the energy used by commercial buildings is wasted due to inefficiencies. California has taken this principle to heart and with three decades of leadership and innovation in the public and private sectors, California leads the nation, and perhaps the world, in developing and implementing successful energy efficiency efforts.

Ultimately, the purpose of this guide is to show facility managers how the ENERGY STAR Measurement and Tracking Tool: Portfolio Manager can assist in evaluating and tracking a facility's energy consumption, help identify underperforming facilities, generate an ENERGY STAR score, track energy savings from implementation of energy efficient measures, and evaluate potential energy saving measures for a facility. With the assistance of ENERGY STAR

Measurement and Tracking Tool: Portfolio Manager, facility owners and property managers can make more informed decisions on topics and matters that are based on energy performance.

2 – Your Electrical ENERGY Future is Now

Credit: AES

Global energy storage installations will multiply exponentially, from a modest 9 GW / 17 GWh deployed as of 2018 to 1,095 GW / 2,850 GWh by 2040, according to the latest forecast from research company BloombergNEF. This 122-fold boom of stationary energy storage over the next two decades will require $662 billion of investment, according to BNEF estimates. It will be made possible by further sharp declines in the cost of lithium-ion batteries, on top of an 85% reduction in the 2010-18 period.

As states increasingly push clean energy policies, a number are also investigating how they can adapt their utility grids and business models for emerging resources. Nearly every state took some regulatory or legislative action on broad grid modernization or utility business model reform in 2018, with 42 states acting in the second quarter on questions of advanced metering infrastructure, storage deployment, data access and revenue reforms, according to the North Carolina Clean Energy Technology Center.

Highlights included the release of Ohio's PowerForward report, a regulatory roadmap to guide utility reform in the state. That initiative was significant because it represented the spread of utility reform from traditionally blue states like New York and California to the more conservative Midwest, the state's head regulator told Utility Dive.

In the years to come, many analysts expect that expansion to continue, with states taking a more comprehensive look at integrating new performance-based metrics into utility revenues, such as standards for energy efficiency, customer engagement or sustainability. Most utility employees expect that these efforts will result in hybrid revenue models, where their companies make some of their money from traditional cost-of-service investments, and the rest from newer performance-based metrics.

Energy Storage Will Have Its Biggest Year Yet

As utilities plan to decarbonize their systems, many see the current boom in natural gas generation as a "bridge" to a low-carbon future providing dispatchable power to balance out intermittent renewables on their systems. Continued advancements in battery technology, however, could make that bridge shorter than many anticipated.

In November 2018, California regulators approved four battery projects for utility Pacific Gas & Electric (PG&E) to replace three gas plants that had sought ratepayer financial support. The batteries, including two of the world's largest planned projects, represented the first time that a utility and its regulators sought to directly replace multiple major power plants with battery storage.

California has ambitious environmental and battery storage targets, but large-scale storage is also spreading to states without those policies as battery prices decline. Last summer, generator Vistra announced plans for a 42 MWh storage facility connected to a solar farm in Texas, which would be the state's largest battery.

While smaller in scale, the recent growth in utility-size batteries has been outpaced by behind-the-meter installations, which analysis firm Wood Mackenzie says grew more than 300% in 2017 alone. Going forward, Bloomberg analysts expect lower prices and increasing market participation options for storage like FERC's recently approved Order 841 will beget more than 100 GWh of storage capacity in the U.S. alone by 2040.

Lithium-ion Battery Costs Continue to Drop

BNEF's *Energy Storage Outlook 2019*, predicts a further halving of lithium-ion battery costs per kilowatt-hour by 2030, as demand takes off in two different markets – stationary storage and electric vehicles. The report goes on to model the impact of this on a global electricity system increasingly penetrated by low-cost wind and solar.

Just 10 countries are on course to represent almost three quarters of the global market in gigawatt terms, according to BNEF's forecast. South Korea is the lead market in 2019, but will soon cede that position, with China and the U.S. far in front by 2040. The remaining significant markets include India, Germany, Latin America, Southeast Asia, France, Australia and the U.K.

In the USA, a review of compliance filings submitted by grid operators in response to the Federal Energy Regulatory Commission's (FERC) Order 841 shows that Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs) are complying with FERC's directive, but work remains to be done.

Distributed Energy Resources (DERs)

Utilities, keen to prevent load loss to rooftop solar and the like, initially tried to slow the trend with fees and rate designs that discouraged adoption of such resources. But increasingly—and after a series of lengthy state policy battles—they are beginning to recognize that Distributed Energy Resources (DERs) can also provide benefits to the grid and if managed correctly, will become a reliable Behind the Meter (BTM) power resource.

California Independent System Operators (CAISO) refers to storage as a "vital strategy" to meet California's goal of 100% zero-carbon electricity by 2045. The state's current oversupply of solar power in the middle of the day and subsequent drop-off in the evening has led to a curtailment of solar. With more storage on the grid, the oversupply of solar could be captured and used later in the day, reducing the need for curtailment and increasing the grid operator's ability to balance load, CAISO said.

Electric Vehicle (EV) Growth Will Become an Energy Demand Issue

As batteries become cheaper they hold promise for utilities not just as stationary sources of power, but mobile ones as well. By 2050, the National Renewable Energy Laboratory says electric vehicles could increase U.S. power demand by up to 38%, providing an important source of power demand growth for utilities and opportunities to use the vehicles' batteries to meet grid needs.

In 2018, utilities began to realize this opportunity, ramping up their lobbying and public relations efforts around electric vehicles. In the third quarter alone, 32 states and D.C. took some action on electric vehicles, including the approval of utility EV charging programs in Massachusetts, Rhode Island and, earlier, in Nevada.

In the years to come, utilities across the nation are likely to intensify these efforts, pushing for approval to own EV charging stations, studying new rate designs to incentivize charging, and finding new ways to aggregate fleets of vehicles to modulate their charging for grid needs.

EV's Could Overwhelm the Nation's Grids

The power demand from the 20 million electric vehicles (EVs) expected to be on U.S. roads by 2030, up from today's 1.1 million, could overwhelm the nation's grids.

However, the coming EV load could deliver great value to utilities and their customers if it is shifted away from high-priced peak demand periods. That would increase utilities' electricity sales without adding stress to their grids, while also lowering drivers' charging costs. Investing in the communications systems and planning needed to properly manage charging can deliver transportation electrification's full value, stakeholders told Utility Dive.

EVs are the biggest "electric load opportunity for utilities" since the 1950s air conditioning explosion, a May 2019 Smart Electric Power Alliance (SEPA) study reports. But without proper planning to integrate that load, "EVs could lead to grid constraints and increased transmission and distribution peaks" that require new "peaker plants, unplanned grid upgrades, and other costly solutions."

"There is already adequate charging infrastructure technology to incorporate real-time pricing and use price signals to shift charging from peak demand periods to times when utilities have renewables over-generation," the report adds.

What's Coming for EV Energy Storage

The threat to the grid represented by EV growth will not be due to a lack of the Electric Vehicle Supply Equipment (EVSE) used for charging. An estimated 9.6 million EV charging ports will be needed by 2030, according to the Edison Electric Institute, but 2018's 1.2 million North American charging ports will grow ten times to over 12.6 million by 2027, according to Navigant.

With the electrification of trains, trucks, buses and other vehicles, the coming load could be overwhelming. "But worst-case scenarios assume transportation electrification would happen

without optimizing the grid, and there are ways to optimize. Managing the number of cars charging, and when they charge, will determine the real load."

Solar PV Systems

Energy rates and solar policies are in flux, posing a major threat to new solar projects. One major pricing trend—that utilities across the country are adopting—is an increasing emphasis on time-variable rates and demand charges. For an average commercial energy user today, 60% of energy spent is based not on *how much* energy you use, but *when* you use it.

In California, for example, utilities have changed the timing and price of Time of Use (TOU) rates in a way that diminishes solar project economics unless developers pair solar with energy storage.

In addition, utilities have also increased demand charges by more than 100% across the last decade. That means businesses are getting charged more for their peak energy usage each month—and if those peaks occur when time-based rates are highest, it can mean a huge energy bill, and can impact the savings from solar energy.

Solar energy alone does not address the most expensive demand peaks, which now with the new rate structures often occur in the late afternoon when solar production drops. By employing both solar and energy storage, businesses can reduce not only energy charges, but also address demand peaks that may occur when solar output goes down.

During the same period in which energy storage experienced incredible growth, the solar industry witnessed radical threats to existing solar economics due to changing policies and rates. Around the country, Net Energy Metering (NEM) and other market rates and programs have changed substantially over the last few years and will continue to change in the years ahead. Some of the state's leading this transition are:

- Hawaii ended its net metering policies and replaced them with new policies such as a Self-Supply Program (which restricted export) and a smart export program (which requires storage installation).

- In California, NEM 2.0 imposed new fixed charges on monthly bills, which are due to change again in 2020 under NEM 3.0. The new Time-of-Use (TOU rates in California are expected to evolve further.

- In New York net metering has been replaced with an innovative compensation mechanism called the Value of Distributed Energy Resources (VDER), which considers the value of when and where electricity is provided to the grid.

Wind, Thermal, Waste, Hydro & Other Renewable Energy Sources

Because wind, geothermal, biomass and other renewable energy systems are not typically options for most building structures like solar, battery storage and EV charging stations are, they

are not cover in this guidebook. Covering a rooftop with PV panels is possible but mounting a wind turbine on a building's roof top is not.

The same goes for hydro, thermal, biomass and other renewable energy sources that a typical building cannot be equipped for. There are too many structural, special and/or code compliant issues and restrictions to overcome.

3 – Electrical ENERGY Saving Systems for Buildings

Credit: CAISO

The market for solar has grown quickly over the last decade, but ultimately, to tap into the full value of solar energy, businesses need a way to control the timing of that energy use. The best way to do that is with energy storage.

It's pretty simple: Solar energy produced during the day gets stored inside batteries for later use. When the solar production goes down in the late afternoon and time-based rates spike upward, businesses can draw energy from the batteries rather than paying for expensive power from the grid. Businesses can also use power from the batteries when their energy demand is highest to lower their demand charges.

Energy Rates and Solar Policies Are in Flux

Because of solar power's success, utilities across the country are adopting pricing policies that place an increasing emphasis on time-variable rates and demand charges. For an average commercial energy user today, 60% of energy spent is based not on how much energy you use, but when you use it.

In California, for example, utilities have changed the timing and price of Time-of-Use (TOU) rates in a way that diminishes solar project economics unless developers pair solar with energy storage. In addition, utilities have also increased demand charges by more than 100% across the last decade.

That means businesses are getting charged more for their peak energy usage each month. If those peaks occur when time-based rates are highest, it can mean a huge energy bill, and can impact the savings from solar energy. Solar energy alone does not address the most expensive demand peaks, which now with the new rate structures, often occur in the late afternoon when solar production drops. By employing both solar and energy storage systems (ESS), businesses can reduce not only energy charges, but also address demand peaks that may occur when solar output goes down.

Solar will continue to expand but with the shift in energy demand to non PV producing time frames in the evening when demand peaks, the newest and most promising renewable is the use of ESS and the DER technology that allows them to flatten end user energy usage as well as

distribute surplus energy back to the grid all the while reducing buildings energy costs and improving an organizations bottom line.

Be it financial and/or environmental, it's the best of both worlds as the following statistics show:

- U.S. energy storage deployment nearly doubled in 2018 as the nation installed 350.5 MW, 777 MWh—over 80% more than was deployed in 2017 in terms of megawatt-hours, according to a new report.

- Behind-the-Meter (BTM) storage accounted for 53% of the total deployment in megawatts while front-of-the-meter (FTM) installations accounted for 47%, according to the U.S. Energy Storage Monitor 2018 Year-in-Review. FTM installations often had durations of four hours or more.

- Report authors from Wood Mackenzie and the Energy Storage Association expect the energy storage market to double in 2019, deploying 1,681 MWh. By 2024, they expect annual deployments to exceed 4.4 GW that are powered by DERs.

Smart Energy Saving System (SESS) Lowers Building Operation's Energy Costs

As new rooftop solar and battery storage systems evolved, the technology to aggregate their extra energy capacity Behind-the-Meter (BTM) and distribute it back to the power grid has arrived. It's called Distributed Energy Resources (DERs) and it offers utilities the opportunity to meet bulk power sector needs by utilizing their smaller customers who have extra energy reserves to transfer back to the electrical distribution grid.

Until 2019, DER technology moved faster than federal, state and power / gird supplier / operator regulations. In California, now that FERC, CAISO, SCE, PG&E, SDG&E and the California Public Utilities Commission (CPUC) agencies energy regulations are completed and in place, the private BTM aggregators can fully integrate into California's energy markets and offer commercial and industrial facility managers (FM's) substantial savings.

More precisely, a facility or portfolio of buildings can benefit as a distributed energy resource DER if managed effectively by a Smart Energy Saving System (SESS) that lowers their energy usage and in turn reduces their operating costs.

A SESS can manage and regulate energy usage by purchasing it at the lowest peak usage rates and releasing it when energy demand is at its highest. They also prevent energy spikes and excessive energy demand by modulating and flattening energy usage for peak performance. As more loads and generating resources are connected through DERs, power usage will decrease, outages will cease, and this nascent industry will graduate to a full-fledge grid resource, which is ready to happen.

Already, a small mix of aggregators and utility-run programs are starting to bring a wide range of resources together for Facility Managers (FM) and Property Managers (PM) professionals to reduce peak load, take stress off the system in key areas, and reduce the need to purchase expensive power. This could help defer or replace more costly investment in traditional grid

infrastructure, as well as help integrate renewable resources and decrease sector emissions, all part of California's aggressive goal for a sustainable near future.

Facility & Property Managers Can Significantly Reduce Their Energy Costs

The commercial and residential need for rooftop solar, electric vehicles and now battery storage shows no sign of slowing down and will accelerate to meet our nation's growing electrical requirements that are replacing non-renewable resources like coal, petroleum and natural gas.

Until now, getting from the grid of the past with demand response load reductions to the multi-resource network today of Distributed Energy Resources (DERs) was no easy task. It required not just managing the impacts of countless new resources on utility distribution systems but designing the software products and market models to allow the new aggregations to meet grid needs.

The same is true for DER, a catch-all term for rooftop solar, battery storage, and electric vehicles electrical and power sources attached to the distribution grid. For the typical commercial and industrial (C & I) facility, transforming and integrating their various power requirements with the latest solar, battery and EV technologies requires a SESS.

Smart Energy Saving Systems (SESS) for Battery Storage Have Arrived!

A limited number of certified open Automated Demand Response (ADR) program providers in California are beginning to offer Smart Energy Saving System (SESS) programs in 2019. There is no better return on investment for energy reduction savings in California than these promising SESS programs!

Because Energy Storage Systems (ESS) providers collaborate and partner with their clients for the most effective and profitable SESS, they design, install, operate, and maintain their proprietary Aggregated Energy Resource Solutions (AERS) system using advanced building energy demand and emulation analysis that balances your energy rate as well as using the lowest rates available.

All their energy saving partners need to do is provide the necessary (interior or exterior) equipment space for a SESS and a copy of their energy usage data and electrical bill. Design to completion is typically 3 months or less and from then on the SESS installer owns, operates and maintains the equipment and shares the energy savings per a mutually agreed percentage with its partner. Or, the partner can own, operate and maintain it as a capital investment and keep all the energy savings.

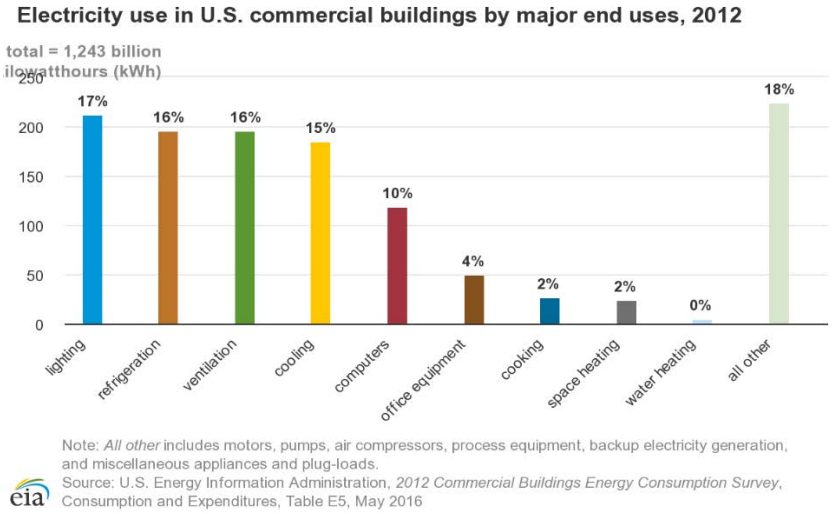
A Smart Energy Saving System (SESS) network operation center specializes in lowering and flattening peak energy time of usage (TOU) by storing energy and releasing it as needed by utilizing a Qualified Balance Resources (QBR) system. QBR essentially releases stored energy during peak demand and TOU periods after purchasing the facility's peak power usage reserves during the time of day with the lowest TOU rates.

A SESS's AERS makes qualified balancing resources of electrical consumption using kw Demand Charge Management (DCM) and kwh Energy Charge Management (ECM) systems. These client and the SESS's integrated systems help control and distribute energy resources between the electrical power grid and the building's energy demand which maximizes a client's energy bill savings and helps balance the electrical grid.

4 – Potential ENERGY Cost Savings

EPA's ENERGY STAR Portfolio Manager program calculates that a 10 percent decrease in energy use could lead to a 1.5 percent increase in Net Operating Income (NOI) with even more impressive figures as the energy savings grow. Using commercial real estate as an example, energy use is the single largest operating expense in commercial office buildings, representing approximately one-third of typical operating budgets and accounting for almost 20 percent of the nation's annual greenhouse gas emissions.

By becoming more energy efficient, all types of buildings from industrial, educational, hospitals, retail, warehouse and many others can reduce operating expenses, increase property asset value, and enhance the comfort of their tenants. They can also demonstrate their commitment to the environment by reducing pollution and the harmful Greenhouse Gas (GHG) emissions that contribute to global warming.



Credit: EIA

No Cost to Low Cost Opportunities

Looking for a quick return on an energy investment? Here's a laundry list of ideas to get started with saving energy that often have a rapid payback. Complete these items first before you consider other options. The best part? These energy management best practices continue to save you money long after the initial project cost is paid off.

Cost Effective Measures

- Measure and track energy performance.
- Turn off lights when not in use or when natural daylight can be used.
- Set back the thermostat in the evenings and other times when a building is unoccupied.
- Educate tenants and employees about how their behaviors affect energy use.

- Improve operations and maintenance practices by regularly checking and maintaining equipment to ensure it is functioning efficiently.
- Optimize start-up time, power-down time, and equipment sequencing.
- Revise janitorial practices to reduce the hours that lights are turned on each day.

Cost-Effective Investments

- Use energy management software.
- Engage in energy audits and retrocommissioning to identify areas of inefficiency.
- Install energy efficient lighting systems. ENERGY STAR qualified compact fluorescent lights prevent carbon dioxide from entering the atmosphere.
- Purchase energy-efficient products like ENERGY STAR qualified office and commercial food service equipment.
- Retrofit, upgrade, or install new heating and cooling equipment to meet reduced loads and take advantage of efficient technologies.
- Use a performance contract to guarantee energy savings from upgrades made.
- Work with an energy services provider to manage and improve performance.
- Plug air leaks with weather stripping and caulking.

Low Cost to Medium Cost Items

If you're looking for a higher return on investment (ROI) in relation to more expenditures for energy savings products and practices, look into these solutions if your budget permits. If it doesn't, the quick payback in energy and cost savings can justify the expense.

Lighting

- Replace old fluorescent and incandescent lighting with T-8 (or even T-5) fixtures, ENERGY STAR certified CFLs or LEDs, and other energy-efficient lighting systems that improve light quality and reduce heat gain. CFLs cost about 75 percent less to operate, and last about 10 times longer.
- Install LED exit signs. These signs can dramatically reduce maintenance by eliminating the need to replace lamps.
- Swap out incandescent light bulbs with ENERGY STAR certified CFLs or LEDs in your desk, task, and floor lamps.

- Install occupancy sensors to automatically turn off lights when no one is present and back on when people return. Storage rooms, back-of-house spaces, meeting rooms, and other low-traffic areas are often good places to start. Occupancy sensors can save between 15 and 30 percent on lighting costs. Before you begin, check with your local utility to see if they offer any incentives. Reference the DSIRE - Database of State Incentives for Renewables & Efficiency section in the Appendix for more information.

- Examine the opportunity to switch from high-pressure sodium lamps to metal halide lamps in parking lots and consider upgrading to LED lighting for outdoor signage.

Food Service Equipment

- For existing refrigerators, clean refrigerator coils twice a year and replace door gaskets and door seals as needed.

- Have large and walk-in refrigeration systems serviced at least annually. This includes cleaning, refrigerant top off, lubrication of moving parts, and adjustment of belts. This will help ensure efficient operation and longer equipment life.

Heating and Cooling

- Tune up your heating, ventilation, and air conditioning (HVAC) system with an annual maintenance contract. Even a new HVACR system, like a new car, will decline in performance without regular maintenance. A contract automatically ensures that your HVACR contractor will provide “pre-season” tune-ups before each cooling and heating season. Your chances of an emergency HVACR breakdown also decrease with regular maintenance.

- Install window films and add insulation or reflective roof coating to reduce energy consumption.

- Upgrade and maintain heating and cooling equipment. Replace chlorofluorocarbon chillers, retrofit or install energy-efficient models to meet a building’s reduced cooling loads, and upgrade boilers and other central plant systems to energy-efficient standards.

- Use a performance contract to guarantee energy savings from upgrades made.

- Work with an energy service provider to help manage and improve energy performance.

- Retro or recommission the building to make sure it’s running the way it was intended.

- Consider energy audits to identify areas where building systems have become inefficient over time and bring them back to peak performance.

Food Service Equipment

- Consider retrofitting existing refrigerators and display cases with anti-sweat door heater controls, and variable speed evaporator fan motors and controls.

Longer Term Solutions & Larger Capital Expenditures

These larger cost and long term investments can also generate a high return on investment (ROI) over an extended period of time. However, they're for consideration after the low no cost to mid cost energy saving ideas have been implemented. For more information for a plan to secure approval and funding for these measures, see Chapter 14 – Securing an ENERGY Savings Plan Budget.

Heating and Cooling

- Install variable frequency drives (VFDs) and energy-efficient motors.
- Upgrade and maintain heating and cooling equipment. Replace chlorofluorocarbon chillers, retrofit or install energy-efficient models to meet a building's reduced cooling loads, and upgrade boilers and other central plant systems to energy-efficient standards.
- Install economizers on rooftop package units.

Food Service Equipment

- Purchase ENERGY STAR certified commercial food service equipment.

Office Equipment

- Purchase energy-efficient products like ENERGY STAR certified office equipment, electronics, and commercial cooking equipment.

5 – Sustainable ENERGY Buildings Plan

Credit: Innovation Origins

A building can't be green if it isn't energy efficient. Why? The energy used by buildings is mostly generated by burning fossil fuels, which releases Greenhouse Gas Emissions (GHG) that contribute to climate change. No building should define itself as "green" unless it consumes less energy and generates fewer greenhouse gas emissions than average.

How can you be sure that a building is energy efficient? Many new buildings today are designed and built to be green—a very exciting trend that will pay big dividends in the future for building operators and for the environment. Most have not.

However, just because a new building is built to be green, doesn't mean it will be energy efficient. Nor will a building built before green standards were implemented—cannot be green. And even more important, buildings often don't perform the way they were designed to. It's important to rely on proven methods to ensure that buildings are designed to maximize energy efficiency, and that they actually perform as intended once they're operational.

Many building and property managers today are being asked: "What are we doing in our buildings to be more sustainable?" Whether it's determining your current status towards being more sustainable, or how you can save money in your building's operations by being more energy efficient or taking you through a building rating system certification—the answers on how to effectively manage your facilities and properties using sustainable practices to are not always on hand and easily accessible—until now.

An in depth study performed by the International Facility Management Association (IFMA) members, primarily FM's, revealed that most have implemented a variety of sustainable practices. However, the majority does not have a master plan in implementation but rather selectively choose different sustainable practices. Many are familiar with the term "green design," but were not as familiar with the LEED rating system or environmentally preferable purchasing. The facility managers in this study consider projects to be sustainable if they:

- Use a minimal level of energy to operate.
- Have a lower total environmental impact.

- Have fewer harmful emissions.
- Contain products that are easily recycled.
- Use products manufactured in an environmentally friendly way.
- Have products made from recycled products.

What is a Sustainable Energy Buildings Plan (SEBP)

A Sustainable Energy Buildings Plan (SEBP) optimizes Energy Storage Systems (ESS) and efficient energy management in support of the primary purpose of the organization. A SEBP has the potential to manage energy resources in a manner consistent with all that is green, zero-net-energy and high-performance. The idea of sustainable energy is not just about doing something that is environmentally or people-friendly. It's about that, but it's also about making facilities last, perform at a level that meets the needs of the organization, managed in a manner that is consistent with the mission, vision, and values of the organization, and most of all, lowering energy usage.

Energy saving performance characteristics include; energy efficiency, low reliance on natural resources, low-carbon, and a healthier indoor environment. The term "high-performance" fits well into the facility manager's lexicon because it basically describes an outcome that facility and property managers have been seeking since long before buildings were termed "green." Their goal has always been to optimize performance while saving energy.

Starting a Sustainable Energy Buildings Plan (SEBP)

The challenge with successfully incorporating energy saving practices is often found within the organizational culture. Change is not easily accepted and "business as usual" seems to be the motto when new ideas or methods are introduced. However, in any organization, at any point in time, change is necessary and will more than likely require a gradual, result-driven integration.

Today, sustainable energy management is not the sole responsibility of one department; it must become a part of the organizational culture. At all levels within an organization, there are lessons to be shared with regard to the synergy between sustainability and energy management. In order to ddevelop a successful SEBP, the following needs to happen:

- Identify the impact of existing facilities on people, the environment, and the finances of the organization, known as the Triple Bottom Line (TBL)..

- Understand Total Cost of Ownership (TCO), Return on Investment (ROI), and Life-Cycle Costing (LCC).

- Determine if your organization's mission statement includes Corporate Social Responsibility (CSR) which is the commitment to contribute to economic development while improving the quality of life of the workforce and their families as well as of the community and society at large.

- Align the facility and property management strategies with the organization's commitment to the TBL and CSR efforts.

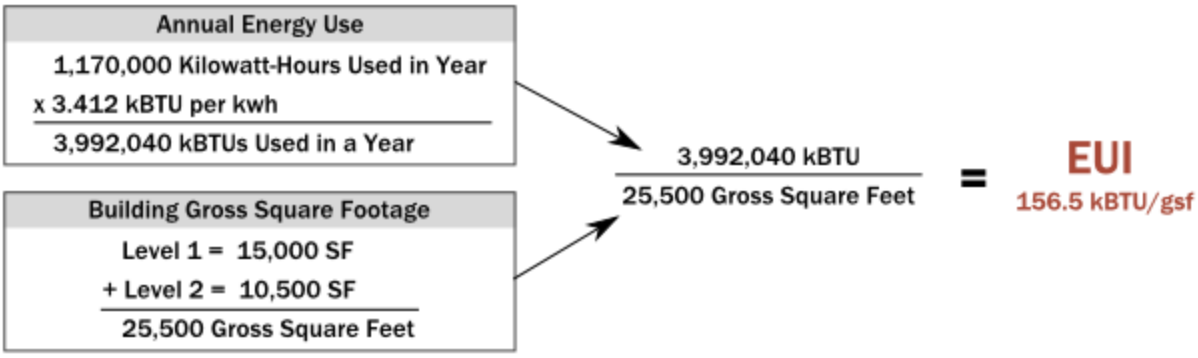
- Create a strategy for delivering sustainable energy management.
- Secure senior management buy-in and/or a policy champion to make it happen.
- Create a process for measuring and monitoring energy, resources, use and savings.
- Develop a change management strategy and communications plan to engage your workforce in sustainable energy management.

Energy Use Intensity (EUI) is the Key Performance Indictor (KPI)

The key performance indicator (KPI) for a SEBP is the Energy Use Intensity (EUI) metric. When using EUI, energy use is expressed as a function of a building's total area or "footprint" or other characteristics. In the United States, EUI is typically expressed in energy used per square foot of building footprint per year. It is calculated by dividing the total gross energy consumed in a one-year period (expressed in kilowatt-hours or kilo-British Thermal Units) by the total gross square footage of the building.

Calculating a Building's EUI

Example: A school contains a main floor consisting of 15,000 square feet, a second floor consisting of 10,500 square feet. The school used 1,170,000 kilowatt-hours of power during the year in question. Kilowatt-hours is multiplied by 3.412 to obtain kBTUs, therefore 1,170,000 * 3.412 = 3,992,040 kBTUs. This is divided by the total square footage of 25,500 square feet for an Energy Use Intensity of 3,992,040 / 22,500 = 156.5 kBTU/sf.



What Affects a Building's EUI?

EUI can vary significantly depending on building type. Hospitals have EUIs that can range from 400 to 500 kBTU/sf, due the high energy demand of interior lighting and hospital equipment. In contrast, a school may have an EUI in the range of 150 kBTU/sf. Food services facilities tend to have very high energy usage, and can have EUIs in the range of 800 kBTU/sf.

Climate can have a significant effect on EUI, due to the variations in heating and cooling costs between different areas of the country. For this reason, EUI values may be broken up into region

to provide a more accurate comparison of selected structures, or the values may be “weather-normalized” to adjust the EUI to be compared against a building in a different type of climate.

The US Energy Information Administration (EIA) compiles information via the Commercial Buildings Energy Consumption Survey (CBECS) that allow for a comparison of energy consumption based on building sizes and types of use. EIA has set energy use reduction challenge targets for the year 2030 that comprise energy use reductions of 70%, regardless of building type or use.

Reduction of Energy Use Intensity (EUI)

Some of the methods used to reduce energy use intensity are:

- Ensuring proper maintenance of equipment to improve efficiency of operation.
- Installing motion activated lights (occupancy sensors).
- Incorporate the use of natural sunlight into the design of occupied spaces.
- Provide a means for passive heating and cooling of interior spaces.
- Develop on-site renewable energy generation.

HVACR and lighting in building spaces together comprise the majority of energy use and obtaining efficiencies in these two areas can result in a significant amount of cost savings, as well as gains in compliance with the 2030 energy reduction goals. Building automation and energy management systems are designed to tell us how much energy and water we use, how we're consuming our resources, and how well we are managing comfort and safety in the workplace.

Energy Usage Reporting Requirements

Environmental sustainability and energy performance analysis helps organizations monitor and reduce energy consumption and their carbon footprint. With more and more organizations seeking ESS and other building certification, energy performance tools are the latest addition to facility management software systems. Many solutions have monitoring, reporting and forecasting capabilities.

Monitoring tools track how much energy is used in an area of a building, and the amount of greenhouse gas emissions the building produces. Reporting and analytics tools aggregate this information so that facility managers can identify energy consumption trends and make informed business decisions. Forecasting tools help organizations understand the financial impact of energy efficiency that help save energy costs over time.

Reduce Energy Related Expenses

Some organizations are taking a look at their energy performance for the first time. Reporting dashboards calculate total energy consumption while helping to identify operational inefficiencies. This kind of analysis demonstrates how an organization is performing and where there’s room for improvement, while encouraging sustainable behavior among a building’s occupants. Organizations can often see an immediate savings in energy-related costs by

implementing environmental performance dashboards that can track no / low / mid / high cost saving opportunities.

6 – ENERGY and Buildings Management Software

Credit: ENERGY STAR Portfolio Manager

Many energy management software systems are designed to perform in sync with and/or are a component of facility and property management software systems. Most facility and property management software systems feature the components listed below, but the one we're going to focus on in this chapter is the first one, environmental sustainability & energy performance analysis.

- Environmental sustainability & energy performance analysis
- Mange assets and track important equipment information
- Manage maintenance costs
- Automate maintenance workflows
- Create and manage recurring tasks
- Increase asset efficiency
- Streamline work order processes (e.g., repair requests, completion tracking)
- Reduce space and maintenance costs

As noted in the previous chapter, the Energy Use Intensity (EUI) metric will be the Key Performance Indicator (KPI) environmental sustainability & energy performance analysis. The one environmental sustainability & energy performance software program that provides the industry standard for energy analysis, tracking and savings is EPA's free ENERGY STAR Portfolio Manager program.

ENERGY STAR Portfolio Manager

The ENERGY STAR Portfolio Manager is free and focused on energy management and cost savings. It also tracks water and waste management that are not covered in this book. It is also the essential energy management software program required to provide the necessary energy performance and benchmarking information for most of the US based green building certification programs such as LEED that are covered in Chapter 13 - ENERGY Certifications for Facilities and Managers. No facility should be without it!

ENERGY STAR's Portfolio Manager can assist in evaluating and tracking a facility's energy consumption, help identify underperforming facilities, generate an ENERGY STAR score, track energy savings from implementation of energy efficient measures, and evaluate potential

energy saving measures for a facility. With the assistance of ENERGY STAR Measurement and Tracking Tool: Portfolio Manager, facility owners and managers can make more informed decisions on topics and matters that are based on the energy performance of their facility.

By entering basic information about a facility and its energy consumption data, the tool calculates annual energy consumption, which can be compared to other similar facilities using the CBECS benchmarking data. Some facilities that meet certain criteria can take this further and use the tool to benchmark energy usage against facilities across the nation and determine the building's ENERGY STAR score.

You've heard it before you can't manage what you don't measure. That's why EPA created ENERGY STAR Portfolio Manager®, an online tool you can use to measure and track energy and water consumption, as well as greenhouse gas emissions. Use it to benchmark the performance of one building or a whole portfolio of buildings, all in a secure online environment.
Benchmark any type of building

You can use Portfolio Manager to manage the energy and water use of any building. All you need are your energy and utility bills and some basic information about your building to get started. Are you designing a new commercial building, or remodeling, or adding an addition to an existing one? You can also use Portfolio Manager to set your energy use target and see how your estimated design energy stacks up against similar existing buildings nationwide.

Other Types of Energy and Facilities Management Software

With more than a hundred vendors in the facilities and property management software landscape, this market can be difficult to navigate but there's no excuse for not using one, preferably one that integrates with EPA's ENERGY STAR Portfolio Manager. Vendors use different terms to describe software functionality for energy management and have varying strengths and weaknesses where energy management is the emphasis. Buyer beware!

Most of the energy management software systems will have Building Automation System (BAS) and/or an Energy Management System (EMS) capabilities. Others are more facilities and property management focused, others more maintenance and operations centric. They are categorized in a handful of functional categories and are known as Computer-Aided Facility Management (CAFM), Computerized Maintenance Management Software (CMMS), Enterprise Asset Management (EAM) and Integrated Workplace Management System (IWMS).

Even Building Information Modeling (BIM) programs now have post design and construction capabilities that can track and manage energy resources. Meanwhile, software is becoming available that will interconnect different facility software systems linking BAS/EMS, IWMS, CMMS/CAFM programs and BIM.

No particular software providers are endorsed here, however, for a list of the leading vendors and the pros and cons of their capabilities, please visit the Appendix at the end of the book for ENERGY and Facilities Management Software Review Providers links for more information.

BAS/EMS

In this day and age, most properties and facilities should have a Building Automation System (BAS) and/or an Energy Management System (EMS). BAS and EMS software systems provide a single control center that handles the remote monitoring and operation of building systems such as electricity, lighting, plumbing, HVACR and environmental control systems. Continual monitoring of all these systems ensures a reliable working environment for personnel and visitors and is an effective tool for resource conservation and waste minimization.

CMMS/CAFM

Computerized Maintenance Management System (CMMS) and Computer-Aided Facility Management (CAFM) software packages maintains a database on the maintenance and operations in an organization as well as the facilities and properties. Viewed by some professionals as the nervous system of a facility, CMMS/CAFM packages produce status reports and documents detailing and summarizing maintenance, operations, facility and property activities and statistics.

EAM

Enterprise Asset Management (EAM) involves the management of the maintenance of physical assets of an organization throughout each asset's lifecycle. EAM is used to plan, optimize, execute, and track the needed maintenance activities with the associated priorities, skills, materials, tools, and information. This covers the design, construction, commissioning, operations, maintenance and decommissioning or replacement of plant, equipment and facilities.

IWMS

An Integrated Workplace Management System (IWMS) is a software platform used by enterprises which integrates the five key components of functionality into a single technology platform and database repository, or from a storage receptacle. It is an enterprise platform that supports the planning, design, management, utilization and disposal of an organization's location-based assets.

BIM

Building Information Modeling (BIM) is a shared 3D digital representation of the physical and functional characteristics of the built environment. It is a knowledge resource for information about a facility, designed to form a reliable basis for management decisions during a facility's life cycle. The basics of BIM revolve around the ability to insert, extract, update or modify information to support and reflect the responsibilities of the facility manager.

7 – ENERGY Surveys, Inspections, Audits and Commissioning

Credit: RAND Engineering & Architecture, DPC

The SMART concept can be applied to energy surveys, inspections, audits and commissioning. SMART is an acronym for Specific, Measurable, Assignable, Realistic and Time-related. It's widely used in business environments to define plans, strategies, and specially, objectives to achieve them—such as energy savings.

This chapter will cover the Specific part and the first SMART concept for energy assessments. The ENERGY STAR Portfolio Manager and the other types of energy and facilities management software can provide the Measurable, Assignable, Realistic and Time-related and those four concepts will be as unique to each property, facility and organization as are each facility/property manager and CFO unique compared to each other.

Many CFO's and facility/property managers assume they're using SMART goals in their efficiency plans. Sadly, this may not be the case. If they haven't developed and implemented a Sustainable Energy Buildings Plan (SEBP) and are not utilizing the best energy and building management software systems available, the chances are they're not reducing energy usage to its full potential.

The only way to find out, with a variety of options, is to perform energy surveys, inspections, audits and/or commissioning. Some buildings may require a simple survey, some more defined site inspections, others an in-depth energy audit, and still others a retro or recommissioning of their highest energy consuming equipment or system.

Conducting Energy Assessments

ENERGY STAR partners have found that conducting plant assessments is vital to a strong energy management program, for without them, it's difficult to continuously improve energy efficiency and demonstrate savings.

Energy assessments can be conducted by internal staff, external energy service professionals, or a combination of both. As previously noted, they can be simple survey, some more defined site inspections, others an in-depth energy audit, and still others a retro or recommissioning of their highest energy consuming equipment.

Regardless of the type of assessment, it's recommended that the team represent varied expertise, including process engineers, maintenance experts, systems managers, energy specialists, etc. if these resources are available. If they aren't, energy consultants and independent contractors can assist.

Plant assessments vary in their focus and depth of involvement based on the program needs and resources available to energy managers. Most organizations can perform surveys and inspections with their own staff, while most will rely on energy consultants and independent contractors to perform the audits and commissioning.

Energy Treasure Hunts

An Energy Treasure Hunt is a form of assessment that engages employees to identify low cost or no cost energy saving opportunities by focusing on improving the day-to-day operations of existing equipment. Unlike traditional energy assessments that typically rely on outside experts, a two to three day Energy Treasure Hunt engages internal cross functional staff to find the opportunities.

By using internal resources, the Energy Treasure Hunt process helps build energy teams and internal processes for managing energy with a focus on continuous improvement. The advantage of starting with an in-house energy survey is that it focuses on improvements that often can be made immediately and without significant expenditures.

Exploring Ways to Save – Non-Business Hours

After the facility tour, teams should begin to look for energy efficiency opportunities in their respective areas. If the Energy Treasure Hunt begins on a non-operational day, the teams should focus on investigating savings opportunities that can only be found when the facility is not carrying out its typical operations. Teams might look for:

- Lights, computers, and other equipment that has been left on.
- HVACR systems that have been left running or HVACR operations beyond standard temperature set points.
- Lighting that is too bright, not efficient, or not directed to necessary tasks.
- Air compressors operating when not needed or system air leaks.
- Other building or process equipment left running unnecessarily.

Exploring Ways to Save – Business Hours

Energy Treasure Hunt teams can focus on energy efficiency opportunities that are observable during regular operations and in typical equipment processes. These might include:

- Temperature set point too high or too low.

- Compressed air being wasted.
- Energy supply equipment, such as compressed air and lights, not interlocked to turn off at the same time as production equipment.
- Production equipment operating but no product being produced.

During staff lunch and break periods, teams should check the facility for equipment that could be turned off, such as:

- Workspace lighting, motors, and pumps that are not in constant use.
- Equipment that does not have a lengthy start time but is left on.

Energy Audits Using ASHRAE Levels 1, 2 & 3

An energy audit is the key to a systematic approach to decision-making in the area of energy management. The primary function of an energy audit is to identify all of the energy streams in a facility in order to balance total energy input with energy use. The four main objectives of an energy audit are as follows:

- To establish an energy consumption baseline.
- To quantify energy usage according to its discrete functions.
- To benchmark with similar facilities under similar weather conditions.
- To identify existing energy cost reduction opportunities.

Before beginning an energy audit for a building or portfolio of buildings, a preliminary energy use analysis must be carried out. This analysis requires access to energy and natural gas consumption and cost data for the last 24-36 months. The purpose of this analysis is to compare the Energy Usage Index (EUI) of each building with the national average and to identify both high and low energy performers. Once the analysis is completed a recommendation is made as to which buildings should be audited first and the type of audits to be carried out.

Energy audits vary in depth, depending on the potential at a specific site for energy and cost reductions and the project parameters set by the client. As per ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) standards there are three types of audits, outlined below.

ASHRAE Level 1 – Walk-Through Analysis/Preliminary Audit – The Level 1 audit alternatively is called a simple audit, screening audit or walk-through audit and is the most basic.

ASHRAE Level 2 – Energy Survey and Analysis – A Level 2 audit includes the preliminary ASHRAE Level 1 analysis, but also includes more detailed energy calculations and financial analysis of proposed energy efficiency measures.

ASHRAE Level 3 – Detailed Analysis of Capital Intensive Modifications – This level of engineering analysis focuses on the potential capital-intensive projects identified in the Level 2 analysis and involves more detailed field data gathering as well as a more rigorous engineering analysis.

Completing an energy audit of a facility provides an organization with customized energy conservation measures and may also indicate energy consuming equipment is not operating at peak performance. If that's the case, retrocommissioning of the existing equipment in question is required.

Retrocommissioning & Recommissioning

Specifically, retrocommissioning is a form of commissioning. Commissioning is the process of ensuring that systems (lighting, HVACR, etc.) are designed, installed, functionally tested, and capable of being operated and maintained according to the most energy efficient operating criteria.

Retrocommissioning is the same systematic process applied to existing buildings that have never been commissioned to ensure that their systems can be operated and maintained according to the most energy efficient operating criteria. For buildings that have already been commissioned or retrocommissioned, it is recommended that the practices of recommissioning or ongoing commissioning be applied.

Recommissioning is the term for applying the commissioning process to a building that has been commissioned previously (either during construction or as an existing building); it is normally done every three to five years to maintain top levels of building performance and/or after other stages of the upgrade process to identify new opportunities for improvement. The LEED EB+OM building certification requires recommissioning every 5 years as part of the LEED building recertification process.

In **Ongoing Commissioning**, monitoring equipment is left in place to allow for ongoing diagnostics. Ongoing commissioning is effective when building staff have the time and budget not only to gather and analyze the data but also to implement the solutions that come out of the analysis.

Building owners, managers, staff, and tenants all stand to gain from the retrocommissioning process. It can lower building operating costs by reducing demand, energy consumption, and time spent by management or staff responding to complaints. It can also increase equipment life and improve tenant satisfaction by increasing the comfort and safety of occupants.

Energy researchers statistically analyzed more than 224 new and existing buildings that had been commissioned, totaling over 30 million sf. of commissioned floor space (73% existing buildings and 27% new construction). The results revealed the most common problem areas and

showed that both energy and non-energy benefits were achieved. Analysis of commissioning projects for existing buildings showed a median commissioning cost of US$0.27 per sf. energy savings of 15%, and a simple payback period of 0.7 years.

A recent study of retrocommissioning revealed a wide variety of problems—those related to the overall HVACR system were the most common type. Retrocommissioning provided both energy and non-energy benefits—the most common of these, noted in one-third of the buildings surveyed, was the extension of equipment life.

The top candidates for retrocommissioning are those buildings with:

- A low ENERGY STAR performance rating or a high energy use index (Btu per sf., Btu per patient, and so forth) that cannot be explained, or unexplained increases in energy consumption.

- Persistent failure of building equipment, control systems, or both.

- Excessive occupant complaints about temperature, airflow, and comfort

8 – ENERGY Benchmarking Using Portfolio Manager

Credit: Strategic Management Insight

The EPA currently maintains performance ratings for all major commercial building types, including banks, financial institutions, courthouses, hospitals (acute care and children's), hotels and motels, K–12 schools, medical offices, offices, residence halls and dormitories, retail stores, supermarkets, warehouses (refrigerated and nonrefrigerated), wastewater treatment plants and a limited number of categories of manufacturers.

The benchmarks and ratings for such buildings are made available through the ENERGY STAR Portfolio Manager which allows users to set up private accounts to track building portfolios, set baselines, share information, and document the results of their efforts to improve energy performance. Again, Portfolio Manager is your "go to" energy measurement and savings tool.

This rating system is based on statistically representative models that compare the energy consumption of a building to similar buildings from a national survey conducted by the United States Department of Energy (DOE) every four years called the Commercial Building Energy Consumption Survey (CBECS). Essential information from this survey can highlight facility performance criteria such as:

- **Energy Use** – Shows rating, EUI, source EUI and change from baseline.
- **Environmental** – Shows rating, EUI, change from baseline energy use, and change from GHG emissions.
- **GHG Emissions** – Shows EUI, current GHG emissions, baseline GHG emissions, and change from baseline.
- **Water Use** – Shows water use, water cost, wastewater use, and wastewater cost.
- **Financial** – Shows annual cost of energy, water, and cost/SF of energy and water.

A score of 50 indicates that the building, from an energy consumption standpoint, performs better than 50% of all similar buildings nationwide, while a score of 75 indicates that the

building performs better than 75% of all similar buildings nationwide. Ultimately, EPA expresses the rating on a 1-100 scale where 1 point on the scale represents 1 percentile of the commercial building market.

To track and manage energy performance, each building's rating is expressed on a scale of 1 to 100, which denotes the percentile of performance relative to the other buildings in the national CBECS data set. A rating of 75 means a particular building outperforms approximately 75 percent of its peers; these buildings are in the top quartile for their building type and are eligible to earn an ENERGY STAR label.

Using ENERGY STAR Portfolio Manager to Benchmark EUI

In general, buildings with lower ratings have a greater opportunity to improve their energy performance levels. The areas with the greatest energy savings potential throughout most building types are typically lighting, HVACR systems, and other high energy usage items such as refrigeration, office and kitchen equipment.

Organizations and businesses are reducing their energy use by 30 percent or more through effective energy management practices that involve assessing energy performance, setting energy savings goals, and regularly evaluating progress. Building-level energy performance benchmarking is an integral part of this effort. It provides the reference points necessary for developing sound energy management practices and strategies and for gauging their effectiveness.

ENERGY STAR's Portfolio Manager can assist in evaluating and tracking a facility's energy consumption, help identify underperforming facilities, generate an ENERGY STAR score, track energy savings from implementation of energy efficient measures, and evaluate potential energy saving measures for a facility. With the assistance of ENERGY STAR Measurement and Tracking Tool: Portfolio Manager, facility owners and managers can make more informed decisions on topics and matters that are based on the energy performance of their facility.

Do buildings that consistently benchmark energy performance save energy? The answer is yes, based on the large number of buildings using the U.S. Environmental Protection Agency's (EPA's) ENERGY STAR Portfolio Manager to track and manage energy use. Over 35,000 buildings entered complete energy data in Portfolio Manager and received ENERGY STAR scores for 2008 through 2011, which represents three years of change from a 2008 baseline. These buildings realized savings every year, as measured by average weather-normalized energy use intensity and the ENERGY STAR score, which accounts for business activity. Their average annual savings is 2.4%, with a total savings of 7.0% and score increase of 6 points over the period of analysis.

Setting Up a Facility for an ENERGY STAR Score

After registering as a Portfolio Manager user, the next step is to create a facility in Portfolio Manager and populate the necessary data with the following:

- Essential building information such as year built, building type, floor area, number of occupants, etc.

- Break out space uses that are fundamentally different from the defined core building space.

- Twelve (12) months of monthly energy consumption data.

Facilities can be grouped in Portfolio Manager to show how certain groups of facilities may be performing against an entire portfolio or within the group.

Internal Benchmarking allows an organization to compare the energy use at a building or group of buildings to that of others in that organization. The results can be used within an organization to compare energy performance among buildings, to identify buildings with the greatest potential for improvement, to track performance over time, to identify best practices at individual sites that can be replicated, and to increase management's understanding of how to analyze and interpret energy data.

In **External Benchmarking,** buildings are compared to other, similar buildings. The results can be used to assess performance relative to peers in the same sector or industry and across other sectors and industries, to compare the energy performance of facilities against a national performance rating, to track performance against industry or sector performance levels, to identify new best practices for improving building performance, to increase understanding of how to analyze and evaluate energy performance, and to identify high-performing buildings for recognition opportunities such as the ENERGY STAR label.

Setting and Interpreting Energy Performance Goals

The next step is to set goals and targets for improving energy efficiency. Portfolio Manager has features that allow the user to set energy performance goals and estimate how much energy will need to be saved to meet those goals. This feature allows reasonable goals and targets to be set for the facility and provides an estimate of how much energy must be saved to achieve the goals.

Energy savings can be tracked as energy conservation measures are implemented. The impact of past energy-saving measures as a whole across the entire facility can also be estimated. Once energy performance improvements have been implemented, you can evaluate how much energy these improvements have saved. If energy performance improvements have been implemented in the past, Portfolio Manager can also help in evaluating the savings received from these improvements as a whole or over a period of time.

Based on the scope of the project, benchmarking can be repeated over time to assess progress relative to the defined goals and to encourage continuous improvement. It is important to track progress and compare actual energy consumption data with stated goals. This comparison will show whether or not goals have been achieved and how much money energy savings have contributed to the organization's bottom line. The comparison will also help to identify the organization's best practices and will inform decisions about how to achieve future goals. Setting new goals on a regular basis will help foster an environment of continuous improvement.

Develop a Benchmarking Plan and Data Requirements

Facility managers can use benchmarking data to screen their portfolio of facilities or properties. The information will help them decide where to do on-site audits, identify which sites would get the best return from tune-ups and retrofits, or even just know when to remind local managers about energy-efficient behaviors. With this data, they can also calculate what is needed to meet an internal or external goal across the organization.

The quantities of electricity, natural gas, steam, chilled water, and other delivered energy sources may be gathered at the corporate, campus, building, process, or equipment level. These data may come from accounting systems or bill-handling services. Depending on the types of energy used, more-detailed consumption data may be available from process or equipment submeters. All energy sources must be accounted for a minimum of one year to develop a rating score.

A successful benchmarking study often requires the help of other parties, who should be identified and engaged at the beginning of the process. Primary candidates for participation include departments or organizations that own the data that are needed for the benchmarking effort. For external benchmarking, look for partners in the same industry or sector. An effective partnership requires that the partners understand the objectives, expected outcomes, and schedule of the project, and know their role and the costs and benefits of their participation.

By using the tracking tools, continuously collecting information about the facility and setting new energy performance targets, sustainability goals can be achieved and met. Consultants with industry expertise and relevant training such as the LEED AP Operations & Maintenance, Facility Management Professional (FMP), and the Certified Construction Manager (CCM) credentials can provide ENERGYSTAR Portfolio Manager set-up, monitoring, and benchmarking services in lieu of performing them in-house.

9 - ENERGY Efficient Lighting

Credit: Ramselec

Lighting uses about 18 percent of the electricity generated in the U.S., and another 4 to 5 percent goes to remove the waste heat generated by those lights. Lighting in commercial buildings accounts for close to 71 percent of overall lighting electricity use in the U.S.

Lighting consumes close to 35 percent of the electricity used in commercial buildings in the United States and affects other building systems through its electrical requirements and the waste heat that it produces. Upgrading lighting systems with efficient light sources, fixtures, and controls can reduce lighting energy use, improve the visual environment, and affect the sizing of HVACR and electrical systems.

Low, mid and high cost energy saving solutions for electrical systems were covered briefly in Chapter 4 – Your Potential Energy Cost Savings. However, when initial investment, life-cycle costing, and energy savings are taken into consideration for electrical equipment upgrades, the end of this chapter provides a detailed list of these with the greatest energy savings potential.

A Whole-System Approach

Many lighting-efficiency efforts are oriented toward the installation of specific pieces of equipment, such as electronic ballasts or compact fluorescent downlights. But as with many other types of complex systems, the interactions among system elements in lighting equipment create energy and power savings that can be greater than the sum of their parts.

Starting with a system of fixtures containing four energy saver T12 lamps, an upgrade to standard T8 lamps and electronic ballasts can produce energy savings of more than 25 percent; using high-performance T8 lamps boosts savings to more than 40 percent.

The next option begins to capture some system interactions. Each fixture is equipped with a specular reflector and a new acrylic flat prismatic lens. Because these are significantly better at getting light out of the fixture than the old white-painted luminaire and aged diffuser, the fixture can be delamped by 50 percent—to two high-performance T8 lamps—and still provide virtually the same amount of light for the task. Adding reflectors and new lenses to the fixtures enables delamping—a reduction in the number of lamps required per fixture—with little loss in light levels, for a savings of 71 percent compared to the base case.

Adding occupancy sensors and daylighting controls can boost savings to more than 80 percent compared to the base case, and more than 50 percent compared to a system with standard-grade T8 lamps and electronic ballasts.

Use Efficient Light Sources

Efficient lighting begins with the use of as much daylight as possible. After that, choose the lamp / ballast / fixture combination that will maximize efficiency while balancing the considerations of lighting quality and quantity described above. There is a wide variety of light sources to choose from including fluorescent (linear and compact), high-intensity discharge (HID), and newer sources such as induction lamps and light-emitting diodes (LEDs).

These sources vary widely in their efficacy, color quality, service life, and the applications for which they are best suited. Historically, fluorescent lighting has been used for high-quality, general purpose indoor diffuse lighting. HID lighting has been used for industrial and outside lighting.

However, technical advances and a flood of new products have led to some crossover in the way these lamps are applied—fluorescent lighting is now the most effective choice for many industrial and exterior lighting applications, while HID lighting (specifically metal halide) is now a good choice for some interior uses.

Fluorescent lighting systems offer high efficacy, long life, and good light quality, and they generally have few operational limitations for most indoor lighting applications. They are the best choice for general lighting in commercial, institutional, and industrial spaces with low to medium ceiling height. In addition, the introduction of high-intensity fluorescent lamps and fixtures makes fluorescent systems a leading choice for areas with high ceilings (more than 15 feet)—the type of application that used to be the exclusive domain of HID light sources (see sidebar).

Picking the Right Fluorescent Lamp

Manufacturers have introduced a wide array of linear fluorescent lamp choices, including reduced-wattage, premium, and high-performance versions. There are also choices of CCT, CRI, lamp diameter, light output level (standard, high-output, or very high output), and starting method (rapid-start, programmed rapid-start, or instant start). For most general lighting upgrades, the best choices are:

- T8 (eight-eighths of an inch in diameter)
- Four-foot lamps

Standard-output lamps are more efficient and less costly than high output (HO) and very high output (VHO) systems, and they are available with a wider range of color temperatures. T5HO lamps are often used for high-bay applications because their high-intensity light is useful in large spaces.

- CRI in the 80s

- CCT of 3,500 K to 4,100 K

Ballast choices can be equally bewildering. The best choices for ballasts are:

- Electronic (high-frequency)
- Instant-start
- Programmed-start
- Universal-input

Finally, make sure that lamps and ballasts are compatible. Most lamps are only compatible with one starting method; the major exception is high-performance T8s, which can use either rapid or instant-start ballasts.

Compact Fluorescent Lamps (CFL)

Use compact fluorescent lamps (CFLs) to replace incandescent lamps in downlights, sconces, table lamps, task lights, and wall washers. They cost more initially than incandescent lamps do, but quickly pay for themselves through energy and maintenance savings. The longer the annual operating hours, the more attractive the economics of CFLs become, because more incandescent relamping costs are being avoided per year.

One of the most common uses of CFLs in commercial buildings is in recessed downlight cans. A wide range of fixtures is now available for this fixture class, some with very good reflector designs, good optical control, and dimming capabilities. Care must be taken in this application to ensure that excess heat buildup does not shorten the lamp life.

When using CFLs, remember these key points:

- Go for a 3:1 ratio
- Limit the number of CFL types
- Use dedicated fixtures
- Choose CFLs that have earned the ENERGY STAR rating

Other Light Types

Depending on the area of usage and purpose, some of these other lighting choices might be a better choice in your facility.

High-Intensity Discharge (HID) Lamps – Wherever an intense point source of light is required, HID light sources are the primary alternative to high-wattage incandescent lamps. Although HID lamps can provide high efficacy in a wide range of sizes, they have special requirements for start-up time, restrike time, safety, and mounting position.

Metal Halide Lamps – Metal halide lamps offer good color quality and efficacies of up to 100 lm/W. Were it not for several limitations of the older probe-start technology, metal halide lamps might be considered the ideal light source.

Sodium Lamps – There are two types of sodium lamps: high-pressure sodium (HPS) and low-pressure sodium (LPS). HPS lamps, which produce a yellowish light, vary widely in their efficacy and color quality.

LED's (Light Emitting Diodes) – LED's are the latest and most exciting technological advancement in the lighting industry and are small, solid light bulbs which are extremely energy efficient and long lasting.

Induction Lamps – Also called electrodeless lamps, consist of a high-frequency power generator, a coupling device that generates a magnetic field (essentially an antenna), and a glass housing that contains the gases and phosphor coating—no electrodes required.

Submetering & Current Transformer (CT) Monitoring

You can't manage what you can't measure. Electric submeters can be installed at discrete points in a building to monitor energy usage by one or more electrical loads (e.g., individual HVACR units) and/or one or more segments of a building. Electrical submeters connect to individual circuits using Current Transformers (CTs).

Every entity that has an energy saving interest in a building (e.g., building owners and operators, energy service companies, consultants, engineering firms, etc.) will want real-time submetering data to track utility costs per floor, per tenant, per equipment, etc. Submetering and CT Monitoring provide a base foundation of understanding consumption profiles in a building.

Achievable Electrical Energy Targets for Commercial Buildings

Application of specific energy savings measures across all building types and climate zones resulted in cutting energy use by nearly half, according to results of approved research funded by ASHRAE. The national weighted change is 47.8 percent more energy efficient than ASHRAE Standard 90.1-2013 based on site energy and 47.8 percent more energy efficient than ASHRAE standard 90.1-2013 based source on energy.

The question of "how energy efficient can commercial and multifamily buildings become in the near future if first cost is not considered" was explored in ASHRAE 1651-Research Project, "Development of Maximum Technically Achievable Energy Targets for Commercial Buildings: Ultra-Low Energy Use Building Set."

From the resulting list of almost 400 measures, 30 were chosen for additional analysis. Sixteen prototype buildings that were consistent with Standard 90.1-2013, Energy Efficiency Standard for Buildings Except Low-Rise Residential, across 17 climate zones were used as baseline models. The 30 measures then were individually modeled. Each of the 30 measures, often with many options, were applied to each building and climate combination. In general, the measures were applied in the following order:

- Reduce internal loads
- Reduce building envelope loads
- Reduce HVACR distribution system losses

- Decrease HVACR equipment energy consumption
- Major HVACR reconfigurations

After each measure was applied to each of the 272 building and climate combinations, if the energy consumption was reduced, it remained in the model. After all 30 measures (which included 9 electrical and 21 HVACR) were applied, the projected U.S. national weighted energy consumption for new buildings was nearly cut in half compared to Standard 90.1-2013.

The 2 general and 9 electrical energy efficiency measures modeled were:

- Optimal Roof Insulation Level
- Optimal Choice of Vertical Fenestration
- LED Exterior Lighting
- Highest Efficiency Office Equipment
- High Performance Lighting (LED)
- Shift from General to Task Illumination
- Optimal Daylighting Control
- External Light Shelves
- Daylighting Control by Fixture

10 - ENERGY Efficient HVACR Systems

Credit: Sander Mechanical Service

HVACR systems function in a critical role in any building (the "R" is added for refrigeration). Everyone becomes acutely aware of HVACR performance when malfunctions occur. The level of interest has only increased today. Whether concerns about energy efficiency, building sustainability, operations and maintenance, or indoor air quality (IAQ), more visibility is required.

There are many different types of HVACR equipment such as package units, split systems, central plants, chillers, boilers, refrigeration, and so on. Each has its own unique energy savings opportunities, but the one common denominator for all of them to save as much energy as possible, is first and foremost, proper, consistent and certified HVACR maintenance.

When that happens, HVACR systems on average will use at least 15 to 20 percent less energy than those where systems that are allowed to deteriorate without maintenance and/or not maintained properly, consistently and with certified service technicians. This will be the focal point of the first part of this chapter.

Low, mid and high cost energy saving solutions for HVACR were covered briefly in Chapter 4 – Your Potential Energy Cost Savings. However, when initial investment, life-cycle costing, and energy savings are taken into consideration for HVACR equipment upgrades, the end of this chapter provides a detailed list of equipment with the greatest energy savings potential.

The HVACR Quality Installation/Maintenance Challenge

Using California as a prime example, commercial buildings there consume more electricity than any other sector in California, constituting 38 percent of the state's power use and over 25 percent of natural gas consumption. To meet the state's Zero Net Energy mandates AB 758 is a significant challenge, with Heating, Ventilation, Air Conditioning and Refrigeration (HVACR) as a major source of potential energy savings.

The California Long-Range Energy Efficiency Strategic Plan states that quality installation and maintenance should become the industry and market norm (CPUC 2008). More specifically, this goal states that 100% of HVACR systems would be installed to quality standards and optimally

maintained throughout their useful life by 2020, with HVACR related permits obtained for 50 percent of installations by 2015 and 90 percent or more by 2020 (CPUC 2008). This would reduce overall energy use and lower energy costs.

Pressures on California's HVACR workforce are high, as a very large percentage of the state's 58,000 incumbent workers are not trained in energy efficiency, and many of those trained have difficulty keeping up with changes in technology, codes, and standards.

Poor installation and maintenance of residential and commercial HVACR systems is a widespread problem. The California Energy Commission (CEC) estimates that up to 50% of new HVACR systems and up to 85% of replacement systems are not installed and maintained to a quality level of specification. Given the high potential savings associated with improving residential and commercial installation and maintenance practices, the CPUC set targets to improve HVACR performance by 50% by 2020 and 75% by 2030.

The HVACR industry has struggled to provide qualified technicians, and market conditions rarely value quality installation and maintenance (QI/QM). Less than 10 percent of HVACR systems obtain legally required pre-installation local building permits and 30-50 percent of new central air conditioning systems are not being properly installed. As a result, Californians pay a large price for the lack of quality installation and maintenance, with commensurate poor performance. The factors that have led to a 20-30 percent increase in the peak energy needed to provide consumers with the cooling and comfort they demand on hot summer afternoons has been accompanied by an estimated 30 percent increase in carbon emissions.

HVACR Training, Certifications and Credentials

Requirements for HVACR certification will vary by type of certification and by organization offering it. For example, for some certifications, students might need to have a completed course of training while for others, time on the job provides the sufficient knowledge needed to pass an exam. Additionally, different types of testing may be required for certifying exams, varying from a written test to a hands-on display of skills. Here is a look at some common certifying organizations and their certifications:

EPA Section 608 Certification

As mentioned above, the EPA requires those who work with refrigerants or refrigeration systems to seek an EPA Section 608 certification. The EPA certifications that are available include: Type I for small appliances; Type II for high-pressure appliances; Type III for low-pressure appliances; and Universal, which is a comprehensive credential. A plurality of organizations provide coursework, preparation materials, and exam sites to test for these certifications.

North American Technician Excellence (NATE)

NATE offers a wide range of specialty certifications at varying levels. NATE requires that aspiring HVACR technicians pass a core exam and one specialty exam in order to achieve certification. The specialty exams are divided into three categories: installation, service, and senior.

- **Installation Specialties:** The five installation specialties include air conditioning, air distribution, heat pump (air-to-air), oil heating (air), and gas heating (air).

- **Service Specialties:** The nine service specialties – with many offered in Spanish – include air conditioning, air distribution, oil heating (air), gas heating (air), heat pump (air-to-air), hydronics gas, hydronics oil, commercial refrigeration, and light commercial refrigeration.

- **Senior Level Technician Certification:** The senior level technician certification is open to candidates with two NATE specialty certifications.

NATE also offers the **Industry Competency Exams (ICE)—**formerly called the ARI/GAMA competency exams—covering a range of residential and commercial HVACR systems and related skills.

HVAC Excellence Programs

HVAC Excellence offers a number of certifications for both high school students who have completed vocational training and for more advanced HVAC technicians. By setting program standards and verifying that they have been met, trainees and technicians can meet the challenges facing the HVACR quality control and assurance requirements by continuous improvement in a way that prepares applicants for energy efficient and compliant services. To accomplish this, HVAC Excellence provides the following programs:

- **Student Outcome Assessments for High Schools –** Secondary (high school) HVACR instructors need to validate if a student has the retained knowledge to move on to the next level, or if they need additional training. HVAC Excellence offers the tools needed to accomplish this through our Heating, Electrical, & Air Conditioning Technology (H.E.A.T.) and H.E.A.T. + student outcome assessments.

- **Employment Ready Certifications –** Post-Secondary (college, trade school, apprenticeship, manufacturers, wholesaler) instructors need to validate if a student has the retained knowledge necessary for employment in the HVACR industry, or if they need additional training. HVAC Excellence offers the tools needed to accomplish this through their Employment Ready Certifications.

- **Technician Certifications: Professional Level –** HVAC Excellence offers progressive levels of certification that identify an individual's knowledge and skill level through each phase of their career. Professional Level Technician Certifications covering a variety of HVACR components are intended for experienced technicians, is a series of discipline-specific, closed-book, comprehensive written exams, that were specifically designed for technicians with two or more years of field experience.

- **Master Specialist: Hands-On –** The HVACR industry and consumers have greatly benefited from technician certification. It has been accepted as a tool to validate that a technician has the retained knowledge of heating and cooling systems. However, no one can be sure if a technician could properly apply this knowledge, unless they are Master Specialist Certified.

Refrigeration Service Engineers Society (RSES)

The RSES provides several different levels and subject areas of HVACR certification including the mandatory EPA Section 608 Certification for refrigeration workers mentioned above. There are eight specialized written examinations: commercial air conditioning, commercial refrigeration, controls, domestic service, dynamic compression, heating, heat pump, and HVAC-R electrical. Please note that these specialized credentials are exclusively for active members of RSES. The organization also provides R-410A training and certification.

Achievable HVACR Energy Targets for Commercial Buildings

As previously noted in Chapter 9 - ENERGY Efficient Lighting, the application of specific energy savings measures across all building types and climate zones resulted in cutting energy use by nearly half, according to results of approved research funded by ASHRAE. The national weighted change is 47.8 percent more energy efficient than ASHRAE Standard 90.1-2013 based on site energy and 47.8 percent more energy efficient than ASHRAE standard 90.1-2013 based source on energy.

The question of "how energy efficient can commercial and multifamily buildings become in the near future if first cost is not considered" was explored in ASHRAE 1651-Research Project, "Development of Maximum Technically Achievable Energy Targets for Commercial Buildings: Ultra-Low Energy Use Building Set."

"The value of establishing such ultra-low-energy targets for buildings is two-fold," Jason Glazer, principal engineer for GARD Analytics who oversaw the project, said. "These targets will indicate to building design professionals what may be achieved if first cost is not considered and challenge the creativity of those professionals to achieve similar results in actual designs with the real-world constraints of first costs. They also will help advance design guides, standards and codes by providing an ultimate goal."

For the project, researchers assembled a list of energy efficiency measures that can be included in the design of non-residential buildings. The list included both commonly used and cutting edge energy efficiency measures, according to Glazer.

From the resulting list of almost 400 measures, 30 were chosen for additional analysis. Sixteen prototype buildings that were consistent with ASHRAE Standard 90.1-2013, Energy Efficiency Standard for Buildings Except Low-Rise Residential, across 17 climate zones were used as baseline models. The 30 measures then were individually modeled. Each of the 30 measures, often with many options, were applied to each building and climate combination. In general, the measures were applied in the following order:

- Reduce internal loads
- Reduce building envelope loads
- Reduce HVACR distribution system losses
- Decrease HVACR equipment energy consumption
- Major HVACR reconfigurations

After each measure was applied to each of the 272 building and climate combinations, if the

energy consumption was reduced, it remained in the model. After all 30 measures (which included 2 general, 7 electrical and 21 HVACR) were applied, the projected U.S. national weighted energy consumption for new buildings was nearly cut in half compared to Standard 90.1-2013.

The 21 HVACR energy efficiency measures modeled were:

- High Performance Fans
- High Performance Ducts to Reduce Static Pressure
- Demand Controlled Ventilation/CO2 Controls
- Multiple-Zone VAV System Ventilation Optimization
- Optimal Water/Air Cooling Coils
- Occupant Sensors for Air Handling Equipment
- Energy Recovery Ventilators
- Indirect Evaporative Cooling
- High Efficiency/Variable Speed Packaged DX Cooling
- High Efficiency Heat Pumps
- Ground Source Heat Pump
- High Efficiency and Variable Speed Chillers
- Heat Recovery from Chillers
- High Efficiency Boilers
- High Efficiency Building Transformers
- Chilled/Cooled Beam
- Dedicated Outside Air System with Heat Recovery
- Underfloor Air Distribution
- Hybrid/Mixed Mode Ventilation
- Radiant Heating and Cooling and DOAS
- Variable Refrigerant Flow Air Conditioning

11 – California's Time-of-Use ENERGY Rate Changes

Credit: CEC

For utilities, electricity is generally more expensive and complex to deliver when demand is high. To help cover these costs, California's utilities have traditionally imposed Time-of-Use (TOU) rates, which created a daily schedule that applies different prices for power based on demand trends on the grid. When demand is highest, prices are highest under TOU rates.

In the past, daily grid demand ramped up in the morning, peaked from noon into the early afternoon as temperatures and air conditioning usage increased, and then gradually decreased as the day progressed. Though there is some additional nuance to the scheduling, California's utilities have long scheduled on-peak hours—during which rates were the highest—from around 11 am to about 6 pm. Off-peak hours, meanwhile, were generally applied through the other hours of the day.

For utilities, TOU rates helped increase revenue to cover the high costs of delivering power when demand was high. For energy consumers, this created an incentive to minimize reliance on the grid for power during on-peak hours. This has long been a significant part of the value of on-site solar photovoltaics (PV) for the state's large energy consumers. The hours when solar generation is at its highest levels happen to coincide with the on-peak hours, enabling large energy users to rely on their on-site solar power and avoid exposure to several hours of high on-peak rates every day.

However, the rise of solar power generation in the state—both Behind-the-Meter (BTM) and at the utility scale—has disrupted the dynamics of the supply mix supporting California's electric grid. Utilities are adapting to these new realities with changes to their TOU rate schedules, which will have a significant impact on the business case for behind-the-meter solar PV and Energy Storage Systems (ESS).

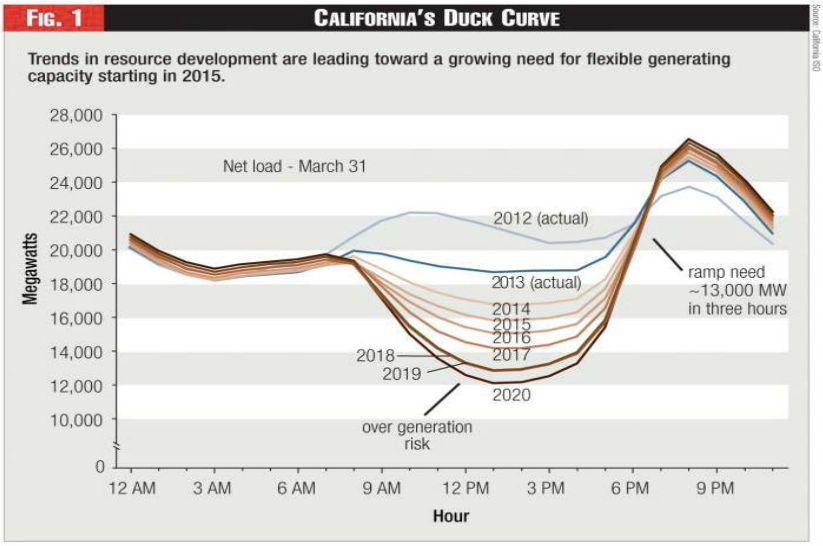
California's Utilities Respond to the 'Duck Curve'

From 2007 to 2017, utility-scale solar power generation in California grew from 557 GWh to 24,353 GWh, according to the US Energy Information Administration (EIA). This rapid increase has created a number of serious challenges for the state's utilities, which rely largely on natural gas generation to supply the majority of power on the grid.

Solar production increases in the late morning hours and peaks around noon before tailing off in the late afternoon and early evening. This reduces demand for natural gas during the midday

hours, when utilities traditionally imposed higher, on-peak TOU rates. Then, as solar power generation diminishes in the late afternoon hours, utilities face a spike in demand for power from natural gas.

California's Independent System Operator (CAISO) illustrated this trend in the graph below, which is now commonly known as the "duck curve."



Credit: Energy Institute at Haas

The Duck Curve creates several challenges for utilities. The first is accommodating the late-afternoon spike in demand. This often requires a reliance on natural gas peaker plants, which can generate power quickly but are expensive to operate on a regular basis. Compounding the cost problem is that much of this early evening spike in demand falls outside of the traditional on-peak hours when utilities could expect to make up the high cost of delivering power.

In addition to the high costs, the reduction in midday demand has depressed a traditional source of revenue for natural gas generators, while high levels of solar production have decreased electricity prices, sometimes leading to negative prices. For utilities, TOU rates helped increase revenue to cover the high costs of delivering power when demand was high.

In response, California's utilities have begun adjusting their TOU rate schedules to account for the duck curve. San Diego Gas & Electric (SDG&E) shifted on-peak hours for its summer season to 4 pm-9 pm, from its previous schedule of 11 am-6 pm. Pacific Gas & Electric (PG&E) and Southern California Edison (SCE) implemented the same types of schedules for on-peak hours in 2019.

Under these new schedules, the utilities apply on-peak rates when demand for natural gas spikes in the late afternoon to early evening hours, helping them adapt to the economic realities of the duck curve. For the state's large energy consumers, meanwhile, the shift disrupts the economics of behind-the-meter solar PV and energy storage.

The Impact of New TOU Rate Schedules on Solar PV and Energy Storage

Under the new TOU rate schedules, peak production for a solar PV system will occur largely during the new off-peak hours at midday. This undercuts the value of stand-alone solar PV as a source for off-grid power to avoid on-peak rates.

To illustrate the impact of the shift in TOU rates on a stand-alone solar PV system, analyzed was a 2-MW solar PV system installed at an office building with $1.2 million in annual energy spend, 7 GWh of annual energy usage, and a peak load of 1.6 MW. The latest TOU rate schedules reduce the value of the solar PV system by 19% over a 20-year period!

However, combining solar PV with energy storage can enable large energy users to use their self-generated power more strategically. If customers can charge an Energy Storage System (ESS) with their on-site solar PV assets during off-peak hours, they can transition their facility onto that low-cost energy during on-peak hours. Distributed energy resources (DER) optimization software facilitates this process, charging the ESS with power generated via solar PV and automatically transitioning the facility's load onto the on-site capacity available to reduce consumption from the grid when on-peak rates are applied.

Looking at the same building analyzed above, adding a 500 kW/1 MWh ESS with the existing on-site solar PV actually makes up the value that the system would have lost as a result of the new TOU rate schedules. That equates to a difference of about $1.9 million.

The shift in TOU rate schedules will also affect the business case for stand-alone energy storage. Again, DER optimization software plays an important role in managing these costs, automatically charging the batteries at times when power prices are lowest and deploying the power during on-peak hours.

To understand the impact on energy storage, calculated was the value of a 630 kW/1 MWh stand-alone ESS for a food-processing facility with annual energy spend of about $650,000, annual usage of 3 GWh, and a peak load of 1 MW. For this facility, the new TOU rate schedules would increase the value of an ESS by 16%, resulting in more than $3.1 million in total value over a 20-year period.

Looking Ahead: The Long-Term Value of Energy Storage in California

The change in TOU rate schedules came as a result of a fundamental shift to a more renewable-heavy power generation mix. As the fundamental market dynamics behind the electric grid evolve, energy storage and distributed energy resources (DERs) will become increasingly important to help large energy users adapt to these market realities and brace for the impact.

For example, the rise of electric vehicles (EVs) in California threatens to disrupt the grid. In 2017, EV sales in California reached nearly 95,000, up 28.5% from the year prior and considerably higher than the next closest state, New York, which saw just over 10,000 in sales of EVs in 2017, according to data from the Alliance of Auto Manufacturers and IHS Markit. Large energy users in California could see multiple challenges as a result of the rise of EVs.

Grid-level challenges: How will the rise of EV charging affect the grid? What new challenges will energy providers face, and how will those challenges affect energy consumers?

Facility-level challenges: As EV charging becomes a necessity to integrate on-site—whether to charge a fleet of EVs owned and operated by the company or to provide an amenity to customers, tenants, or employees—how will the equipment affect the facility's load profile and energy costs? Energy storage and DERs position customers to adapt to these kinds of new developments seamlessly. The ability to store and deploy power on-site, whether generated via on-site resources or sourced at times when grid costs are at their lowest, enables energy users to manage their reliance on the grid strategically. TOU rates are an important part of the equation, but they are far from the only way California's energy consumers can create value by maximizing their flexibility with DERs.

Additionally, the gradual decrease in incentives for DERs in California makes it important for those in California who would benefit from DERs to act soon. The Self-Generation Incentive Program (SGIP) offered by California's Public Utilities Commission (CPUC) will diminish over time, leaving less incentive capital available as more customers take advantage of the program in the next few years. Additionally, the investment tax credits for DERs are set to decrease from 30% in 2018 to 10% by 2021.

12 - ENERGY Code Compliance Measures

Credit: CALGreen

Throughout this chapter, California will be the role model and example. If your facility is not located in a zero net energy driven state like California, it may not be too far behind or already in the process of achieving similar goals and measures.

As the leader in the nation on environmental stewardship, energy reduction, sustainability, and green building standards, California has set an ambitious goal in accomplishing these objectives starting with Assembly Bill 32: California Global Warming Solutions Act of 2006. From this progressive legislation, California has developed and approved the CALGreen Code, Zero Net Energy and Assembly Bills 758, 802, 2514 and 2868 as well as Senate Bill 350 requirements.

AB 32 requires California to reduce its GHG emissions to 1990 levels by 2020—a reduction of approximately 15 % below emissions expected under a "business as usual" scenario. When Gov. Brown took over, he and the California Energy Commission (CEC) had a much bigger ambition to set Zero Net Energy (ZNE) goals above and beyond AB 32 requirements by reducing GHG emissions for all new and existing commercial buildings to 40 % below 1990 levels by the year 2030.

Zero Net Energy (ZNE) Standards and Challenges

In 2008 the California Public Utility Commission (CPUC) issued its Zero Net Energy (ZNE) goals for all new residential construction by 2020 and for commercial buildings by 2030. California's Zero Net Energy (ZNE) Standard is already in place through the state's energy and green building standards codes (Title 24 Parts 6 & 11) to achieve the 2020 and 2030 ZNE construction targets. The 2013 Energy Code will reach 70% of the residential ZNE goal, the 2016 Energy Code 85% and the 2019 Energy Code will meet the 100% goal of ZNE. By 2030 every new school is supposed to be a zero net energy building.

A Zero-Energy Building, also known as a Zero Net Energy (ZNE) building, Net-Zero Energy Building (NZEB), or Net Zero Building, is a building with zero net energy consumption, meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site. These buildings still produce greenhouse gases because on cloudy (or non-windy) days, at night when the sun isn't shining, and on short winter days, therefore, conventional grid power is still the main energy source.

Because of this, most zero net energy buildings still get half or more of their energy from the grid. Buildings that produce a surplus of energy over the year may be called "energy-plus buildings" and buildings that consume slightly more energy than they produce are called "near-zero energy buildings" or "ultra-low energy houses".

To help attain these ZNE measures, California requires their existing buildings to be energy efficient. To ensure attainment of these goals, CALGreen building code requirements were adopted by the California Building Commission (CBC), and included in modified Part 11, of the Title 24 building code.

To summarize the California Energy Efficiency Strategic Plan, the state has ambitious goals for the development of zero net energy buildings. These include:

- All new residential construction will be zero net energy (ZNE) by 2020.
- All new commercial construction will be ZNE by 2030
- 50% of commercial buildings will be retrofit to ZNE by 2030
- 50% of new major renovations of state buildings will be ZNE by 2025.

The CPUC released a draft Commercial Zero Net Energy Action Plan (Commercial ZNE Plan) in December 2017. A prior Commercial ZNE Plan was finalized in June 2011, but the updated plan will align with changes to the market and state policies such as better integration of distributed energy resources into the grid and a decline in the cost of solar generation and energy storage. The new Commercial ZNE Plan will add zero net energy for “multi-building projects, campuses and large-scale developments.” The new draft also looks at how existing buildings can attain zero net energy use. California also has a goal that 50 percent of all existing commercial structures will achieve zero net energy use by 2030.

AB 758 – Comprehensive Energy Efficiency in Existing Buildings Law

California has implemented a groundbreaking law, AB 758 that requires all existing buildings that fall significantly below Title 24 to improve their efficiency. This first-of-its-kind legislation has the potential to dramatically reduce the amount of energy and electricity that buildings consume and could be a model for the rest of the country. More than half of California’s 13 million residential buildings and over 40% of commercial structures were built before the implementation of Title 24 in 1978. According to the California Energy Commission’s (CEC) “cost effective” estimates, the new law could reduce projected electricity use by 9% and projected natural gas use by 6% in California, which translates to $4.5 billion dollars in consumer savings.

AB 758 requires the California Energy Commission (CEC) to develop and implement a comprehensive program to achieve cost-effective energy savings in the state’s existing residential and nonresidential building stock that fall significantly below the efficiency required by the current version of Title 24. The law also requires the California Public Utilities Commission (CPUC) to investigate the ability of each electrical and gas corporation to provide various energy efficiency financing options to their customers for the purposes of implementing the program.

Change is inevitable and planning for AB 758 as early as possible is the first step in successfully managing it. Seeking assistance, at a minimal cost, from a qualified consultant to perform a

sustainable facilities assessment and develop an action plan for meeting AB 758 requirements can save energy costs, prevent lost opportunities, and avoid future aggravation. An assessment and action plan can also create high performance building operations and sustainable systems that allow facility and property managers to do more with less and be the enablers of their own success.

California's Green Building Code (CALGreen)

The purpose of the California Green Building Code (CALGreen for short), Part 11 of Title 24, is to improve public health, safety and general welfare by enhancing the design and construction of buildings through the use of building concepts having a reduced or negative impact on energy usage or a positive environmental impact that encourages sustainable construction practices for most all building types.

Among the new requirements under CALGreen, every new building in California will have to reduce water consumption by 20%, divert 50% of construction waste from landfills and install low VOC materials. Separate indoor and outdoor water meters for non-residential buildings and moisture-sensing irrigation systems for large landscape projects will be required. There will be mandatory inspections of energy systems, such as furnaces and air conditioners for non-residential buildings over 10,000 square feet. According to the California Air Resources Board (CARB), the mandatory provisions will reduce greenhouse gas emissions by 3,000,000 metric tons by 2020.

Although CALGreen was initially developed for new construction, lackluster new building starts in the Great Recession economy blunted the code's influence. To fix this problem a new section of Chapter 5, Division 5.7 – Additions & Alteration to Existing Non-Residential Buildings was added, and now widens the 2019 CALGreen's focus to include existing buildings. Regarding school construction, CALGreen is required for any new campus that's built and entire campuses that are rebuilt.

The trigger for existing buildings is when a project has a minimum of 1,000 sf. of construction and a minimum cost of $200,000 for remodels, additions and alterations. Only buildings above those levels have to meet CALGreen Code requirements. The City of Los Angeles led this effort to include existing commercial buildings in their local amendments to the 2010 CALGreen Code because approximately 90% of the impact for green construction is going to be realized in existing buildings through remodels, additions and alterations.

AB 802 – Mandatory Energy Benchmarking & Disclosure

In October 2015, the State of California passed AB 802 to provide building owners access to their building energy use data from utilities, and to track consumption in their buildings. The purpose of AB 802 is to help building owners, tenants, and others better understand the energy consumption of their buildings through standardized energy use metrics.

For building owners and managers, there are five important data points when reviewing and understanding AB 802:

- Non-residential and multi-family buildings over 50,000 sq. ft. (with certain exceptions).
- Multi-family buildings over 50,000 sq. ft. and with 17 or more dwelling units.
- Owners must report their ENERGY STAR score to the California Energy Commission every two years.
- The initial reporting period for non-residential building was June 1, 2018. After that, fines can be levied as noted below.
- The first reporting period for multi-family starts April 1, 2019 with data due by June 1, 2019. After that, fines can be levied as noted below.

Energy Reporting (And Use) Law Enforcement in California

If you have not benchmarked your building in California yet, you'll need to do so quickly. The challenges owners and operators may be facing include:

1) Fines: According to the bill's Section 1685 Violations, penalties for non-compliance include, "A Civil penalty to be $500-$2,000 per day for each category of data the person did not provide and for each day the violation has existed and continues to exist." In this case, a "category of data" typically means each energy type and/or meter. The Energy Commission will provide the owner a 30-day grace period to report once notified of a violation.

2) Obtaining the Data: Obtaining consumption data can be a very difficult and tedious process, especially if there are multiple meters and/or tenants within a building. If the meter data is unavailable from a tenant, you'll need to contact your local utility provider for that information. The utility provider is required by law to provide the data, but there is no guarantee when and in what format you will receive it. This can cause delays in reporting, so to avoid missing any critical deadlines, collecting utility data should be your top priority.

3) Finding Time to Report: Several hours are required to fulfill the reporting requirement. This includes identifying all buildings that qualify for energy benchmarking, identifying all meters, and entering all the data and meter information accurately.

4) Falling Below Standards: What if your building falls below the national benchmarking standard? If this is the case, you're likely wasting money through excessive energy consumption.

Even if your building falls below the ENERGY STAR score of 75 (75th percentile of like kind buildings across the nation, and the baseline minimum set by the State of California), you're still in compliance with the bill just for having reported your utility data.

However, owners/operators in buildings that fall below the 75th percentile of their peer group will receive information and resources from the State on how to improve energy profiles. If you learn your building is unnecessarily costing you money, you'll want to assess the best approach of reducing those identified expenses.

5) Newly Designed/Constructed Buildings: These are generally aligned towards State compliance. Buildings that are in design and construction may receive favorable energy reports when utilizing state approved compliance software. However, these simulations do not accurately reflect hours of operation and occupant behavior.

SB 350 – Clean Energy & Pollution Reduction Act

Lastly, California approved SB 350: Clean Energy & Pollution Reduction Act approved in 2015 that requires the state to double statewide energy efficiency savings in electricity and natural gas end uses by 2030 and create a building energy-use benchmarking and disclosure program. SB 350 is considered the most significant climate and clean energy legislation since the passage of AB 32: California Global Warming Solutions Act that set the statewide goal of reducing greenhouse gas emissions to 1990 levels by 2020.

In addition, AB 32 directed and authorized various state agencies to engage in actions necessary to achieve this goal. Building off of AB 32, SB 350 established California's 2030 greenhouse gas reduction target of 40 % below 1990 levels. To achieve this goal, SB 350 sets ambitious 2030 targets for energy efficiency and renewable electricity, among other actions aimed at reducing greenhouse gas emissions. SB 350 will greatly enhance the state's ability to meet its long-term climate goal of reducing greenhouse gas emissions to 80 % below 1990 levels by 2050.

AB 2514 – Energy Storage

Assembly Bill (AB) 2514 is California's landmark legislation that will create a smarter, cleaner electric grid, increase the use of renewable energy, save Californians money by avoiding costly new power plants, and reduce greenhouse gas emissions and other harmful air pollutants through the use of energy storage technologies by utility companies.

The 2012 bill requires the California Public Utilities Commission (CPUC) to open proceedings to establish Investor Owned Utility (IOU) procurement targets for viable and cost-effective Energy Storage Systems (ESS) to be achieved by December 31, 2015, and an additional target to be achieved by December 31, 2020. A Publicly Owned Utility (POU) would have comparable requirements and would be required to develop plans to maximize shifting of electricity use for air-conditioning and refrigeration from peak demand periods to off peak periods.

City/County/Municipal Energy Efficiency Ordinances and Regulations

As building efficiency improvements become more affordable, they are also becoming law. California cities such as Los Angeles, San Francisco, San Diego, San Jose and Berkeley have all enacted ordinances requiring commercial and multi-family buildings to report their annual energy usage. Many states have also implemented state-wide programs, such as California's AB 802, that require energy disclosure and audit reports to be completed.

The Los Angeles Department of Building Safety (LADBS) has released a notice regarding the Existing Buildings Energy and Water Efficiency Ordinance (EBEWE). The purpose of this ordinance is to reduce energy and water consumption in existing buildings in the City of Los Angeles. The ordinance requires existing commercial and multi-family buildings to be

benchmarked, audited, retrofitted, and/or retro-commissioned. These efficiency improvements will lower the use of energy, water and greenhouse gas emissions citywide.

Benchmarking through Energy Star's Portfolio Manager software is required for both city- and state-wide legislature, and the Energy Star score reveals big opportunities for energy savings. Benchmarking is becoming common practice not only in the law, but also in making financial and business decisions. Many states and cities are in the process of implementing programs and the great majority of them rely upon EPA's Portfolio Manager to assess operating performance.

For your city's particular ordinances and energy reporting requirements, please visit the Appendix at Existing Building Energy and Water Efficiency Ordinance (EBEWE) Update (pages 8 & 9) to see if your city is on the national list.

13 - ENERGY Certifications for Facilities and Managers

Credit: ENERGY STAR

There are a number of energy efficient building rating systems that have more similarities than differences. While there is no legal or clearly articulated definition of what a "green building" is, these organizations offer standards for green buildings, albeit in slightly different ways. The other green building standards you may want to consider in addition to the ENERGY STAR Building Certification are LEED, Green Globes, Living Building Challenge, WELL Building Standard, Passive House, Net Zero Energy Building, BOMA 360 Performance Program, CHPS and others.

In terms of LEED alternatives, a growing number of state and local governments are adopting different green building standards that aren't tied to LEED, such as California's statewide CALGreen building code that took effect last year. In addition, several other rating systems are cropping up and gaining momentum, such as the Green Building Initiative's Green Globes, which is touted as a simpler and less expensive rating system.

Green Building Certifications, Rating Systems and Labels

In addition, some governments are adopting building codes that apply green standards outside of the LEED blueprint. CALGreen represented the first statewide green building code in California, and it eschews outside (third-party) evaluations like LEED's.

ENERGY STAR Building Certification

ENERY STAR was originally developed by the U.S. Environmental Protection Agency (EPA) as a voluntary labeling program to promote energy-efficient products and reduce greenhouse gas emissions. In the late 1990s, EPA partnered with the U.S. Department of Energy (DOE) to increase the scope of the ENERGY STAR program by launching a whole building program, ENERGY STAR for Buildings.

ENERGY STAR for Buildings includes specifications for Existing Buildings, Commercial New Construction, Industrial Energy Management, and ENERGY STAR for Small Business. The program includes three tools as follows for assisting and encouraging organizations in their efforts to reduce energy use and limit resulting greenhouse gas emissions:

- **ENERGY STAR Portfolio Manager –** This software tool allows organizations to measure, track, and compare their energy use to other buildings. It is the backbone of the ENERGY STAR for Buildings program and a key verification component of the LEED for Existing Buildings: Operations & Maintenance rating system.

- **ENERGY STAR Task Manager –** This no-cost online tool allows architects and building owners to set energy targets and receive an ENERGY STAR energy performance score for projects during the design process.

- **ENERGY STAR Energy Performance Scale –** A score between 1 and 100 indicates building performance relative to similar buildings nationwide. Buildings with an energy performance scale score of 75 or higher achieve the ENERGY STAR Building Label, indicating that they perform in the top 25% of their building type.

Leadership in Energy & Environmental Design (LEED)

Leadership in Energy & Environmental Design (LEED) is an internationally recognized green building certification system and standard. It delivers third-party verification that a space or building was designed and built using best-in-class strategies to address its entire life cycle. Developed by the U.S. Green Building Council (USGBC), LEED provides building owners and operators with a concise framework for identifying and implementing practical and measurable green building design, construction, operations, and maintenance solutions.

LEED can be applied to all building types and even to entire neighborhoods. LEED rating systems are groups of requirements for projects that are pursuing LEED certification. Each group is geared towards the unique needs of a project or building type. Non-residential building projects can earn any of four levels of LEED certification based on the number of points they achieve, and those 4 levels are: Certified, Silver, Gold and Platinum.

Living Building Challenge (LBC)

The Living Building Challenge (LBC), administered by the International Living Future Institute (ILFI), is far more stringent than Energy Star or LEED and must produce at least as much energy as it uses. They are comprised of 20 imperatives to guide projects into the realm of sustainability. LBC is performance-based and, therefore, its outcomes are indicators of success.

WELL Building Standard

The WELL Building Standard focuses on the health and wellness impacts that buildings have on occupants. The standard is arranged into seven areas of concentration, called Concepts and standard can be applied to a variety of building types, including commercial tenant spaces, existing commercial buildings, hospitality, sports facilities, restaurants, and residential buildings.

Passive House

The German PassivHaus, or Passive House, rating system is designed to cut energy use by 90 percent. It has none of the other requirements of a Living Building Challenge approach and is all about energy consumption, or the lack thereof.

Net Zero Energy Building

The International Living Future Institute (ILFI) provides a certification option for a Net Zero Energy Building (NZEB) under its umbrella of the holistic Living Building Challenge (LBC) certification. Such buildings have 100% of their energy needs supplied by on-site renewable energy on a net annual basis.

BOMA 360 Performance Program

The program is sponsored by Building Owners and Managers Association (BOMA) International. The BOMA 360 Performance Program, intended to be an overarching evaluation of building operations, recognizes buildings that meet industry best practices in building operations and management, safety and risk management, training and education, energy performance, environment and sustainability, and tenant/community relations.

Green Globes

The Green Building Initiative developed Green Globes as a cheaper, simpler Web-based alternative to LEED. The standards are fairly similar; however, Green Globes is primarily focused on energy efficiency rather than some of the product sourcing criteria in LEED. Green Globes also is more flexible than LEED and allows a greater degree of self-reporting.

Collaborative for High Performance Schools (CHPS)

CHPS Verified™ and CHPS Verified Leader™ will ensure that a school project is well-designed, operated, and maintained K-12 educational facilities that enhance student performance; positively impact student, teacher, and staff health and wellness; make education more enjoyable and rewarding; and promote positive environmental stewardship.

Facility & Property Management Credentials/Certifications

Credit: IFMA

The following facility and property management related credentials in some way or form help their users, and ultimately their facilities and properties, to become more efficient, economical and/or sustainable. As part of that process, energy management and cost savings are an integral part of their success and contribute to energy savings and efficiency. The most popular and recognized credential and certification programs are from the following organizations.

International Facility Management Association (IFMA)/Royal Institution of Chartered Surveyors (IFMA/RICS)

The IFMA-RICS collaboration also provides additional educational resources to help FMs find proven solutions to industry challenges, increase their knowledge base and stay informed about

industry trends. The IFMA-RICS suite of credentials and professional qualifications provides opportunities for entry into and advancement in facility management. These options represent a full spectrum of professional development for every career stage, from new entrants to experienced practitioners. Their suite of credentials and professional qualifications are as follows:

Facility Management Professional™ (FMP®) – IFMA's FMP is a knowledge-based credential for FM professionals looking to increase their depth-of-knowledge in the core FM topics deemed critical by employers.

Certified Facility Manager® (CFM®) – IFMA's CFM is an internationally recognized credential that sets the standard for ensuring the knowledge and competence of practicing facility managers. It is a competency-based certification that requires ongoing professional development and periodic renewal.

Sustainability Facility Professional® (SFP®) – IFMA's SFP is an assessment-based certificate program delivering a specialty credential in sustainability. By earning your SFP credential, you will develop and gain recognition for your expertise in sustainable FM practices while impacting your organization's economic, environmental and social bottom lines.

RICS Chartered Qualification (MRICS) – A chartered qualification demonstrating regulated, FM professional and strategic advisory expertise and ethics for FMs with a combination of academic and/or professional credentials, as well as experience.

RICS Associate Qualification (AssocRICS) – A qualification demonstrating regulated, technical FM expertise and ethics for technical and commercial experts with four years of FM experience or a credential recognized by RICS.

Essentials of Facility Management® – The Essentials of Facility Management is a series of training workshops that describes the field of facility management and its organizational value.

Building Owners and Managers Institute (BOMI) International

BOMI International is the educational arm of the Building Owners and Managers Association (BOMA). All certificate programs provide the fundamental knowledge you need to better understand your job responsibilities and are a good way to begin your journey toward earning a BOMI International designation. A certificate that fits your needs is listed below:

Property Administrator Certificate (PAC) —Ideal for those who manage the overall operations of a building or a portfolio of buildings.

Property Management Financial Proficiency Certificate (PMFP) —Ideal for those responsible for analyzing, managing, and investing in real estate assets.

Facilities Management Certificate (FMC) —Ideal for those who manage the ongoing operation and maintenance of facilities.

Building Systems Maintenance Certificate (SMC) —Ideal for those who operate and maintain multiple building systems.

Building Energy Certificate (BEC) —Ideal for those in operational and system maintenance roles.

Certified Manager of Commercial Properties™ (CMCP™) —Ideal for those looking to take the first step in building a successful career in commercial real estate.

Association for Facilities Engineering (AFE)

The AFE is a professional membership organization serving all professionals working in the built environment. AFE defines the term built environment as the surroundings people construct to provide settings for human activity and interaction, ranging in scale from buildings to parks, often including their supporting infrastructure such as water supply and energy networks.

Certified Plant Engineer (**CPE)** – Designed to validate your skills as an experienced facilities engineer who possesses the expertise and the technical knowledge required to successfully ensure the optimal performance of any facility, including project and maintenance/equipment engineering.

Certified Professional Maintenance Manager (CPMM) – Designed to validate your skills as an experienced facilities professional who possesses the basic technical and management expertise and knowledge required to successfully lead a maintenance organization in reducing costs while increasing operating efficiencies through designing and implementing effective maintenance programs utilizing the latest methodologies.

Certified Professional Supervisor (CPS) – Designed to validate your skills as a competent facility team supervisor who possesses the required professional demeanor and expertise to be a leader among other facilities management professionals, capable of motivating and training front-line maintenance technicians to specialized engineers; and to rise above your peers in the necessary elements of administrative, organizational and technical tasks to move to the head of the line for job advancement.

Association of Physical Plant Administrators (APPA)

APPA represents more than 18,000 educational facilities professionals from over 1,300 learning institutions worldwide. APPA's community represents the broadest coalition of educational facilities professionals possible, ensuring a diversity of experiences and situations, and availability of best practices.

Certified Educational Facilities Professional (CEFP) - Is a certification designed for both aspiring and existing educational facilities professionals with eight years of combined education and professional facilities management experience. Earning the CEFP demonstrates that you have a mastery of professional expertise and is a mark of superior proficiency in the core competencies for education facilities professionals.

Pathway to Professionalism (P2P) – A new program designed to help educational facilities organizations and their institutions keep pace with accelerating rate of change, while providing continuous learning opportunities for their staffs and schools.

LEED Professional Credentials – US Green Building Institute (USGBI)

A LEED credential denotes proficiency in today's sustainable design, construction and operations standards. More than 203,000 professionals have earned a LEED credential to help advance their careers. Showcase your knowledge, experience and credibility in the green building marketplace as a LEED professional.

LEED Green Associate – A foundational professional credential signifying core competency in green building principles.

LEED Accredited Professional (AP) – An advanced professional credential signifying expertise in green building and a LEED rating system with specialty in Building Design + Construction, Homes, Interior Design + Construction, Neighborhood Development and Operations + Maintenance.

Institute of Real Estate Management (IREM)

IREM® is an international force of nearly 20,000 individuals united to advance the profession of real estate management. Through training, professional development, and collaboration, IREM® supports their members and others in the industry through every stage of their career.

Certified Property Manager (CPM) – For property and asset managers of any property type who are ready to achieve their desired endgame of lifelong career success.

Accredited Residential Manager (ARM) – For residential property managers newer to the profession and aspiring to take the next step in their careers, and gain control over their future.

Accredited Commercial Manager (ACoM) – For commercial property managers newer to the profession and aspiring to take the next step in their careers, and gain control over their future.

Accredited Management Organization (AMO) – For real estate management firms with a CPM in an executive position and ready to achieve and display company-wide excellence.

Association of Energy Engineers® (AEE®)

The AEE® is a nonprofit professional society of over 18,000 members in more than 100 countries. The mission of AEE is to promote the scientific and educational interests of those engaged in the energy industry and to foster action for Sustainable Development.

Certified Energy Manager (CEM) – Is an individual who optimizes the energy performance of a facility, building or industrial plant.

American Hospital Association (AHA)

The AHA is the national organization that represents and serves all types of hospitals, health care networks, and their patients and communities.

Certified Healthcare Facility Manager(CHCM) – Is a health care administrator who has passed the prestigious CHFM exam through the American Hospital Association (AHA).

14 – Securing an ENERGY Savings Plan Budget

Credit: Texas SECO

The benefits of energy efficiency don't stop at the meter—they extend to your bottom line. Improved energy performance can boost your net operating income (NOI) and increase your property's asset value. ENERGY STAR calculates that a 10 percent decrease in energy use could lead to a 1.5 percent increase in NOI with even more impressive figures as the energy savings grow.

In light of the current compression of capitalization ("cap") rates (net operating income divided by the sales price or value of a property expressed as a percentage), it is possible to turn pennies into millions. For example, in a 200,000-square foot office building that pays $2 per square foot in energy costs, a 10 percent reduction in energy consumption can translate into an additional $40,000 of NOI. At a cap rate of 8 percent, this could mean a potential asset value boost of $500,000!

Tailoring the Business Case to Your Organization's Energy Saving Goals

To build the strongest business case for energy savings and efficiency, you should not only leverage the appropriate financial metrics to assess project impacts, but also present the proposal at the right time and in the context of other planned expenditures. Preparing a draft for your CFO's review ahead of time, cementing an ally to save energy costs, and showing how you'll improve your organizations financial bottom line as well as the triple-bottom line—are all wise moves.

With an energy audit and benchmarking report in place, a FM will be equipped with the essential reports and statistics to make their point. Data, reports and energy efficiency is directly tied to lower utility bills and, consequently, lower overall operating expenses.

There are also a host of non-energy benefits to efficiency. A recent study by the U.S. Department of Energy (DOE) found that high-performing buildings are able to demand higher rental rates. They also attract better quality tenants with superior creditworthiness and maintain increased occupancy rates. Although it may be challenging to quantify, efficient buildings increase tenant comfort, improve occupant health, and allow an owner to market the property as sustainable. The resulting increase in overall rental income, in combination with lower operating expenses, means higher NOI.

This translates to increased asset value and a competitive advantage in commercial real estate markets. Energy efficiency offers an opportunity for owners and asset managers to invest in repositioning their building and reduce the associated risk of their investment. Appraisers are increasingly adept at including the value of energy efficiency in their property valuations. This improves an owner's access to favorable financing and underwriting. Finally, strong energy performance is a reflection of excellent building management and can be a key differentiator for a building or an entire firm in competitive markets.

Some financial metrics are more effective than others in evaluating the true costs and benefits of an energy efficient building. It's imperative that efficiency champions communicate efficiency performance metrics in terms that will resonate with tenants and ownership. At the most basic level, this requires translating energy savings from simple kWh or KW to monetary benefits, such as increased rental rates and decreased operating expenses in dollars per square foot.

Many of the most common financial metrics, such as simple payback period, internal rate of return (IRR), and return on investment (ROI) in fact do not capture the full benefits of energy efficient buildings. To build the strongest case for your energy efficiency upgrade or investment, emphasize the following key financial metrics:

- **Net Present Value (NPV)** takes into account the investor's discount rate to calculate how much a cash flow from energy savings is worth in today's dollars, which more accurately reflects the value of efficiency across an efficiency project's payback horizon.

- **Savings-to-Investment Ratio (SIR)** reflects the present value of cash inflows from a project, relative to the present value of cash outflows, which more accurately reflects your return to investment than similar metrics, such as the internal rate of return (IRR)

For more details on how to quickly and easily estimate the costs and savings for a large, complex energy retrofit project at your building, check out the Appendix link for the Spark Tool: A Personalized Business Case to Present to Ownership.

Investment Analysis and Financing Options if Needed

To implement your action plan, consider taking the following steps:

- Create a Communication Plan—Develop targeted information for key audiences about your energy management program.

- Raise Awareness—Build support at all levels of your organization for energy management initiatives and goals.

- Gain Support From Upper Management – In most companies, it's necessary to gain the support of upper management to move forward with any significant project.

Create a Communication Plan

Good communication does not just happen. It requires careful planning and implementation. To communicate strategically, you will need to identify key audiences, determine the information that they need, and adapt your messages appropriately for each one. ENERGY STAR offers a variety of communication resources, such as posters and templates that your organization can customize to help you spread the word to employees, customers, and stakeholders. These resources are available on the ENERGY STAR web site.

Raise Awareness in Your Organization

Everyone has a role in energy management. Effective programs make employees, managers, and other key stakeholders aware of energy performance goals and initiatives, as well as their responsibility in carrying out the program.

Communication strategies and materials for raising awareness of energy use, goals and impacts should be tailored to the needs of the intended audience.

Gain Support From Upper Management

The most important point of your energy savings plan is to demonstrate how your goals help upper management reach their bottom line. In most companies, it's necessary to gain the support of upper management to move forward with any significant project. Members of upper management are the decision-makers and gatekeepers for making changes.

- **Survey Those Involved –** When attempting to initiate a new project, gather information from those involved in it. Build your case by showing the necessity of a new proposal. Without this evidence, senior management is not likely to see the need for a proposed change.

- **Show the Budget –** If you're suggesting to implement change at work or put a new process in place, show how it will be funded. Senior managers are more likely to support an idea that already has financing in place.

- **Give Them a Choice -** You're more likely to gain upper management support if they feel they had a hand in a decision. When you want to change how something is done, come up with more than one solution. More options are better than none.

- **Fit Into Their Goals –** Upper management has its own set of goals and objectives to meet throughout the year. Show how your goals help achieve the bottom line and you're more likely to gain support for an idea.

Unconventional Opportunities

When searching for project capital, begin by bargain hunting for special programs that support energy performance. Every organization planning an energy performance upgrade should

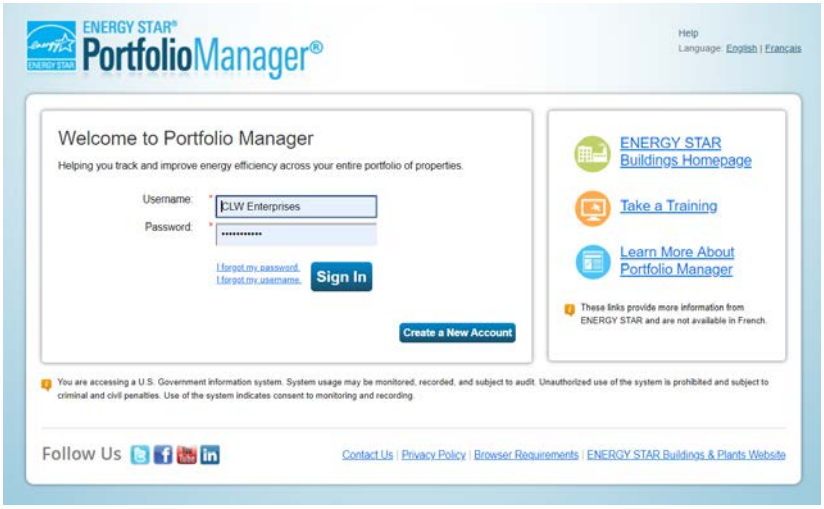
investigate utility incentives, state assistance, and other funding opportunities. A good place to start is the DSIRE - Database of State Incentives for Renewables & Efficiency in the Appendix.

- **Utility Incentives** - Utilities often provide financial incentives for energy-performance upgrades through grants, rebates, fuel-switching incentives, low-interest loans, and energy audits.

- **State Assistance** - Many states offer financial assistance to local governments, nonprofit organizations, small businesses, and other targeted organizations for energy-efficiency upgrades.

- **Foundations and Nonprofit Organizations** - Many foundations and nonprofit organizations sponsor programs that fund energy-efficiency projects.

15 - Your ENERGY Savings Dashboard



Credit: ENERGY STAR Portfolio Manager

The future is now for energy savings and energy management and taking advantage of everything that ENERGY STAR Portfolio Manager has to offer is a wise decision. It takes one year of energy usage data collection to measure your building's performance with others for your benchmarking score. So why wait any longer than you have been? The time to get started is now!

It is no secret that a focused, well-defined sustainability strategy, Sustainable Energy Buildings Plan (SEBP) is beneficial to an organization's bottom line, whether it is a federal, private-sector, military or nonprofit entity. Sustainable practices are not only the right thing to do for the environment; they also benefit the communities in which they are implemented. Sustainability is the business implementation of environmental responsibility.

Energy sustainability is all around us. Federal, state and local governments are increasingly applying regulatory constraints on design, construction and facility operations standards for energy reduction. Employees expect their employers to act responsibly, and vice versa, in saving energy. Going green is no longer a fad or a trend, but a course of action for individuals and businesses alike – benefiting the Triple Bottom Line of people, planet and profit.

Today's facility and property managers needs to be able to clearly communicate the benefits and positive economic impact of sustainability and energy-efficient practices, not only to the public, but also to the C-suite. While there is a dramatic need for each of us–and our organizations–to care for the environment, it is just as important that we convey to executives and stakeholders how these initiatives can benefit our company's financial success.

EPA's ENERGY STAR Portfolio Manager on-line energy management tool helps you measure and track the energy and water use, waste and materials, and greenhouse gas emissions of your buildings, all in a secure online environment. You can use the results to identify under-performing buildings, set investment priorities, verify efficiency improvements, and receive EPA recognition for superior energy performance.

By entering details about your property and consumption data, you can:

- Assess whole building energy performance.
- Track changes in energy, water, waste, greenhouse gas emissions, and cost over time.
- Track green power purchases.
- Create custom reports.
- Share data with others. Learn more about the tool's features and functionalities!

Creating a Portfolio Manager Account

To create a Portfolio Manager account, go to portfoliomanager.energystar.gov/pm/signup. In the upper right there is a Portfolio Manager login box. Hover over the link to bring up the login box. Then select the "Register" option to complete an Account Information form and complete the requested information. As the final step, an activation email will be sent to you with a link to activate the account. If you do not see this email, please be sure to check your 'spam' folder.

Benchmarking & Energy Savings

Do buildings that consistently benchmark energy performance save energy? The answer is yes, based on the large number of buildings using the U.S. Environmental Protection Agency's (EPA's) ENERGY STAR Portfolio Manager to track and manage energy use. Over 35,000 buildings entered complete energy data in Portfolio Manager and received ENERGY STAR scores for 2008 through 2011, which represents three years of change from a 2008 baseline. These buildings realized savings every year, as measured by average weather-normalized energy use intensity and the ENERGY STAR score, which accounts for business activity. Their average annual savings is 2.4%, with a total savings of 7.0% and score increase of 6 points over the period of analysis.

Buildings that start with lower ENERGY STAR scores and higher energy use achieve the greatest savings. In fact, buildings starting with below average energy efficiency in 2008 (i.e., score under 50) saved twice as much energy as those starting above average.

How Do Savings Levels Vary Among Buildings?

Over 70% of the buildings (25,926) reduced their energy consumption. Close to 90% of these experienced average annual reductions in the range of 0 to 10%. A smaller number of buildings experienced average annual reductions greater than 10%, which may be expected with large scale energy efficiency investments. This suggests that slow and steady improvements over time are typical of buildings that consistently track and benchmark energy consumption.

Energy savings were experienced by all building types. Among those with above average savings are Retail, Office, and K-12 School, the sectors with the most buildings benchmarking in Portfolio Manager. These buildings represent over 60% of the buildings benchmarking consistently from 2008-2011.

What Are the Potential Energy Savings Over Time?

Organizations benchmarking consistently in Portfolio Manager have achieved average energy savings of 2.4% per year, and an average increase in ENERGY STAR score of 2 points per year in their buildings. If all buildings in the U.S. followed a similar trend, over 18 million metric tons of carbon dioxide equivalents could be saved each year. Through 2020, the total savings could be approximately 25%.

What Is the Financial Value Of Benchmarking?

The financial value of benchmarking can be expressed in terms that are meaningful to each building sector. A savings of 2.4% for three consecutive years is equivalent to the following:

- **For a 500,000 square foot office building:** Cumulative energy cost savings of $120,000. Increase in asset value of over $1 million.
- **For a medium box retailer with 500 stores:** Cumulative energy cost savings of $2.5 million. Increase in sales of 0.89%.
- **For a full service hotel chain with 100 properties:** Cumulative energy cost savings of $4.1 million. Increase in revenue per available room of $1.41.
- **For an 800,000 square foot school district:** Cumulative energy cost savings of $140,000. Salary of 1.2 full time teachers each year.

Setting Up a Facility for an ENERGY STAR Score

After registering as a Portfolio Manager user, the next step is to create a facility in Portfolio Manager and populate the necessary data with the following:

- Essential building information such as year built, building type, floor area, number of occupants, etc.
- Break out space uses that are fundamentally different from the defined core building space.
- Twelve (12) months of monthly energy consumption data.

Facilities can be grouped in Portfolio Manager to show how certain groups of facilities may be performing against an entire portfolio or within the group. For example, if the portfolio consists of retail buildings and distribution centers, these different types of buildings can be grouped together, thus allowing comparison of a facility's performance against its specific group. ENERGY STAR scores are only available for individual buildings.

Reporting and Tracking Options in Portfolio Manager

The various reporting and tracking options in the Portfolio Manager® Management Tool portal is a free online secure platform at www.energystar.gov/portfoliomanager that allow users to:

- Assess whole building energy consumption
- Track changes in energy and cost over time
- Track green power purchasing
- Share/report data with others
- Create custom reports
- Apply for ENERGY STAR certification Metrics Calculator
- Use more than 150 metrics available
- Energy consumption (source, site, weather normalized)
- Water consumption (indoor & outdoor)
- Waste & materials management
- Greenhouse gas emissions
- ENERGY STAR 1-to-100 score for energy efficiency

This rating system is based on statistically representative models that compare the energy consumption of a building to similar buildings from a national survey conducted by the United States Department of Energy (DOE) every four years called the Commercial Building Energy Consumption Survey (CBECS). This survey collects data, such as building characteristics and energy usage, from buildings located across the United States.

A building's peer group for comparison are those buildings in the CBECS survey that have similar building and operating characteristics. Essential information from this survey can highlight facility performance criteria such as:

- **Environmental** – Shows rating, EUI, change from baseline energy use, and change from GHG emissions.

- **Financial** – Shows annual cost of energy, water, and cost/SF of energy and water.

- **GHG Emissions** – Shows EUI, current GHG emissions, baseline GHG emissions, and change from baseline.

- **Water Use** – Shows water use, water cost, wastewater use, and wastewater cost.

- **Energy Use** – Shows rating, EUI, source EUI and change from baseline.

A score of 50 indicates that the building, from an energy consumption standpoint, performs better than 50% of all similar buildings nationwide, while a score of 75 indicates that the building performs better than 75% of all similar buildings nationwide. Ultimately, EPA expresses the rating on a 1-100 scale where 1 point on the scale represents 1 percentile of the commercial building market.

Consultation

If it's your desire to delegate your facility and property management benchmarking and certification duties to an outside consultant with industry expertise and relevant training such as the LEED AP Operations & Maintenance (EB+OM), Facility Management Professional (FMP), and

the Certified Construction Manager (CCM) credentials, CLW Enterprises can provide this service as well as others for sustainable facility programs, certifications and construction management such as:

- ENERGY STAR Benchmarking and Certification
- Energy Savings Consulting
- LEED Building Certifications
- Project and Program Management
- Alternate Project Delivery Methods

For more information on these services or to get started right now with an ENERGY STAR Portfolio Manager account, please contact Corey Lee Wilson at CLW Enterprises at (951) 415-3002, CLWEnterprises@att.net or follow the link to www.CLW-Enterprises.com. For a more detailed list and explanation of services and credentials, please head to the last page of this book, the Biography section.

Appendix

ASHRAE 1651-Research Project, Development of Maximum Technically Achievable Energy Targets for Commercial Buildings: Ultra-Low Energy Use Building Set:
https://www.ashrae.org/about/news/2016/new-research-from-ashrae-outlines-measures-to-reach-toward-net-zero-energy

ASHRAE Standard 90.1-2013, Energy Efficiency Standard for Buildings Except Low-Rise Residential:
https://www.ashrae.org/technical-resources/bookstore/standard-90-1

Building Energy Benchmarking Program: California Energy Commission (CEC):
https://www.energy.ca.gov/programs-and-topics/programs/building-energy-benchmarking-program

DSIRE - Database of State Incentives for Renewables & Efficiency: www.dsireusa.org.

Energy and Facilities Management Software Review: https://www.softwareadvice.com/

ENERGY STAR for Buildings Program: http://www.energystar.gov/

ENERGY STAR Portfolio Manager: www.energystar.gov/benchmark

Energy Use Intensity (EUI):
https://portfoliomanager.energystar.gov/pdf/reference/US%20National%20Median%20Table.pdf

Existing Buildings Energy and Water Efficiency Ordinance (EBEWE)
https://www.energy.ca.gov/programs-and-topics/programs/building-energy-benchmarking-program/local-benchmarking-ordinances

IFMA'S 30 Minute ENERGY STAR Webinar:
https://attendee.gotowebinar.com/recording/8637296428037464835

Spark Tool: A Personalized Business Case to Present to Ownership:
http://betterbricks.org/resources/spark-tool-a-personalized-business-case-to-present-to-ownership

U.S. Energy Information Administration (EIA) Electric Grid Monitor:
https://www.eia.gov/todayinenergy/detail.php?id=40993#

U.S. Energy Storage Monitor 2018 Year-in-Review:
https://www.woodmac.com/research/products/power-and-renewables/us-energy-storage-monitor/

Glossary

Aggregated Energy Resource Solutions (AERS). An AERS is a system using advanced building energy demand and emulation analysis that balances your energy rate as well as using the lowest rates available.

California Independent System Operator (CAISO): A non-profit Independent System Operator (ISO) serving California. It oversees the operation of California's bulk electric power system, transmission lines, and electricity market generated and transmitted by its member utilities.

California Power Exchange: A State-chartered, non-profit corporation which provides day-ahead and hour-ahead markets for energy and ancillary services in accordance with the power exchange tariff. The power exchange is a scheduling coordinator and is independent of both the independent system operator and all other market participants.

Conservation: A reduction in energy consumption that corresponds with a reduction in service demand. Service demand can include buildings-sector end uses such as lighting, refrigeration, and heating; industrial processes; or vehicle transportation. Unlike energy efficiency, which is typically a technological measure, conservation is better associated with behavior.

Demand Response Programs: Demand response programs are incentive-based programs that encourage electric power customers to temporarily reduce their demand for power at certain times in exchange for a reduction in their electricity bills.

Demand Side Management (DSM): A utility action that reduces or curtails end-use equipment or processes. DSM is often used in order to reduce customer load during peak demand and/or in times of supply constraint.

Distributed Energy Resource (DER): A non-utility based energy source, typically from a renewable source such as rooftop PV, stationary battery storage or EV battery.

Distribution Provider (Electric): Provides and operates the wires between the transmission system and the end-use customer. For those end-use customers who are served at transmission voltages, the Transmission Owner also serves as the Distribution Provider.

Distribution System: The portion of the transmission and facilities of an electric system that is dedicated to delivering electric energy to an end-user.

Duck Curve: In utility-scale electricity generation, the duck curve is a graph of power production over the course of a day that shows the timing imbalance between peak demand and renewable energy production.

Existing Buildings Energy and Water Efficiency Ordinance (EBEWE): These ordinances requires existing commercial and multi-family buildings to be benchmarked, audited, retrofitted, and/or retro-commissioned.

Energy Efficiency: A ratio of service provided to energy input (e.g., lumens to watts in the case of light bulbs). Services provided can include buildings-sector end uses such as lighting, refrigeration, and heating: industrial processes; or vehicle transportation. Unlike conservation, which involves some reduction of service, energy efficiency provides energy reductions without sacrifice of service. May also refer to the use of technology to reduce the energy needed for a given purpose or service.

Energy Service Company (ESCO): A non-utility entity that provides retail, commercial, or industrial energy services. Also known as an energy service provider.

Energy Storage System (ESS): An ESS works by capturing electricity and storing it for discharge when required which allows users to come off the grid and switch to stored electricity, at a time more cost effective to them, giving them greater flexibility and control of electrical usage. Furthermore, at times of high grid power demand an ESS with an excess supply of energy can release stored energy back to the grid, helping to balance it between periods of low energy supply and high energy demand.

Energy Use Intensity (EUI): EUI is typically expressed in energy used per square foot of building footprint per year. It is calculated by dividing the total gross energy consumed in a one-year period (expressed in kilowatt-hours or kilo-British Thermal Units) by the total gross square footage of the building.

Federal Energy Regulatory Commission (FERC) Order 841: Requires the removal of barriers to the participation of energy storage in the capacity, energy, and ancillary services markets operated by ISOs and RTOs.

Greenhouse Gas Emission (GHG): A gas that absorbs and emits radiant energy within the thermal infrared range. Greenhouse gases cause the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide and ozone.

Independent System Operator (ISO): An independent, federally regulated entity established to coordinate regional transmission in a non-discriminatory manner and ensure the safety and reliability of the electric system.

Investor-Owned Utility (IOU): A privately-owned electric utility whose stock is publicly traded. It is rate regulated and authorized to achieve an allowed rate of return.

Kilowatt hour (kWh): A measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu.

Photovoltaics (PV): Solar-electric energy cells in any of numerous forms and configurations.

Qualified Balance Resources (QBR): A QBR system essentially releases stored energy during peak demand and TOU periods after purchasing the facility’s peak power usage reserves during the time of day with the lowest TOU rates.

Regional Transmission Organization (RTO): An electric power transmission system operator (TSO) that coordinates, controls, and monitors a multi-state electric grid. The transfer of electricity between states is considered interstate commerce, and electric grids spanning multiple states are therefore regulated by the Federal Energy Regulatory Commission (FERC).

Renewable Energy Resources: Energy resources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

SMART: An acronym for Specific, Measurable, Assignable, Realistic and Time-related.

Smart Energy Saving System (SESS): A SESS can manage and regulate energy usage by purchasing it at the lowest peak usage rates, store it in a battery storage system, and releasing it when energy demand is at its highest. They also prevent energy spikes and excessive energy demand by modulating and flattening energy usage for peak performance.

Sustainable Energy Buildings Plan (SEBP): A SEBP optimizes an Energy Storage System (ESS) and efficient energy management in support of the primary purpose of the organization. A SEBP has the potential to manage energy resources in a manner consistent with all that is green, zero-net-energy and high-performance.

Triple Bottom Line (TBL or 3BL): Is an accounting framework with three parts: social, environmental (or ecological) and financial. Some organizations have adopted the TBL framework to evaluate their performance in a broader perspective to create greater business value.

Zero Energy Building (ZEB): An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

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Author Bio

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ENERGY SAVING SOLUTIONS FOR SUSTAINABLE FACILITIES & PROPERTIES

- **ENERGY STAR Benchmarking and Certification** services for energy management tailored to each client's O&M and FM systems needs and requirements to help reduce their energy costs 5% to 10% on average and more. Services include energy consumption analysis, on-site product and behavior recommendations, and facilitation of energy rebates, grants, and tax incentive programs.

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- **LEED Building Certifications** featuring the LEED Existing Building Operations + Maintenance (EBOM) rating system to ensure your buildings are meeting California's zero net energy goals, CAL Green / Title 24 code compliance, AB758 - California's comprehensive law on energy efficiency in existing buildings and AB327 regarding solar energy upgrades and net metering.

- **Project & Program Management** services from the development and design stages to the procurement, construction, and post construction phases using owner partnering and integrated project development. Services cover commercial, retail, medical and industrial facilities for new, addition, remodel and maintenance type projects of various sizes, working directly with the owner and/or the contractor.

- **Alternate Project Delivery Methods** implementation using Design-Build / Assist and the Bridging Method of project / contract delivery methods and systems that typically saves owners 6% on design and construction costs, reduces the total project schedule by as much as 33%, eliminates change orders, improves design, quality and performance and stakeholder satisfaction.

ENERGY Cost Savings For Facilities

CLW ENTERPRISES

Energy! It's one of your major cost components. It's a hot topic and will continue to be so. For most facilities and properties, the cost of energy is not going down—only up. It's essential to reduce energy costs on your building(s) whether new or existing.

Energy management is an integral part of the day-to-day operations for facility managers and property owners. Rising energy costs and increasing interest in sustainability are driving the need to reduce energy consumption in buildings and develop strategies for better management.

How energy efficient is your property? How does a facility overall energy efficiency compare to a portfolio of buildings? Or, how does it compare to other similar buildings regionally, nationwide or internationally?

Doing more with less! That's an often heard catch-phrase for FM's and CFO's in managing costs. The purpose of this handy guide is much the same. Energy issues can drain your budget and consume valuable resources.

This guide is also essential for facility and property managers along with their financial officers who are serious about reducing energy usage and the cost of it to their organization's triple bottom line.