

WHITE PAPER FOR C&I ENERGY MANAGEMENT

Optimizing Energy Management Solutions for Commercial & Industrial Buildings in the Pennsylvania Area (PA, MD, DC, NJ, NY, VA, WV, DE)



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Executive Summary

The scope of energy management responsibility has moved beyond economic viability into business resiliency, relevancy, sustainability, and future growth potential. For these reasons, building energy management and the old complacency mode is becoming a thing of the past. Energy experts foresee that global market pressures and energy volatility will continue to grow. These energy-conscious practices will become standard operating procedure for those who wish to remain competitive in their industry.

This is why we have developed a comprehensive approach for C&I building decision makers which we hope they can use to become better energy managers. There is currently no, one-size fits all approach to energy management. However, there is a general schematic that any energy manager can overlay on their particular set of goals, challenges, assets, and energy demands. In this report, we will highlight this schematic in order to deliver an energy educational framework that can be applied to any C&I building energy optimization scenario.

“In total, building energy waste costs commercial and industrial entities \$60 billion in unnecessary energy spend annually.”

- Justin Gerdes, Forbes & EnerNOC Study ¹

Some of the significant benefits of adopting a building energy management framework include:

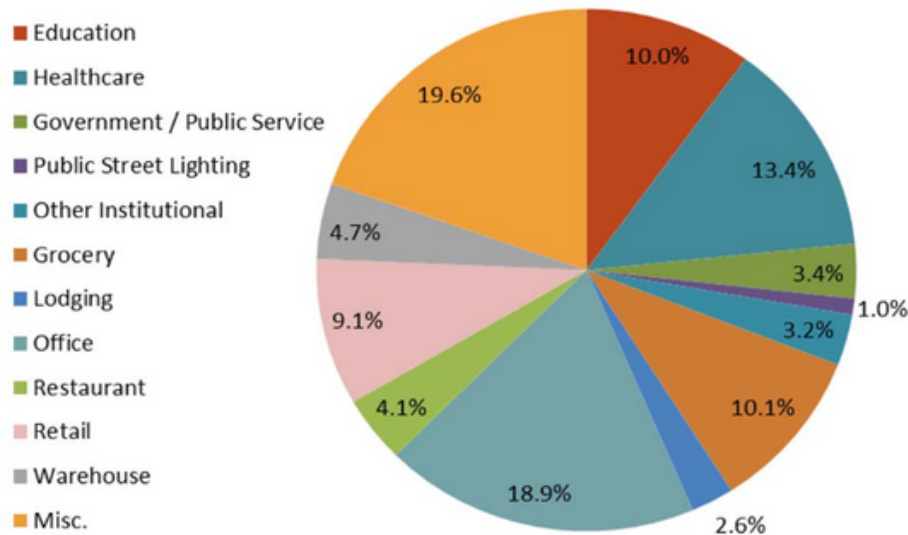
- Reduce, control, and manage energy waste
- Reduce, control, and manage energy costs
- Improve operational and worker productivity
- Create new market opportunities
- Leverage rebates, credits, grants, and other sustainability incentives
- Improve relations with all stakeholders, including community
- Satisfy local benchmarking requirements
- Hedge against future energy threats

We’ve developed this report to share our 12 years of commercial and industrial building energy optimization and financial expertise with building management. We recommend this report to all commercial and industrial building energy decision makers that aim to be successful in their role and take the lead on energy optimization for their facility and in their industry.

Optimizing Financial Performance

The initial economic savings potential for existing commercial buildings that exercise energy efficiency is upwards of 20%, and lighting alone accounts for up to 40-60% of this potential savings, according to The Department of Energy.²

Figure 1. 2020 Commercial Energy Savings Distribution by Building Type, Achievable Base



Graph source: Pennsylvania Public Utility Commission, Pennsylvania Energy Efficiency Potential Study Report, 2015.³

“One thing that I have working for me is that people have started to recognize that energy is not rent—it’s an actual, manageable cost.”

- Eric Bliss, Senior Engineering Manager Blommer Chocolat⁴

Leveraging Secondary Benefits

Energy optimization spans the scope of all smart energy decisions that align with principles of continued growth, including but not limited to financial growth. There are a host of additional benefits that arise when standard practices of energy optimization are applied to current building systems and standard operating procedures. Including but not limited to:

- Improved productivity
- Emissions compliance
- Reduction of fossil fuel usage
- Qualify to lease building space to government agencies
- Energy Star and Leed Certification opportunities

Addressing Energy Decision Makers

Within most industrial and commercial building energy decisions, there exist multiple decision makers across the board. Some outdated models of energy management have led to the current complacency or stalemate within the decision making funnel. Some of these stalemates include lack of staffing, silos in energy decision-making, access to unbiased information, the skillset to make higher-level decisions on energy. These challenges have been addressed by many building owners who have already tackled their energy management and have directed all efforts toward full energy optimization. It is from their lessons and victories that strategic plans have become more accessible to prescribe and adopt, even when considering the dynamics and goals that shift from building to building.

Building a Foundation

While any affirmative energy action is an achievement, many building owners approach energy with limited tools, understanding, and resources that can limit the full potential of a holistic approach to energy, where all aspects are considered simultaneously to gain the greatest benefit.

There is a better framework with which to take action toward a generalized goal of full energy optimization that must be addressed. This goal of full energy optimization includes:

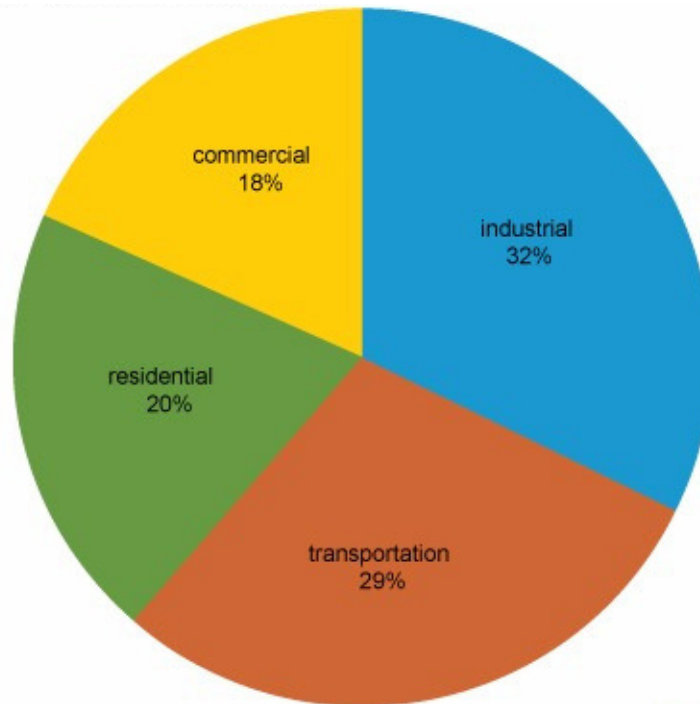
- **Energy Efficiency**
- **Energy Procurement**
- **Energy Generation**

Approaching energy with this three-pronged strategy allows C&I building managers to build toward increasingly larger energy goals, thus continually leveraging the success of previous achievements toward the accomplishment of increasingly beneficial measures that can withstand the demands of tomorrow's unpredictable energy forecast.

Commercial and Industrial Energy Optimization Framework

While energy has historically been relegated as a bill to be paid by the accounts payable department, understanding the role that energy plays in the ability to run operations without a hitch, is paramount to understanding its impact into the future of a facility. Commercial and Industrial energy sector buildings consume 50% of the total energy spend in the U.S. or 48.85 quadrillion BTUs, and have the greatest room for improvement.⁵

Figure 2. Shares of Total U.S. Energy Consumption by end-use sectors, 2017.
Total = 97.7 quadrillion BTUs



Note: Sum of individual percentages may not equal 100 because of independent rounding.
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 2.1,
April 2018, preliminary data



Graph source: U.S. Energy Information Administration, *Monthly Energy Review*, 2018.⁵

C&I Energy Trends

Energy management has become an increasingly vital trend for C&I buildings to grasp and finally excel at. Energy independence and flexibility are no longer concepts far from reach. With the help of reduced costs for renewable energy generation and open market energy purchasing, energy managers are able to leverage financial strategies toward energy self-reliance. Some of the major trends we see in C&I building energy management and optimization include:

- More affordable software and tech solutions
- Demand response utility company incentive programs
- Storage + Solar PV Energy on-site generation
- PPAs and Energy-as-Service Pricing Models
- Sustainability Initiatives becoming core to business models
- IoT for Energy Efficiency
- City, County, and State Benchmarking Requirements
- Maturing energy efficiency data improving measurement and verification (M&V) systems
- Increased pressure for building resilience and energy reliability
- Smart metering

Energy Profile for C&I Buildings

Missed opportunities for energy control have the potential to reduce the relevancy of a building and its energy portfolio. Although the rewards begin with reducing financial expenses, there are great gains in other areas as well, including productivity, energy self-reliance, and building valuation which exhibits some of the highest potential moving into a future of energy management as the norm.

Federal, State, and Local Programs and Incentives

All levels of government directly affect the future outlook of energy. This includes the types of energy that are incentivized, how energy is used, what types of equipment will be rewarded and what types of energy spends will be penalized. Because of this, many programs and policies have been created specifically for C&I buildings as they have the potential to make significant impacts on energy loads. The investment into these programs sets the tone for things like renewable energy credits, LED lighting incentives, and benchmarking programs. The list of incentives for the private sector to partake in energy optimization and management protocols are a timely asset that should be used to help implement building energy projects. Investments in infrastructure, equipment, and many other building items can help to ensure a more sustainable future for local communities as well as increased commercial building market value and ROI.

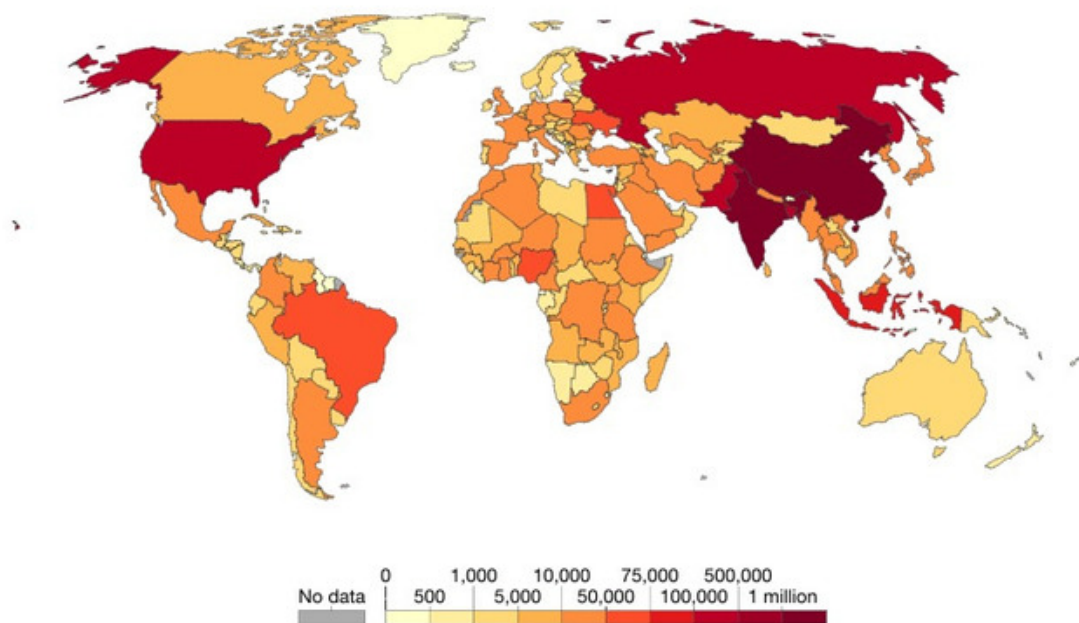
Regulations and Mandates to Mitigate Air Quality

According to a World Health Organization Report, in 2016 there was an estimated 4.2 million premature deaths caused by poor ambient quality (outdoor air pollution) in both cities and rural areas.⁶ While the Clean Air Act has set a baseline standard for pollution emissions, many states are increasing the regulations on this baseline. Emerging data on air quality death rates will continue to inspire stricter sanctions on non-renewable energy sources, industry-based emitters, and combustion emissions from targeted industries. Areas with the most room for improvement in air quality will be:

- Industry: solutions to energy waste, implementation of cleaner technologies, retrofitting equipment and processes, improve waste streams that off-gas, and implementation of incineration alternatives.
- Energy: movement toward maximum efficiency and reduction of waste.
- Power Generation: Improve on-site capabilities for clean and renewable energy generation like micro-grids, cogeneration or “combined heat and power” (CHP) and solar, wind, and hydropower.
- Municipal Waste Management: Implement effective recycling programs, clean waste disposal methods, and incentivize businesses and residents to participate in better materials recovery systems.

The most viable solution begins with energy management and optimization. Addressing energy efficiency is generally the most accessible path toward lowering emissions and minimizing the amount of carbon required to run operations. The next solution is to piggyback these energy savings onto procurement techniques to lower energy bills which can help to leverage opportunities for implementing renewable energy generation on-site. Reducing fossil fuel consumption and energy demand is the first step in a path to developing cleaner facility operations.

Figure 3. Absolute number of deaths from outdoor air pollution, 2016
Absolute number of deaths by country attributed to ambient (outdoor) air pollution of particulate matter and ozone.



Map source: Institute of Health Metrics and Evaluation and Our World in Data, 2016. ⁷

Increasing Accountability on Energy Waste Externalities

Disguised as the ‘cost of doing business,’ the waste generated from C&I buildings throughout operations that is not accounted for, emerges when addressing embedded energy costs. While building management may spread across geography and/or responsibility it becomes difficult to calculate real insight into operations deliverables and costs, especially, when combined with the total sum of energy waste and unpaid environmental externalities; the ‘cost of doing business’ begins to increase. Understanding that costs are configured differently for consumers is key to understanding that the actual cost of energy wasted is never fully paid for when taking into account carbon that is unnecessarily emitted because of poor or no energy management protocols. The solution for these environmental externalities begins with benchmarking and addressing waste.

The Future of Commercial & Industrial (C&I) Building Energy Management Optimization

Part 1: Energy Efficiency

Every energy efficiency journey must begin with energy audits or benchmarking. Benchmarking helps us set baselines, develop a strategy, assert market position, and to create a plan-of-action that is rational and tailored to each building's needs. Energy efficiency is the practice by which energy demand is assessed, and technologies and protocols are adopted to reduce the waste. Often this practice arises as a means to reduce expenses and increase building revenue, but ultimately it is the first marker on the path to fully optimizing every aspect of a building's energy makeup.

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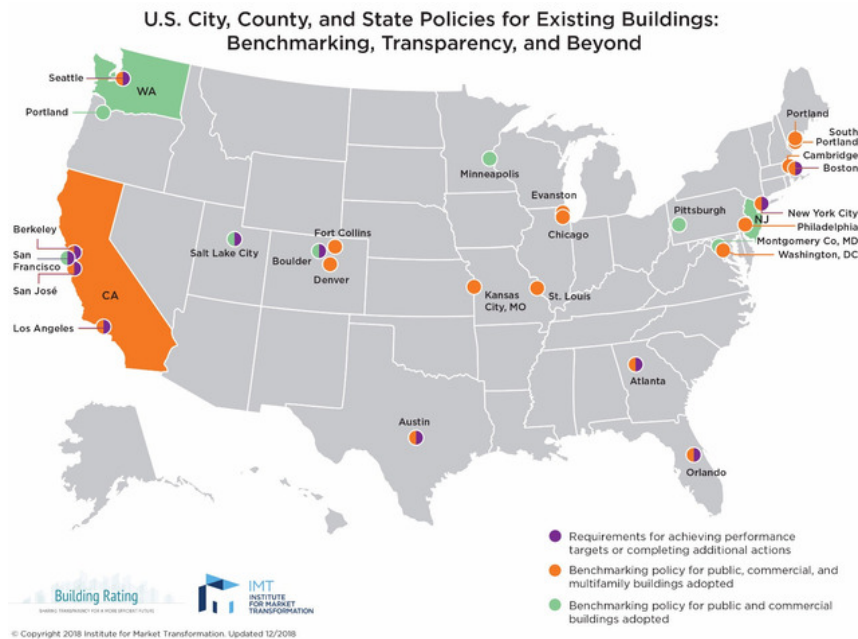
Benchmarking

The average C&I building wastes about $\frac{1}{3}$ of the energy it consumes according to the U.S. Energy Information Administration.⁸ Benchmarking allows for ongoing data-informed decision making processes to take place. The more data that is fed into energy demand analysis, the more effective benchmarking measures will become. The ability to compare like-buildings allows energy managers to curate data and best practices from hundreds of similar buildings, allowing for more streamlined, predictable, and agile efforts for the planning process. The benefits of benchmarking include:

- Set a baseline for energy demand
- Prioritize areas for greatest improvements
- Gain awareness of energy usage and taking immediate efficiency measures
- Distinguish efficient buildings from inefficient buildings
- Lower utility bills
- Increase rents to tenants willing to pay more for greener buildings
- Improve lending opportunities
- Greener buildings have higher marketplace relevancy
- Expose areas needed for retrocommissioning projects

Increasingly, U.S. cities are developing climate-initiated policies that require commercial and industrial buildings to participate in energy benchmarking techniques in their energy management practices. Benchmarking and energy analysis measures are the starting point in executing a full energy optimization plan.

Figure 4: U.S. City, County, and State Policies for Existing Buildings: Benchmarking, Transparency, and Beyond



Map source: Institute for Market Transformation, 2018.⁹

Energy Efficient LED Lighting

With room to create one of the most significant impacts on energy demand, Lighting Retrofit Projects have the ability to save commercial facilities 40-60% of their current energy spend, according to U.S. Department of Energy.²

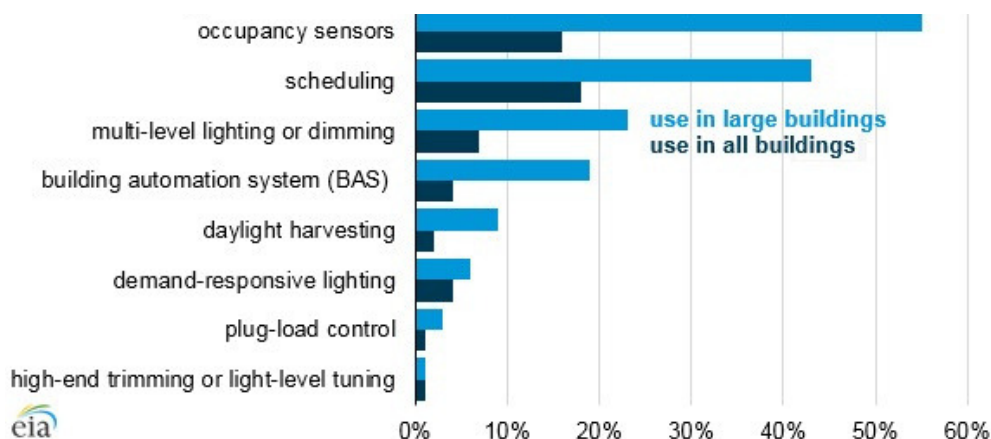
“Innovations in photonics and solid state lighting [LEDs] will lead to trillions of dollars in cost savings, along with a massive reduction in the amount of energy required to light homes and businesses around the globe.”

- Rensselaer Polytechnic Institute ¹⁰

Optimized Usage and Lighting Control

Lighting controls prove to be some of the easiest energy efficiency measures to implement for commercial and industrial buildings. Lighting control measures tend to be accessible, affordable, and benefits can be achieved in a very short-term time frame.

Figure 5: Lighting controls used in commercial buildings. Share of lit buildings.



Graph source: Energy Information Administration, 2017. ¹¹

Based on the most recent Commercial Buildings Energy Consumption Survey (CBECS) on lighting control strategies for commercial buildings, we can see that occupancy sensors and lighting schedules are some of the most prominent control strategies for lighting in large buildings, over 50% of large buildings have occupancy sensors installed. However, we can also see that the long list of lighting control strategies are not maximally leveraged. Some of which include:

- Daylight Harvesting
- Smart Time Scheduling
- Lighting Zones
- Switching
- Occupancy/Vacancy Detection
- Multi-level Lighting & Dimming
- Load Shedding
- Demand-Responsive Lighting
- High-End Task Tuning
- Scene Selection/Personal Control
- Integration With Building Automation Systems (BAS)
- Plug-load control

“Unfortunately, if commercial and industrial LED products are installed without networked lighting controls, the opportunity to capture much of the savings potential that they offer can become stranded for many years because retrofitting networked lighting control systems onto already installed LED products is both expensive and technically challenging.”

- Dan Mellinger, Energy Futures Group¹²

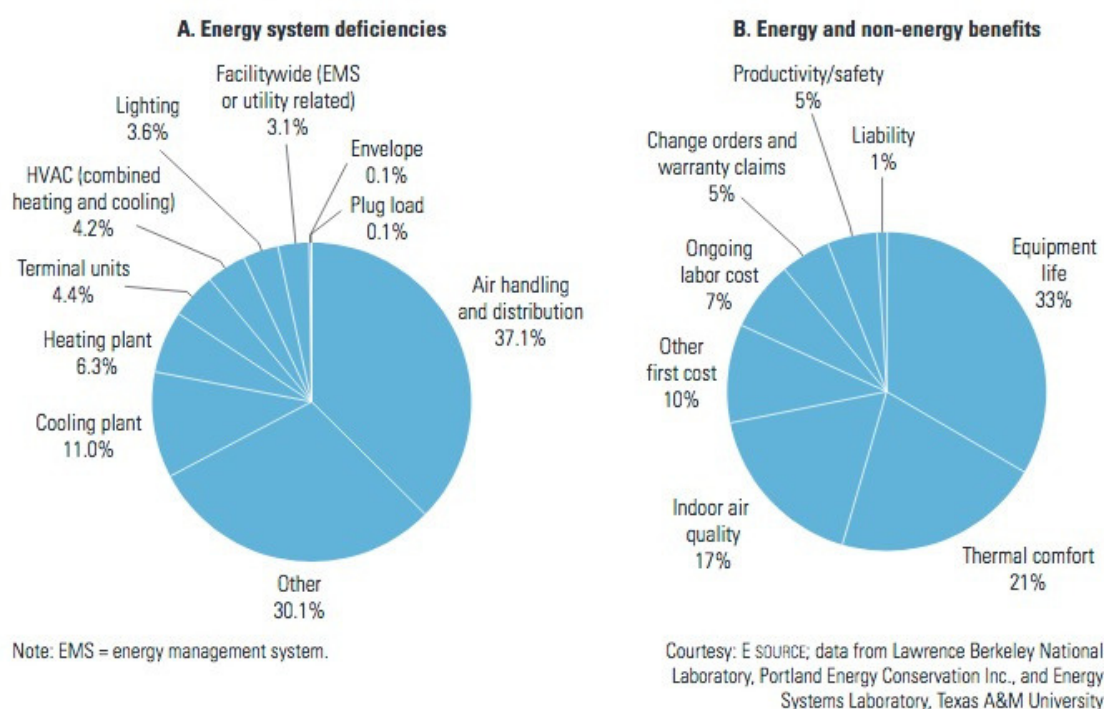
Retrocommissioning

The purpose of retrocommissioning is to ensure that building operations are running at top efficiency in the manner they were intended to run. Commissioning is the active oversight of system installations and their assessment as to whether they are operating as expected to the owner's manual, i.e., are they adequately installed, designed well, tested to run efficiently, and can withstand the operational load of day-to-day use.

According to Energy Star, retrocommissioning helps C&I buildings save on average \$0.27/sq.ft. An energy savings average rate of about 15% that sees payback within roughly 0.7 years. This act serves to establish a baseline which will be set for each system and dictate necessary repairs, upgrades, and subsequent monitoring will be put into a procedure for timely evaluations and upkeep.¹³

Figure 6: Retrocommissioning results

Building energy system deficiencies: A recent study of retrocommissioning revealed a wide variety of problems—those related to the overall HVAC system were the most common type (A). **Energy and non-energy benefits:** 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 (B).



Graph source: Energy Star, 2017.¹⁴

Part 2: Energy Procurement

Energy markets are volatile and complex. As such, energy procurement has become a high priority for industrial and commercial building management. The desire for budget certainty has led many building managers to seek fixed price contracts. C&I facilities with one or two shift loads might be best served with a fixed price or a hybrid contract. Operations that run two or more shifts are slated for drastic savings by managing peak load hours and leveraging the many strategies available. A 20% cut in energy costs alone, can be equated to a 5% increase in sales for retailers, according to The Carbon Trust¹⁵ Seeking creative strategies can help optimize energy resources and approaches to smart energy buying.

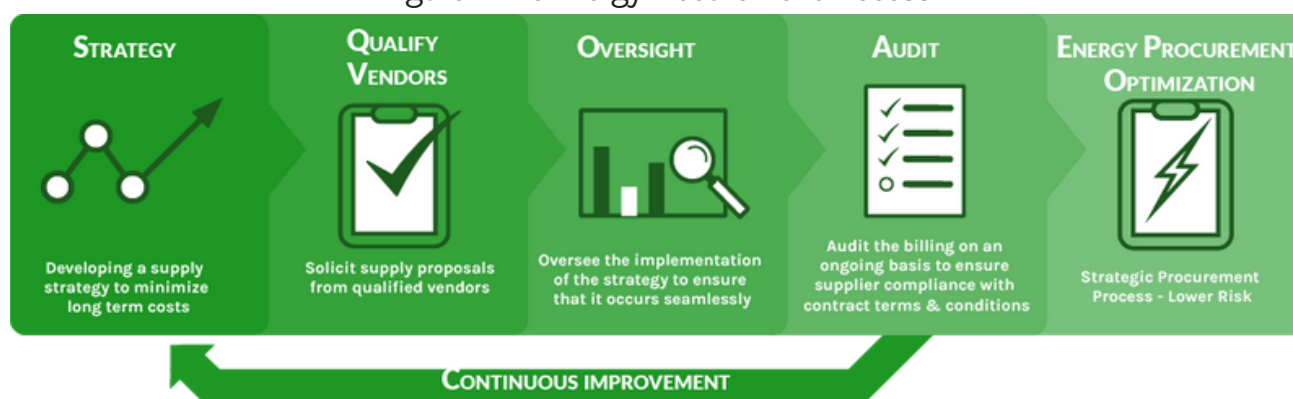
Since energy deregulation, CFOs and Building Managers are finding increased challenges as well as increased opportunities for connecting the energy dots. Through trusted partnerships with local energy experts and providers, building management can take their energy solutions to the highest levels by making sure that energy contracts align with specific building requirements and details.

Energy Procurement is vital in the process toward energy optimization. Professional energy procurement services help C&I management teams locate their best strategies, lock down the best contracts with the most appropriate energy suppliers for their needs.

The process for successful energy procurement will always require an in-depth analysis of the facility's load profile and a dedicated partner to guide you through each step of the process. Strategies that can be leveraged for various building types and energy usages include:

- Market-Based Rate
- Aggregated Purchasing Discounts
- Split Percentage Hybrid
- Cost Averaging
- Seasonal Strategy
- Temporal Strategy
- Market Timing-Based Strategy
- Optimized Contract Structure
- Load Management

Figure 7: The Energy Procurement Process



Part 3: Energy Generation

Energy Management requires a wide range of solutions that lead to the ultimate goal of energy cost control and independence. The production of on-site energy is part of the ultimate goal in a energy secure future for C&I buildings. New business model structures are opening the floodgates for on-site energy generation and infrastructure installations. Zero Capital and Power Purchase Agreement (PPA) models are helping building owners take advantage of the benefits of Solar PV and Combined Heat & Power Systems (CHP) without the upfront costs often associated with infrastructure installation.

Solar PV Energy

With the drastic reduction in cost and growing need for more reliable energy sources, Solar PV is paving the way for maximized energy optimization. C&I buildings are poised for some of the most significant benefits of incorporating Solar PV (Photovoltaic) Energy Generation into a facility's energy portfolio including:

- Improved carbon footprint
- Reduced costs on energy
- Increase control of energy load shifting
- Improved energy stability
- Increased facility value

In conjunction with energy efficiency and procurement processes, Solar PV projects help to leverage on-site energy to hedge bets for a secure energy future, improve sustainability, and increase company profitability. For newcomers to Solar PV, it can seem overwhelming to identify risks and opportunities without the help of an expert. The general process for beginning a Solar PV project looks like this:

1. Feasibility Study
2. Finance Modeling
3. Secure solar subsidies
4. System design and approval
5. Project procurement and installation
6. Operation and maintenance

"As the world's largest owner and operator of logistics real estate, we are committed to minimizing our environmental impacts and contributing to a more sustainable global distribution system. Our holistic approach to sustainability is a core component of our long-term business strategy, helping deliver greater value for our customers and stronger returns for our shareholders. This is evident from the 175 MW of solar generating capacity in our global property portfolio, keeping us on track to achieve our goal of 200 MW by 2020."

- Matt Singleton, senior vice president, Global Energy, Prologis!¹⁶

Combined Heat & Power (CHP)

A Department of Energy Study discovered there's an untapped potential for CHP estimated at 75,900 MW for commercial and multifamily homes and 65,400 MW for industry.¹⁷ While larger CHP systems are typically customized, small to midsize projects can be administered with a more plug and play model. Historically these combined heat and power customized projects were reserved for large industrial facilities that had a reserved budget for such infrastructure. Now, small to midsize facilities can also take advantage of implementing comprehensive CHP infrastructure, without the setback of costs.

The rise in PPA energy buying structures have effectively removed the main barrier to entry for CHP projects, upfront capital. In addition, CHP infrastructure projects that have turnkey abilities have also effectively reduced pricing and timetables by 25-30%.

CHP systems offer key-values, especially for medical facilities, retirement homes, community centers, and schools, that require seamless energy supply. These key-values include:

- Sustained operations during extreme events
- Power reliability & quality
- Flexibility in technology that provides heating, cooling, and electrical needs more efficiently
- Cost savings
- Lower emissions
- Diverted energy costs can go toward other facility upgrades

Barriers to an Energy Optimization Strategy

C&I building management encounters many barriers to entry when attempting to apply energy-smart decisions to a plan of action including:

- Siloed Energy Roles
- Disconnection of Energy Optimization from Property and Business Value
- General Complacency
- Lack of Staff Collaboration
- Lack of Long-term Decision Making by Management
- Lack of Energy Expertise & Market Knowledge

While these barriers have prevented many C&I building energy decision-makers from embarking on a full strategy toward energy optimization, the most detrimental of all is the short-term goal seeker. Management who are only interested in significant short-term gains lack the incentive for making long-term plans for the energy betterment of the entire company or building. For this reason, it's vital to create an alliance of key players that can undertake energy initiatives as a team without forfeiting for quick revenue schemes. The long-term changes that are made today for energy management will benefit ownership, management, employees, and all stakeholders involved in boosting the overall system efficiency and sustainability outlook.

"In 80% of the public sector entities we work with, there is no single person responsible for energy efficiency and energy performance. Our program partners tell us this is because personnel resources are stretched thin, so staff has multiple responsibilities. As a result, it is difficult for internal staff to dedicate the time necessary to effectively analyze energy use and cost data, report on the performance of their buildings, take corrective action as needed, and keep up with changes in technology that can improve the energy efficiency of their organizations."

- 2008 ACEEE Summer Study on Energy Efficiency in Buildings ¹⁸

Energy Optimization Adoption

Since every building has a different set of goals, infrastructure, priorities, and costs associated with its operations, it's essential that energy management take the time and explore the details within the data, widening the scope and exploring the opportunities to develop the best energy management strategy possible.

Energy Team Collaboration Across Departments and Roles

Gathering key players in the energy decision-making process is vital to access the most significant benefits that can be explored by a facility. This is because each person in their role has specialty experience and day-to-day knowledge which is vital to the data collection process and understanding the intricacies of the facilities.

These roles tend to include: CEO, CFO, Building Operations Manager, Facility Manager, Sustainability Coordinator, Building Owner, and President.

Energy Expertise and Guidance

Energy optimization depends on many considerations that span from the capacity to explore options to the procedural steps that must be taken to reach energy goals. Soliciting the insight of an objective energy expert will help solidify the decision-making process. You will need a leader who will identify risks and opportunities with a financial prowess and energy acumen. Energy optimization readiness is characterized by these key points:

- Capability and willingness to collect data and implement an energy strategy
- Ability to follow through with decision-making as a Building Energy Team
- Readiness to strategize your energy portfolio and leverage a deregulated market
- Willingness to build toward on-site energy generation with Solar PV and CHP projects
- Commitment to long-term strategy for optimal energy outcomes
- Energy efficiency improvements

"To stay competitive in the face of increasingly accelerated disruption, many companies need to rethink and retool their offerings and operations. That kind of transformation, however, requires a collaborative effort from all parts of the organization, no matter how different their processes, systems, and cultures have been in the past."

-Dealing with Market Disruption, Seven Strategies for Breaking Down Silos ¹⁹

Next Steps for Taking Action Toward C&I Building Energy Optimization

1. Adopt Energy Optimization (efficiency, procurement, generation) as a business value
2. Identify key energy leaders and bring all to the table
3. Develop a goals sheet with input from the energy team
4. Develop accountability model for reaching energy goals
5. Collect necessary data, learn, and document building intricacies
6. Establish a plan-of-action and assign responsibilities
7. Document changes and keep track of ROI
8. Reinvest savings into new energy optimization projects
9. Commit to ongoing management and oversight

Impacts of Energy Optimization

C&I Building Owners and Management stand to make significant gains in energy management beyond the financial benefits and into a sustained energy future. With increased opportunity comes increased noise and difficulty in moving from the complacency model. With the correct framework to tackle energy management and optimization via a three-pronged approach that includes (1) energy efficiency; (2) energy procurement; and (3) energy generation, the landscape becomes increasingly navigable. The rewards now outweigh the challenges when it comes to commencing a C&I building energy strategy. When incorporating these measures as standard operating procedures for building energy management, building and business owners alike will become less susceptible to global market pressures, extreme weather incidents, and energy market volatility.

About A1 Energy

A1 Energy is a leader in energy consulting services and is committed to develop and deliver creative solutions to optimize energy efficiency, reliability, and sustainability for our clients. We combine our deep industry knowledge and financial expertise to dramatically lower energy costs and meet sustainability measures for our clients. We support government agencies, industrial, and commercial clients achieve energy efficiency through reduced demand, strategic procurement, and alternative energy sources.

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