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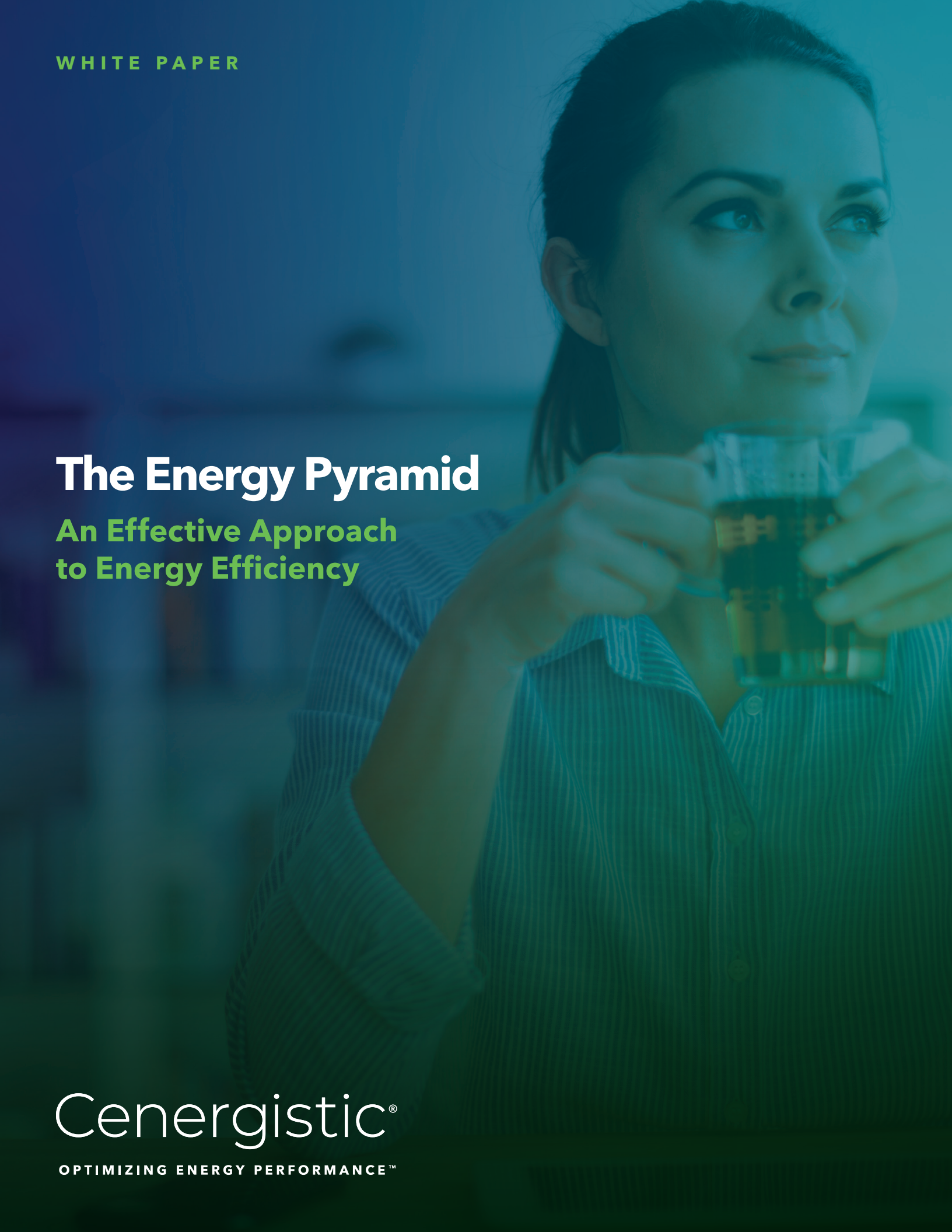


The Energy Pyramid

An Effective Approach to Energy Efficiency

Cenergistic®

OPTIMIZING ENERGY PERFORMANCE™

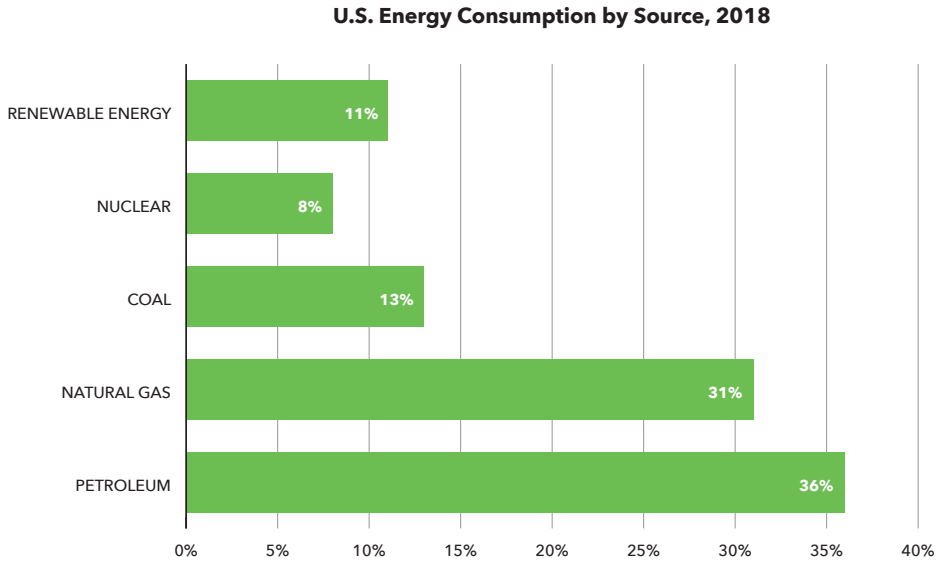
Executive Summary

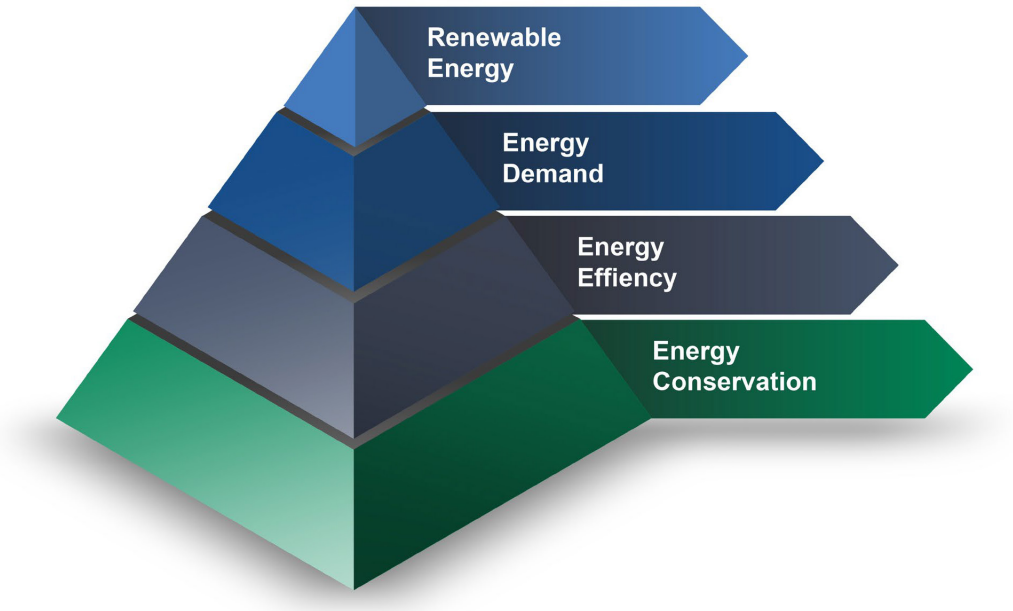
As nations across the world brace for the impact of climate change, organizations seek ways to reduce environmental footprints. Power generation is one of the most fossil fuel-intensive aspects of American energy use, providing an avenue for organizations to limit operational impact on the environment.

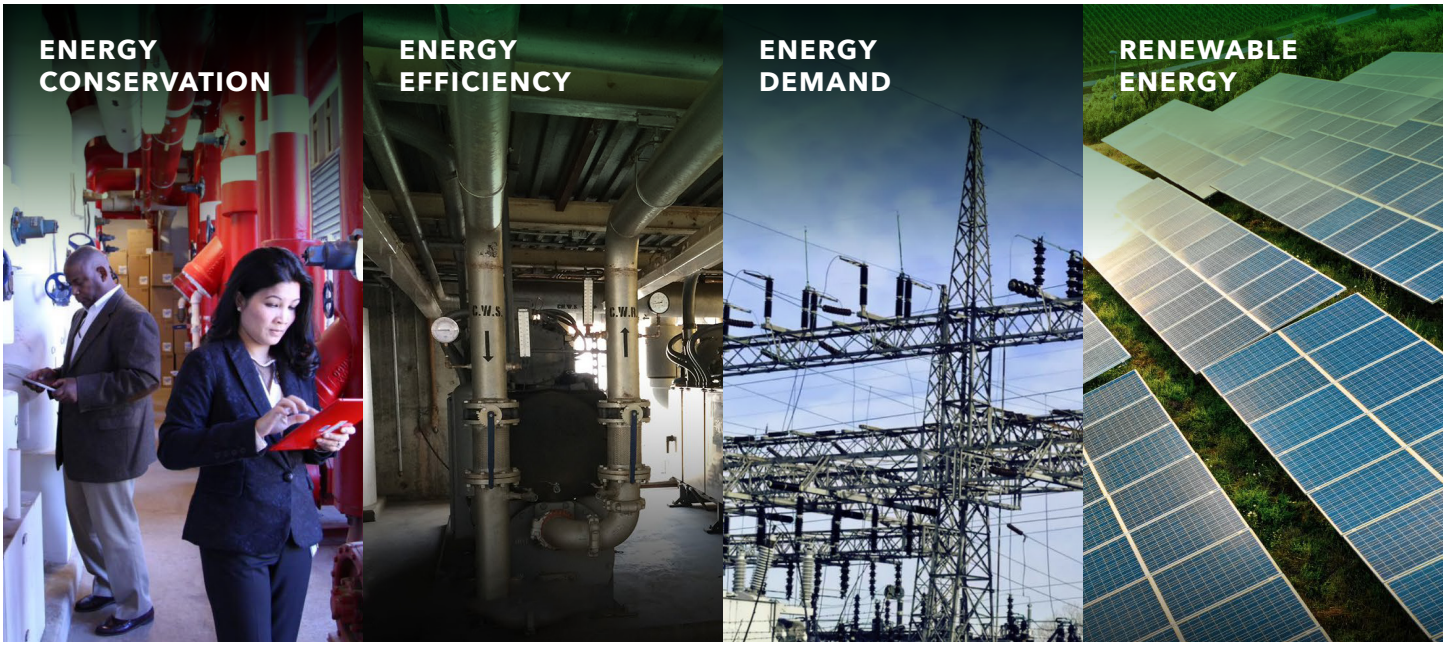
Renewable energy has finally become accessible to consumers over the past decade, but facilities looking to install renewable technology should know they will not realize maximum budgetary nor environmental efficiency with this strategy alone – and may well waste valuable funds by starting with renewables.

Rather, renewable energy should be seen as the final phase in a multistage Energy Pyramid. Set the proper foundation for a comprehensive environmental movement with energy conservation – focusing on the optimization of operational procedures, individual behavior and equipment optimization. After this has been mastered, facilities should make energy efficient upgrades to equipment, retrofitting and installing machinery that consumes energy in a more effective manner. The third stage, energy demand, sees facilities shift operations to take advantage of off-peak utility rates wherever possible.

Only after these three stages have been addressed and facilities have mastered demand for energy should organizations look to install renewable infrastructure. Approaching the stages in this logical order minimizes the need for initial investment and help facilities operate at maximum sustainability.







Introduction

The Second Industrial Revolution of the late 19th century kicked off America's dependence on coal, oil and gasoline and shaped the relationship our country has with energy today. Nearly every facet of American life is defined by fossil fuels – electricity generation, transportation, heating and cooling all depend on greenhouse gas-emitting energies. This reliance, however beneficial or convenient, is a major contributor to climate change.

Luckily, the increasing affordability of renewable energy has led to many organizations adopting solarand even wind-derived power to run facilities. This certainly has a positive effect on the planet, but most organizations across the country cannot afford the hefty upfront costs of installing solar panels at every facility. Even those who are able to invest in renewable technology may not be able to reap its benefits, as no amount of cheap energy can offset wasteful spending habits and poor operational procedures. Optimizing facility operations can set the necessary foundation for organizations to further maximize energy conservation, efficiency and independence – without necessarily having to invest in renewable infrastructure.

According to Dr. Dennis Buffington, P.E., C.E.M., C.B.E., of Penn State University, the elements of maximized energy conservation build off each previous element, each stage aligning in the form of a pyramid. Elements must be added in an orchestrated order for optimal performance, rather than implemented ad hoc.

The foundational and most vital element of the Energy Pyramid requires the formulation and implementation of **energy conservation** practices across organizational facilities. These initiatives focus on optimizing current facility equipment and encouraging behavioral changes among staff and patrons.

The second tier involves purchasing and installing equipment with higher **energy efficiency**. Upgrades to equipment or systems may pose an up-front cost but usually pays dividends over the long term. To optimize the return on projects in the energy efficiency stage, energy conservation measures must already be fully implemented and ingrained.

Energy demand, the third stage, relies upon facilities altering consumption schedules to take advantage of hours with off-peak rates. Organizations that are able to regulate energy consumption to take advantage of these lower rates find additional savings when combined with the earlier stages.

Only once these three stages have been implemented does **renewable energy** become a viable prospect. The organizations that adopt lean and efficient operational practices, equipment and demand schedules can best realize the benefits of renewables in budgets and the environment.

Energy Conservation

Often thought of as an individual endeavor, energy conservation provides exponential savings when implemented across an entire organization. An effective energy conservation program includes three major parts, in addition to a fourth optional one – energy audits, behavioral changes, equipment optimization and carbon offsets.

Conducting regular energy audits grants insight into building operations efficiencies and allows facility personnel to pinpoint energy waste that can be addressed. The process involves monitoring building operations at different times of day, week and year.

For optimal results, organizations should ask the following.

- **When do primary occupants first arrive?**
- **How long does it take to bring a building (or area) from setback to occupied temperature?**
- **How does equipment perform at peak times of operation?**
- **What equipment can be set back at night?**
- **What staff members can play a role in tightening operations?**

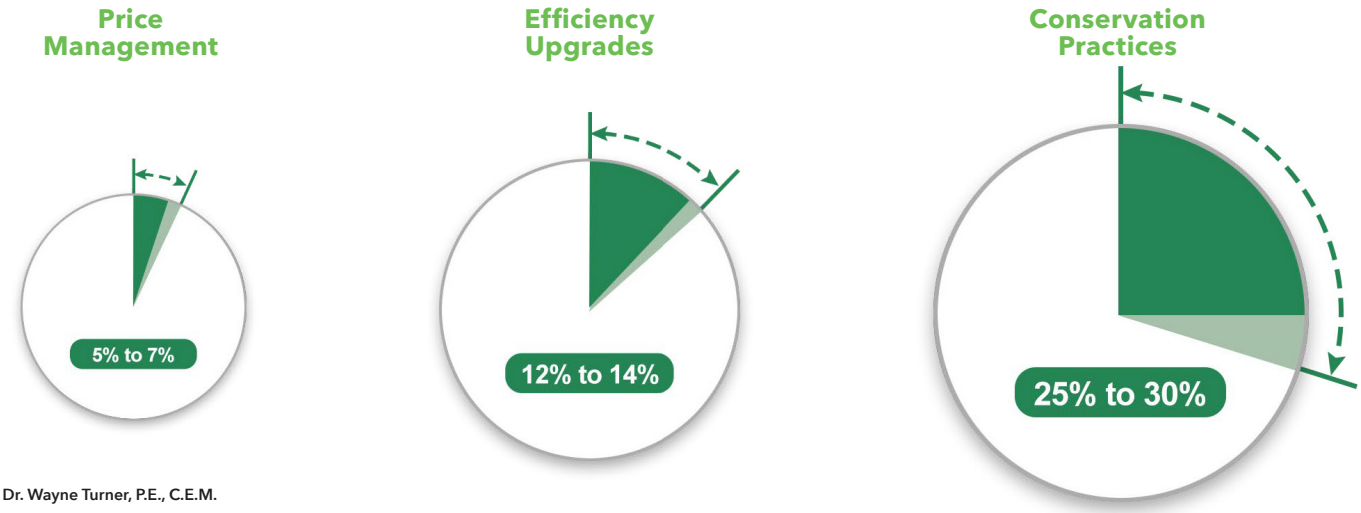
Answering these questions directs facility managers toward the right steps to take for optimizing operational procedures.

Behavioral changes in facility operational procedures work to optimize energy use by reducing consumption among staff. For example, having teachers in a K-12 facility turn off and unplug electronics when they leave for the night prevents the unnecessary waste of having these devices consume power overnight. On an aggregate scale, schoolwide initiatives of this act can potentially save districts thousands of dollars a year and sizably reduce the organization's environmental footprint.

Behavioral initiatives are not, however, just limited to staff. Encouraging patrons to limit water consumption, minimize occupational hours or close doors can save energy and the related expenses of each activity. These campaigns have the added effect of demonstrating to patrons how to act responsibly in their personal lives.

As with most structural changes, behavioral campaigns experience the greatest success through top-down involvement. Executives and administrators need to also follow the clear, impactful and attainable goals they set – leading by example has been linked to increased acceptance of change among employees and even patrons. Additionally, effective motivational tactics – e.g., promotions or sustainability-based competitions between groups – in tandem with behavioral campaigns can provide incentives for patrons to lower their individual energy dependencies.

The human side of operations only represents one side of the equation. To recognize maximum energy and dollar savings, organizations must look to optimize current

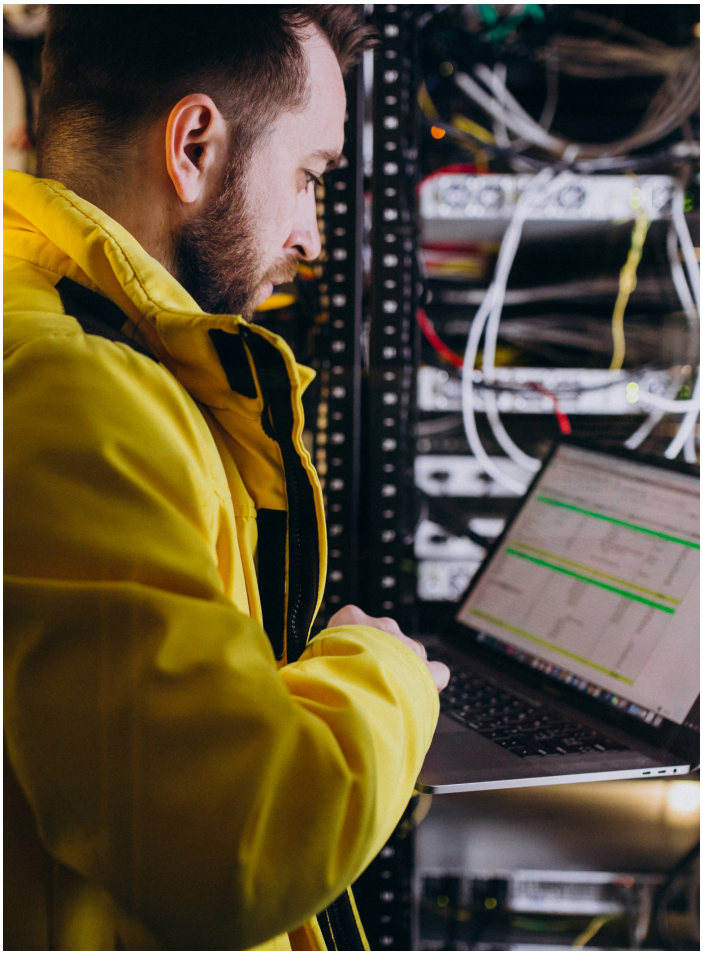


Source: Dr. Wayne Turner, P.E., C.E.M.

machinery in ways that reduce wasteful consumption. This can include ensuring equipment operates as designed, replacing parts that cause consumption inefficiencies or reworking equipment schedules so that they are used less – or not at all – during off-hours.

Equipment alterations tend to have a profound impact on facility consumption. Part replacement or reducing active hours can yield immediate savings – equipment operating for fewer hours of the day will require less energy to provide the same level of services to patrons.

Over the long term, facilities may recognize significant savings in the form of reduced maintenance costs. Operating equipment only when needed – and eliminating inefficiencies that place extra burden on machinery to continue running at a desired output – significantly increases the life of capital assets. Equipment life is longer when it does not have to operate as long or is not overtaxed with energy-guzzling inefficiencies. Put another way, machinery takes longer to break down when used more efficiently.



Finally, organizations can look to purchase or implement carbon offsets, which counter emissions through separate projects that sequester carbon from the atmosphere. Organizations held to this standard become incentivized to reduce carbon emissions wherever possible, resulting in a more cognizant effort to reduce energy consumption.

Further benefits, in addition to recognized utility and maintenance savings, may include government rebates after reaching certain thresholds, positive recognition in the press and more effective facilit management.

Organizations may find that reducing energy consumption across a facility may prevent the need for some capital expenses. Facilities that may otherwise need additional equipment may find that running current machinery at less than capacity under an energy conservation program can replace the expected demand for an extra asset.

Better management of room temperatures – and the humidity control that goes along with this process – can lead to fewer comfort complaints from staff and patrons. The perception of comfort in buildings has been linked to increased patron health and overall experience. High comfort levels reduce the strain placed on maintenance and grounds crews, reducing backlog and allowing other priorities to be addressed.

Cenergistic has made energy conservation its bread and butter since 1986, helping over 1,450 clients minimize their energy usage and complete the first level of the Energy Pyramid. Through comprehensive approaches to energy reduction and the use of patented Opti-Commissioning® practices, Cenergistic has saved its clients over $5.6 billion.

If your organization wants to maximize its ROI on energy conservation practices, click here to see if Cenergistic can find the solution for your organization.

For an organization serious about reducing its environmental footprint while maximizing the impact of investments, the crucial first stage is to conserve energy wherever possible. Doing so not only lays the groundwork for realizing success when moving into the energy efficiency, energy demand and renewable energy stages, but saves money in the short and long terms, benefits patron experiences and positions organizations as the environmental leaders of their respective industries.

Energy Efficiency

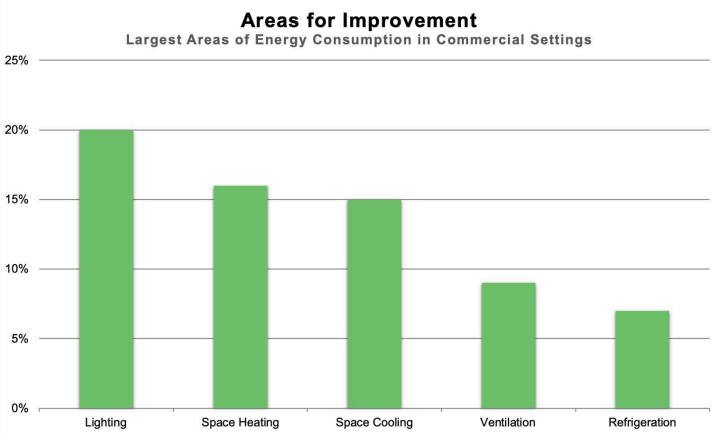
During the energy efficiency stage, facilities begin purchasing and installing more efficient equipment. This retrofitted machinery requires less energy to produce the same desired output, reducing theresources that must be consumed to run facilities during occupied hours.

Common examples of energy efficiency upgrades include:

- **Upgrading florescent or incandescent lighting structures to LED lamps**
- **Replacing machine parts with those of the highest efficiency standards**
- **Installing water-efficient faucets and shower heads**
- **Replacing outdated or ineffective equipment entirely**

Retrofits should serve to complement energy conservation, not replace it. Energy-efficient equipment consumes the least amount of power while in use, minimizing energy consumption, greenhouse gas emissions and utilities spending. In return, equipment is operated on an optimized schedule to limit its use and regularly maintained to prevent inefficiencies, further saving energy and funds.

For energy efficiency upgrades to make sense, however, the upfront capital investment needs to pay for itself through realized savings over the course of the asset's lifetime. Capital assets may include steep upfront costs, but organizations can rely on recognized energy savings from retrofits and upgrades to cover the cost of installation.



Source: Environmental and Energy Study Institute

For example, say an energy conservation program has greatly reduced the daily run-time of a machine. If it would take longer than the lifetime of the machine to recognize enough energy savings to pay for a newer, more efficient ventilation fan (since the machine is now running at only a fraction of its former time), the project would not be considered necessary or viable from a financial perspective.

For trustworthy, third-party validation of a product's energy efficiency, the Environmental Protection Agency's ENERGY STAR® program certifies energy-efficient appliances, office equipment and industrial machinery – in addition to many consumer products. ENERGY STAR certification designates a product that is among the most energy-efficient in its industry but does not sacrifice quality or utility.

Despite the relatively high upfront price of these products, all ENERGY STAR-labeled devices must save consumers or organizations more money in the value of lifetime consumption avoidance than the extra initial costs. Consumers of ENERGY STAR products can rest easy knowing that their investments will pay off in the long term.

Organizations can further their energy conservation movements through ENERGY STAR Building Certifications. These Certifications recognize the highest echelon of energy-efficient buildings in the country compared to industry peers.

Cenergistic's energy conservation programs constantly set its clients up for success in the energy efficiency stage. In the case of William Floyd School district, we were able to work with facilities to minimize energy consumption while they installed a previously-planned ESCO project.

Has your organization already skipped ahead to the energy efficiency or renewable energy stages? See how we saved William Floyd $2.3 million…while they implemented an ESCO project. Download the case study here.

Energy Demand

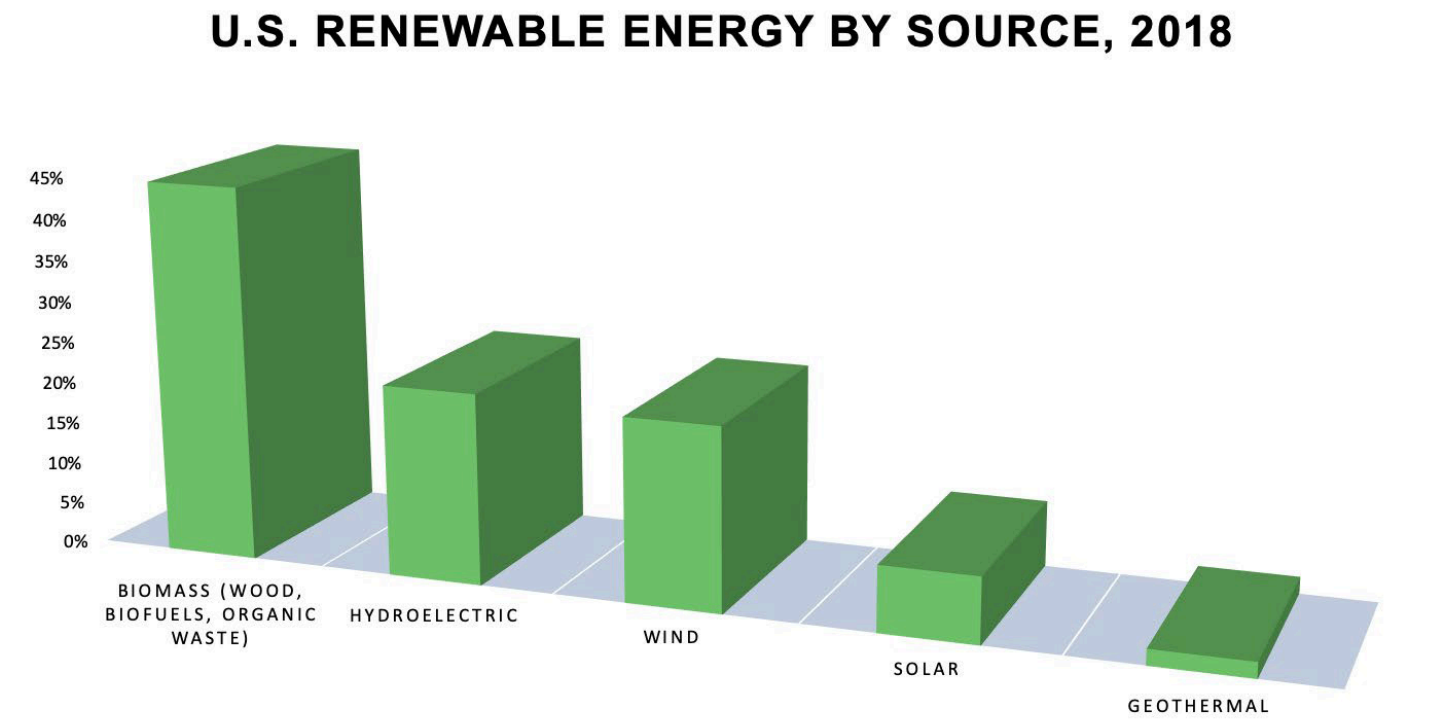
In the energy demand stage, also referred to as Demand Management, organizations that have mastered energy consumption and have maximized equipment efficiency should look into ways to shift as much energy consumption as possible to what are known as "off-peak hours." Off-peak hours are defined as hours the grid sees less demand. In an effort to drive more usage to these off-peak hours, utilities may offer discounts for consumption of electricity and/or natural gas – incentivizing shrewd consumers to adjust schedules where possible to draw power over this time period.

Organizations can take advantage of this opportunity for continued dollar savings by finding ways to shift necessary operations to times of lesser demand. To do so, organizations are encouraged to reschedule operational procedures that consume the largest rates of energy to off-peak times wherever possible. By doing so, the level of energy consumed at the highest rates of billing is reduced, driving down the amount on monthly utility bills.

To visualize, say a corporation's peak energy use runs from 8 a.m. through 2 p.m. Should a manager find that the company's utility provider offers an off-peak rate between the hours of 2 p.m. and 3 p.m., an opportunity exists to shift peak energy use to a schedule of 9 a.m. through 3 p.m. In this scenario, the company is able to take advantage of the off-peak rate while seeing no decrease in productivity. This stage is not about using less or cleaner energy, but energy demand schedules allow savvy organizations to manage consumption demand patterns to further save money.

Not all organizations, however, can ethically take full advantage of this stage. Having to rearrange consumption schedules across facilities may not be feasible in settings such as hospitals or 24-hour shipping warehouses. Knowing when and where to manipulate consumption schedules varies based on the organization and the needs of its staff, patrons and consumers.

In an organizational setting, it becomes imperative to determine how consumption changes will impact facility occupants and the surrounding communities before embarking on the energy demand stage. An active energy conservation program will have much of that data readily available.



Source: U.S. Energy Information Administration

Renewable Energy

Only after the first three stages have been comprehensively implemented can an organization fully recognize the benefits of renewable energy. Implementing renewable energy sources alone does not address energy or budgetary waste. But the four stages of the Energy Pyramid work together to create an energy-conscious and financially shrewd organization. What additional benefits does this four-stage cycle give an organization? Patient organizations that take the time to implement the first three stages of the Energy Pyramid can typically take advantage of a smaller scale of installation – reducing the cost of investment for renewable technologies.

In other words, organizations that learn to consume less energy require less renewable infrastructure to meet facility needs. By implementing the Energy Pyramid stages in order, savvy facility managers save more money and energy with significantly less investment.

Billings Public Schools in Montana did just that, partnering with Cenergistic to implement a districtwide energy conservation program. Later investments in energy efficiency upgrades and utilization of demand management strategies gave BPS maximum control of their energy consumption. With the first three stages complete, BPS has recently undertaken solar array installations at all three high school campuses, completing the Energy Pyramid in the most efficient manner – even in the face of steep budget cuts.

The two most common types of renewable energy available come from solar and wind sources. Photovoltaic solar panel systems are diverse and can fit the needs of just about any facility. Despite relatively high initial costs to install, solar power itself is a free resource, reducing dependence on fluctuating fossil fuel prices. Additional financial benefits arise in states with net-metering, which allows facilities that produce excess energy to sell it to the power grid.

Wind energy has created a larger imprint on the U.S. electrical grid compared to solar and has plenty of room to grow, making it a promising energy source. However, unless a facility has enough land to place a wind farm, it will continue to be subject to the prices of the grid – although wind prices are relatively stable. Facilities looking to take advantage of on- or off-site wind energy will need to compare the projected long-term costs to those of on-site solar use.

In the near future, hydropower, biofuel and geothermal sources may become more widely available to consumers, so facilities should always gauge which options make the most sense based on pricing, service and needs.

To combat the initial barriers of renewable energy and to encourage sustainable operations, many states and organizations offer incentives for these projects through grants and rebates. These programs offer to mitigate the high initial costs for qualifying organizations, furthering the appeal of sustainable operations. Facilities already proficient in the Energy Pyramid see further savings from efficient operations, while organizations that skip to the top have a larger scale of investments to make.

Once renewable systems are installed, facilities have completed the Energy Pyramid and are running at maximum sustainability.

Conclusion

The 2020s will likely be defined by increasing demands for a more sustainable world through renewable energy, and facilities can join this movement while still acting in a financially responsible manner. To best capitalize on investment dollars, organizations should look to the rest of the Energy Pyramid, seeking ways to maximize the value energy conservation methods, energy efficiency upgrades and energy demand schedules before a switch to renewable infrastructure takes place. Upon fulfilling the Energy Pyramid, organizations can look to other ways to further reduce their environmental footprint. Taking full advantage of newly installed renewable energy sources and complementary renovations to transform a structure into a net-zero building demonstrates a mastery of sustainable facility management.

Likewise, investing in upgraded technology and advanced facility software gives operators greater control over facility systems, and greater efficiency in operations yields savings in energy consumption. These measures, in combination with the supplementary managing of utility costs through price negotiations give facility managers ultimate control over energy expenditures.

In the age of sustainability, organizations need to minimize the energy their facilities consume. Longterm strategies revolving around the building blocks of the Energy Pyramid provide the blueprint for this purpose. Minimizing energy consumption through comprehensive energy conservation practices increases the effectiveness of optimizing equipment through energy efficiency upgrades – and those savings are further heightened through energy demand management. Only when these three stages have been completed should facilities look to renewable infrastructure.

Help your organization build a sturdy foundation on its Energy Pyramid through the energy conservation experts at Cenergistic. Our comprehensive energy programs have saved clients over $5.6 billion – we've partnered with over 1,450 organizations to implement the first stage of their Energy Pyramid.

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