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NJARNG Sustainability Newsletter

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Clean Cut Quarterly

BMS

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Photovoltaic

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Mold is devastating commercial buildings. Details on page 8.

Cellular Shades vs. Reflective Film. Which is more energy efficient. Story on page 6.

The Comprehensive Benefits of Building Management Systems

By: David Miller & Sarah Remick

Building Management System

A Building Management System (BMS) is an advanced centralized system designed to oversee and regulate a building's mechanical and electrical infrastructure. It functions as a computer-driven control mechanism that supervises and coordinates various aspects of the building's environment, including heating, ventilation, air conditioning (HVAC), lighting, power systems, and security measures. The main purpose of a BMS is to make running a building easier by letting you control everything from one place. This saves energy and money because you can adjust heating and lighting to work more efficiently. Being able to control and access real-time information about your building's systems results in proactive management, ultimately lowering downtime and maintenance expenses. Implementing and utilizing a BMS yields benefits in terms of more comfort and productivity, energy conservation, and sustainability.

Getting Started

Implementing a Building Management System (BMS) involves several key steps. Firstly, thorough planning is essential which includes defining project scope, setting timelines and milestones, and establishing a budget. This planning phase should involve all relevant stakeholders, including building owners, facility managers, and contractors. Next, the hardware components of the BMS, such as sensors, actuators, and control panels, are installed. After this, the installation of necessary software like control algorithms and user interfaces are implemented. For example, incorporating unoccupied temperature setbacks is a good starting point to optimize energy efficiency during non-business hours or vacant periods. The BMS needs to be integrated with building assets and equipment, potentially requiring configuration to communicate with other systems or devices. Next is testing to ensure the BMS functions correctly, verifying its ability to monitor and control building systems as intended. Finally, training sessions and in-depth documentation are provided to stakeholders to ensure they understand how to effectively use and maintain the BMS, including its capabilities and limitations. This systematic approach ensures efficient implementation and operation of the BMS, contributing to effective building management.

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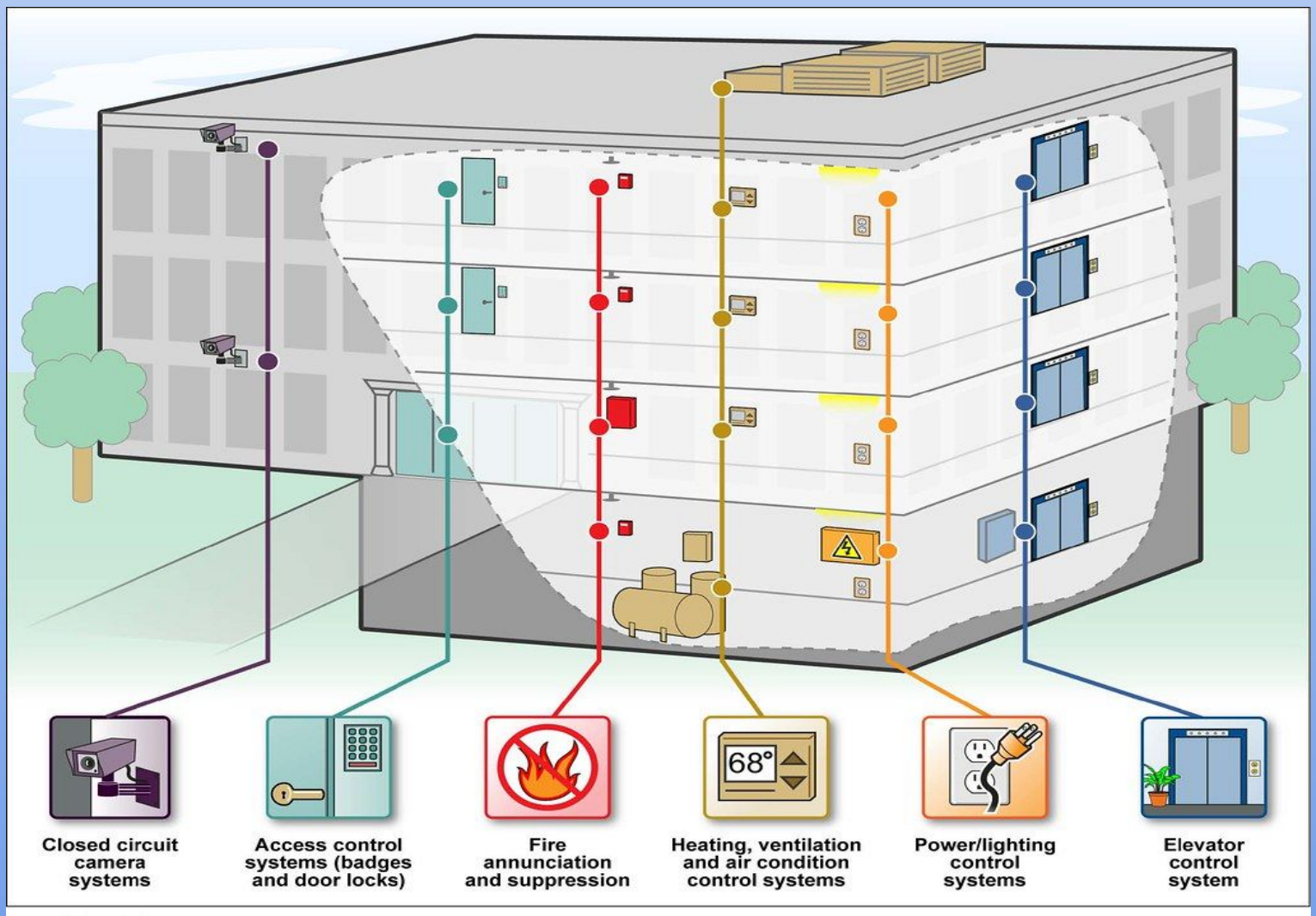
Comfort and Productivity

When considering a BMS, multiple factors exist. Are the financial and temporal costs worth the benefits? It has quite a bit to do with each situation, and there is a major boost to productivity and efficiency following the establishment of a BMS. This bump will vary, but it will always be more than noticeable. This centers around the building's mechanical and electrical systems, which include HVAC, lighting, and security. Centralized control of any or all of these components will give users an environment that can adapt to their needs. Weather variations and the seasonal extremes that occur need to be dealt with effectively. A consistent and temperate building can eliminate outside variables and will allow for greater focus on everyday tasks. It's important to evaluate its impact beyond just financial metrics, focusing particularly on the comfort and productivity of the users within the building environment. Integrating a BMS can significantly enhance the living and working conditions by providing a more adaptable and responsive space



BMS Diagram

'BMS' continued on page 3

Energy Conservation

Energy conservation is the prevention of the wasteful use of energy, especially to ensure its continuing availability. A primary improvement of implementing a Building Management System is energy conservation. A BMS allows for centralized control and monitoring of various systems such as HVAC, lighting, and security, and by optimizing these systems based on occupancy patterns, weather conditions, and time of day energy consumption can be significantly reduced. A BMS that can automatically adjust the HVAC system like implementing occupancy sensor setback points will reduce energy when the building is unoccupied. A way for the BMS to reduce energy on the lighting system is by setting occupancy censored lighting for when a room or the building is unoccupied. A Building Management System helps reduce energy waste, lower energy costs, and contribute to overall sustainability efforts while ensuring that the building remains comfortable and functional for its occupants.

Sustainable Integration

A BMS functions at the top of operational sustainability, serving as an essential tool in enhancing and optimizing a building's use of resources, and its operation allows for a focus on energy efficiency, operational precision, and enhanced occupant comfort. While undeniably crucial, the scope of sustainability extends well beyond energy efficiency. Important benefits include waste reduction and water conservation. There's a range of implementations that can affect how much of a benefit these will have, two options can be implemented by simple sensors and enhanced organization and utilization systems such as recycling and waste tracking. Achieving a sustainable, comfortable, and efficient workplace does not require dramatic measures. Understanding and engaging with the relationship between your BMS and facility is key. It opens the door to nuanced adjustments that significantly enhance long-term functionality.

Photovoltaic Systems: New Technologies, and Developments in Industry

By: Ed Coyle, Payton Keblish, Jordan Jeffers

For approximately 4.6 billion years the sun has been blanketing our planet with energy-rich light. It was only recently that the technology to harness this resource and transform it directly into electricity was developed. Not only has this allowed for a reduction in the dependence on nonrenewable fuel sources, but also a drastically lower electricity bill for those who can install these panels. In addition, PV panels also allow the property owner to claim numerous tax deductions and other government benefits. As referenced below the solar industry may be young but the future is bright.

Solar Panel

The efficiency of solar technologies have progressed over the past ten years because of society's desire for a greener future. Manufacturers have responded to the public's desire for clean energy with increased production, competition, and research. In turn, the refining of solar cell design, exploring new materials for manufacturing, and refining manufacturing as a whole. This significant increase in efficiency jumped from about 15% in 2010 to 22% today. Professor Steve Albrecht with the Helmholtz Center for Materials and Energy, located in Berlin Germany, published a paper that stated that his research group had “achieved efficiencies of up to 32.5% for silicon-perovskite cells.” Perovskite cells are setting new standards every year and seem to have a tight grip on emerging high-efficiency solar panels. These cells are readily available and inexpensive but have short lifespans compared to silicon cells. Scientists aim to extend the lifetime of Perovskite cells by developing methods to counteract the negative effects of oxygen and moisture that break these cells down. In addition to these advancements in efficiency, PV panels have decreased in cost significantly. Once again according to NREL The cost to install and operate PV panels has decreased 82% over the past decade. On average a single solar panel in New Jersey generates as much as 1.5 kilowatt-hours per day.

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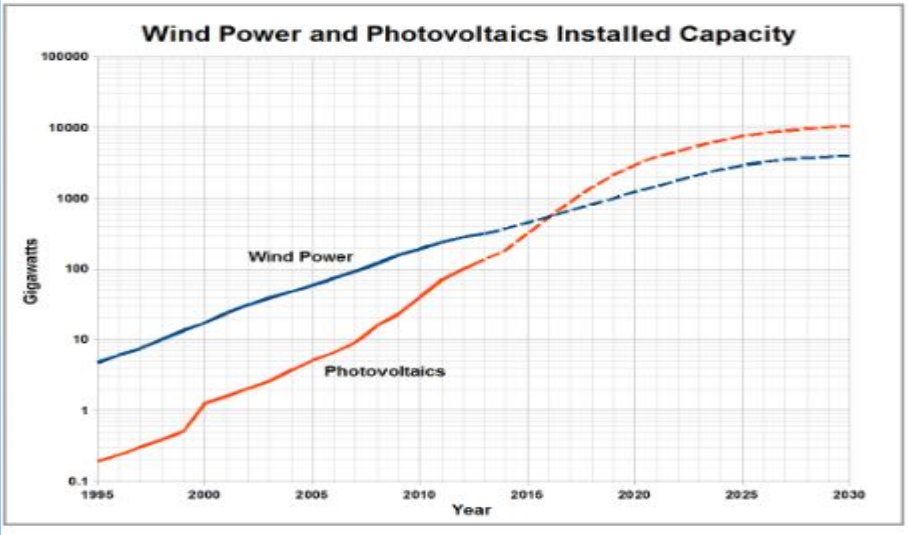
The commercial outlook of PV systems has improved as the government releases incentives for owners of these systems, such as tax exemptions and tariffs, making the upgrades to solar technologies more worthwhile to consumers. A rundown of federal tax credits for solar manufacturers is provided by The U.S. Department of Energy (DOE) and Solar Energy Technologies Office (SETO) and can be found on the website of the 'Office of Energy Efficiency and Renewable Energy. The continued technological advancements and the world's overarching switch to more renewable energy will continue to drive the PV market up. A predicted trend for the installed capacity for both PV and wind power (WP) over the previous years as well as predictions for the coming years can be seen below.



Graph

The market capacity for photovoltaics is expected to continue to increase for the coming years as displayed by a steeper slope when compared to wind power, showing the exponential growth rate of PVs. The Y-axis of the graph demonstrates the available amount of gigawatts, or how much energy the plant can hold, showing the overarching push towards sustainability. Reported 2022 benchmarks created by the NREL (National Renewable Energy Laboratory) noted that industries and residential zones described high and volatile component prices and competition for limited supplies, which was noted the following year to be reduced, displaying the rapid advancement of this technology.

To meet the demands of this rapidly growing market, new solar PV technologies must be developed. For example, it was found that making the PVs very thin with high levels of transparency allows for the bending movement of these solar cells. Photovoltaics are still a relatively new technology, which means much to be discovered.

While it may only be an industry in its infancy the impact of the solar panel is immense. With increasing incentives from governments around the world, the only barrier to the improvement of the solar panel is time.

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Window Coverings and Energy Savings: Cellular Shades vs. Reflective Film

By: Maryella Galardo

Sustainable Choices in Window Coverings

Property owners should start looking for ways to reduce their carbon footprint as climate change effects continue to impact the world. With sustainable commercial buildings on the rise in recent years, it's crucial to understand how even owners can do their part in creating a healthier living environment. A simple choice of what window coverings to add to one's building allows the chance for more energy conservation. Owners have the option between cellular shades or reflective film, both are efficient in saving more energy in structures. The U.S. Department of Energy states that, "In heating seasons, tightly installed cellular shades can reduce heat loss through windows by 40% or more, which equates to about 10% heating energy savings. In cooling seasons, cellular shades can reduce unwanted solar heat through windows by up to 60%." Choosing the correct window coverings aids in energy bill costs and regulates temperatures.

Cellular Shades

Numerous types of coverings can be put on a window to ensure that energy is being saved for consumers. By examining which are the most effective, it is important to identify their differences and similarities, so customers are buying the best one. Cellular shades are seen as the simplest and most effective, they are highly energy-efficient honeycomb window coverings. To ensure proper installation, Consumer Reports states that one must mount them as close to the glass as possible within the window frame, which creates a sealed space.

These cells in the fabric pockets of the shade allow air to be trapped, preventing heat or cold from entering a room. For consumers, this is very beneficial because it decreases the need to turn on the air conditioner and heater. While the sustainability aspect of the cellular shades is useful for saving energy, the price is just as important. Property owners can contact commercial window shade installers who base the price on the building's global position, current cooling cost, and material composition.

'Window Coverings' continued on page 7

Blinds

Reflective Film

If one is browsing for something that doesn't cover the window, films are another alternative best for cooling seasons. During these times, property owners are looking to keep the heat out of their buildings as temperatures outside increase. Depending on the size, orientation of the window, and whether the window has interior insulation, determines its effectiveness. These films are known to be silver, and mirror-like, and are usually more effective than colored transparent film. In hot climates, west-facing windows capture the hottest light, so during the cooling season when people want their homes cool, it is best to place the reflective window film here. From the Florida Solar Energy Center the covering "reflects the unwanted solar heat gain away from the window before it is absorbed," to find the best kind of reflective film, choose one by visible reflectance (VR) value. Buying one that has a higher VR value means the window will be shinier, which means more reflection of heat. The downside of it is that it can be harder to clean and hard to install as it should be precise; no air bubbles during its application. Based on the size needed of film, can vary with price, however, installers can measure commercial windows to determine a quote.

Saving Energy

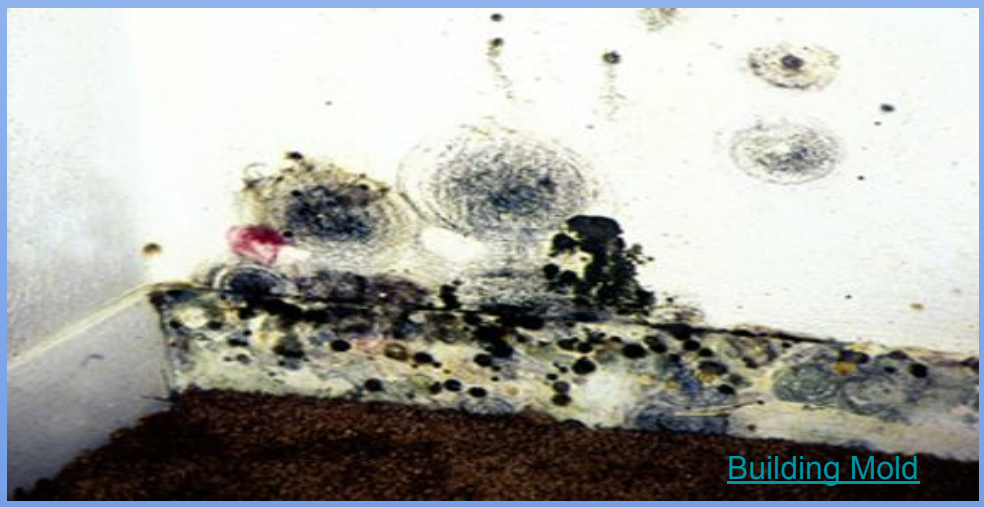
Examining the two types of window coverings, it is essential to identify what the climate is outside of the structure. If there are short cooling seasons, it is not recommended to use reflective film. However, both do the job of saving more energy, while allowing property owners to spend less money on electricity bills. The Oak Ridge National Laboratory reports that "cellular shades achieve up to 24% in heating energy savings, which in long terms, allows for carbon emissions to reduce up to 3 million tons." As energy waste rates are going up, it is important to look for sustainable ways to heat and cool commercial buildings.

Humidity Havoc: Molds in NJ's Commercial Buildings

By: Meet Patel

Along with the immediate destruction that comes with coastal and inland flooding caused by hurricanes or long-lasting rain storms, follows the creeping, tenacious, and exponential growth of mold. Coastal buildings and homes in New Jersey, in the thousands, were left in the claws of mold after Superstorm Sandy in October 2012. USA Today reported that 20% of all New Jersey homes and commercial buildings developed mold as a result of Hurricane Sandy - the biggest mold problem the state has ever witnessed. The devastating effects of storm-caused humidity extend beyond its instantaneous damages. The collateral damage caused by such incidents, particularly to commercial buildings, includes expensive remediation work, deteriorated indoor air quality, possible health risks to occupants (as every 1 in 10 people are allergic to mold), and structural damage, causing perpetual expenses in maintenance and operation.

Molds are a type of fungi (Figure 1) that decompose dead materials and bring them back into a state of organic matter that is used by other living organisms, destroying whatever comes in its way perpetually and exponentially, unless treated promptly. The Centers for Disease Control (CDC) explains how mold is common in older-constructed buildings that have an increased possibility of leaks in roofs, windows, floors, or pipes as well as poor ventilation or unvented combustion appliances. Particularly, changes in construction practices from the 1970s to the 1990s led to tightly sealed buildings lacking ventilation, potentially causing moisture accumulation. Moreover, delayed or insufficient maintenance is also associated with moisture problems in schools and large buildings. Because mold spores need water or humidity to grow, the destruction can begin from as little as bathroom or kitchen steam that lingers on walls and other surfaces.



Building Mold

'Mold' continued on page 9

The first-most step to control mold is to ACT QUICKLY! Mold does not wait for anyone. Logically, catching the root of the problem will ensure mold does not come back. Attack the moisture problem first by fixing leaks in pipe or elsewhere in the building, watch for condensation and wet spots, and address moisture sources immediately by either increasing surface temperature or reducing humidity levels, while also ensuring clean, unobstructed HVAC drip pans, venting moisture-generating appliances outdoors when feasible, maintaining indoor humidity below 60%, performing regular building/HVAC maintenance, and promptly cleaning and drying wet areas within 48 hours, according to the Environmental Protection Agency (EPA). To further combat mold, it's crucial to hire professionals who can implement large-scale remediation. Utilize methods such as wet vacuuming for water removal on floors and hard surfaces, followed by detergent for nonporous materials. Employ High-Efficiency Particulate Air vacuums for the final cleanup of remediation areas. Discard irreparably damaged materials to prevent further contamination. Additionally, consider the use of biocides or disinfectants judiciously, following ventilation protocols and safety precautions to minimize exposure risks. Regular monitoring and reassessment throughout the process are essential to ensure effective mold control and minimize the risk of recurrence.

The proliferation of mold presents multifaceted challenges ranging from the structure’s health to the occupant’s. Swift action and expert intervention remain crucial to mitigate its spread and impact, safeguarding both the building and occupants from its pervasive effects. Tackle the mold, halt the havoc!

Hazard

Meet the Authors

David Miller & Sarah Remick

Facilities Management Clinic

The Comprehensive Benefits of a Building Management System

David is a junior majoring in Electrical and Computer Engineering. He enjoys pumping iron and modding retro video game consoles. David is also pursuing minor is Civil Engineering. His goal is to work in a diverse position that will utilize his electrical and civil skills.

Sarah is a junior studying Mechanical Engineering. Sarah is passionate about the manufacturing process and aspires to work in the material science or manufacturing field. She enjoys spending quality time with friends and family, or collaborating with her father on home projects. Sarah also likes to travel, explore new places, and engaging in outdoor activities.

Ed Coyle, Payton Keblish, & Jordan Jeffers

Building Energy and Water Audits Clinic

Photovoltaic Systems: New Technologies and Developments in Industry

Ed is a junior in the Electrical and Computer Engineering program. His favorite hobbies are painting, cooking, and carpentry. Ed intends to be a professional engineer

Payton is a junior studying Civil and Environmental Engineering. She spends her free time taking care of plants, going on hikes, and making jewelry. Payton's career goal is to help with the advancement towards a more sustainable future, potentially assuming a leadership role. Her primary focus is on environmental preservation and exploring ways to safeguard it.

Jordan is an up and coming Civil and Environmental Engineer. He enjoys camping, hiking, and swimming. One day he hopes to realize his goals as a land developer.

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Meet the Authors

Maryella Galardo

Journalist & Student

Window Coverings and Energy Savings: Cellular Shades vs. Reflective Film

Maryella is double majoring in journalism and health and science communications. She is an avid writer for the Whit and as a journalist she likes to focus on topics that have to do with health care, environmental science, and technology. She loves hiking, traveling, walking around parks, and photography. Her career aspirations are to become an environmental science journalist, or a science communicator.

Meet Patel

Building Information Modeling Clinic

Humidity Havoc: Molds in NJ's Commercial Buildings

Meet Patel is a junior majoring in Civil Engineering. He explores innovative technologies to enhance their design and construction. Meet is passionate about inclusivity and accessibility to education and has founded a service-based club aimed at providing insights and education on engineering, to local high schools and middle schools.

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