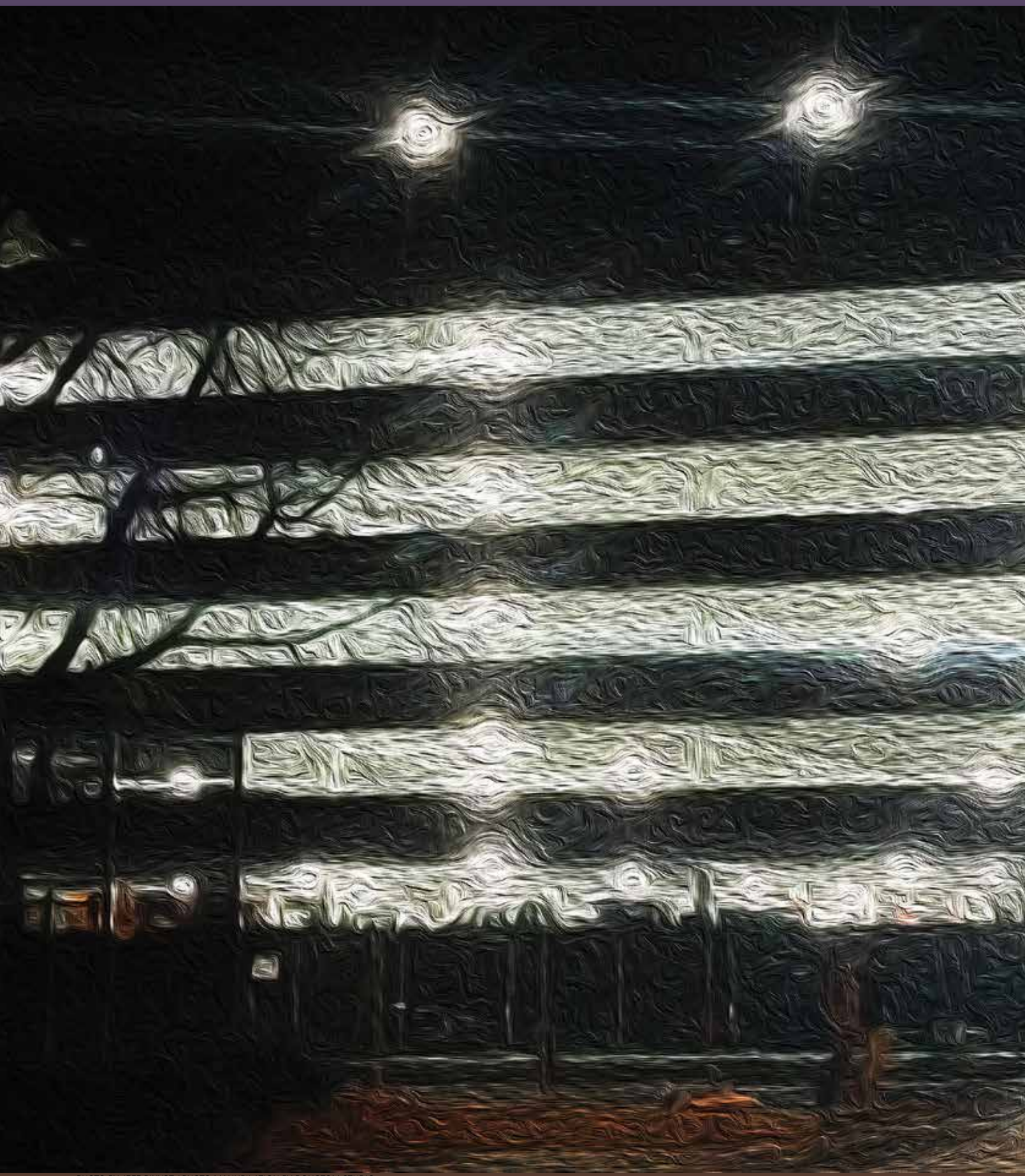

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BE A DIMWATT!

The best ways to reduce energy use and cost from lighting.

By Jeff Pinyot

YOU CAN PROBABLY IMAGINE how many times a garage lighting specialist is asked about motion sensors in parking structures. They come up at every trade show and meeting we attend. Some people are passionate about wanting them, and others don't understand the need. Because it is, at the very least, an often-discussed topic, let's explore the financial basics of motion sensing, when it's appropriate to use sensors, and what they really mean in terms of cost effectiveness.

First, let's get on the same page. Understand that when I say "motion sensor," I am talking about a small sensor that is unit- or remote-mounted on a wall or ceiling. When a recognized motion is sensed (assume we mean the movement of a human being and not a rat), the sensor energizes (or turns on) an individual lighting fixture or a bank of fixtures. The general and only reason to use these would be to save additional energy on top of what might be gained by a fixture change-out.

A well-illuminated garage at the Ohio State University.

Safety

So here's my first opinion on the subject: Using motion sensors does not reduce the environment for crime. Having lights on and full on will always do a better job of that. Consider this: When you go out at night, do you turn your outdoor lights on for safety and crime avoidance, or do you turn them off? I always chuckle when I visualize someone turning lights off to draw a burglar into their house only to scare them off by turning lights on once they get inside. Who would do that? If a guard dog was at the end of the hallway when the lights came on, I would call that effective, but someone has to feed the dog and take it for walks. It's probably a better plan to keep the burglar outside by not enticing him with a dark environment in which to do his work.

All lighting should support and ensure the safety and security of the area it illuminates. Lighting is also used for wayfinding, but in general, we come back to the need to provide a safe and secure environment for our customers. Lighting that is dimmed ineffectively can contradict the idea of safety and security. You should never dim your lighting, regardless of the time of day, below the Illuminating Society of North America (IESNA) minimum recommendations. One should illuminate a parking structure to an average of 5 footcandles (fc) when occupied. When unoccupied, theoretically, one might be able to drop to 1 fc on average until motion returns it to the desired minimum 5 fc level. (There may be some controversy here, but we're not discussing if the proper lighting level should actually be 10 fc or 7.5 fc and whether or not a garage should be considered a high-risk area.)

Let's say your new lighting solution offers an average of 5 fc in your garage and you are considering adding motion sensors to further increase energy savings. In your lighting retrofit, you likely replaced a 175-watt metal halide that was consuming 208-watts per fixture. You chose to replace the HID (high-intensity discharge) fixture with a low-energy consuming LED fixture that consumes only 62-watts per fixture. Congratulations: You are experiencing a 146-watt savings per fixture (70 percent energy savings) since the changeout.

Assume the 62-watt fixture holds 5 fc and that is perfect for you. Now, let's equip the fixture with a motion sensor that reduces the light level to 2 fc (never lower than 1 fc!). That means you can save an extra 70 percent of energy when you dim, which equates to 43.4 watts (.0372 kW) of incremental savings. An LED fixture has an efficiency gain when underdriven, so the increase is more than a linear relationship.

Here is where the unknown occurs. To really understand how much dimming will happen, you need to monitor the facility to know the usage pattern and vehicular and foot traffic that would trigger the motion sensors. Say the property is a college campus with classes starting throughout the day and into the evening. It is pretty safe to say that between 11 p.m. and 7 a.m., you will have some motion. For this example, though, assume there is no motion and the lighting never raises from the minimum 2 fc for those eight hours. Throughout the rest of the day, let's assume that somehow you will get four more hours interspersed with no motion, totaling 12 hours of inactivity. You end up with a lighting reduction 50 percent of the time.

Doing the Math

Calculate 43.4 watts (possible savings) × 50 percent of the time. This is the wattage savings enjoyed when going from full wattage producing 5 fc of light to the reduced wattage that will provide 2 fc of lighting.

So, .0434 kW × $.075/kWh (blended cost of energy) × 8,760 hours per year × 50 percent of the time = $14.25 per year additional savings per fixture due to dimming 50 percent of the time to 2 fc. Keep in mind that the 146 watt savings all the time enjoyed by reducing the fixture size will save you $96 per year per fixture.

Now, the dimming option will cost between $75 per fixture installed and set up (if unit-mounted and factory installed) and $100 per fixture (field installed). If we assume the least cost for the dimming/bi-level controller to be $75 per fixture and it saves $14.25 per year, the simple payback is $75/$14.25 = 5.26 years.

The dimming device may come from a reputable manufacturer and have a five-year warranty. All sensors are rated for numbers of cycles. If the device has a warranty or life expectancy of fewer than the required years needed to justify the expense (payback years), you can see that it may not be worth the expense.

Many utilities offer about $15 to $20 per sensor as an incentive. For this example, go with $20.

$$\$75 - \$20 = \$55$$

$55/$14.25= 3.86 years revised payback. With the added incentive, we are getting closer to a scenario that might be worth considering.

If the purpose of lighting is safety and security and a fully illuminated garage offers more safety and security than a garage using motion sensors (in my opinion), it's important to weigh the financial benefits against the risk. In this case, to dim or not to dim is subjective.

Of course if the utility rate where your project is located is higher or the incentives are more attractive, dimming or bi-level control may be justified. Run the numbers as above to see.

The answer, it seems, is simple. Do the math instead

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of installing equipment just because someone else did the same thing. Educate yourself and those around you as to why you have or have not chosen to dim; the answer will be different depending on each property and job. It's likely that an airport in a major city that has virtually no low-traffic opportunities for dimming is likely not a great candidate to experience further savings from motion sensors. But a condo in a city with little garage activity during the day or night is a prime candidate to see savings from the devices.

Other Secrets to Success

Besides a calculator, what else will help? Start by picking a lighting partner who can be your trusted advisor and ensure he has the credentials to support his ideas.

It is imperative to do a demonstration of whatever lighting changes you are considering. Seeing is believing and understanding whether or not a change will result in a good thing. The 2014 IPI Conference & Expo had a great example: the Green Parking Council (GPC, an affiliate of IPI) hosted a technology demonstration in the parking garage of the Gaylord Texan Resort. There, one could see and touch actual lighting choices that showed good options such as non-glare solutions. The demonstration also helped attendees to see for themselves the value of uplighting in a parking garage. Finally, it provided an example of unit mounted lighting controls.

Another area to be careful is fan speed control. A large percentage of parking garages relies on exhaust fans to remove dangerous carbon monoxide (CO) and permits fans to run wild without time control or particulate control. These fans are huge consumers of energy and require a high degree of maintenance. By equipping your facility with CO monitors and a front-end control system designed to operate your fans at the proper speed and for the amount of time necessary to eliminate the CO, you can significantly reduce the operational cost of this fan horsepower. Equipping the fans themselves with variable frequency drives (VFDs) will allow fans to run at reduced speeds and save energy on a cubic relationship with horsepower; in other words, experience mega energy savings!

Once you get your garage in order from an energy consumption standpoint, there may be one more avenue to walk down. If your facility is located in a state in which your energy costs are deregulated, you may be in for a big surprise. Working with your trusted advisor who knows his stuff, put your energy needs up for auction. A parking garage is a perfect client for an energy provider. Because of very predictable energy needs, garages are a perfect baseload for energy providers who wish to sell all of their generated energy without spikes resulting from changing demand conditions such as hot weather. Most energy providers will bid very low dollar-per-kilowatt rates in a competitive environment.

So that's it. Dim when it makes financial sense. Demo what you are considering doing. Control your fans, and negotiate your energy costs. Do all of that and you'll be a good DimWatt!