



# ALL'S WELL THAT ENDS WELL

By Carrie Hawley and Matthew Tanteri

## INTRODUCTION - WELL BUILDING STANDARD

The United States Green Building Council (USGBC) has introduced the first version of the WELL Building Standard, a performance-based system for measuring, certifying and monitoring features of the built environment that impact human health and well-being through air, water, nourishment, light, fitness, comfort and mind. Because the WELL Building Standard is in its infancy, like the early days of the Leadership in Energy and Environmental Design (LEED), there is still confusion and limited clarification available on ways to meet the standard. Today, we're going to look specifically at the "Light" category, which has some particularly challenging requirements. We have consulted with two lighting design experts to understand their perspectives on the current state of the WELL Building Standard, its current challenges and ongoing research that is fueling lighting aspects of health and well-being.

## Q&A

**1. Why is the WELL Building Standard important to you, and why do you believe it is important for our readership?**

The emergence of the WELL Building Standard points to an industry-wide awareness that is forming, which we see as the next level of sustainability-design that influences behavior and promotes well-being. There is a new driver on the scene. It is you, me and every other human life for which natural light and health is so critically linked, yet we all spend most of our days in buildings. WELL seeks



to capture our “well-being,” a state that combines our wellness, health and comfort. It’s an area of breakthrough discoveries, ongoing research, new applications and widely divergent health claims. The Light Feature has particularly controversial aspects. We believe by sharing our evolving knowledge, we can develop a group literacy on this topic. It is an arena we enter with excitement and caution to explore wellness aspects of design, but first, to do no harm.

We see the WELL Building Standard as being the next wave influencing perceived quality in the built environment. This may result in improved health and wellness of employees and occupants, and it may even potentially drive higher lease rates. In addition to doing the right thing for people (in other words the moral imperative), there is a potentially strong marketing message being sent by owners and organizations that pursue WELL. Frankly, extra features to achieve WELL will very likely cost more money, but Millennials will expect these features because it’s improving their quality of life. We expect the influence of the WELL Building Standard to become mainstream in the coming years.

## 2. What’s the difference between the WELL Building Standard and LEED?

Unlike LEED, the WELL Building Standard’s focus is on the well-being of its occupants, rather than on the sustainability aspects of the building. Both are under the realm of the USGBC. We observed over the years that many LEED projects were being pursued for somewhat limited reasons by clients, often for marketing and compliance reasons, rather than focusing on the true benefits to people and the environment. The focus of the pursuit became the successful accumulation of points rather than the ongoing benefits for the environment and the occupants

WELL bills itself as “a third-party, science-backed, evidence-based standard.” It relies more on quantitative justification based on current research, theories and data. The big difference is that WELL requires not just initial certification, but an ongoing commitment

by owners to occupants. Unlike LEED, it is not heavily documented during the design process, but is, instead, focused on commissioning to verify compliance of Features after the project is completed, as well as 3-year cycles for ongoing certification. WELL has been quick to adopt current research and has been gaining momentum. Currently, we estimate that 50 percent of our projects

that are considering LEED are now also considering WELL.

## 3. It seems that Light is an important Feature of WELL. Why?

Our circadian system controls everything going on in our body—heart, brain, stomach and more... Among a myriad of other vital functions, it regulates our alertness, performance and controls our

sleep-wake cycle. It does this through hormone release, mainly through the timing of sleep and the circadian clock.

So why has the link between circadian timing, sleep and health suddenly come to the forefront? Humans are different than all other species. The U.S. Centers for Disease Control and Prevention estimates that 35 percent of U.S. adults don't get adequate sleep. We spend most of our lives indoors, which makes control of our "master clock" highly reliant on environmental factors and the way we interact with each other. If we are to promote health, we need to do something about it.

The major concept is that light is the most powerful stimulus that synchronizes our internal biological rhythm with the 24-hour diurnal cycle of the earth. It is fundamental to our evolution and continued existence, both on or off this planet. Only recently have we come to learn the precise mechanics of this synchronization on a molecular level.

The name zeitgeber has been coined to describe these external factors that can entrain the oscillation of our master clock and affect the regulation of biological rhythm. There are others: food, drugs, stress, sleep, temperature, exercise (and coffee!), but light is still the most powerful regulator of our circadian rhythm. Without its reset effect, our day would lengthen back to the 24.1-24.3-hour average of our internal biological clock. The WELL Building Standard has introduced a required precondition geared towards supporting people's healthy circadian rhythm.

#### 4. That's fascinating, but how does light reset our master clock?

You may already be familiar with how the visual system traditionally works. Our visual system relies on light entering the eye through our pupil, focused by the lens, and a visual signal is projected on the retina at the back of the eye, which then sends information to our brain and allows us to interpret a visual image.

The retina is made of up different types of photo receptors, initially thought to be just rods and cones. Rods allow us to see in low light levels and

give us peripheral vision, while cones provide color vision and central detail through three types that are sensitive to red, blue and green light.

But only very recently, in 2002, another type of photo receptor was discovered – intrinsically photosensitive retinal ganglion cells (ipRGCs). Unlike rods and cones, ipRGCs are photo sensitive but produce no visual effects. Instead, effects are biological, affecting hormone levels and the sleep-wake cycle. ipRGCs have what is called the melanopsin photopigment, which was discovered in 2005, and provides non-visual pathways to the central nervous

## CIRCADIAN LIGHTING AND HUMAN-CENTRIC LIGHTING

are simply referring to lighting exposure, both electric and natural, that considers melanopic light content to support healthy circadian rhythm in humans.

system. Scientists and doctors started to realize that even people who had retinal damage and couldn't see still had circadian entrainment. This led to additional research and discovery of ipRGCs.

Our knowledge of the biological effects of light is evolving every year, and we won't have totally comprehensive information for quite some time. But, what we do know is that light matters, even if you can't see it.

#### 5. I've heard terms like circadian lighting and human-centric lighting used in regard to well-being, and I've also heard concerns about blue light. Are they all related?

These are buzzwords that are widely and loosely used, and yes, they are interrelated. Let's first explain what the big deal is with blue light. Melanopsin is a type of photopigment belonging

to a larger family of light-sensitive retinal proteins, and we have a melanopsin sensitivity curve. The melanopsin is more sensitive to blue light, and it biologically affects us.

Melanopic vision acknowledges that there is more going on than purely visual perception, there is also the biological impact of light. Melanopic light resets our master clock. The hormone melatonin is the key to our pattern of wakefulness and sleep. The production of this hormone is suppressed during the day by a naturally blue-rich light environment. We steadily fall asleep at night when there is very little blue in our light.

Circadian lighting and human-centric lighting are simply referring to lighting exposure, both electric and natural, that considers melanopic light content to support healthy circadian rhythm in humans. Lighting manufacturers may show you products claiming to deliver circadian lighting that produces enough melanopic light. That's only one part of the puzzle. Lighting solutions need to be carefully considered and designed to support or deliver adequate melanopic light content at the right time, ideally in the morning and early afternoon, and avoiding later hours which would actually create harm to people. New research even shows that supplemental red light may improve alertness in later hours without creating harm. Until more research has been conducted to better understand this relationship, we recommend using lighting solutions that promote alertness without disrupting the melatonin cycle

#### 6. Beyond circadian rhythm, does WELL focus on any specific attributes of light?

Yes. WELL focuses on many best practices in lighting application:

- ▲ Creating a quality visual environment
- ▲ Using high-quality lighting products
- ▲ Reducing glare through shielding or proper lens brightness
- ▲ Providing a comfortable balance of interior furniture and finishes
- ▲ Incorporating automated shading and dimming controls
- ▲ Giving people access to views and daylight

## ▲ Specifying high-performance and high-quality glazing

Many of these items are considered best practices, and WELL simply promotes their widespread use in the built environment. For example, WELL requires that you minimize lens brightness and provides metrics that need to be achieved.

### 7. Why is lens brightness such a big concern?

One of the big concerns with lensed fixtures is excessive brightness of the lens, which can produce glare. This has become an increasingly common problem as luminaires have become smaller and smaller. Products have trended to smaller profiles over the years, and this puts a lot of pressure on lenses when trying to produce enough light for spaces.

In order to reduce glare, use reduced output lensed fixtures closer on center, or consider increasing to larger or wider lensed fixtures if you need greater output. The wider the slot or the bigger the lensed downlight, the more lumens you can comfortably project through it.

Given the concerns of glare with lenses, we're seeing the re-emergence of louvers in product design. Our old friend, the louver, is making a big comeback, this time in sleek, new designs and micro-scales. Europe has really re-embraced this concept, and U.S. manufacturers are now introducing louvers in their LED products as well. We expect to see this trend to expand greatly in new LED product design and continue for many years.

### 8. What do you mean by specifying high-performance and high-quality glazing?

The characterization of glazing as high-performance typically refers to its Light-to-Solar Gain ratio, a measure of the ability of glazing to transmit light in relation to its ability to transmit heat. This metric captures the energy aspect of glazing performance but doesn't address the visual perception part, its impact on an occupant's view looking out the building or its render of the interior. Blue-tinted glazing with a low-E solar control coating, or electrochromic glazing that has the ability to change tint state, may provide excellent LSG values, however, causes undesirable color distortion. For view out, the effect can be severe enough to prevent the determination of time-of-day or weather condition. On the interior, it can render objects, surfaces and people in a way that is perceived as unnatural, unhealthy or gloomy. From a productivity standpoint, it can reduce an occupant's ability to perform work tasks that involve some level of color discrimination. Therefore, by high-quality, we are referring to color uniformity, which is the ability to maintain source spectrum without excessive spectral distortion. WELL looks to ensure the daylighting and view properties of glazing through performance factors that address size, location and transmittance. Regarding color, it has introduced a unique metric that limits the amount of frequency (color) variation in the visible spectrum so that individual wavelengths do not vary by more than a factor of two.

### 9. Is WELL particularly suited to any specific project applications?

Yes, there are certain types of projects that lend themselves to WELL. Shift work environments are one example. Day-shift and night-shift nursing staff have different lighting needs. During the day, lighting should be designed to promote circadian entrainment and maintain alertness. At night, the lighting demands are more complicated. While those working at night need to maintain alertness, disruption of the circadian clock by exposure to light

at night, especially short-wavelength blue light, has been associated with negative health effects.

More mainstream applications where WELL is being pursued include K-12 schools, commercial kitchens, healthcare and senior living, commercial office interiors and even multi-family residential projects. Until more research has been conducted to better understand this relationship, we recommend delivering a lighting scheme that promotes alertness without disrupting the melatonin cycle.

**10. We've covered a tremendous amount of ground here and sense the transformation in commercial buildings. Do you have any advice for how we can implement well-being principles of light in our own homes and lives?**

Absolutely! Reduce close-to-eyes screen time, especially at night. Put

phones on night settings and reduce screen time before bed.

Some general rules of thumb:

- ▲ Reduce the intensity of light at night
- ▲ Use amber night lights
- ▲ Make bedrooms as dark as possible when sleeping
- ▲ Early to bed early to rise

To set the pattern, pick a wake-up time that works best with your daily schedule and stick to it because it eventually will train you to fall asleep at the same time every night

And finally, the easiest way to promote well-being through light in your life is to make sure you get outside each day in the morning or early afternoon. Take a walk, and encourage your family and colleagues to do so as well. This is the easiest way to help regulate your master clock, and it doesn't require anything fancy or expensive! **N**

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