

**FULL SPECTRUM LIGHTING  
ARCHITECTURAL LIGHTING**

Experience the healthy lighting difference  
of bringing daylight indoors with

**Full Spectrum Lighting!**





## AL&P Solutions that **createchange**

### **A**bout Us

Alternative Lighting & Power is a Renewable Energy Consulting and Management firm whose primary function and focus is on providing creative and cost effective solutions in indoor/outdoor lighting, architectural lighting, development, design/planning and construction of public/private communications infrastructures, electrical infrastructures and solar farm developments. Our firm of professionals develop unique partnerships with manufacturers and suppliers that provide us with industry leading technologies, equipment and products that eliminate challenging circumstances for all customers. Our goal is to provide the most competitively priced remedy that renders precise, organic and sustainable energy solutions for our clients. Here at AL&P, we strive to benefit the whole of society, through the application of safer, cleaner, and more efficient foundations.

Our teams of knowledgeable experts collect, evaluate and analyze benchmarking data to solve or prevent problems. We offer the kind of insight that will help to optimize the whole project. Our support can be provided throughout the entire process from inception to completion. We provide data that facilitate the best solutions and future-proof projects. We make it our mission to help as many customers share in this joy as we can, and invite you to learn more about how our lighting can help you.

Sincerely,

*Edwin B. Love*

President

# Lighting as Nutrition: Is Your Light Good for You?

For the past 150 years, artificial lighting's primary focus has been on providing enough light to be able to see objects with our eyes.

Modern research suggests, however, that our bodies rely on light for far more than just vision. From regulating our sleep cycles to signaling seasonal changes, our bodies and health are far more receptive to light than we previously believed.

The same way we consider different foods to have different nutritional benefits and risks, it is important to have an understanding of what's in your lighting and how that can affect your health.

## The 4 Fs of Lighting Health: Fullness of Spectrum, Function, Flicker & Focus

Generally, three aspects of artificial lighting can have an effect on your health: fullness of the light's spectrum, light flicker, and distribution/focus of light distribution. For each of these aspects, the goal is to achieve a lighting effect that most closely resembles natural light.

**Fullness of Spectrum:** Natural daylight has all of the visible wavelengths present. The Color Rendering Index (CRI) is a quick way to evaluate a light source's fullness of spectrum. A healthy LED light should have a CRI rating of 95 or higher to most accurately mimic the spectrum of natural light.

**Function:** Consider the function and purpose of the lighting system, and choose a color temperature accordingly. For light therapy, choose a color temperature of 5000K or higher to replicate mid-day sunlight to promote alertness. To limit the impact of blue light during evening hours, choose a color temperature of 2700K or lower.

**Flicker:** Many artificial light sources flash on and off at very high speeds that are not generally visually perceivable, but can have detrimental health effects. The sun provides constant brightness and it is therefore necessary for an LED bulb to not exhibit such strobing. Look for LED lights with a flicker percentage of 5% or lower, and a flicker index value of 0.02 or lower.

**Focus:** We don't usually think of it in this way, but the sky is a huge, dome of natural light that shines down on us. Artificial, narrow focus lights with high levels of glare do not resemble the diffused and broad light that shines down on us during the day. Consider using a higher number of low brightness bulbs, or lighting techniques such as wall washing to achieve a similar effect.

# Lighting Increases Achievement

Nationwide schools [spend \\$8 billion](#) a year on energy – second only to personnel in K-12 budgets. With looming cuts to federal education spending, schools are going to need to cut back. Energy is one line item they can trim through efficiency improvements, like new air conditioning systems or LED lighting.

## **BENEFITS OF FULL SPECTRUM LIGHTING**

- Improves color perception
- Improves visual clarity
- Improves mood
- Improves productivity
- Improves mental awareness
- Improves retail sales
- Improves plant growth
- Improves results of light therapy in treating seasonal affective disorder (SAD)
- Improves results of light therapy for sleep disorders
- Improves scholastic performance of students
- Improves vitamin D synthesis in the body
- Reduces incidence of dental decay

**New Lighting increases achievement in schools and at home “ And it is available to you and your family.**

## **Lighting Increases Achievement**

A recent article entitled: "Learning the Hard Way: The Poor Environment of America's Schools" (Environmental Health Perspectives, vol. 110, No.6, June, 2002) claims that "Children across the country are being subjected to a variety of environmental dangers at school!" including lighting. According to the article, "research has also shown that there is a significant effect of poor lighting on children's ability to learn. **Sunlight is important for human health.** Children who spend large amounts of time in artificial lighting may be missing out on some of sunlight's benefits."

According to the article, lights or lamps which mimic natural daylight improve learning conditions and are far superior to the current, 70 year-old technology of "cool-white" fluorescent ceiling lights. "For example,(the article states) a two-year study of six schools in Johnston County, North Carolina, compared children attending schools with full-spectrum light with those attending traditionally lit classrooms. Students in full-spectrum light were healthier overall and attended school 3.2 to 3.8 days more per year. They also exhibited more positive moods. The study also showed that libraries with superior light had significantly lower noise levels.

A study of students in Capistrano School District in Orange County, California showed that students in classrooms with the most natural light progressed 20% faster on math tests and 26% faster on reading tests in one year than those with the least amount of daylight."

Pediatrician Doris Rapp, M.D. states in her best selling book, **Is This Your Child's World?** that "The best lighting for schools (and elsewhere) is natural light. But in many classrooms, students spend about six hours a day beneath (cool white) fluorescent lights. These ordinary fluorescent lights can emit X-rays, radiation and radio waves “ emissions that can decrease productivity and cause **fatigue, confusion, eyestrain, irritability, depression and hyperactivity** in some sensitive children (and adults!). A study of one classroom concluded that hyperactivity declined by 33 percent when full-spectrum lighting replaced fluorescent lights."

# Lighting Increases Achievement

“Student performance rose from 43% passing state tests to 70% passing within a two year period”

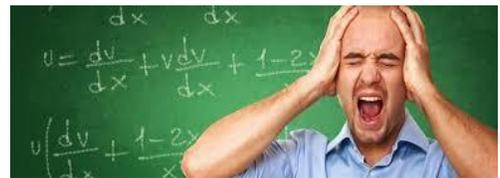
-The National Academy of Integrative Learning, Inc.



The Arco, Idaho elementary school replaced old, cool-white fluorescent bulbs with the new **full-spectrum lights** and saw their special education student referrals drop 66%,



Moreover, these lights help the aging population of retirees whose eyes function far better under these new, innovative lights. Teachers all over the country claim they have no headaches, more energy and less frustration with the full spectrum lighting products.



They also reported that staff and teacher eyestrain, headaches, anxiety and other illnesses were reduced as a result.



# Full-spectrum light is the secret to better schools

*People are inherently tuned to seek out daylight. It's in our DNA that the sun is good for us, [providing the activating source for vitamin D, and helping regulate our circadian rhythms](#) (sleep / wake patterns).*

**Children spend as much as 40 hours per week in school buildings, especially when they participate in after-school activities.** Much of this time is spent under artificial lighting and recess time outside is being cut as swiftly as school budgets. So it's no surprise that there are numerous studies showing how exposure to sunlight during the day is good for learning. Here are a few of the highlights:

**From a two year study of six schools in North Carolina comparing day lit environments to regular classrooms:**

Students in full spectrum light were healthier and attended school up to 3.8 days more per year. Because of the additional Vitamin D received by students in full-spectrum light, they had 9 times less dental decay. Full-spectrum light induced more positive moods in students. Libraries with superior light resulted in significantly lower noise levels.

In Wake County, Durant Middle School noted that natural lighting had a positive effect on students attitudes and performance, displayed lower levels of hyperactivity in the classroom.

**The Capistrano School District in Orange County CA** found that students with the most daylighting in their classrooms progressed 20% faster on math tests and 26% faster on reading tests in one year than those with the least amount of daylighting.

**The Poudre School District in Ft Collins CO** found a 7% improvement in test scores in those classrooms that used daylighting and a 14% to 18% improvement for those students in the classrooms with the largest window areas.

***The additional benefit of energy savings also makes daylighting a solid choice:***

A recently completed conventionally designed middle school of comparable size and construction to Durant (North Carolina) middle school had a typical energy load of approximately 77,000Btu/ft<sup>2</sup>/yr, whereas Durant used only 35,000 Btu/ft<sup>2</sup>/yr, **an over all reduction of more than one half.**

Although the extra professional time allocated to design and testing added an estimated \$115,000 to the total construction cost, **the reduction in total energy use in Durant Middle School will yield a savings of \$165,000 per year.**

The Bethune Elementary School in Rochester, NY **currently saves more than 119,000 Kw/hr annually in energy use** which translates into \$15,040. Based on EPA estimates, the reduction in lighting energy use from this school will result in lower annual emission of toxic chemicals and compounds that contribute to acid rain and smog.

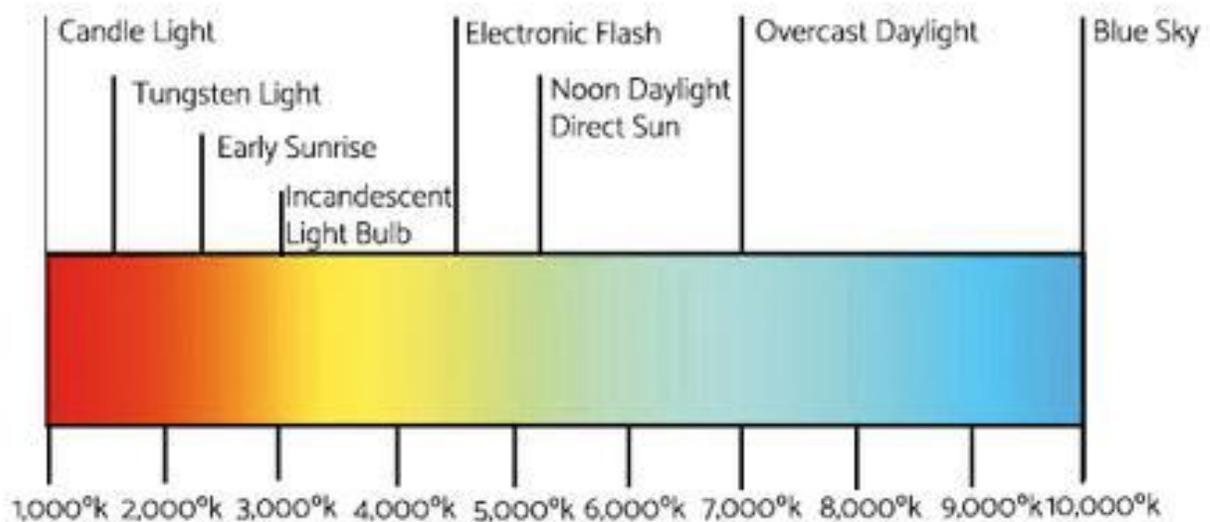
**Daylighting is easy to include in school plans.** Adding skylights in place of fluorescent lighting in main hallways and gathering areas, as just one example, helps with sunlight exposure and cuts down energy use. The [addition of a classroom greenhouse](#) gives other opportunities for learning while getting valuable exposure to sunlight.

There are many studies available to show that poor or inappropriate lighting in schools can adversely affect children's health and their ability to learn. Since people spend over 90% of their time indoors, including full-spectrum light in the school is vital to the health and well-being of the students. The benefit of exposure to direct sunlight exposure outdoors, or skylights in buildings is worth the extra effort.

# What is Natural Lighting

## What Is Natural Lighting And Why It Matters

The term **natural lighting** is one that is thrown around quite loosely these days in the lighting industry. Very simply put, a lighting source that closely replicates natural sunlight can be considered a natural light source. Sunlight in its pure form has a kelvin temperature of around 5,000 degrees kelvin and a color rendering index of 100. As sunlight comes into contact with the earth's atmosphere and is reflected and refracted by water and dust particles the color temperature actually changes throughout the day ranging anywhere from 5,000 to 6,000 kelvin depending on the time of day and the amount of clouds in the sky. Artificial lighting sources within this range can appropriately be considered a natural lighting lamp as long as the color rendering index is above 90. The color rendering index or CRI is a method for describing the effect of a light source on the color appearance of objects, compared to a reference source of the same color temperature. It serves as a quality distinction between light sources emitting light of the same color. The higher the CRI of lamps with color temperatures of 5,000-6,000 the better objects appear compared to outdoors.

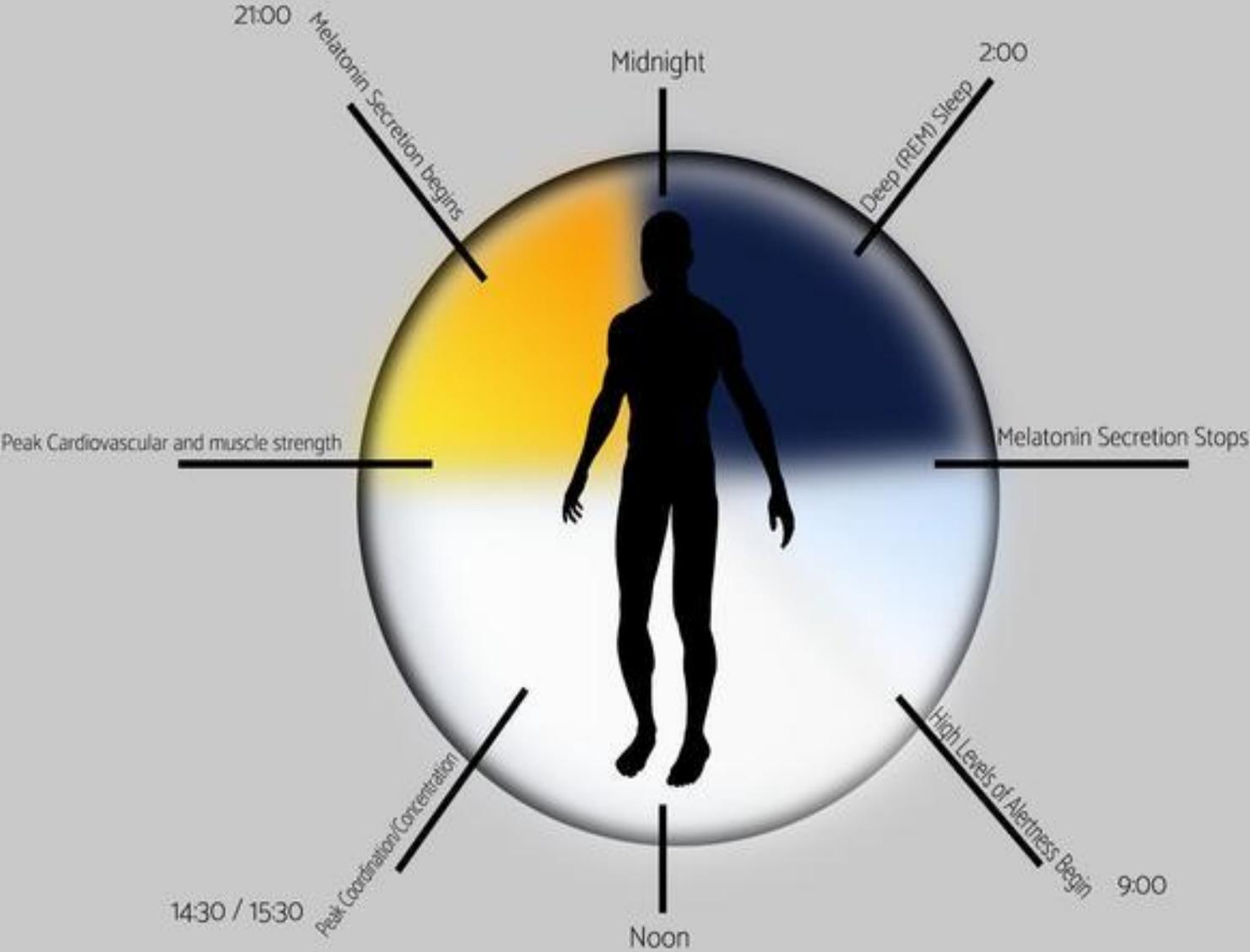


Unfortunately in today's competitive marketplace some companies have taken to making up their own definitions of what natural lighting is. A lamp with a color temperature of 6,500 kelvin and a CRI of 82-84 is simply not a natural lighting source. Even those touting their 5,000 kelvin bulbs with a CRI of only 82 as a form of natural light are doing the consumer a disservice in our opinion. Because CRI is determined in comparison to a source of the same color temperature a company calling its 4100 kelvin lamps a *natural lighting* source with a high CRI is unequivocally misleading, because the color of the light is actually several shades more yellow than sunlight and bears little resemblance to it. An incandescent bulb with its color temperature of 2800 kelvin has a CRI of 100 and we all know how unnatural those are and the same can be said for these 4100 kelvin halogen lamps. **BlueMax Lighting™** was specifically designed to be the most natural lighting source on the market. The addition of 5 custom phosphors along with a high output 70 watt full spectrum bulb have combined to create the closest thing to sunlight indoors. Having a color temperature of 5,900 kelvin and a CRI of 96+ there are no other lamps on the marketplace to even compare against.

# Blue Light, Melatonin and Circadian Rhythms

Many of us now live in a world where we have access to electricity 24 hours a day. However, a growing body of research indicates that exposure to light rich in blue wavelengths during evening hours can be detrimental to sleep quality. Blue light is not only coming from smartphones, computer screens and tablets - it's also abundant in regular light bulbs.

## The Circadian Rhythm in Humans



The circadian rhythm oftentimes referred to as the biological clock, is a biological process that all living organisms experience, and which is controlled by exposure to light. The circadian rhythm is responsible for such things as the sleep-wake cycle in animals, the opening and closing of flowers, and even the production of new cells in simple life forms like fungi and molds. The existence and study of the circadian rhythm has been documented as far back as the 18th century when astronomer Jen Jacques d'Ortuous de Marian noted his plants opening and closing with the cycle of light and dark, and the leaves opening towards the sun. He then, out of curiosity placed the plants in total darkness and observed that they continued to open and close with the light cycle in the absence of total darkness- indicative of an internal clock.

Your circadian rhythm is able to be influenced by artificial light. It is this ability to be influenced that can be a healthful benefit to us.

Examples of positive influence would be the use of artificial light to boost productivity and alertness by being exposed to light in the white to blue spectrum. Light in the 5000k to 6500k range has been shown to boost mental acuity and productivity in the workplace and in schools. This particular spectrum of light mimics midday sun, which coincides with our most productive time of day. On the other end of the spectrum, warmer color temperatures in the 2700k to 3000k range have a calming effect and can help people to unwind and relax prior to sleep.

Another positive effect of light on the circadian rhythm is the use of full spectrum light in the treatment of season affective disorder. During winter months, exposure to natural light in the 5000k-6500k range is limited due to shortened days which can often be cloudy. This causes a disruption in the circadian rhythm which leads to feelings of malaise. With regular exposure to full spectrum lighting from such products as [light therapy boxes, or full spectrum lamps](#), the circadian rhythm can be maintained and the effects of seasonal affective disorder minimized. These color temperature ranges, when used during appropriate times, will reinforce the circadian rhythm and make the sleep/wake cycle function smoothly.

If these light spectrums and exposure to them are used out of sync with our circadian rhythm there can be sleep/wake cycle disruptions as you would expect. [Recent studies show that exposure to the bright white/blue light in the 5000k-6500k spectrum in the evening can interfere with the ability to fall asleep.](#)

So to recap, in its simplest form, the circadian rhythm is your internal clock that helps regulate your sleep-wake cycles. And it can be influenced both positively, and negatively with the use of artificial light.

[The importance and understanding of the circadian rhythm recently gained international attention when in 2017, the Nobel Prize in Physiology or Medicine was awarded to three individuals for their work on understanding the genetic mechanisms behind the circadian rhythm.](#)

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