sustainability

MDPI

Editorial

Sustainability as the Key Framework of a Total Lighting

Antonio Peña-García

Research Group "Lighting Technology for Safety and Sustainability", Department of Civil Engineering, University of Granada, 18071 Granada, Spain; pgarcia@ugr.es

Received: 23 November 2018; Accepted: 23 November 2018; Published: 26 November 2018

Science and technology progress with remarkable velocity. Statements such asthis appear in the mass media almost every day. Such affirmations also resound in lecture halls, classrooms, and especially in the first classes of each new academic year. Despite its status as a trending topic, the truth is that science and technology advance very rapidly. Nevertheless, in the vast labyrinth of what is broadly referred to as "science and technology", there is one technical domain in which the term "rapid progress" is something of an understatement, since advances in this area move at an even faster pace. This is the case of lighting.

It was not so long ago that lighting professionals and professors informed their customers and students, respectively, that replacing traditional discharge light sources with light-emitting diode (LED) lamps in public and private installations was recommendable only if the rate of return was carefully analyzed, and if items such as product warranty were thoroughly examined. Even in new installations, the use of LED lamps was not universal because of their considerably higher price in comparison to high-pressure sodium or metal halide sources. However, in today's world, even though the rate of return and warranties are still key factors, it is now difficult to imagine new or renewed installations without these small and bright light sources that have changed our way of understanding, designing, and creating lighting installations.

Only a few years ago, lighting professors endeavored to teach their students how to design efficient installations that provided users and goods with optimal safety levels in terms of initial costs, maintenance, consumption, and other variables. At that time, the focus was on the main parameters recommended by regulations and standards for lighting installations, such as average luminance or illuminance, average or global uniformity, glare limitation, color or correlated color temperature, and other concepts that were eminently physical. Today, it is also necessary to first address topics such as Intrinsically Photosensitive Retinal Ganglion Cells (ipRGC), melatonin, cortisol, and suprachiasmatic nucleus (SCN); in the past, physiological content was limited to rods, cones, and a basic introduction to eye anatomy.

Although we have known about the non-visual effects of light for a long time, only a more in-depth (but far from complete) understanding of the paths involved has led to their current boom in lighting courses. In fact, this boom has still not been fully integrated in lighting technology programs. Nor is it among the concerns of all professionals in this area. Nonetheless, the current interest in these non-visual paths is not a temporary trend in lighting. Rather, it is an important research focus in lighting projects and a daily praxis that has come to stay.

Some years ago, the net savings in installed power (e.g., consumption per luminary, number of luminaries, and electrical auxiliary devices) and the net economical investment were the main targets for sustainable lighting installations. However, currently, the concept of "sustainable lighting installation" transcends energetic and economic considerations, and has been extended to areas as diverse as user well-being, long-term effects on health and environment, cultural heritage, and access to food and education, as well as many other aspects that enrich the modern vision of "sustainability".

In recent years (which have been even fewer in certain countries) and especially after the Brundtland report, sustainability has acquired a more far-reaching significance and pursues a development geared to "meet the needs of current generations without compromising the ability of future generations to meet their own needs". There is no doubt that lighting plays an important role in this larger scenario.

The ever-increasing volume of research and the implementation of strategies to optimize urban, road, and tunnel lighting as well as other indoor facilities, such as working places and sport lighting, is an eloquent indication of the positive evolution of our understanding of lighting. In this sense, a reduction in its financial and environmental impact is now a reality. However, its impact on other aspects of sustainability, as well as the effective integration of lighting in the circular economy loop still needs some more time.

At first glance, all of these considerations seem to indicate that lighting has evolved from a compact and well-defined branch of engineering (with its problems and paradoxes) to a diffuse mesh of topics that overlap with other fields such as psychology, physiology, sociology, and disease prevention, which would benefit from greater unification.

However, what is clear is that the scope of basic knowledge that is now required by new lighting experts is one of the largest among engineers and scientists. For this reason, professionals must constantly strive to broaden their horizons and be willing to grasp new concepts. I confess that initially I felt somewhat daunted by this need to rapidly acquire expert knowledge in synoptic connections, action potentials, arousal, stress, social aspects of violence, poverty, and macroeconomics. However, rather than a hardship, this quest for knowledge and expansion of horizons should be viewed as a rewarding challenge that enhances the dynamic lighting community. The hours of study and reflection on the implications of lumens in these areas have helped all of us to grow as researchers, professionals, and citizens of this global world.

Furthermore, I am optimistic because we possess the "cement" that can bring together and consolidate all of these different lighting domains. This cement is none other than sustainability, as understood from the perspective of energy and resource savings, as well as within the context of the more general framework outlined in the preceding paragraphs. In fact, it was the challenge to make lighting a vehicle to foster sustainability, and sustainability the framework to unify lighting, which led me to accept the offer of MDPI to be the Guest Editor of this special issue titled *Sustainable Lighting and Energy Saving*.

The positive results stemming from the excellent work of the authors, reviewers, and staff of MDPI has surpassed even my most optimistic expectations. This special issue covers areas of lighting ranging from art and cultural heritage to the optimization of agricultural production. Between these two extremes, there are also traditional but highly relevant topics, such as light pollution, the optimization of lighting networks, and strategies to decrease the environmental and financial impact of lighting from different perspectives.

Taking into account the quality and the evident challenge of presenting lighting as a unified and compact domain (which is essential for sustainable development), it is my hope that this special issue will be useful for the readers and authors of *Sustainability*, whose implication in Lighting has become a reality in recent years.