Illuminating ENGINEERING SOCIETY

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Design Guide on **Active Core Sunlighting for Buildings**

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Prepared by:
Active Core Sunlighting Subcommittee
Daylighting Committee
Illuminating Engineering Society

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1.0 INTRODUCTION

Active core sunlighting systems offer an effective way of providing indoor illumination by making it practical to deliver sunlight deep inside a building during sunshine periods. Active core sunlighting is an emerging field, and there are at least several active core sunlighting systems newly available on the market. Key benefits of active core sunlighting systems include:

- Increased visual quality enabled by overhead illumination
  - High color rendering characteristics of sunlight
  - Less glare than is often associated with sidelighting through windows
- Substantial reduction of energy use through on-site harvesting of sunlight, a renewable energy resource

Active core sunlighting systems can bring sunlight deep into buildings without requiring a substantial increase in floor-to-floor height or large expanses of glazing. Optimal daylighting within a typical building can best be achieved by using both active core sunlighting systems and conventional daylight delivery methods such as windows, skylights and tubular daylighting devices. The inclusion of active core sunlighting technologies as part of a daylighting approach may significantly influence how the building industry approaches energy-efficient building design, while also working within the constraints of conventional building construction techniques.

1.1 Purpose of This Design Guide

This Design Guide is intended to provide an introduction to active core sunlighting systems and their implementation for practitioners and stakeholders in the building industry. Active core sunlighting offers an effective approach to energy-efficient lighting by enabling most areas of a building to be illuminated with sunlight during sunshine periods. As a result, efficient and cost-effective active core sunlighting systems have the potential to significantly improve the overall energy efficiency of many buildings.

Active core sunlighting is an emerging field, and products are just now coming to market. There is a wide-ranging variety of approaches to active core sunlighting, as demonstrated by the range of new commercial products that are currently being introduced. The intent of this document is to lay the groundwork for the eventual adoption of active core sunlighting systems by focusing on the overall performance potential shared by all active core sunlighting systems, rather than focusing on the operational and design details of specific types of products. Examples of some specific systems are offered as a means of generating awareness, but are not intended to be used as detailed design advice or as endorsement of a particular approach.

Definitions and usages of radiometric and photometric terms are provided in IES publications and introductory texts on the subject.[1,2,3]

1.2 What is Active Core Sunlighting? Active core sunlighting is the process of collecting sunlight at the envelope of a building with solar tracking optics, then transporting and directing it within the building so as to provide appropriate illumination for a host of ambient, task and accent lighting applications. (It is important to note that the phrase "collecting sunlight" in the above definition means *intercepting sunlight and redirecting it appropriately so that it can then be transported into the building.* This distinction is made here because, under some circumstances, the word "collecting" is used to refer to the capture and storage of something, and of course sunlight cannot be stored.) Significant electrical energy savings can be realized if the active core sunlighting system replaces electric lighting power that would otherwise be used to provide the required level of illumination.

Ideally, active core sunlighting systems incorporate automated electric lighting controls that substantially dim or completely turn off the electric lights when the sun is shining. When active core sunlighting is included in a space with sidelighting and toplighting from windows, skylights, and tubular daylighting devices, it will be important to integrate the automated active core sunlighting control systems with the systems that control light near the perimeter. Some active core sunlighting systems may incorporate supplemental electric lighting within them, in which case they may be called "hybrid sunlighting systems." In these cases, the hybrid systems can completely replace conventional electric lighting within areas of the building in which they are installed.

For the purpose of this Design Guide, an active *core sunlighting system* is defined as equipment that collects sunlight by intercepting and appropriately stabilizing it, transports the sunlight, and directs it within the deep interior, or core, of a building for the purpose of providing illumination. A properly designed and installed active core sunlighting system should provide the required illumination level for at least several hours during the day and at least during peak periods when direct sunlight is available. It also may incorporate automated electric lighting controls that significantly dim or completely turn off electric lights to realize electrical energy savings.