

## Daylight for Healthy Indoor Environment and Energy Benefits

Editorial

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Recently, many researchers have been concerned to the interaction between environment and energy. Daylighting serves for both to improve indoor environment as well as to save energy utilization. It is clear throughout history that daylight has been an important element to affect health and lighting quality in the architectural designing. Different methods have been developed to bring daylight inside the building. Most of the methods have not been adopted because of their low efficiency and installation problems. What is the possible solution and current need to provide daylight in the buildings?

Besides energy saving, daylight has positive influence, which improves the quality of life, on the human body (e.g., feelings and emotions). Daylight research has shown that it can be used to reduce the impact of illnesses (e.g., seasonal affective disorder) and improve patient recovery rapidly [1]. As daylight includes visible and non-visible light, the eyes and skin absorb non-visible wavelengths that are needed to synthesize vitamin D3. People spend most of their time under artificial light in buildings. As a result, 15% of office workers complain of eye strain, and 78 million have calcium deficiency due to insufficient vitamin D [2]. Low levels of vitamin D have been shown to increase the risk of

strokes and heart attacks by 60% [1]. In general, most of the people prefer to work in a daylighted interior space rather than a non-daylighted interior space. An integrated daylighting design must be incorporated into a building design to produce comfortable indoor environments for healthy lifestyle.

Daylighting has a significant role in the field of renewable energy to reduce energy consumption. It is estimated that buildings are the main source of CO<sub>2</sub> emissions where 46%, 71%, and 50% of total energy is consumed in buildings of South Korea, USA, and Hong Kong, respectively [3,4]. Electric lighting energy utilization in buildings is 40–50% of the total energy cost [5]. One of the principles of sustainable buildings is to utilize daylight at all day for lighting. Buildings that include daylight with lighting control system, which maintains light level in the interior space, are estimated to reduce electric lighting energy consumption by 50–80% [6].

Several concepts regarding daylighting schemes have been demonstrated with opening places [7], windows [8], skylights [9], micro lenses [10], redirecting mirrors [11], light pipes [12], light guides [13], and optical fibers [14,15]. Windows are most common daylight transmit-

ting device in the interior space, but research is in progress to redirect the light for achieving uniform indoor illumination [10]. Skylights are incorporated into the roof of the building; however, these are not suitable for multi-floor buildings. Light pipes are not preferred because they have low transmitting efficiency. Most of the daylighting strategies give non-uniform illumination, which produce visual discomfort, in the interior space. Only optical fibers are capable of fulfilling the requirements for buildings. Current need is to design daylighting methods for newly constructed multi-floor buildings. Researchers have introduced different methods to deliver uniform daylight in multi-floor buildings using optical fibers [16], but most of the methods are in the early stages of development and implementation of the system.

There is no doubt that daylighting provides high quality illumination and health benefits. Using daylight, office worker's performance and patient recovery can be increased. To provide daylight in the interior space, more consideration should be given to make the light collecting system efficient in terms of light concentration and manufacturing process. An appropriate daylighting strategy will lead us to a solution to the energy problem and healthy indoor environment.

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