

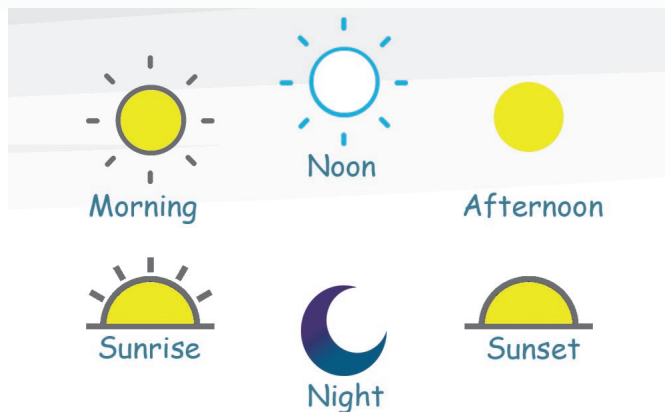


**Biodynamic Lighting**



## What is Biodynamic Lighting?

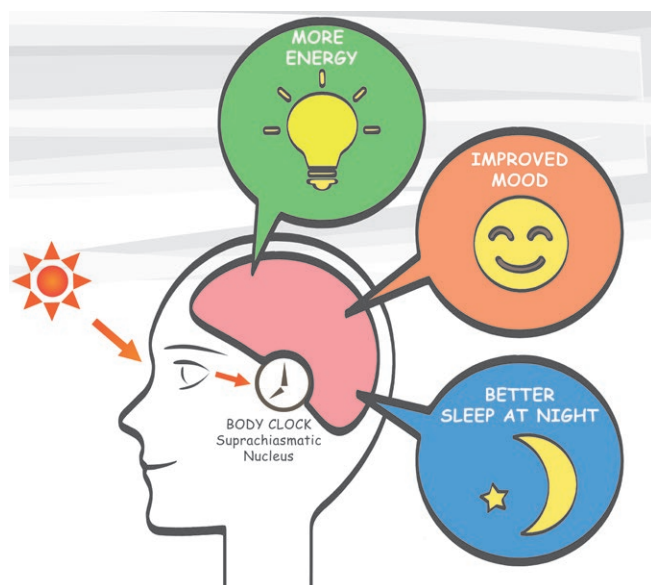
Light is essential for humans and plays key role in our lives. After the invention of the light bulb by Thomas Alva Edison in the year 1879, biodynamic lighting is becoming the next big step in lighting evolution. We



spent much time in enclosed spaces under artificial lighting that normally lacks the dynamism and biological effect of daylight. Generally, we exposure to lighting that is monotonous both in terms of lighting level and colour temperature, which is not consistent with daylight. The lighting level is kept constant according to standard's specific minimum value and the light color is determined at the beginning without changing during operation. Biodynamic lighting is characterised by dynamics with regard to light direction, colour temperature and level in order to positively affect vitality and relaxation, mood, visual acuity and productivity.

Not only appropriate lighting responsible for our visual task performance, but it also has emotional and biological effects on humans. Therefore not only visual but also non-visual lighting effects including the state of anxiety, mental focus, and cognitive performance should be taken into account by innovative lighting concepts. Moreover, innovative lighting concepts promote well-being, mood and health of the person who is at the center of the innovative lighting concepts.

## What is "The Circadian Rhythm"?



The term "Circadian" comes from the Latin words "circa,"(about), and "dies," (day); in other words, "one day rhythm ("Circadian"). The circadian cycle, also known as the circadian rhythm, or circadian pacemaker, is the daily human biological clock that synchronizes with the daylight. Human beings and their bodily functions have cyclic rhythms.

Circadian rhythm has an influence on variety of biological functions, such as body temperature, pulse rate, blood pressure, tuning the body work or rest, release of hormones, immune function. In order to fulfill the needs of a person in day and night periods, the functions of all body organs according to their

features are adapted by the circadian rhythm of brain. "Circadian clock" is also the name of brain function.

Suprachiasmatic nuclei (SCN) is a tiny region of the brain in the hypothalamus and is responsible for controlling circadian rhythms. The suprachiasmatic nuclei, or SCN of the hypothalamus in the brain plays an important role in the daily programming of organismic functions, when natural daylight (approximate wavelength of 460nm to 500nm) is received through the eye.

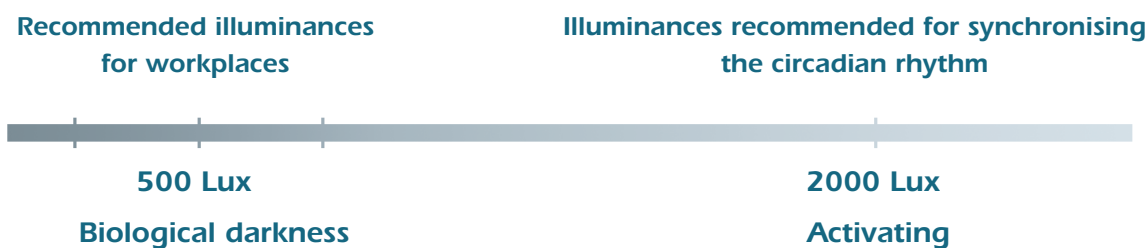
Another area of the brain known as the paraventricular nuclei, or PVN receives the signals that daylight has been detected from the SCN. Then, via nerve pulses, the signal from the PVN is transferred to the preganglionic sympathetic neurons of the spinal cord which control the activity of the superior cervical

ganglia, or SCG. The pineal gland regulates circadian rhythm through secretion of melatonin into the blood by receiving command from the SCG. Human daily sleep/wake cycle and the anxiety of humans are controlled by the secretion or suppression of melatonin.

## What is “The Body’s Master Clock”?

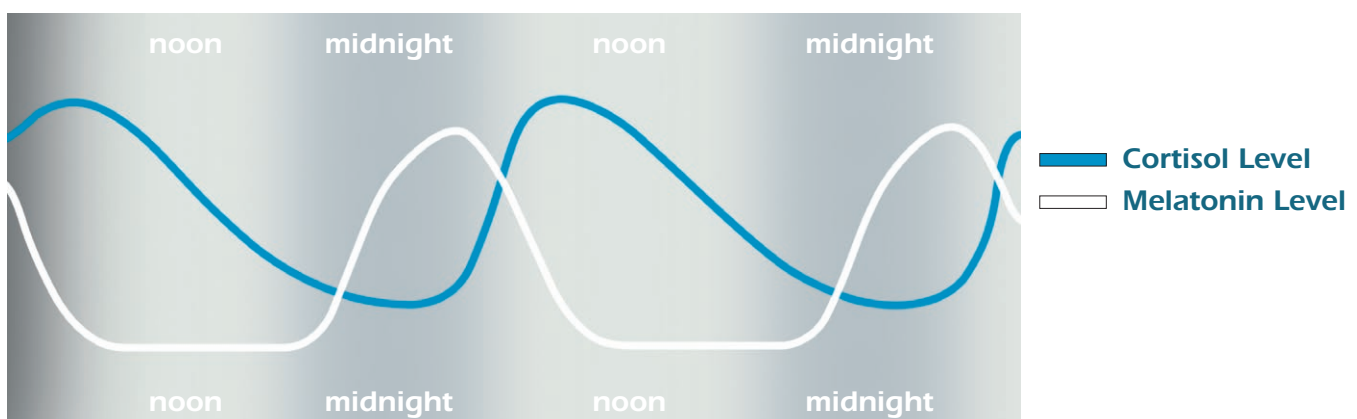
2002 demonstrated the existence of the special ganglion cells as a third photoreceptor in the retina alongside the cones (for colour vision) and rods (for night vision) already known. However, these special ganglion cells are light-sensitive but they are not used for vision.

The control of the biological processes in the body in response to the incident light is the primary role of special ganglion cells. The retinal ganglion cells known as “The Body’s Master Clock” regulate sleep/wake cycles as well as body temperature.



## What is “The Body’s Internal Clock”?

Human biology is directly linked with the daily rhythm of the sun. Differences in secretion of the hormone melatonin and cortisol bring about the rhythm of the tuning the body to the morning awakening and daily work or to rest or sleep at night. When the sun rises, light levels increase, the melatonin level in our blood drops and cortisol level in our blood increases.



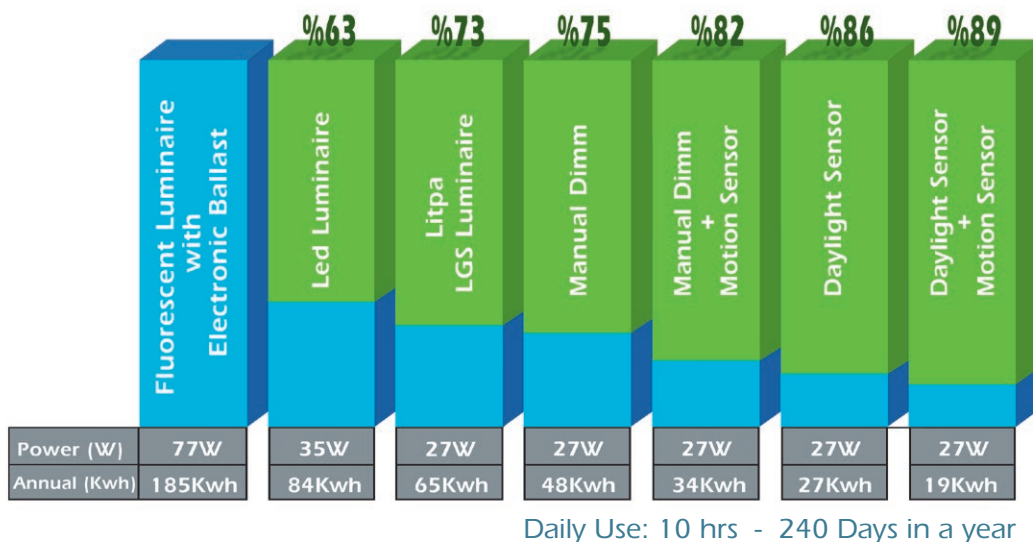
Cortisol has a balancing effect on melatonin and enables active hours. After sunset in absence of daylight or suitable replacement artificial light, the body will increase the melatonin levels in our blood, as a result of which we become sleepy. Melatonin is a well known neurohormone for causing and regulating sleep.

# ENERGY SAVING

Sustainable lighting design plays a significant role in reaching sustainability objectives. Due to rising energy costs and the negative impact of energy consumption on nature, it is important to select the most energy efficient lighting solutions in terms of environmental consciousness. Achieving sustainable lighting design is possible with LED light sources and advanced lighting control technologies.

By combining LED light sources and intelligent lighting control systems, LITPA offers you Biodynamic Lighting Solutions that maximize your energy savings, optimize lighting cost, significantly reduce CO2 emissions, control the body's circadian rhythms and affect overall wellbeing. Compared to the traditional lighting sources, LED is becoming the most efficient and long lasting technology ensuring users' psychological and physiological satisfaction. A dynamic ambiance can be created in office, school and healthcare environments by using of intelligent lighting control technologies and daylighting that has positive effects for the mood of customers and staff.

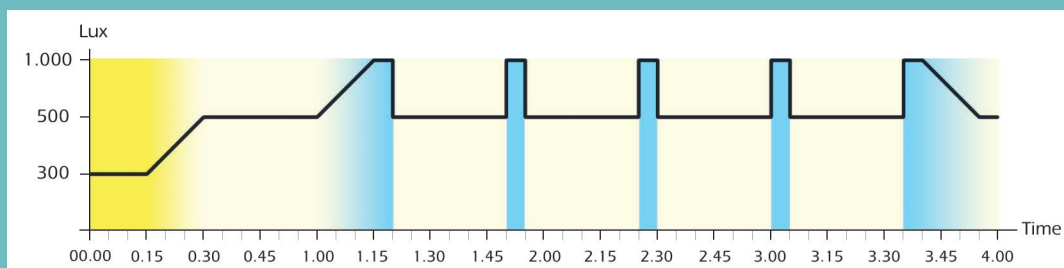
## Energy Saving Chart



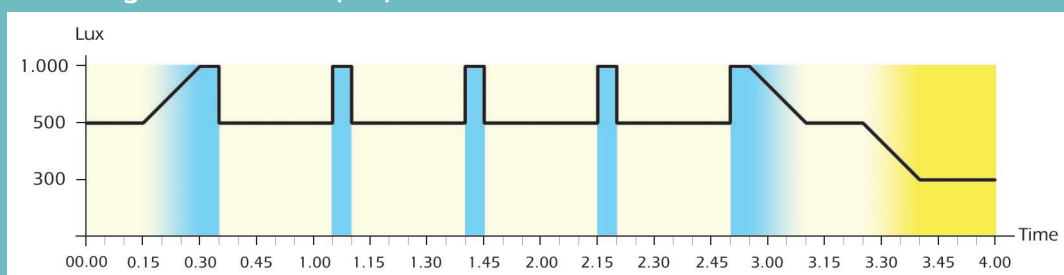
Daily Use: 10 hrs - 240 Days in a year

## Biodynamic Lighting Scenarios

### High Performance (AM)



### High Performance (PM)



# SOLUTION FEATURES

## Biodynamic LED Lighting Luminaires



LITPA's Biodynamic LED Lighting Luminaires (The output of TÜBİTAK 1501-Industrial R&D Projects Grant Program) with pre-programmed lighting cycles as day progresses are produced with highly efficient lighting technology and electronic components for operation.



## Multi Sensor



Multi sensor is implemented in the biodynamic lighting solution in order to maximise efficiency. The multisensor receives user settings from the touchpad and transmit these as well as occupancy and daylight lux data to the controllers on the network.

## Touchpad Controller



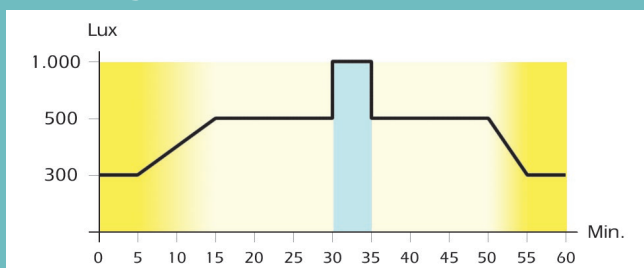
The touchpad enables users to adjust lighting levels, raise, lower and tilt window blinds, as well as increase or decrease the temperature set-point an integral sensor monitors room temperature at desk level.

## Control Unit



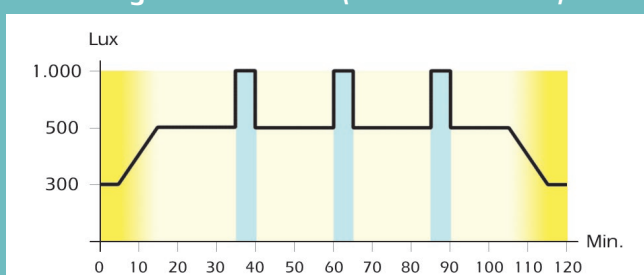
Lighting is controlled based upon occupancy and daylight lux data monitored by the multisensor as well as user lighting levels adjusted via the touchpad.

### High Performance (60 Min. Period)

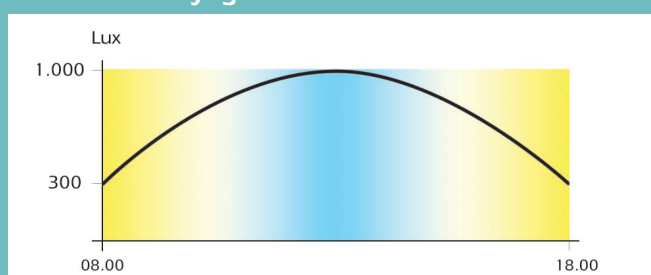


A variety of scenarios where both the level and the colour of the light vary according to what we call the "human rhythm" can be created with the biodynamic lighting system. The automation system itself has different biodynamic lighting scenario programs. These scenarios can be used in areas such as schools, offices and hospitals.

### High Performance (120 Min. Period)



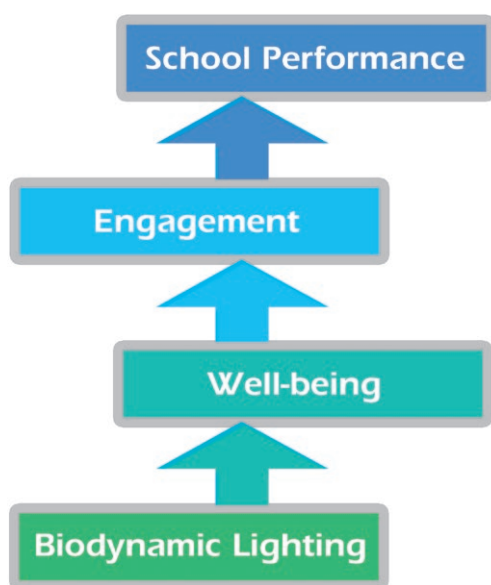
### Daylight Oriented Scenario



# BIOSCHOOL



LITPA's Biodynamic Lighting solution offers customized lighting for students and teachers at educational institutions with achieving a pleasant atmosphere. Our solution with biologically effective lighting and people-oriented smart lighting control system promise many advantages.



## Advantages For The Students

- Improved comfort and well-being
- Less sleepiness
- Increased engagement
- Less anxiety
- Better memory and concentration capabilities
- Improved learning and fewer errors

## Advantages For The Teachers

- Improved visual acuity of teachers
- Reduced work-related stress level
- Increased motivation



## Study Results

- According to studies, the level of anxiety decreases dramatically with higher lighting levels.
- Studies have shown that the incidence of mistakes can be reduced by as much as 30 % when classrooms are illuminated appropriately.
- A field study indicate that blue-enriched classroom lighting in the early morning hours has a positive effect on the speed of cognitive processing and concentration of students.
- Various studies demonstrate that natural light can improve subjective mood, attention, physical activity and sleep quality in students.

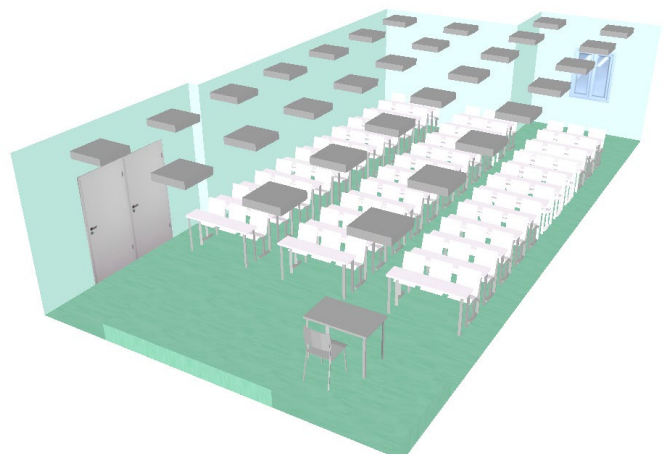
## LITPA's Biodynamic Lighting System Solution

Luminaires: LITPA Biodynamic Lighting Luminaires for general lighting

Lighting management: Delmatic Smart Control System

Room area: 105m<sup>2</sup> (15m x 7m)

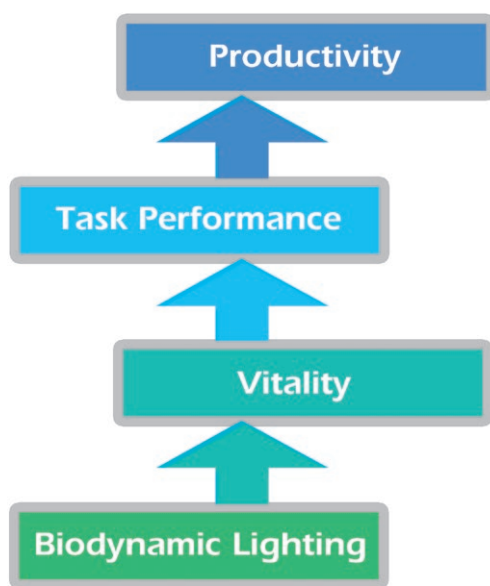
Ceiling height: 3 m



# BIOOFFICE



LITPA's Biodynamic Lighting solution offers customized lighting for workers at office areas with achieving a pleasant working atmosphere. Our solution with biologically effective lighting and people-oriented smart lighting control system promise many advantages.



## Advantages For The Workers

- Less anxiety
- Increased vitality
- Improved biological rhythms
- Improved mood and well-being
- Reduced tiredness of the eyes
- Increased job satisfaction

## Advantages For The Company

- Improved task performance and productivity
- Reduced error rates and less waste
- Increased motivation
- Reduced work-related stress level
- Increased job satisfaction
- Reduced absenteeism
- Increased energy-saving



## Planning Recommendation for Offices according to DIN Spec 67600:2013-04

Meeting room, Seminar room,  
Conference room; Use of  
biodynamic lighting is  
recommended



Example of  
biodynamic lighting in  
the office; Biodynamic light  
adapted on the course of day

- 250lx and 8000K
- 200lx and 3000K
- illuminance level  
depending on the  
viewing task

### Study Results

- Field studies suggest that exposure to blue-enriched lighting in the workplace improves self-reported mood, energy and productivity of office workers.
- Research has shown that lighting with a high correlated colour temperature (CCT) has a positive impact on worker's wellbeing and work performance.
- Multiple studies have revealed that exposure to natural light impacts brain cognitive performance.

### Biodynamic Lighting in the Offices:

LITPA's biodynamic lighting system replicates the dynamic variation of daylight and sunlight through an intelligent control system.

Thanks to biodynamic lighting, the lighting level and colour of light dynamically over the course of the day.

Biodynamic lighting regulates our body clocks and rhythms and influences our biological processes.

Improved employee concentration and working efficiency at the workplace can be achieved through the biological effects of natural sunlight.

# Private Office



The LITPA's biodynamic lighting solutions improve the motivation of employees by affecting on vitality and general feelings of well-being positively.

Modern lighting design should be created to take into consideration that office activities present a wide range of requirements.



The LITPA's biodynamic luminaires with dynamic illumination scenarios for the general illumination prevent workers from phases of exhaustion and tiring.

The LITPA's biodynamic ceiling luminaires with an asymmetrical light distribution curve make workers more focused in private offices.

# Open Plan Office



Flexible and energy efficient dynamic lighting with intelligent control system plays key role in today's open office environments in which employee spend long periods at work as well as in the winter months, when our internal clock is poorly synchronised with daylight. Biodynamic lighting solutions are especially recommended for open plan offices where office workers spend a great deal of time in a small meeting and concentrated work.



The LITPA's biodynamic ceiling luminaires with a high blue content illuminate ceilings dynamically tuned to the time of day.

The LITPA's biodynamic down lighting systems provide lower lighting level bringing the dynamism of natural daylight in open plan offices.

# Team Office



An team office with many workstations located next to each other require a good working light.

The LITPA's biodynamic lighting solutions enhance the daylight feeling of workers in team offices.



The LITPA's biodynamic ceiling luminaires facilitates productivity by respecting our circadian rhythm.

The LITPA's biodynamic ceiling luminaires with daylight harvesting technology plays a major role in creating a positive and motivating ambiance.

# Meeting Room



A wide variety of activities spans from customer meetings as well as internal meetings to presentations are held in meeting and conference rooms.

Different lighting conditions are required for each visual and functional task.

Thanks to biodynamic lighting, it is possible to create a natural light in meeting and conference rooms.



The LITPA's biodynamic lighting luminaires with variable lighting systems and intelligent control systems supports well-being and work performance.

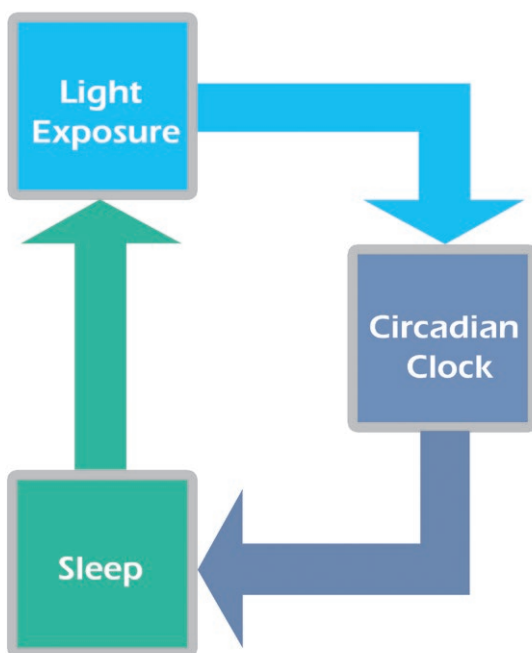
LITPA's biodynamic ceiling luminaires provide general lighting and lighting for more difficult tasks.

The LITPA's biodynamic down lighting systems create variation for face-to-face talks or note taking during presentations.

# BIOMED



LITPA's Biodynamic Lighting solution offers customized lighting for patients and staff at medical facilities with achieving a pleasant atmosphere. Our solution with biologically effective lighting and people-oriented smart lighting control system promise many advantages.



## Advantages For The Patients

- Improved biological rhythms
- Better healing process
- Increased lower rates of depression
- Improved mood and well-being
- Shorter treatment time
- Better sleep-wake cycles

## Advantages For The Staff

- Improved visual acuity of staff
- Reduced work-related stress level
- Improved task performance
- Enhanced work quality

## Planning Recommendation for Medical Facilities according to DIN Spec 67600:2013-04

Patient room, Maternity room, Recovery room; Use of biodynamic lighting is recommended

Example of biodynamic lighting in the medical facilities



- 250lx and 8000K
- 200lx and 3000K
- illuminance level depending on the viewing task

Light is fundamental to human existence and has a significant impact on staff and patient wellbeing and treatment of the patients. Biodynamic lighting designed with lighting cycles containing sunrise, sunset and daylight simulations support patients' circadian rhythms, raise their spirits and thus promote recovery.

### Study Results

- 87% of nurses believe that providing adequate lighting makes patient care and decision-making more easier.
- Studies show that being hospitalized in healthcare facilities with higher lighting level can reduce perceived stress and perceived pain.
- A field study indicates that inadequate illumination of the operating field is an important discomfort factor for surgeons' task accomplishment during operations.
- Research has shown that recovery time can be shortened optimizing the lighting level and quality.

Light as a comfortable atmosphere factor plays an important role in professional medical care centres. It is an important synchroniser for our internal clock along with its aesthetic effect and therefore provides a positive emotional response and shorter recovery times.

Because of illness or mobility issues, residents in hospitals and elderly care centres rarely or never go outdoor and their bed is not always near a window.

When the amount of daylight exposure is insufficient for adequate control of the circadian rhythm in many elderly people, biological processes in the human body especially sleep/wake rhythm are affected negatively.

# Emergency Service



In emergency service both the patient's and staff's needs must be taken into account. The biodynamic lighting satisfies the visual, biological and emotional needs of the patient and the staff. Regardless of the time of day, biodynamic lighting environment can create stress-free environment for critically ill or injured patients.



The LITPA's biodynamic cleanroom luminaires may lead to promote healing process. The LITPA's biodynamic ceiling luminaires provide good working light for staff.

# Information Desk



The biodynamic lighting in the information desk areas can create a relaxing environment for waiting patients and visitors. The biodynamic lighting that mimics daylight in terms of light colour and level helps counteract undesirable feelings such as insecurity, anxiety and impatience.



The LITPA's biodynamic ceiling luminaires can create optimal environments for waiting patients reading in magazines. The LITPA's biodynamic down lighting systems may promote patient convalescence and health.

## Patient Room



Many patients spend days and weeks in patient rooms that have less access to suitable amounts of daylight.

Biodynamic lighting creates a stimulating, 'natural' lighting atmosphere and facilitates patient care in patient rooms.

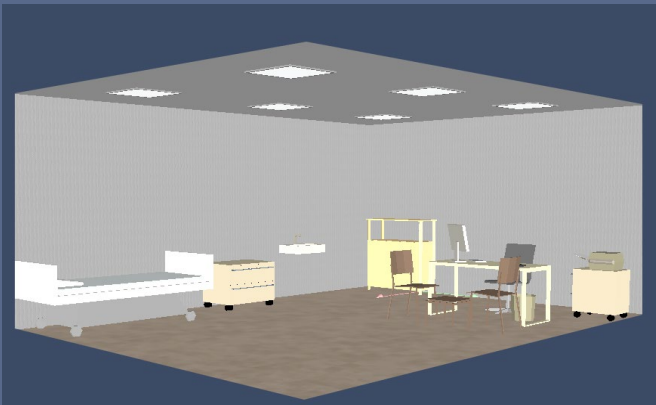
Biodynamic lighting also lead to better sleep/wake cycle and thus ultimately improve the emotional and physical wellbeing of the patients.



The LITPA's biodynamic luminaires can promote the recovery of patients by affecting biological processes in the human body.

The LITPA's biodynamic ceiling luminaires with an asymmetrical light distribution curve ensure reduced stress.

## Examination Room



A biodynamic lighting solution consists of a natural circadian rhythm should be suit various work situations in examination rooms.

Natural light in examination rooms makes people feel safer and more at ease.

The biodynamic lighting may reduce the number on negative patients in the examination rooms adding a more comfortable environment.



The LITPA's biodynamic cleanroom luminaires provide the safest environment for patient diagnosis in examination rooms.

The LITPA's biodynamic ceiling luminaires achieves an adequate general lighting to individuals.

L İ T P A

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