
Human Centric Lighting

Lighting designed to
benefit human health and wellbeing



Nature



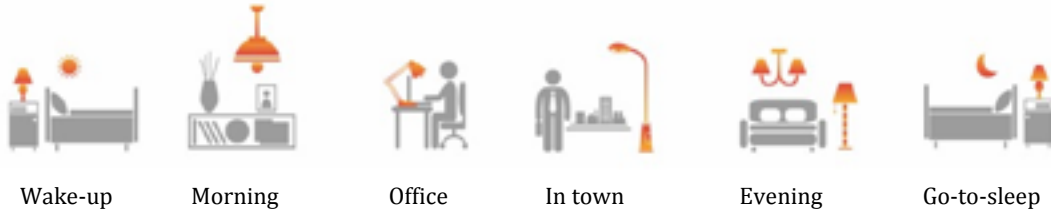
Natural light is dynamic from sunrise to sunset

Mankind has evolved under this light - dark cycle.


24 hour rhythms dominate much of what we are:

- There is a world in the 24 hour rhythms and with changing seasons
- The eye links light and darkness with the body
- Intensity, color, timing and direction are very important in circadian lighting

Our daily world



Artificial light is fixed from wake-up to go-to-sleep

 On a sunny day people outside get
100 000 lux

 On a clouded day
10 000 lux

 Indoor in offices people get
500 lux

 And in school only
300 lux



People spend

90%

Of their time indoor

The problem

Today there is a **disconnect** between natural and artificial light with regard to intensity, color and dynamics of light



Consequences

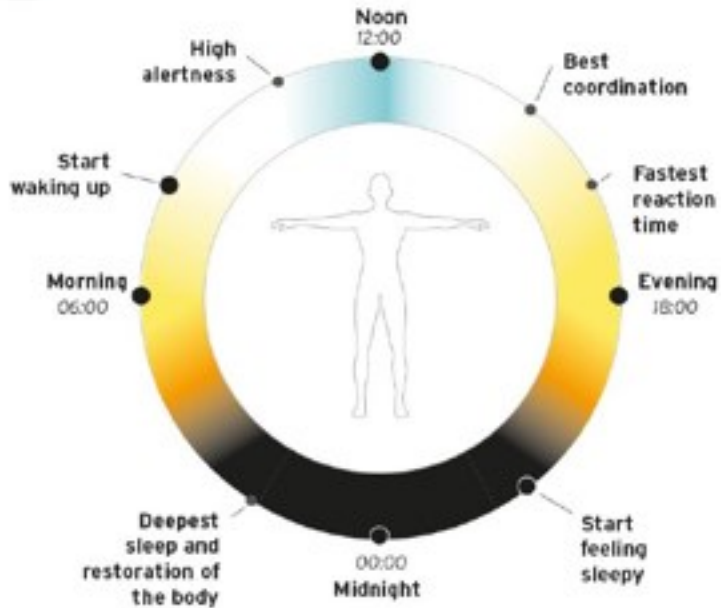
- Poor circadian entrainment, problems with body clock similar to jet-lag.
- Problems with sleep & alertness.
- Disturbance of the hormone system.
- Compromised mood, functioning, well-being and health....

What do we need

We need light and darkness

There is a period of the day when we are active and a period when we are sleeping

Light is the most important timer for our internal clock



The impact of light

Light has an effect on



Vision

Sight



Body

Alertness,
Cognitive
Performance
and sleep/wake
cycle



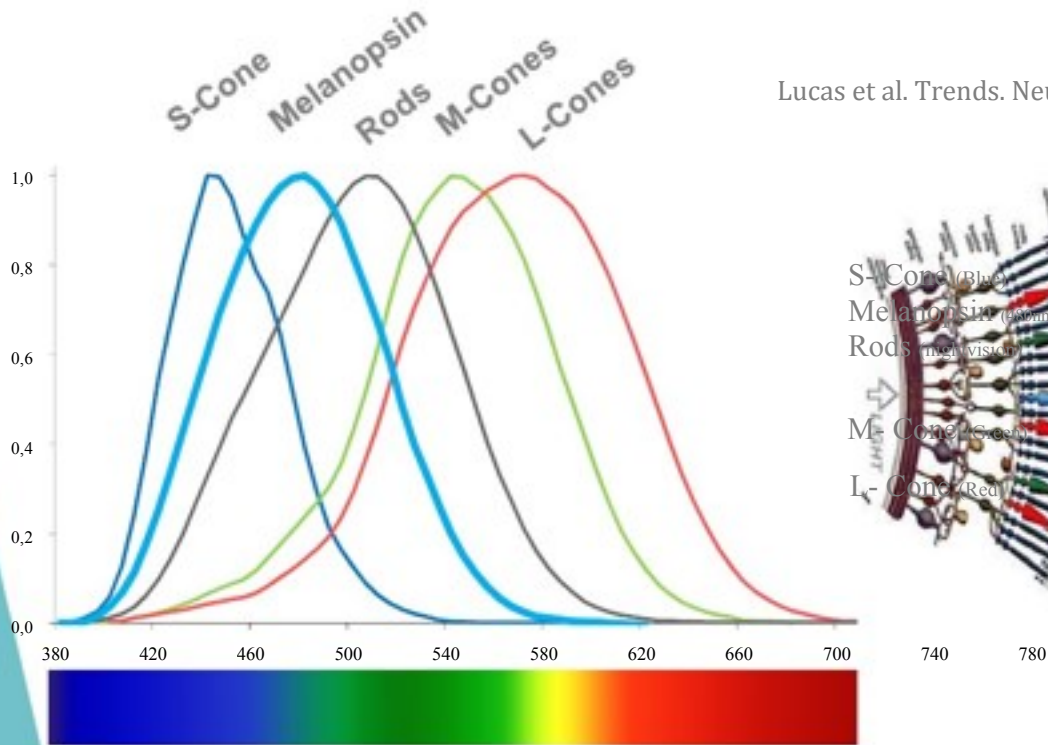
Emotion

Mood, energize
and relaxation



The metrics

Lucas et al. Trends. Neurosci. 2014



normalized data from CIE TN 003 (2015)

The solution

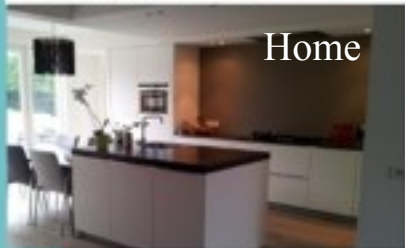
We need the right light at the right place at the right time to support our activities



Put value in people and go beyond energy efficiency

Light in applications

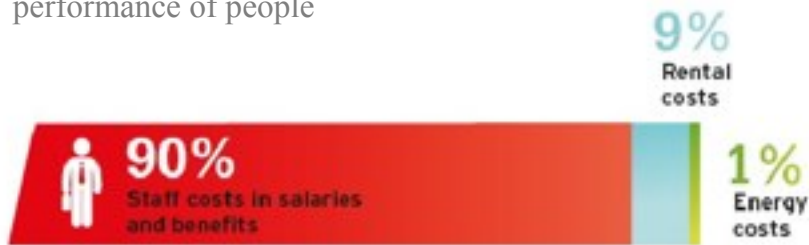
Light needs and settings vary per application



We need the right light at the right place at the right time to support our activities

Economics

Look beyond energy efficiency
Human Centric Lighting increases
the vision, well-being and
performance of people

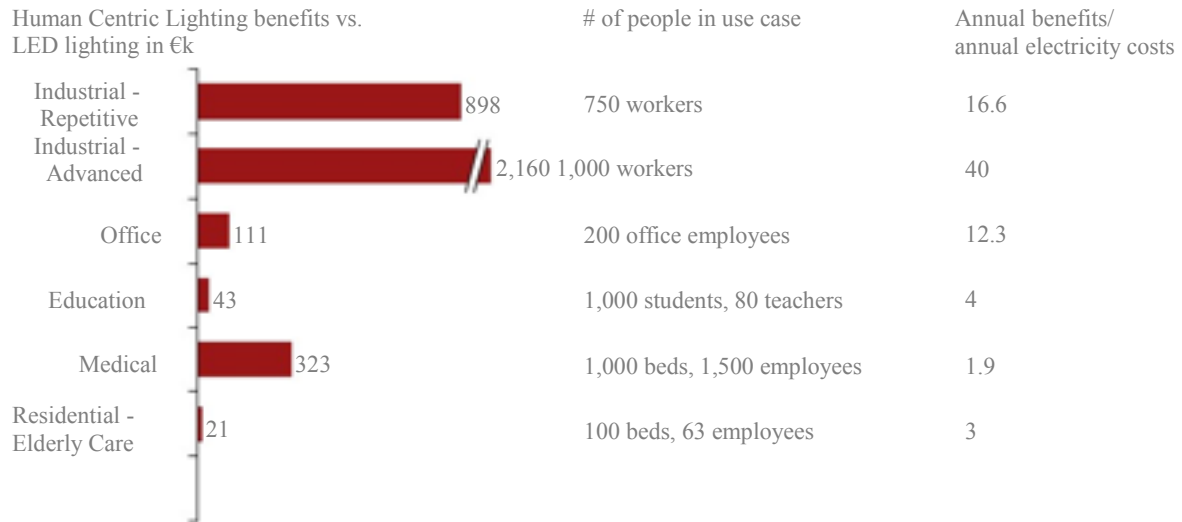


If cost of energy is only 1% of the typical business operation costs, why do we concentrate on energy savings and not on having healthier, happier and more effective people?

Economics

Micro level benefits of Human Centric Lighting

Highly sensitive to assumptions!

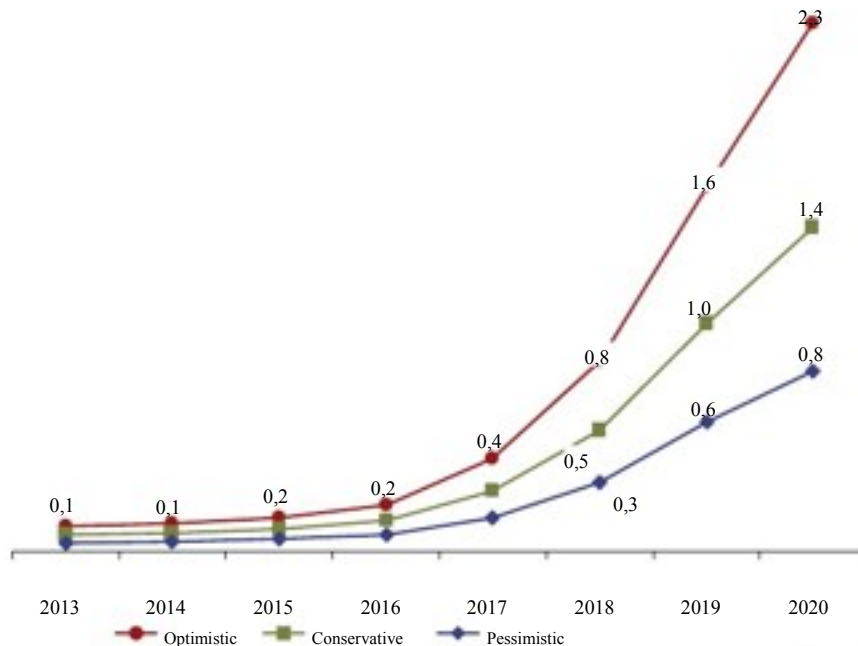


On the micro level, the most significant effects from Human Centric Lighting are realized in industrial segments.

Economics



Human centric lighting can be a multi-billion-euro business in Europe



- **Optimistic scenario** assuming
 - Resolution of economic crisis
 - Significant infrastructure investments
- **Conservative scenario** most probable, assuming
 - Selective government support
 - Joint industry initiatives
 - Considerable marketing investments
- **Pessimistic scenario** assuming
 - Worsening of economic crisis
 - Little infrastructure investments

1. Human centric Lighting
2. Indicated chart values until 2017 are for scenario with high growth
Source: A.T. Kearney "Light and Health" market model

