Improved lighting quality by sustainable LED solutions in industry lighting considering daylight based controls

Increased planning effort for integrated solutions illustrated by an example of an realized industry project

Planning considerations for integrated LED solutions

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Standards and codes

Energy efficiency

Lifecycle consideration

Flexibility

Biological aspects to increase well-being and performance

Industry logistic hall
Basic conditions

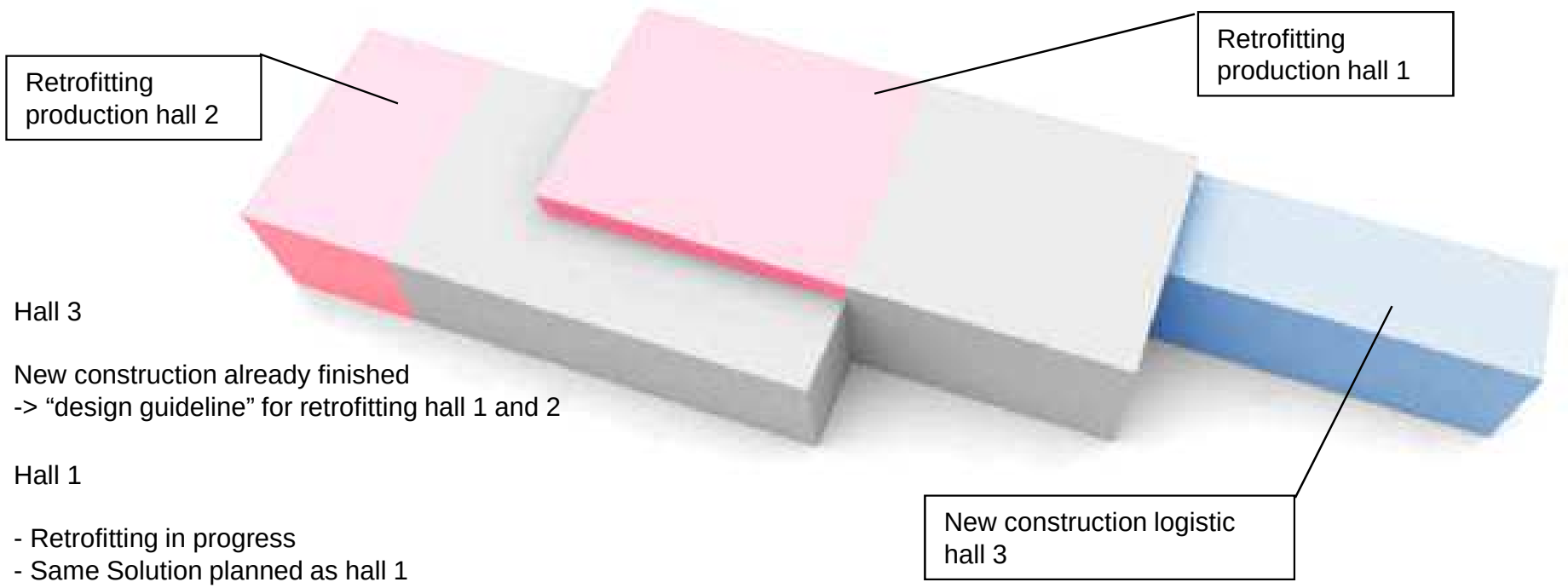

Exemplarily photograph

The case study shows an new construction logistic hall of an medium-sized engineering company based in Germany.

Requirements for the new logistic hall were driven by innovation and energy-consciousness.

The companies' facility manager demanded an energy efficient and easy to use lighting and control system requiring low level maintenance.

Industry logistic hall
Basic conditions



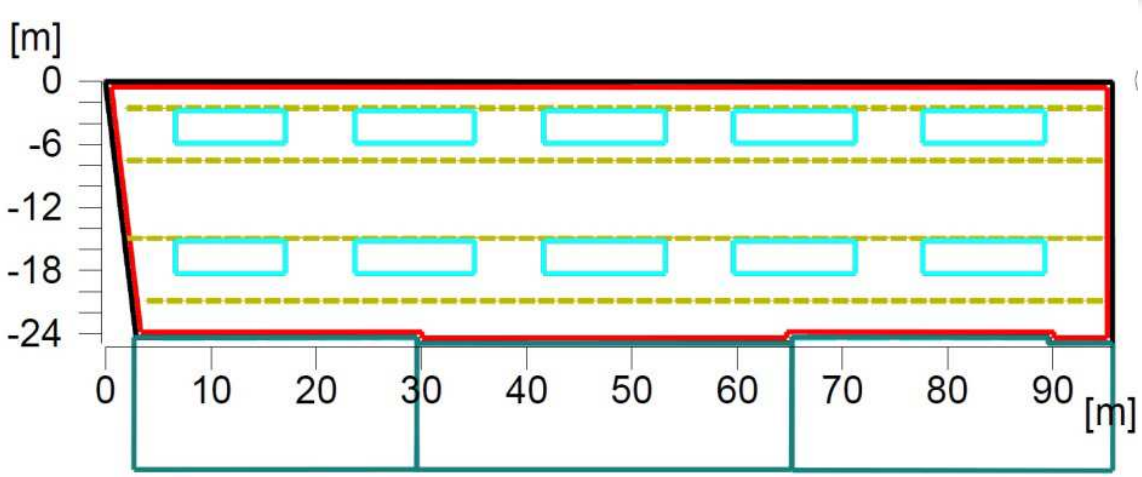
Hall 3

New construction already finished
-> “design guideline” for retrofitting hall 1 and 2

Hall 1

- Retrofitting in progress
- Same Solution planned as hall 1
- Intensive use of daylight by control system
- Replacement of T16 solution by LED

Industry logistic hall
Basic conditions



Hall 3 new construction

2383 sqm total area
2200 sqm logistic area
180 sqm Storage
320 sqm skylights
364 sqm glas façade with sun shading roof


Exemplarily photograph

Artificial lighting planning conditions
Standards and achieved quality

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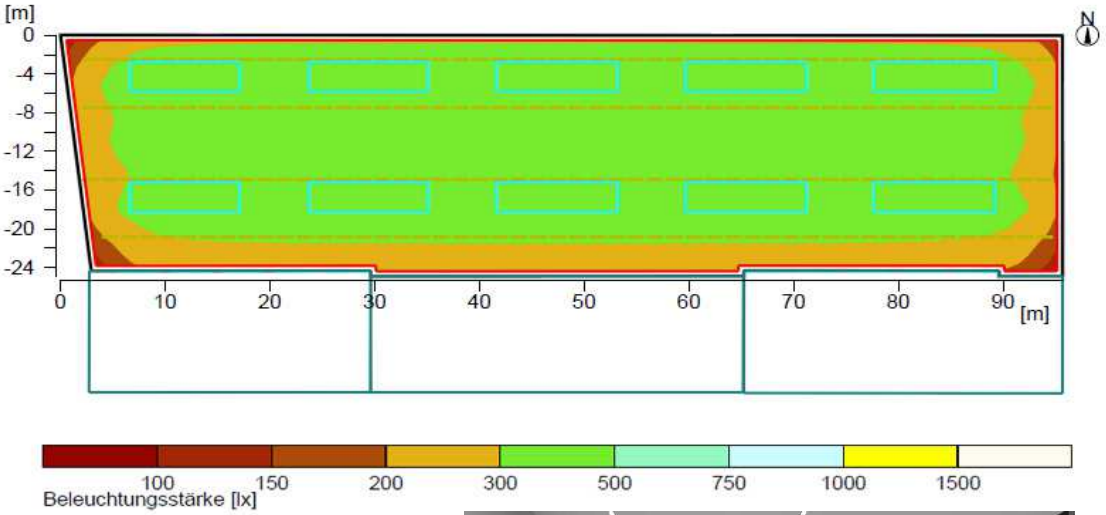
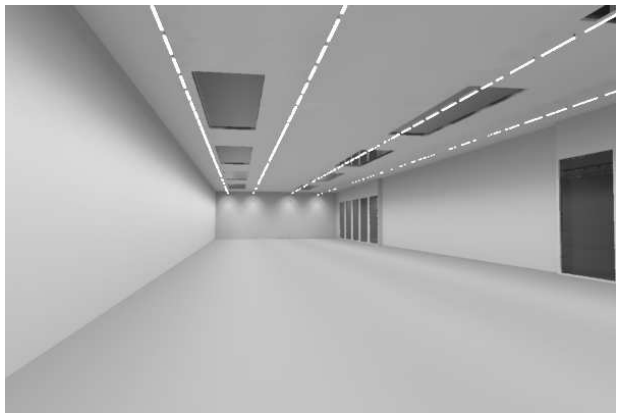
Requirements Logistics (EN12464):
Av. Illum. 300lx; UGR 22; U1 0,6; Ra 60

Calculation Results:
Av. Illum. 348lx
U1: 0,61

Luminaire:
Tecton LED 53W
UGR 22
Ra 80





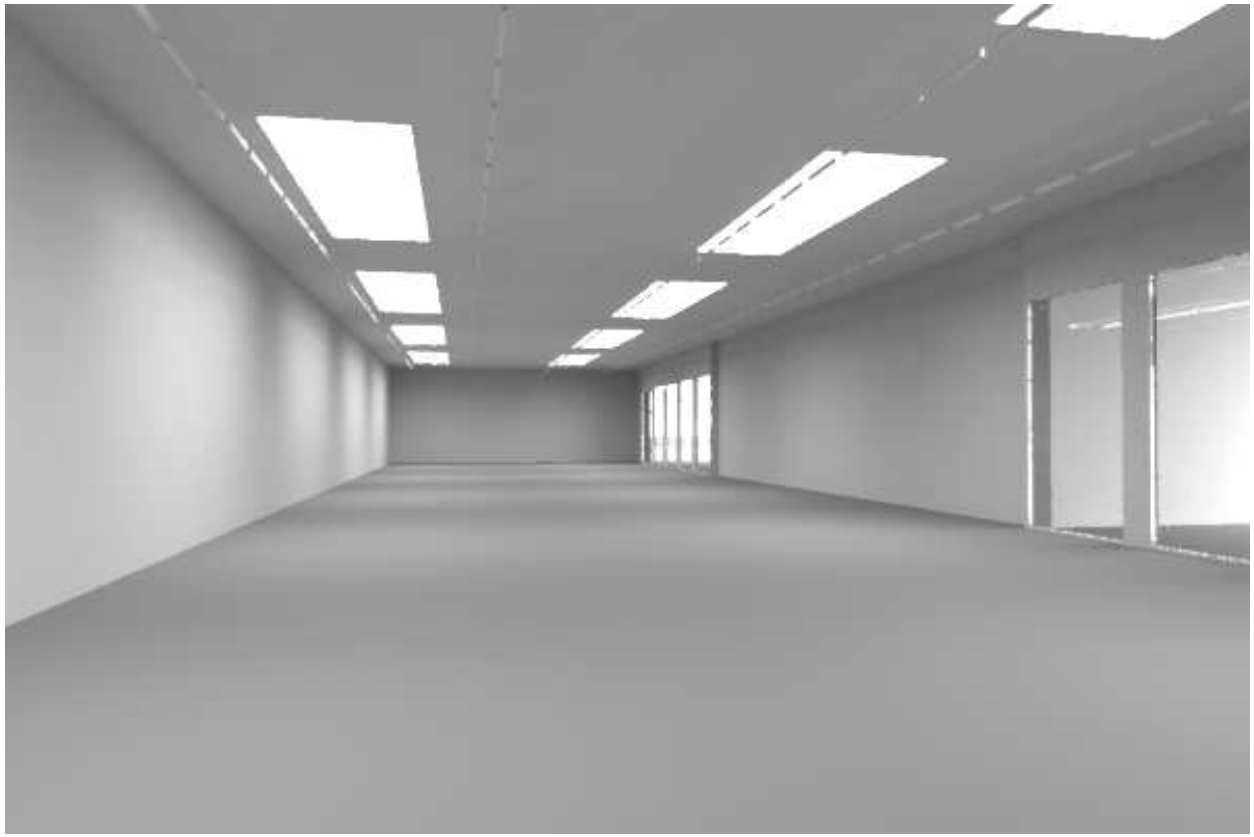
Daylight planning conditions
Standards and achieved quality

Location: longitude 48°, altitude 10.2°

- **Date**: 21.03. 12:00
- Overcast sky CIE
- **Reflectivity:** 70/50/20

- **Facade:**
- Sun protection glas; transmission 60%
- Factor for pollution 0,8
- Factor for partitioning 0,8

- **Skylights:**
- Sun protection glas; transmission 60%
- Factor for pollution 0,8
- Factor for partitioning 0,8



Daylight planning conditions
Standards and achieved quality

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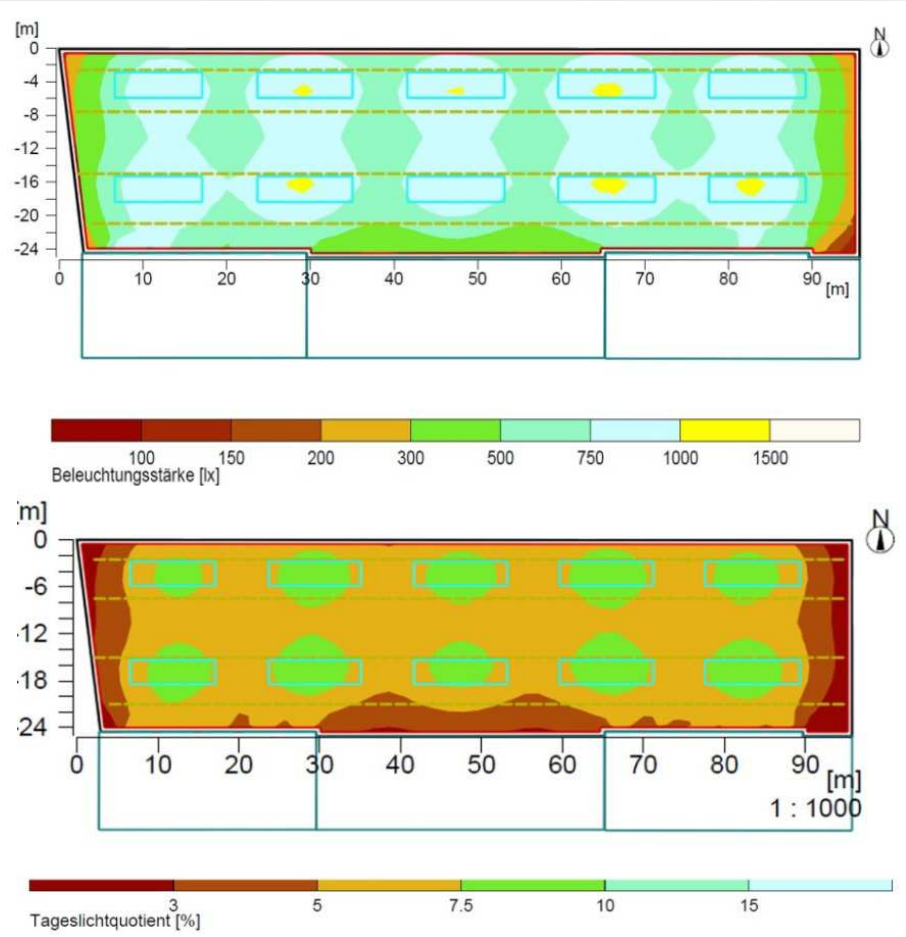
Requirements DIN 5034 and ASR 3.4:
DLF for working spaces with skylights: > 4

Calculation Results:
DLF av: 6,3
DLF max: 8,9
Illuminance (21.06) av: 727lx
Illuminance (21.06) max: 1024lx



Economic conditions
Energy efficiency and cost

Basis for economic comparison:
(accordingly to client information)

Working time: 7.00 – 18.00 Mo-Fr
Burning hours 2868 h/y

Electicity tarif: 15 cent/kWh
Evolution of energy tarif: 5% per year

Lifetime of installation: 20 years

Proposal 1:

Tecton T16 1x80W
60 lm/W

246 pcs.

Illuminance: 340lx MF 0,73

Proposal 2:

Tecton LED 53W
99 lm/W

250 pcs.

Illuminance: 348lx MF 0,61

Proposal 3:

Tecton LED 53W + DL controls
99 lm/W

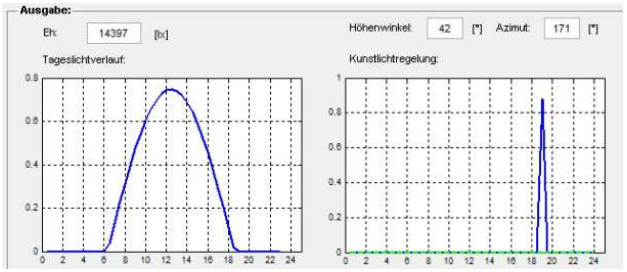
250 pcs.

Illuminance: 348lx MF 0,61

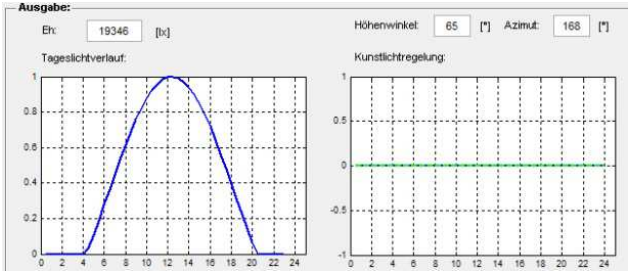
Economic conditions
Energy efficiency and cost

Estimation of saving potential for daylight based control:

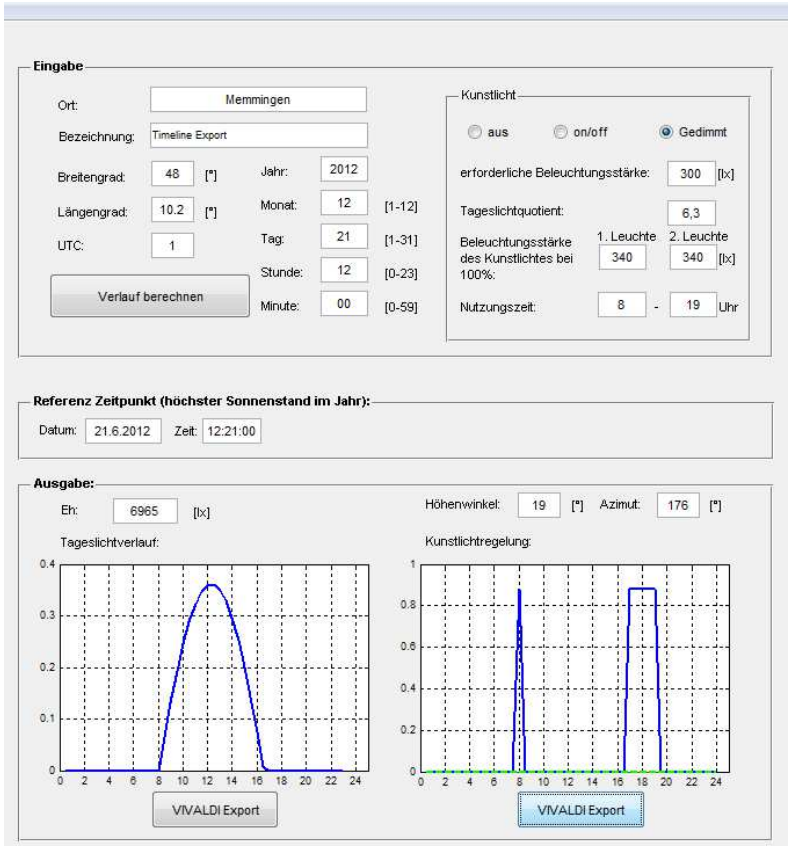
Calculation of dimming curves for artificial light wih overcast sky for 21.03 (double-weighted), 21.06 and 21.12



Dimming curve 21.03



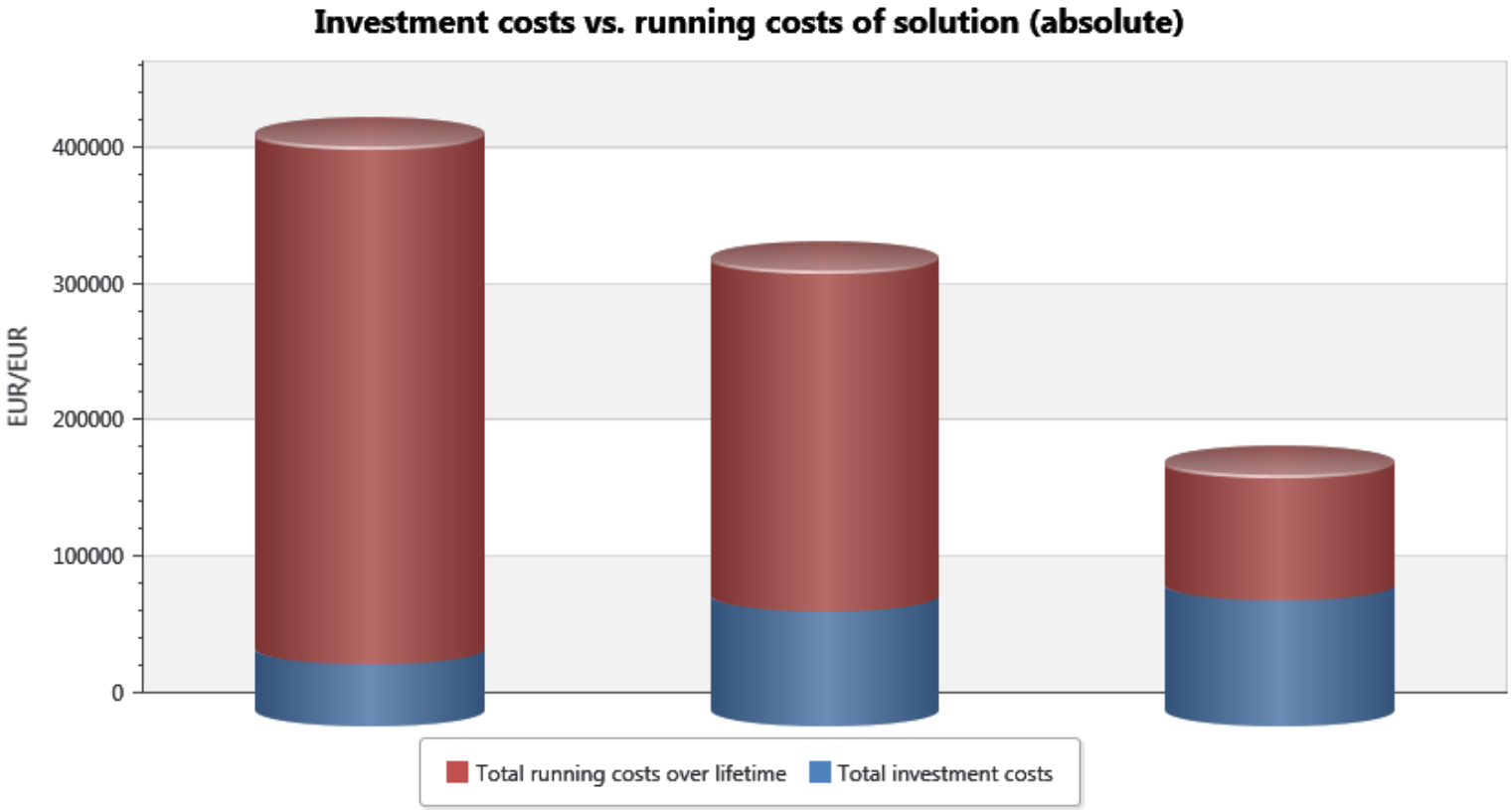
Dimming curve 21.06



Dimming curve 21.12

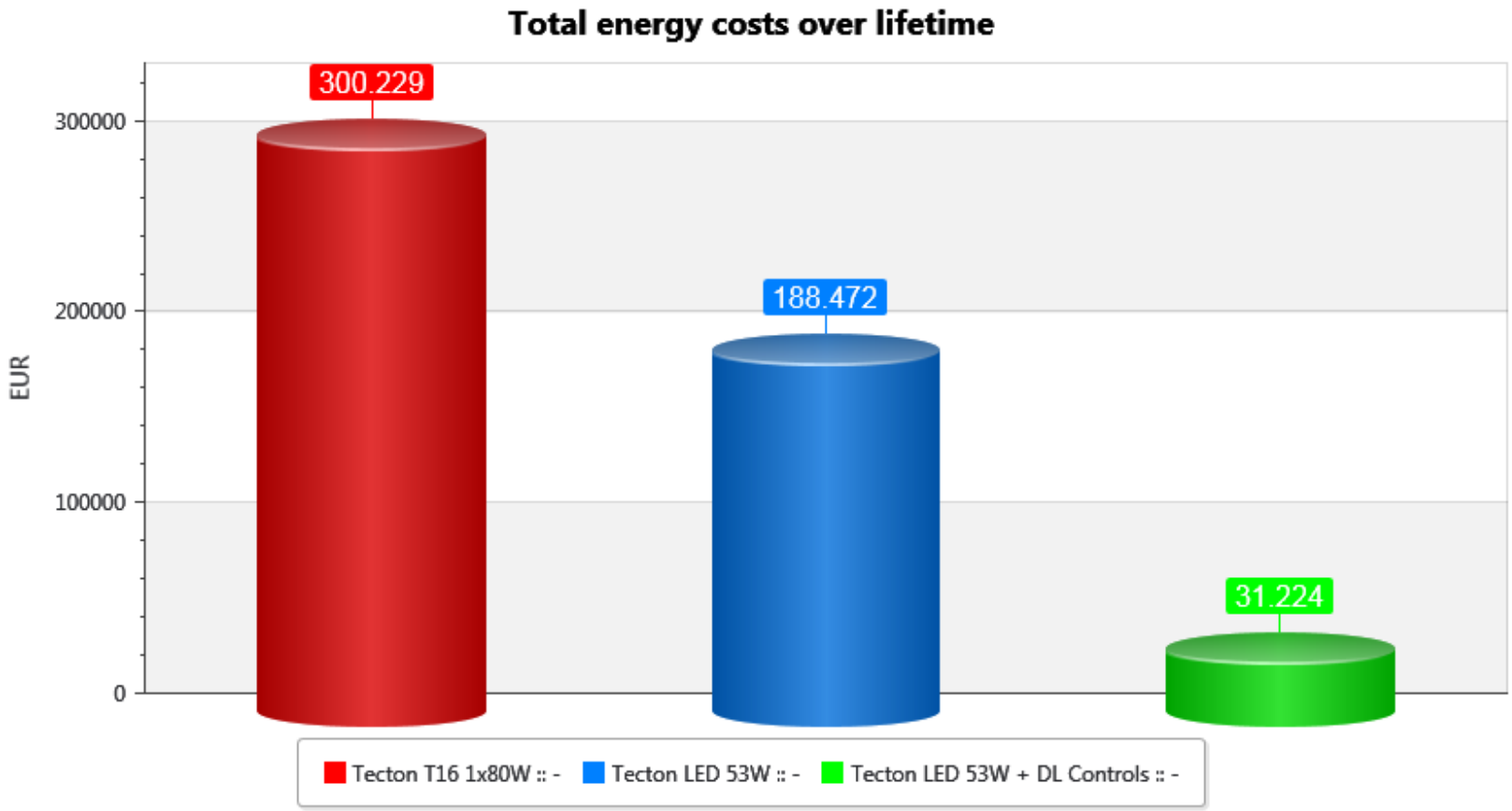
Economic conditions
Energy efficiency and cost

Calculation results



Economic conditions
Energy efficiency and cost

Calculation results



Economic conditions
Energy efficiency and cost

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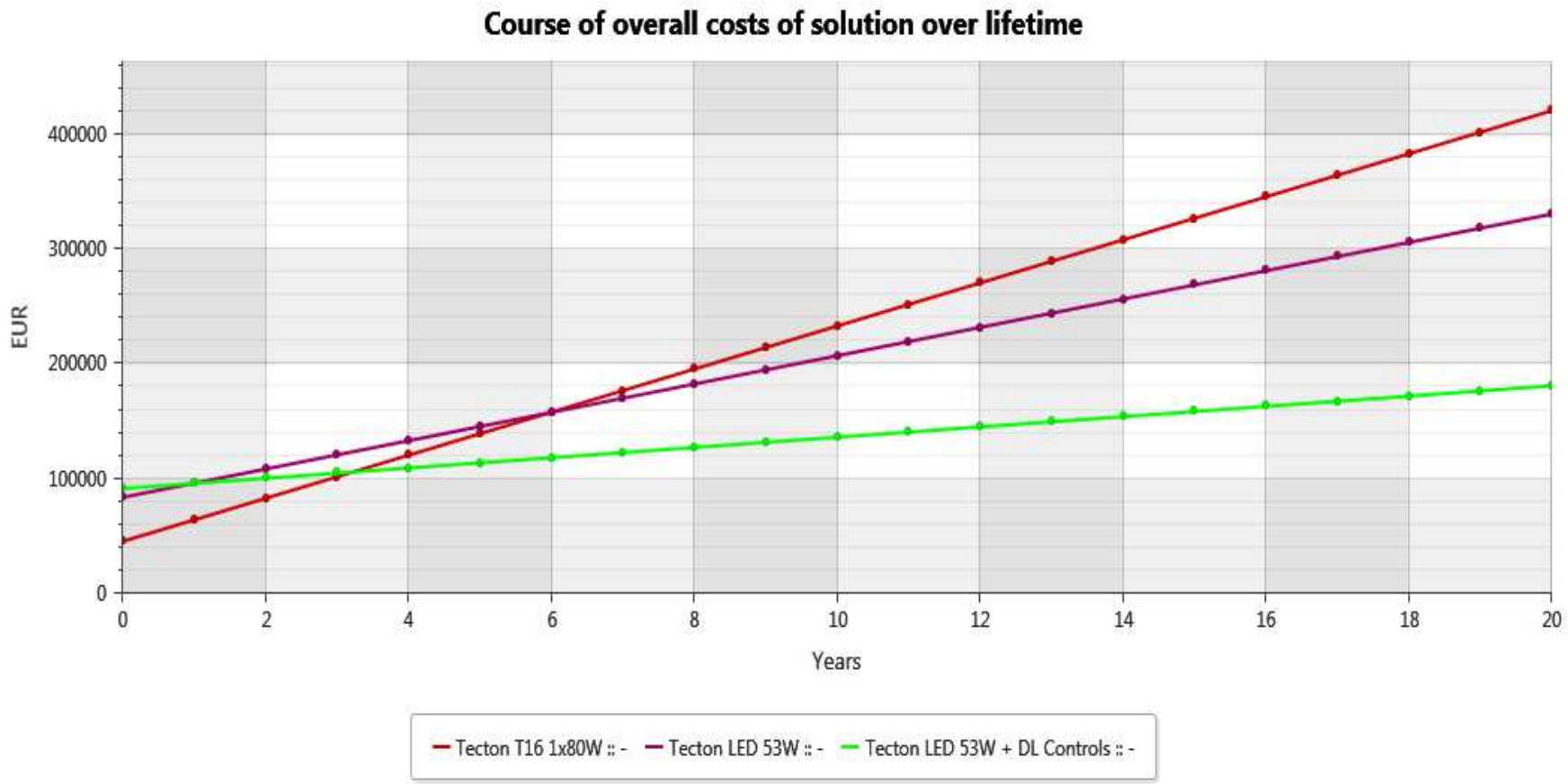
Calculation results



Economic conditions
Energy efficiency and cost

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Lifecircle

Case study: Lifecircle in industry application with 5000 burning hours / year

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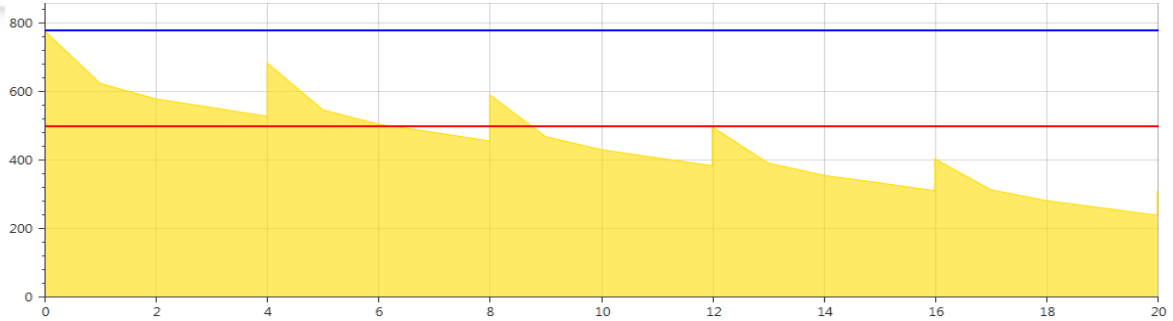
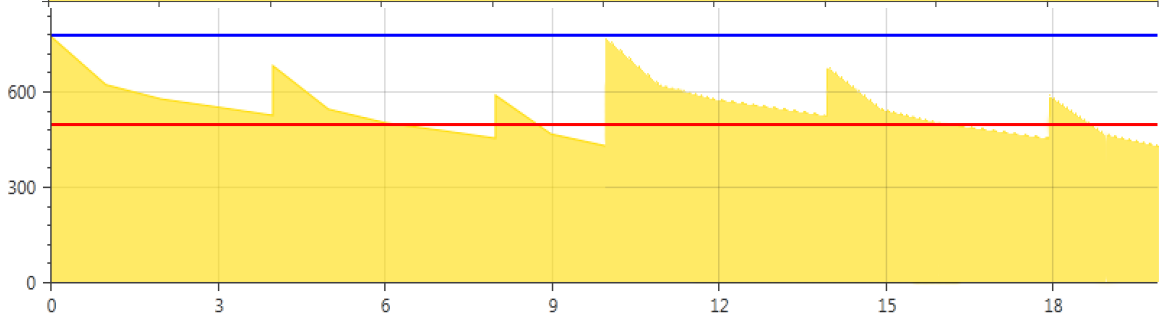
20 years; same number of LED lumiraires



Option: increasing numbers of LED luminaires

Option: replacement of LED luminaires after 11years



Case study: Lifecircle in industry application with 5000 burning hours / year

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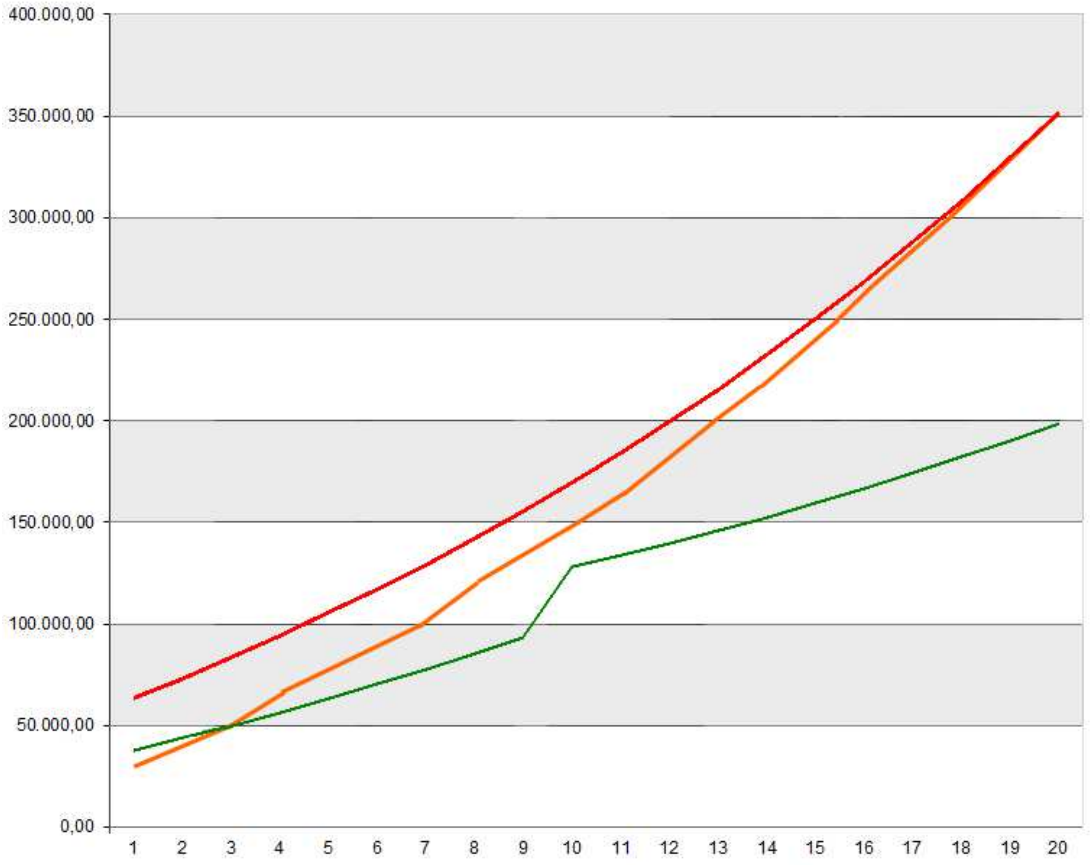
Valuea T16 6x80W, Aura Longlife Lampe

Graft LED L70/50.000h ➔ L40/100.000

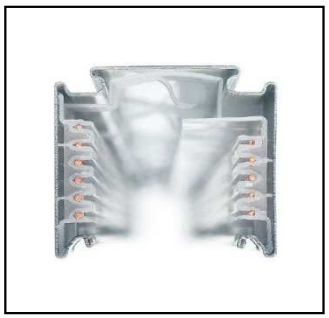
Increased number of luminaires

Graft LED L70/50.000h replacement after 10 years



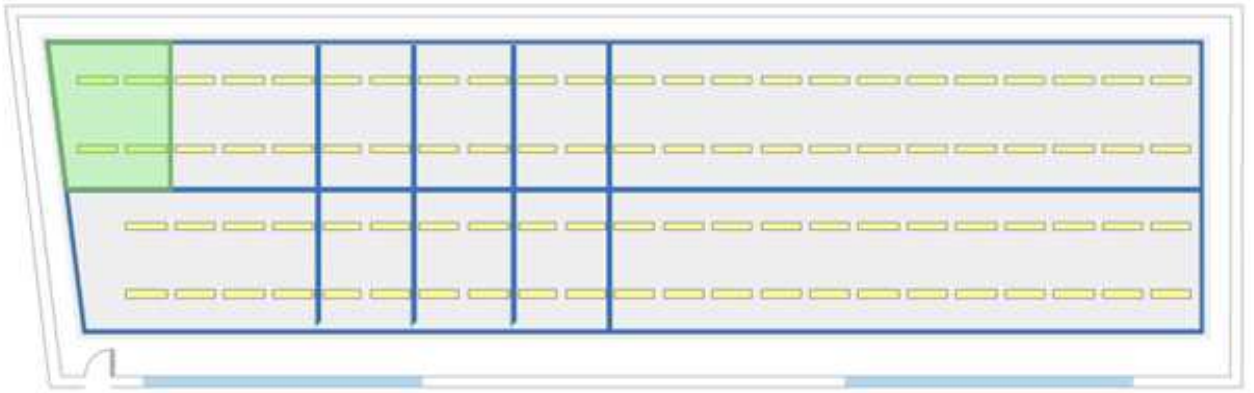
Flexibility by luminaire concept

Changing luminaire type, light distribution or adding emergency light componend by flexible track system



Flexibility by control concept

Creating independant Luxmate groups for future room setups requiering e.g. different fire zones



Luxmate groups (Logistic 300lx)

Storage 200lx

Flexibility by control concept

Possible future room setup

Luxmate groups
(Logistic 300lx)
Storage 200lx

Biological aspects

Improved light quality and daylight use during working hours have positive influence on health and well-being.


Exemplarily photograph

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Thank you for your attention!


Exemplarily photograph