Utilisation of daylight in offices

monitoring in a sample of ten buildings

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SUMMARY

The sun contributes in a significant amount to the reduction of the electricity consumption for artificial lighting but no data are available on the daylight utilisation on a national level in the Netherlands.

This paper reports measurements of daylight utilisation in a sample of ten office buildings. A new measurement technique is applied, which shows in a cost-effective way daylight utilisation, use of artificial lighting and the presence of occupants. In addition explaining variables are examined.

In a previous research, in which a monitoring protocol for daylight utilisation has been developed, for practical reasons the energy conservation by daylight is defined as the product of the timeperiod that artificial lighting is switched off while occupants are present and the installed power for lighting.

The main results of the sample are given in the table below, as percentage of operation time of the offices (working hours being standardised as 40 hours per week)

During working hours	lighting switched on	lighting switched off	Total
Present	45%	12%	57%
Absent	34%	9%	43%
Total	79%	21%	100%

During 12% of working hours daylight is utilised, that means: artificial lighting is switched off and occupants are present. There is some extra potential of daylight use during a part of the 45% of the time that occupants are present with lighting switched on.
According to a rough estimate the reduction of electricity use in office buildings amounts yearly 3% of the total electricity consumption, accounting for about 60 million kWh electricity in the Netherlands.
Daylight utilisation can potentially increase a further 20 to 25% up to about 35% of working hours, leading to an electricity conservation of about 6%.

During 34% of the working hours in which no occupants are present, artificial lighting is switched on. This shows an energy savings potential for occupancy detection being about the same as for daylight utilisation.

Occupants attitude towards artificial lighting is characterised by a short enquiry. This occupants attitude appears to explain a significant part of the utilisation of daylight. The hypothesis that also the amount of daylight and the control possibilities of daylight and artificial lighting will determine daylight utilisation, is not supported in this sample of ten buildings[1].

[1] A sample of some fifty buildings is needed to improve reliability to a appropriate confidence level

Next figure shows a measured profile of an “artificial lighting user”(= kunstlichtgebruiker) with an enquiry score of 0 and a “daylight user” (= daglichtgebruiker) with an enquiry score of 8. Scale from 0 to 10.

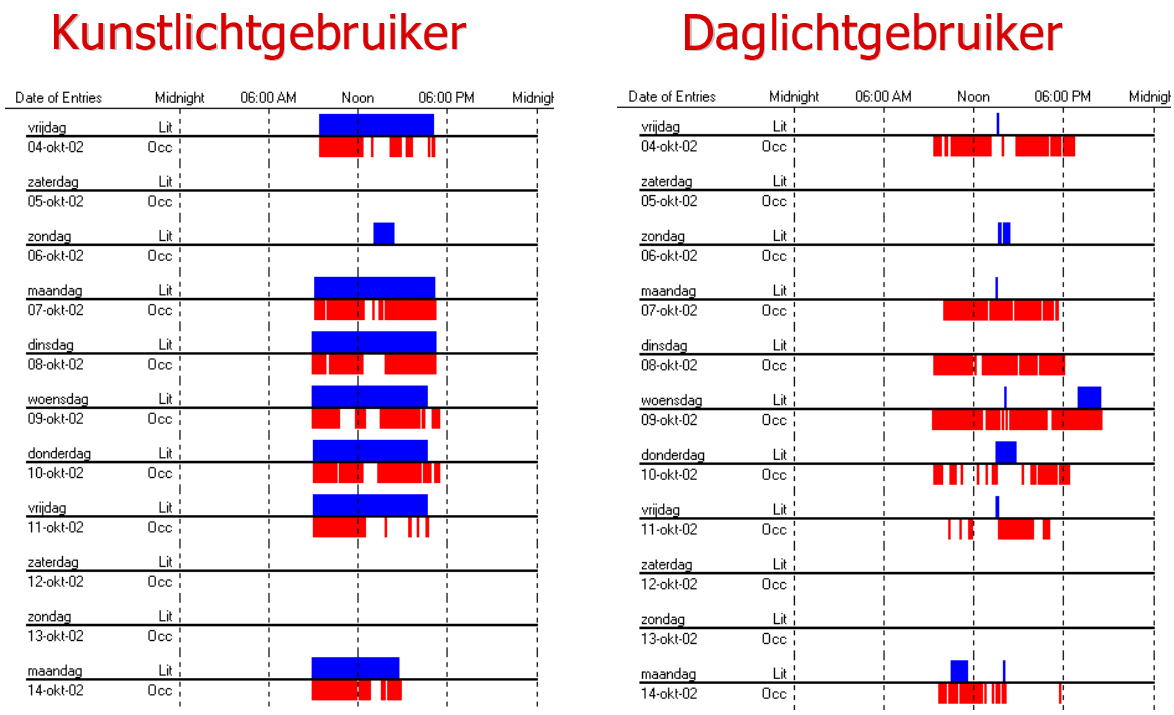

Figure 4.6 Characteristic profiles of “artificial lighting user” *and* “daylight user”
Same building, same period.
Blue: artificial lighting on
Red: occupant present