

UTJECAJ DNEVNE SVJETLOSTI I PRIRODNOG PROZRAČIVANJA U ENERGETSKI UČINKOVITIM ZGRADAMA

SMART URBAN MUNICIPALITIES/CITIES AND ENERGY EFFICIENT INDUSTRIES

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ZAGREB, 13.10.2017.



Održivo stanovanje

Planeta

Održivo stanovanje naša je strategija i odnos prema planeti.



United Nations



Proizvodi

...osiguravamo potrebne proizvode i rješenja.

Čovjek

...sve u cilju optimizacije čovjekova zdravlja uz što manji utjecaj na okoliš.

Zdravi domovi



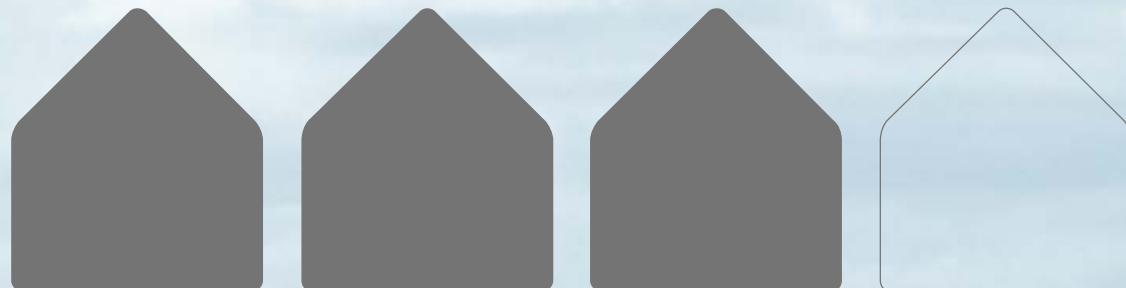
Kako smo se našli u tome?



VE = ventilacija
LUX = svjetlost



- ▶ VELUX grupa promovira održivo stanovanje
- ▶ Želimo optimizirati zdravlje čovjeka sa što manjim utjecajem na okoliš
- ▶ VELUX rješenja i koncepti su alati za postizanje održivog stanovanja
- ▶ Poboljšavaju unutarnju klimu, kvalitetu zraka i energetsku učinkovitost uz prirodno provjetravanje, dnevnu svjetlost i izolaciju
- ▶ Imamo 75 godina iskustva u tome!



3 od 4 zgrade u EU nisu energetski
učinkovite



Postotak renovacija je samo 1-2%

90
%

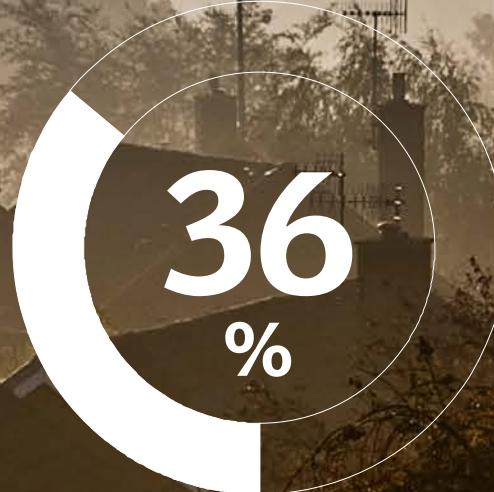
vremena provodimo u
zatvorenom



ENERGETSKA OBNOVA JE KLJUČ ZA POSTIZANJE CILJEVA PARIŠKOG SPORAZUMA



ukupne energije EU
troše zgrade



ukupno CO₂ emisija
EU proizvode
zgrade



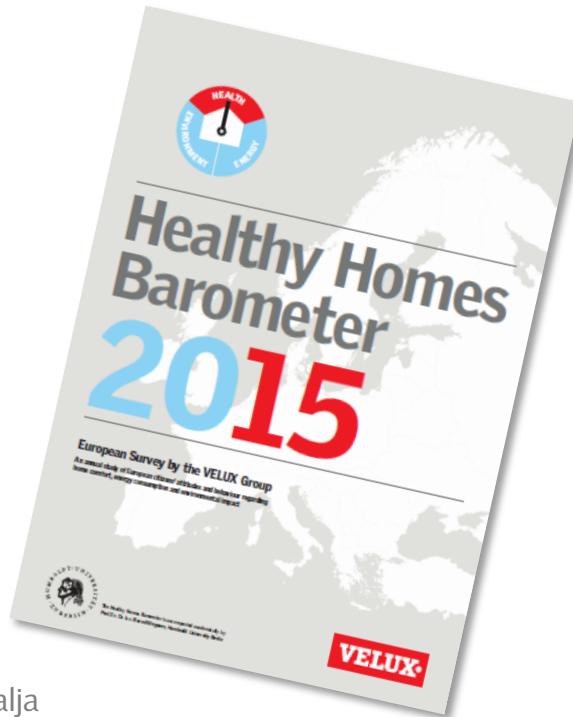
9/10 postojećih zgrada
u EU će se koristiti i
2050. godine

HEALTHY HOMES BAROMETER 2017

- Treća Pan-Europska studija koja istražuje poveznicu između domova i zdravlja
- Prvo istraživanje koje koristi detaljne statističke podatke Eurostat SILC i pokazuje korelaciju između zdravlja i stanja zgrade
- 250,000 odraslih (+16) i 100,000 kućanstava u svim zemljama EU članicama, osim Njemačke



HEALTHY HOME BAROMETER 2015



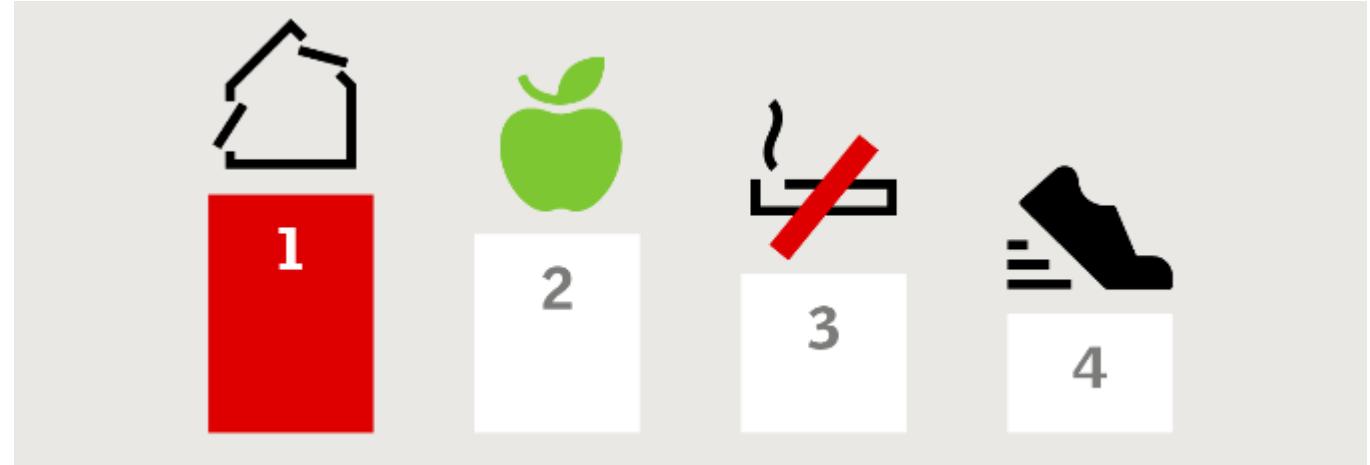
12 zemalja

12,000 ispitanika

Prof. Dr. Dr. h. c. Bernd Wegener, Humboldt University
Berlin

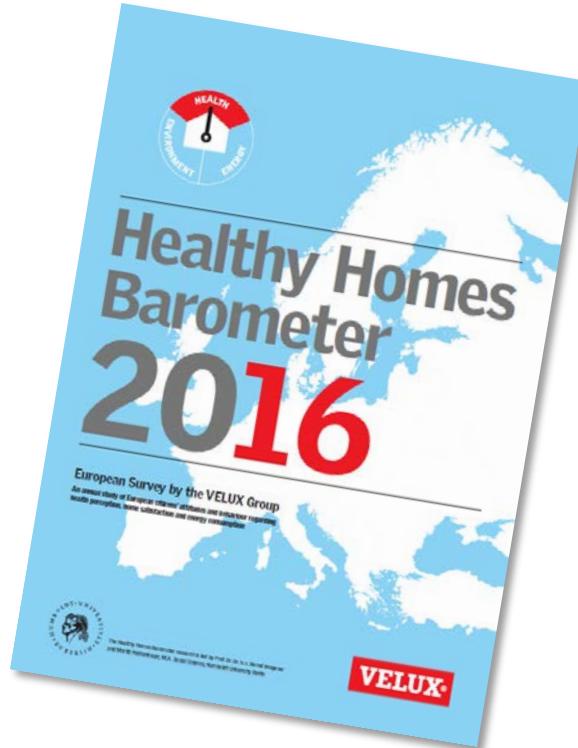
Operate A/S and Wilke

Zdrav život počinje kod kuće



- ▶ # 1 Dobar san
- ▶ # 2 Provjetravanje doma
- ▶ # 3 Zdrava prehrana (voće i povrće)
- ▶ # 4 Uvjeti dnevne svjetlosti
- ▶ # 5 Vrijeme provedeno vani
- ▶ # 6 Izbjegavanje pušenja
- ▶ # 7 Redovna tjelovježbe
- ▶ # 8 Izbjegavanje kemikalija
- ▶ # 9 Dodaci prehrani

HEALTHY HOME BAROMETER 2016



14,000 ispitanika

Prof. Dr. Dr. h. c. Bernd Wegener, Humboldt

University Berlin

Operate A/S and Wilke

5 karakteristika zdravog doma



Zadovoljavajući
uvjeti dnevne
svjetlosti



Svjež zrak



Dobri uvjeti
za spavanje

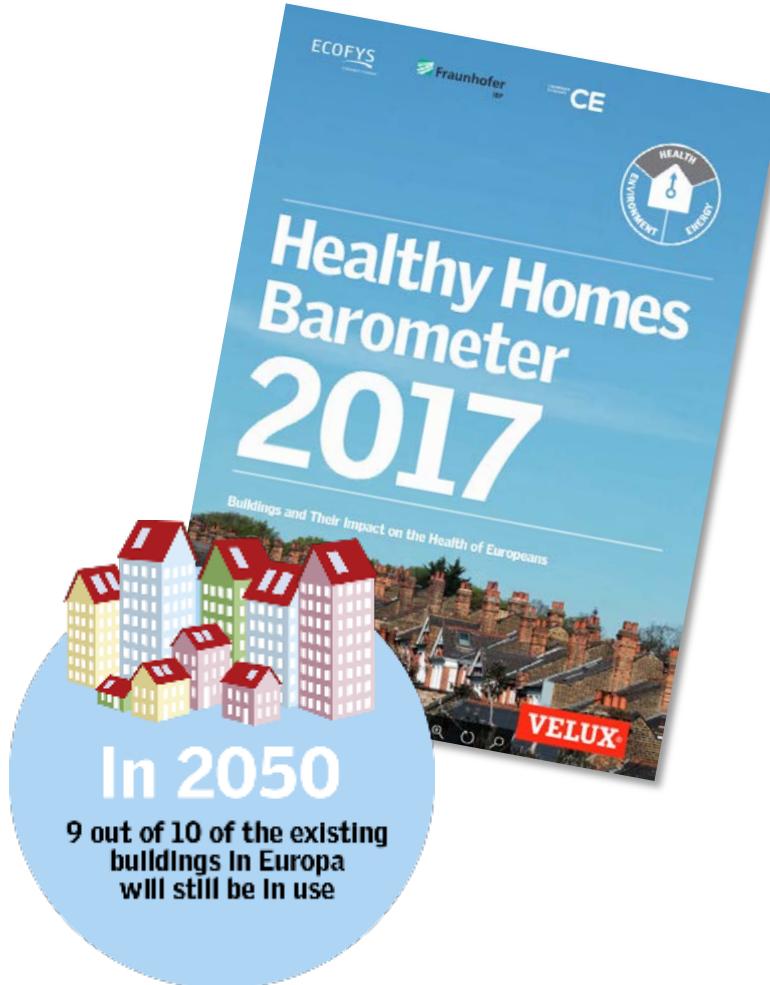


Ugodna
unutarnja
temperatura



Optimalni
uvjeti
vlažnosti

HEALTHY HOME BAROMETER 2017



31.5.2017

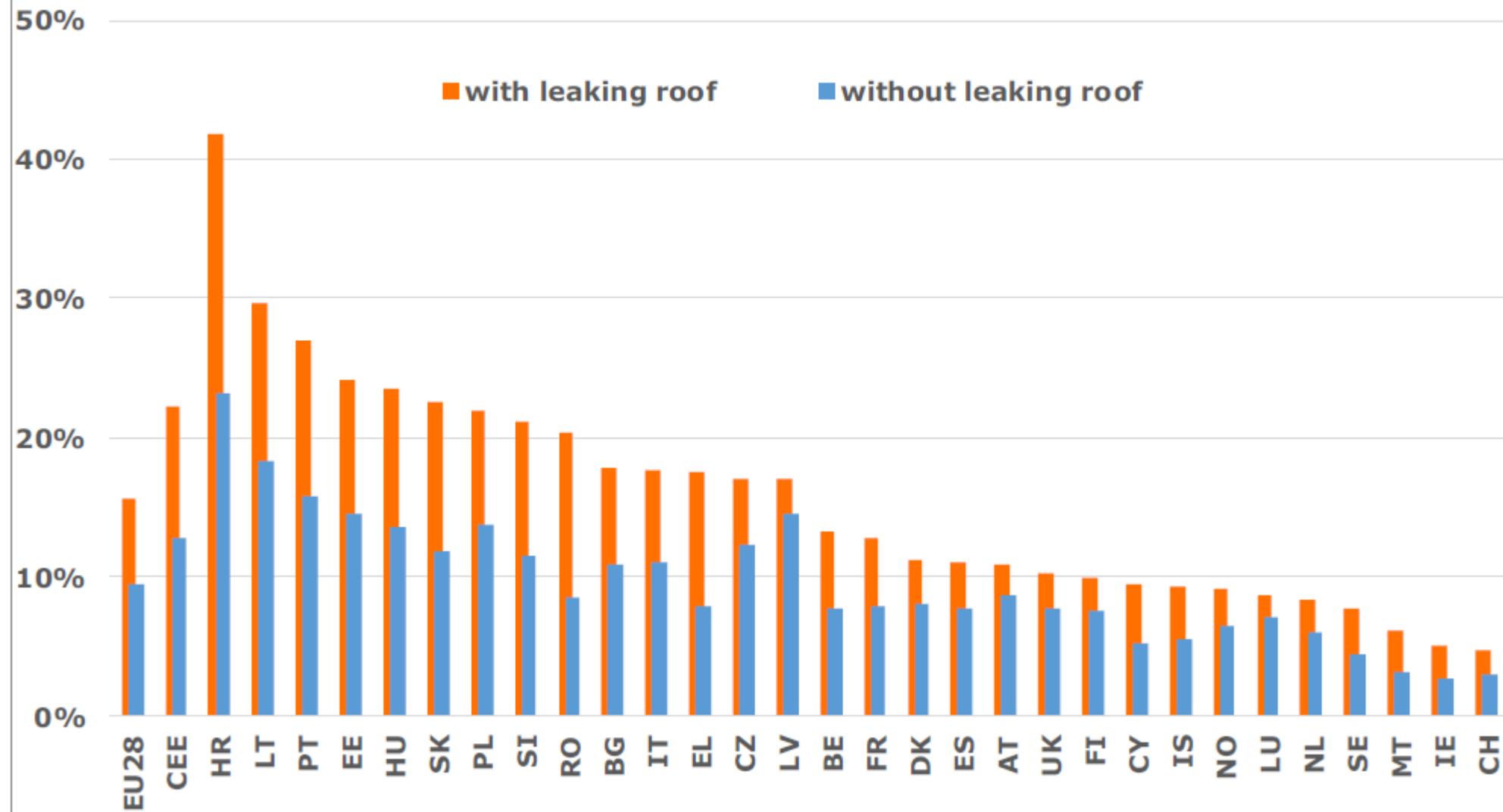
„**Barometer** pokazuje da poboljšanja u stambenom fondu kroz **obnovu** mogu imati značajan utjecaj na **zdravlje i dobrobit** korisnika zgrada”... „Obnova postojećeg stambenog fonda je **ključ uspjeha EU u postizanju klimatskih i energetskih ciljeva**“ Maroš Šefčovič, EU komisija

! The Healthy Homes Barometer 2017 podsjeća nas da zgrade imaju svrhu stvaranja zdrave okoline za korisnike. Ali, alarmantno je pročitati da jedan od šest europskih živi u nezdravoj zgradi.

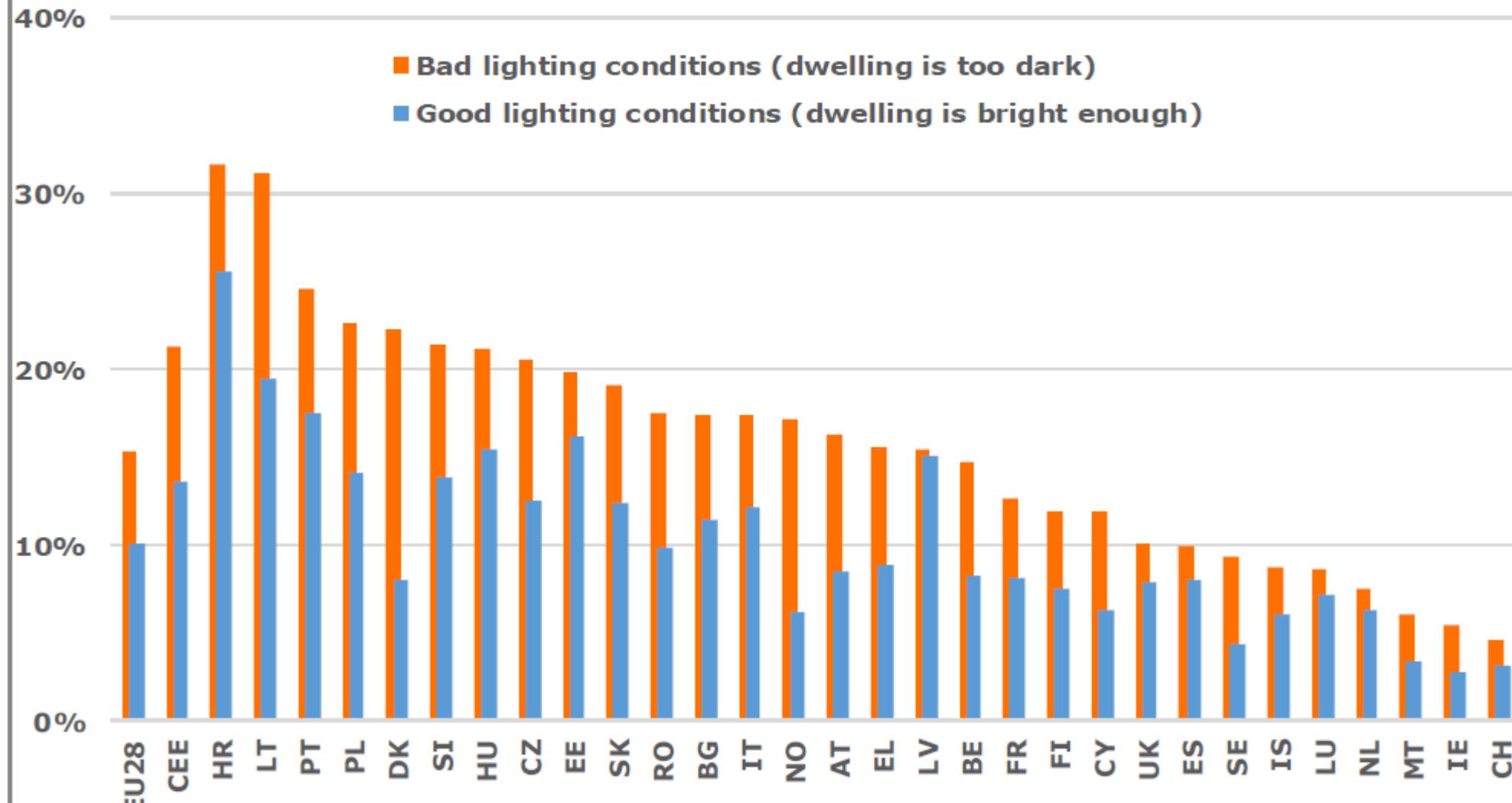
Maroš Šefčovič, podpredsjednik,
Energy Union
European Commission



Share of adults reporting "poor general health" in dwellings with or without leaking roof



Share of adults reporting "poor general health" in dwellings with good or bad lighting conditions

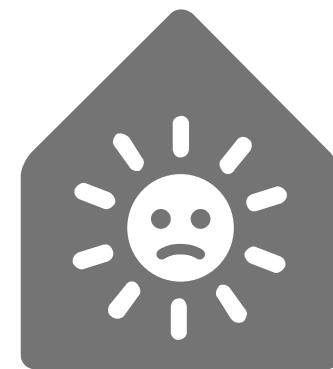


VJEROJATNOST DA ĆE EUROPLJANI KOJI ŽIVE U VLAŽNIM I TAMNIM ZGRADAMA IMATI LOŠE ZDRAVLJE JE DVOSTRUKO VEĆA



x1.7

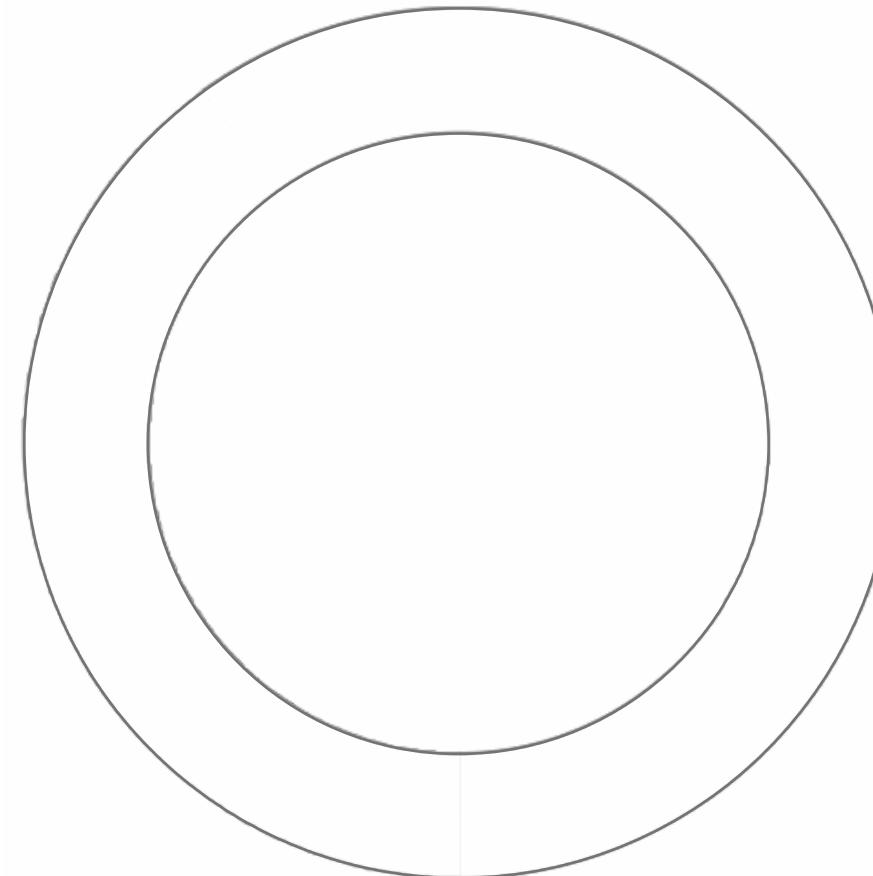
Gotovo dvostruko više Europljana ima loše zdravlje ako žive u vlažnom domu



x1.5

1½ puta više Europljana ima loše zdravlje ako žive u mračnom domu

40% JE VEĆA VJEROJATNOST OBOLJENJA OD
ASTME KADA EUROPLJANI ŽIVE U VLAŽNIM ILI
PLJESNIVIM ZGRADAMA

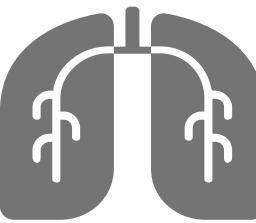


NEZDRAVE ZGRADE I NJIHOV TROŠAK ZA DRUŠTVO



€40 bn

Indirektni godišnji troškovi astme i kroničnih plućnih oboljenja, npr. izgubljena dobit radi smanjene učinkovitosti ¹⁶



€42 bn

Direktni godišnji troškovi liječenja astme i kroničnih plućnih bolesti, npr. lijekovi i briga



=
€82 bn

Ukupni godišnji troškovi za Europske zemlje povezan s astmom i kroničnim plućnim oboljenjima

VELUX®

Energetska obnova škole Endrup (Danska)



Zašto je unutarnja klima ključna komponenta u projektima modernizacije škola?

- Da bi se postigle značajne uštede energije
- Dobri uvjeti dnevne svjetlosti i kvalitetan zrak mogu smanjiti izostanke iz škole
- Unutarnja klima može pozitivno utjecati na učenje
- Bolji uvjeti za učenike i profesore koji rade u tom prostoru

Indoor Air Quality in European Schools

 There are currently **95,000,000 pupils** in Europe¹. As children **70%** spend around **70%** of their time indoors, a good learning environment is **crucial**.

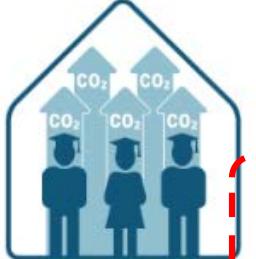
 **CO₂**

Recommended levels of CO₂

As classrooms are densely occupied spaces with a metabolic production of CO₂ by the occupants, the CO₂-concentration is directly dependent on the ventilation rate.

Recommended values lie between **1,000-2,000 ppm**. While levels below 1,000 ppm are considered as hygienically unproblematic, levels above 2,000 ppm are hygienically unacceptable².

CO₂ concentration in classrooms

Although there have been improvements to school buildings in recent years, many classrooms still don't provide an optimum indoor environment for learning.

Studies have reported that many schools have CO₂ levels above the recommended range of 1,000 to 2,000 ppm³.

Improved indoor air quality = Improved performance

An average increase in performance by 2.8%, and even 15% in specific cases⁴

Increased speed

Higher levels of attention and concentration

Lower rates of absenteeism

Increase in performance = economic growth



An increase of school children's performance by 2.8% would lead to a 6.7% - 9.5% increase in the conditional economic growth of the country (based on GDP per capita)^{4,5}.

How to improve the indoor air quality in classrooms



As most schools in Europe have been designed for natural ventilation, more time should be set aside for airing during lessons.



Innovative natural ventilation solutions, e.g. demand-controlled natural ventilation, can maintain the CO₂ level within the recommended range.



Mechanical ventilation systems can ensure an optimum level of air quality without compromising thermal comfort in colder months.



Hybrid solutions can combine the advantages of both natural and mechanical ventilation.

¹ Eurostat: Education Statistics, Distribution of pupils/ Students by level [educ_level], extracted on: 21.06.2015.

² Umweltbundesamt: Gesundheitliche Bewertung von Kohlendioxid in der Innenraumluft. In: Bundesgesundheitsblatt – Gesundheitsforschung – Gesundheitsschutz 51(11) (2008), p. 1358-1369.

³ Fraunhofer-Institut für Bauphysik IBP, Impact of the indoor environment on learning in schools in Europe, December 2015

⁴ The conditional growth calculation is based on the research of Hanushek, Eric A., and Ludger Woermann. 2007. "The Role of Education Quality in Economic Growth." Policy Research Working Paper 4122, World Bank, Washington, D.C. This was related to an increase by 2.8% in PISA test scores for maths and reading.

Infographic based on the following White Paper: Fraunhofer-Institut für Bauphysik IBP, *Impact of the indoor environment on learning in schools in Europe*, December 2015

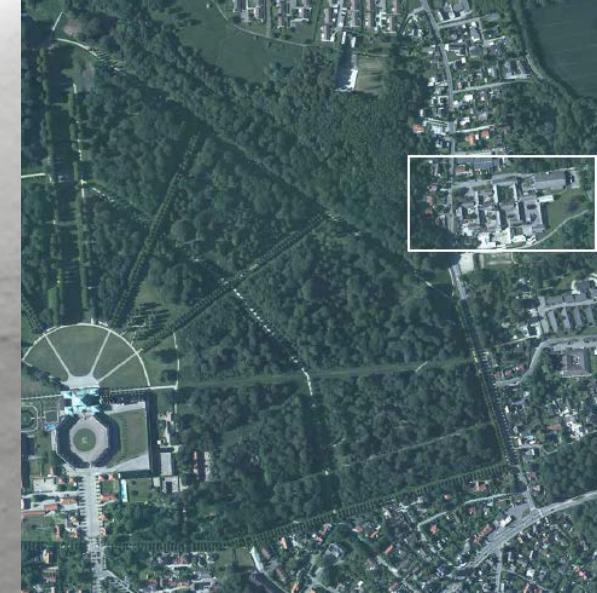
Škola Endrup (Danska)



Građena ranih 70-tih
7000 m² za 450 učenika i 52 nastavnika
Arh. Knud Jensen



Projektni zadatak: energetska obnova koja će osigurati ugodnu unutarnju klimu (bolju kvalitetu zraka, niže temperature u prostoru i više dnevne svjetlosti), te bolju energetsku učinkovitost



Izazov

Neproduktivne učionice

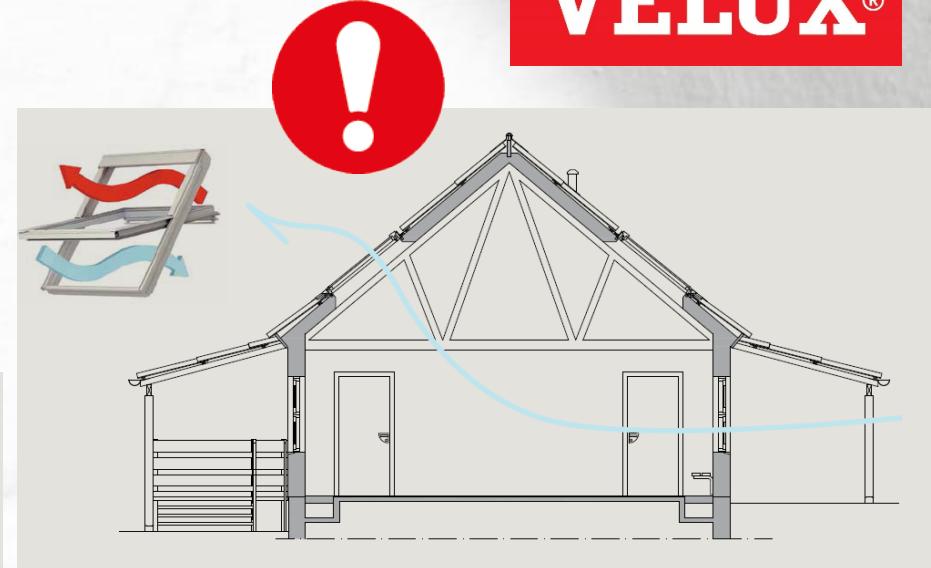
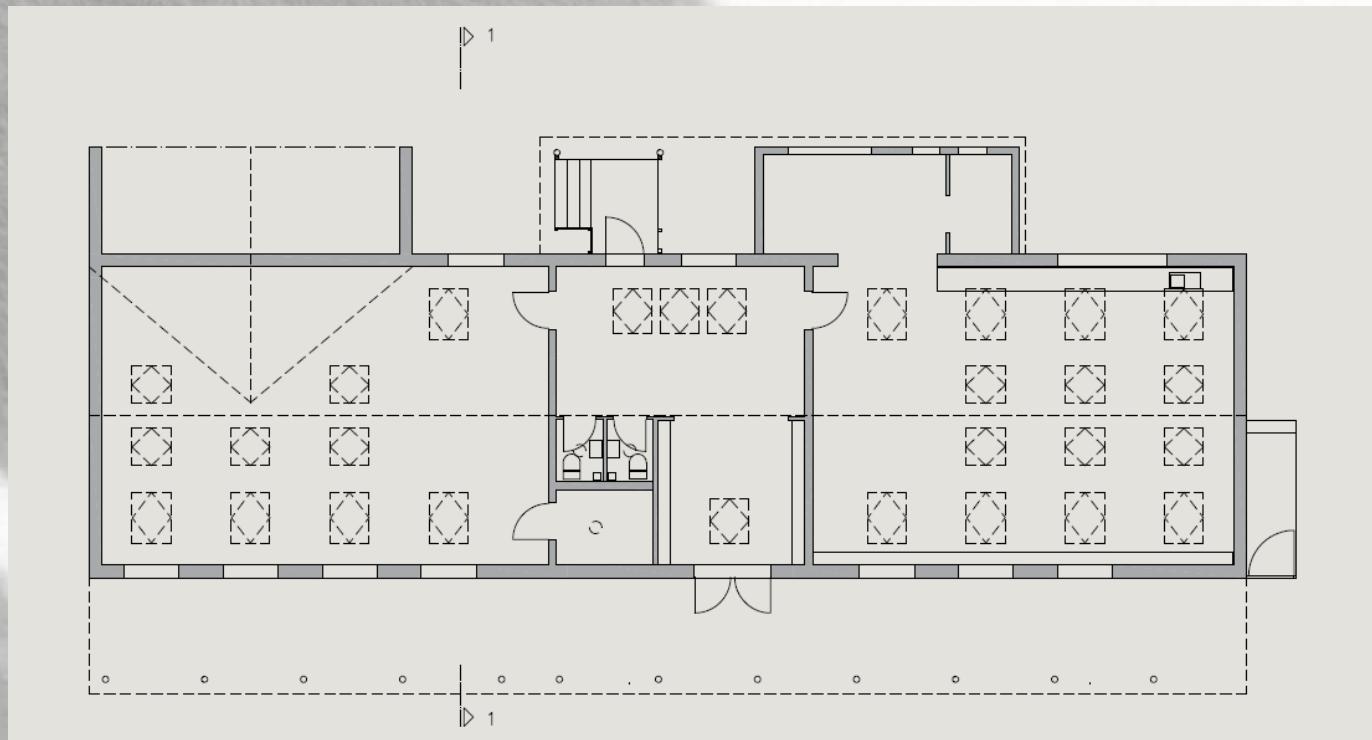


VELUX®



Rješenje

Svjetlost iz svjež zrak odozgora



Mjerenje razine CO₂

VELUX®

CO₂ < 1500 ppm



PROVJETRAVANJE NA ZAHTJEV

VELUX®

Ne obnovljeno

Room 25
All year

← Ručno upravljeni prozori

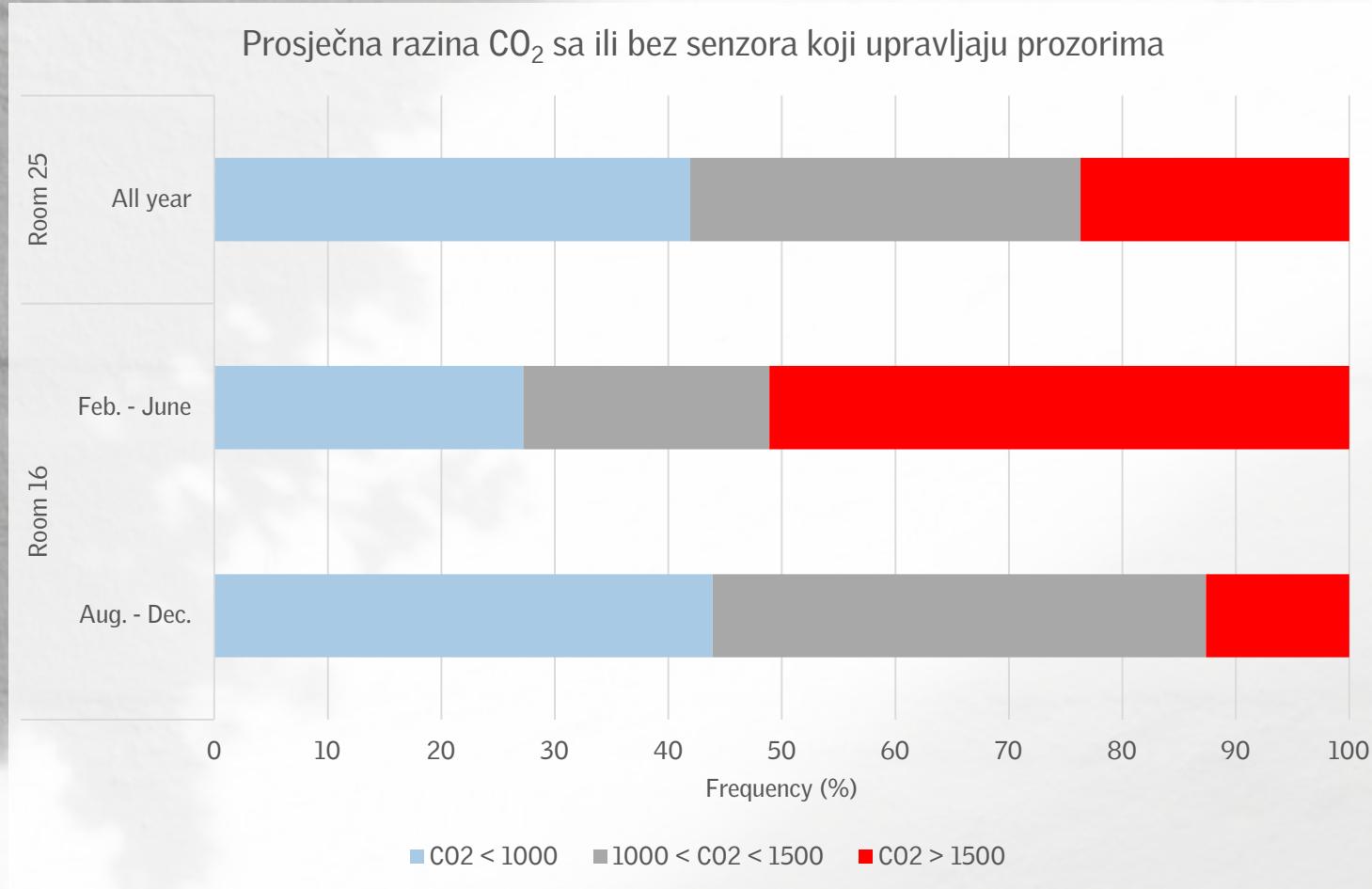
Obnovljeno

Room 16
Feb. - June

← Ručno upravljeni prozori

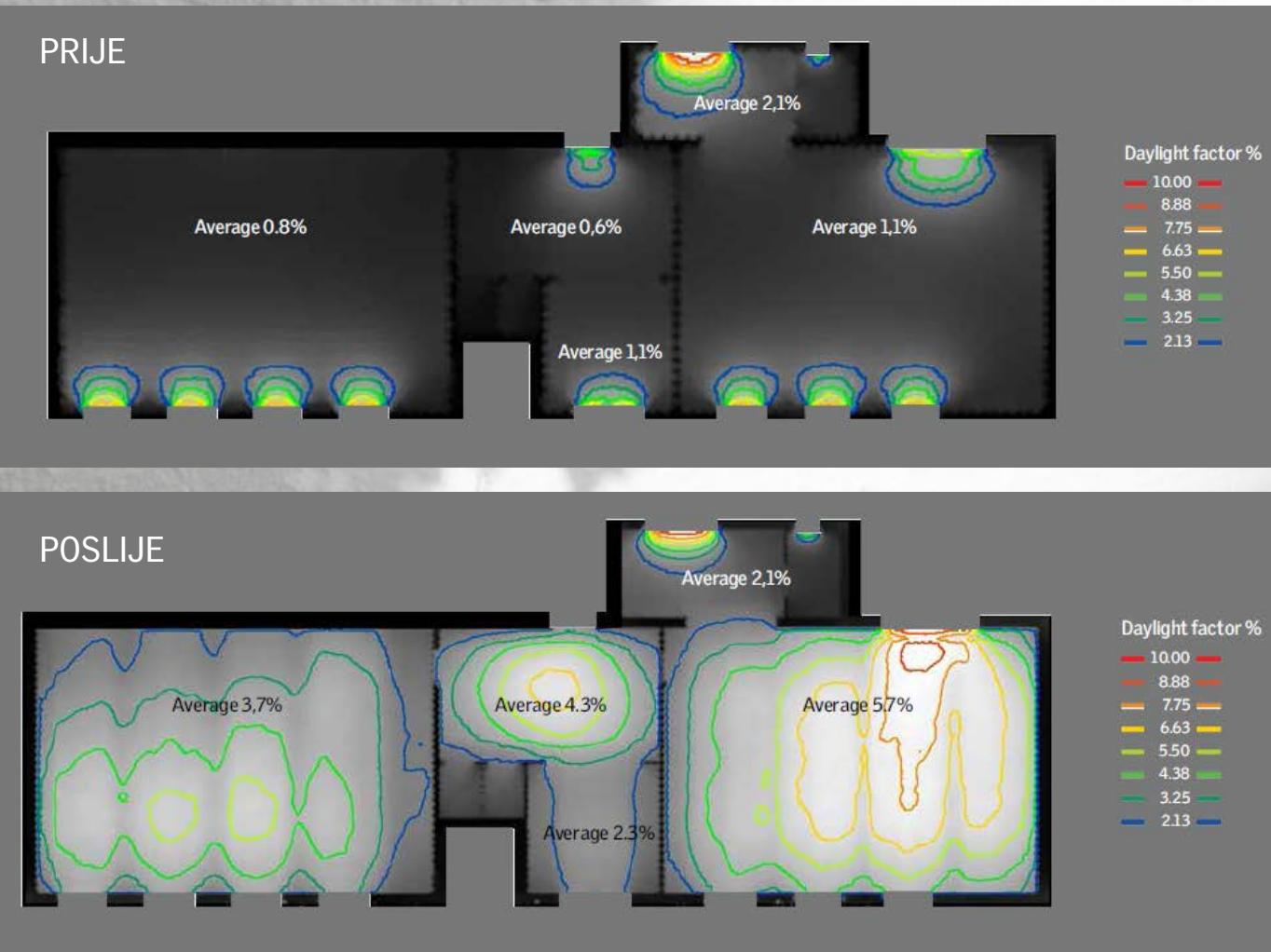
Aug. - Dec.

← CO₂ senzori za upravljanje prozorima



Provjetravanje na zahtjev smanjuje vrijeme previsoke razine CO₂ (iznad 1500 ppm) sa 51% na 13%

Analiza dnevne svjetlosti



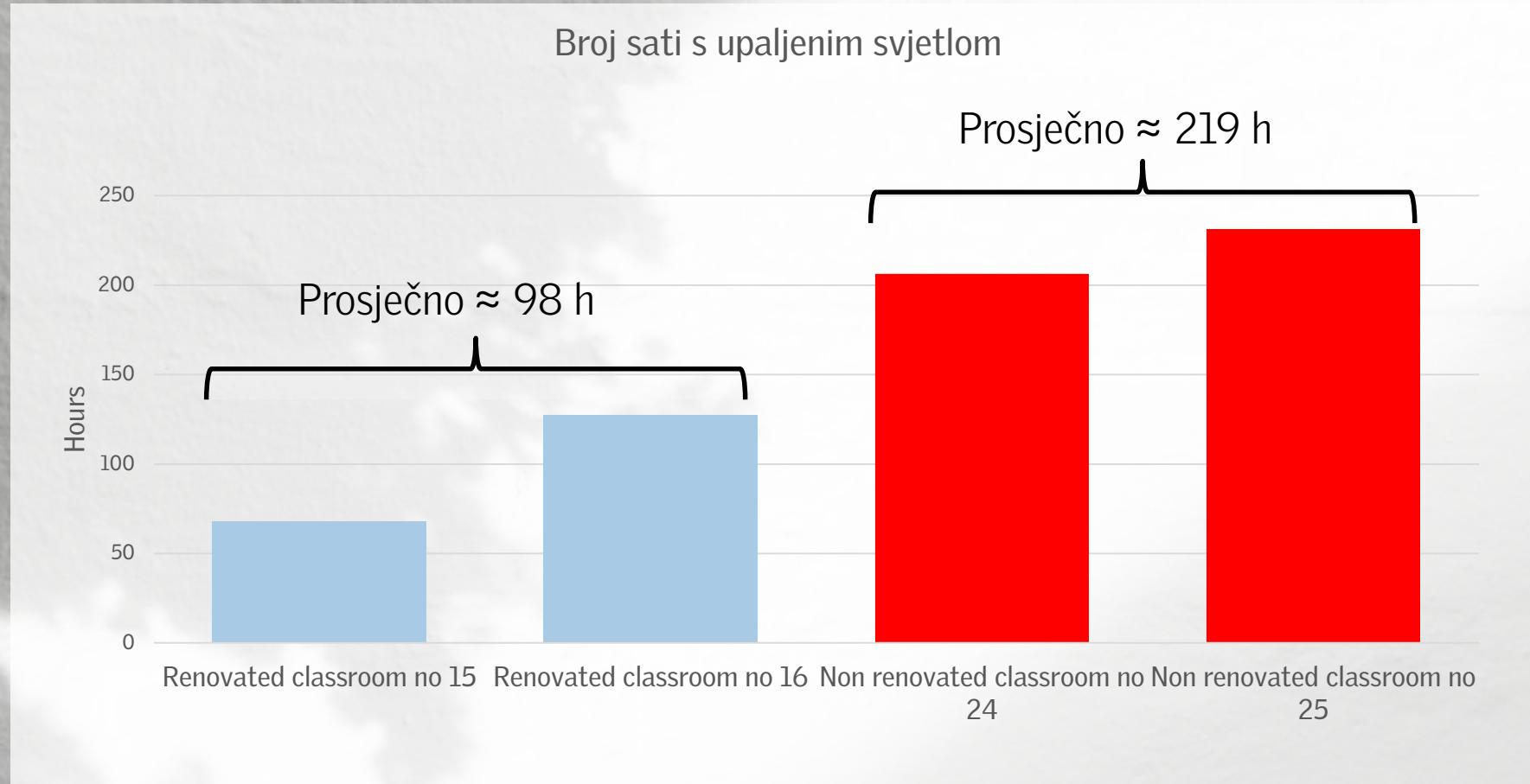
VELUX Daylight Visualizer
<http://viz.velux.com>

Daylight Factor >5%

$$D_T = \frac{E_{\text{Internal}}}{E_{\text{External}}} = \frac{300 \text{ lux} \cdot 100\%}{15\,700 \text{ lux}} = 1.9\%$$



DNEVNA SVJETLOST I KORIŠTENJE EL. RASVJETE

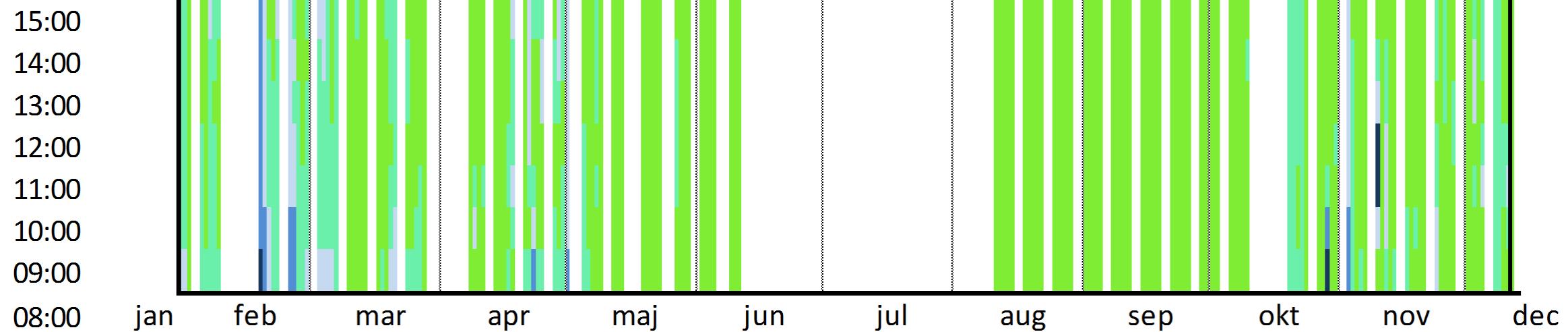


~ 20% vremena kada su učenici u
učionicama

~ 45% vremena kada su učenici
u učionicama

Moguća ušteda ≈ 55%

TERMALNA UDODNOST – OBNOVLJENA UČIONICA



	Hours	Percentage
Too High	0	0.0%
4 high	0	0.0%
3 high	0	0.0%
2 high	0	0.0%
1	844	73.5%
2 low	220	19.2%
3 low	63	5.5%
4 low	17	1.5%
Too low	4	0.3%
Weekends and holidays		

- Najveći dio školskih sati – kategorija 1 (najbolja)
- Nema pregrijavanja ljeti
- Sezona grijanja, temperature padaju ispod kategorije 1 (ukupno ~ 26% vremena)
 - 19% vremena temperature su između 20 i 21°C
 - 7% vremena su ispod 20°C

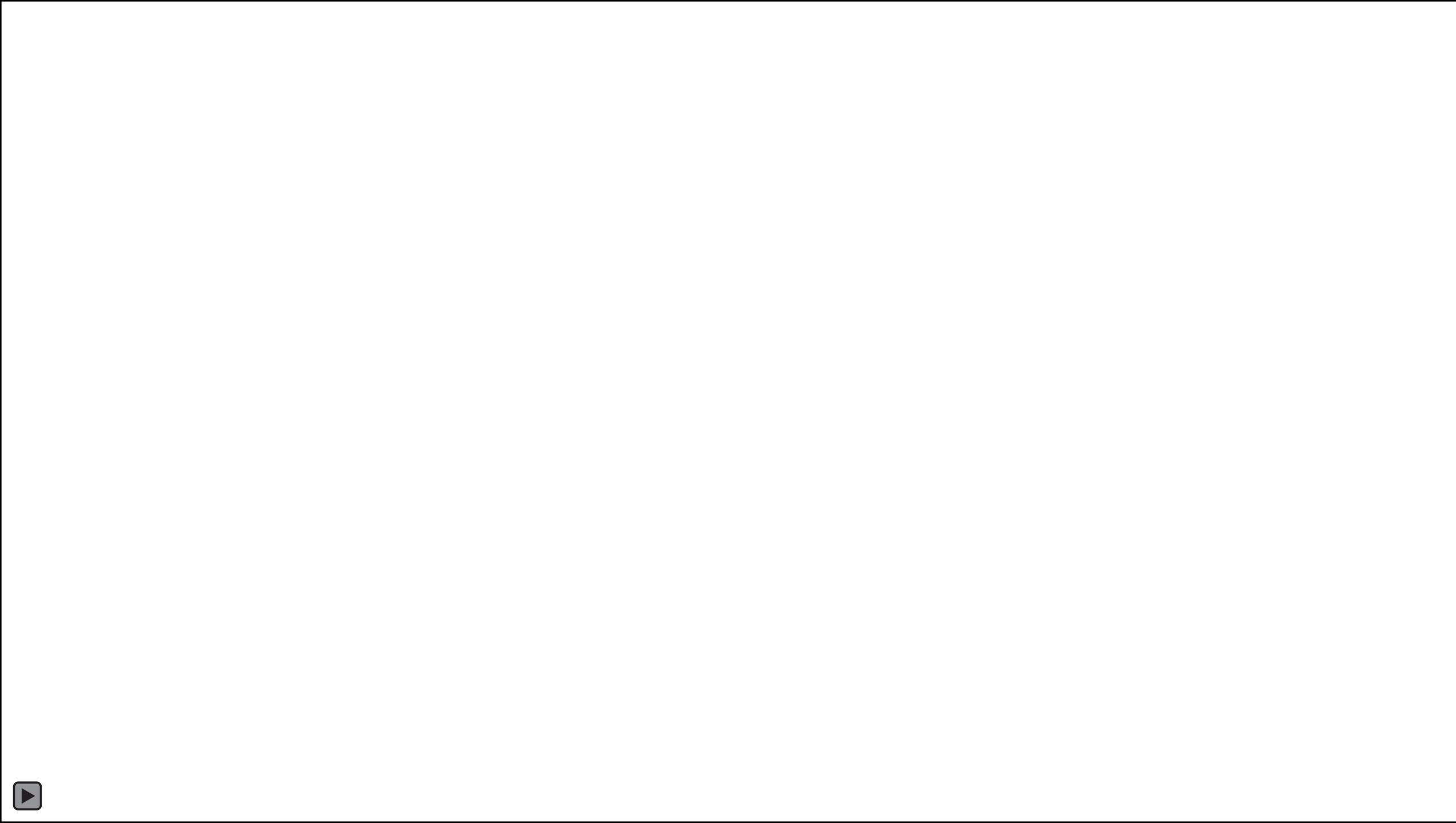


Ne gradimo da bismo uštedjeli energiju, bez obzira koliko je to plemenito i važno.

Gradimo da bismo korisnike zaštitali i osigurali im dobre uvjete za život, rad, učenje, igru i ozdravljenje.

Pawel Wargocki
Technical University of Denmark





VELUX®

Bringing light to life™

HVALA NA PAŽNJI!

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