HEALTHY INDOOR CLIMATE, DAYLIGHT AND
THE EUROPEAN HEALTHY HOMES BAROMETER

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HOW TO CREATE HOMES FOR THE INDOOR GENERATION?

of our time is spent indoor; our homes (2/3 of this time), at workplaces, schools, and other public spaces.

WHO Europe (2014)
PER 160 SEKUNDŽIŲ JŪS NUSPREŠITE, KAIP ŠI ISTORIJA BAIGSIS
Our definition of a healthy home relies on knowledge, inherited from the Active House concept.

The vision of Active House is to create buildings that offer better comfort and healthier indoor conditions without impacting negatively on the climate.
Healthy light is linked to healthy darkness at night.

The environment in the bedroom has a huge impact on our health and wellbeing.

The environment can positively influence productivity and well-being.

Human well-being relies on regular exposure to light and dark each day.

The daily light dose received might be too low.

Our biology responds to light intensity, duration, timing, and spectrum.

In 2004, CIE promulgate five “principles of healthy lighting” (CIE, 2004/2009), and the same report also suggested that these principles should lead to a renewed emphasis on architectural daylighting.
@ HOME
Natural light is the single most important attribute in a home, with over 60% of respondents ranking it as important\(^1\).

WHO’s report that residents with inadequate natural light in their homes have greater risk for depression and falls\(^2\).

Higher daytime light exposures result in more positive mood, less pain and smoother social interactions\(^3\).

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\(^1\) The Way We Live Now, RIBA and Ipsos MORI, 2012


\(^3\) Veitch, J. A. & Galasiu, A.D. The Physiological and Psychological Effects of Windows, Daylight and View at Home: Review and Research Agenda, 2012
1st & 2nd Healthy Homes Barometer (2015/16) was a questionnaire-based survey and 12-14,000 Europeans replied. It ensures statistical representation, and represents more than 430 million Europeans.

3rd & 4th Healthy Homes Barometer (2017/18) use Eurostat SILC database (Survey on Income and Living Conditions) to show the correlation between the health of an inhabitant and the building’s state. It is based on 250,000 adults (+16) and 100,000 households across all EU Member States.
**REAL LIFE STATUS**

What we want

- 61% of all Europeans rank daylight and fresh air as the most or second most important in relation to their health.

How it is

- 76% of the Europeans report that they need to turn on the light during the day when it is daylight outside.

- 20% of the Europeans say that they are too dependent on artificial light during the day.

- ... but 80% of all Europeans express above average satisfaction with the amount of daylight in their current home.
What we want

- 61% of all Europeans rank daylight and fresh air as the most or second most important in relation to their health.
- People living in households suffering from asthma or allergies are only marginally more concerned about living in a building with unhealthy indoor air quality.

How it is

- About 75% of the Europeans report that opening the windows is part of their daily routine and to let out unhealthy air.

- Only 28% air out more than once a day in the winter, but 68% air out more than once a day in the summer.

- ...78% Europeans are very satisfied or satisfied with the air quality in their current home.
• HHB 15 found that sleeping well at night is rated highest.

• HHB 16 showed that the Europeans whose home allows for a good night’s sleep are 50% more likely to feel they have good health

• A total of 77% of Europeans do not have optimal sleeping conditions in their home (e.g. darkness, ‘cool’ bedroom, good IAQ)

• One out three (36%) report the quality of their sleep within the last four weeks as either very bad or fairly bad

Pittsburgh Sleep Quality Index (PSQI)
HOW TO CREATE A ‘HEALTHY’ HOME

Five steps to a healthy home

- Ensure good sleeping conditions; 72% of Europeans do not air out their bedrooms before going to sleep
- Strive for comfortable indoor temperatures; 37% of Europeans value low energy costs over comfortable indoor temperatures
- Let in fresh air: 59% of Europeans air out their homes less than the recommended two times a day (WHO Europe, 2009)
- Let in daylight: 76% of Europeans compensate for insufficient access to daylight by turning on artificial light
- Avoid humidity: 49% of Europeans do not place priority on avoiding too much humidity
The Healthy Homes Barometer 2017 is the first report to use detailed statistical data from Eurostat SILC (Survey on Income and Living Conditions) to show the correlation between the health of an inhabitant and the building’s state.

This year’s study continues to further demonstrate just how important our suburban areas are to achieve a healthier building stock, as well as also offices and buildings where we spend our working days.
THE HEALTHY HOMES BAROMETER 2017
URBAN AND SUBURBAN LIVING
Opportunities and quality of life

In Europe, suburban populations grew on average 54% more than urban populations between 1961 and 2011, with people looking to enjoy the relative space and comfort of single-family homes. Yet, when it comes to unhealthy buildings, these suburbs are in danger of being overlooked.
URBANISATION: A GLOBAL PHENOMENON

Cities around the world continue to grow. In 2016, an estimated 55% of the world’s population lived in urban settlements. By 2050, more than two-thirds of the world’s population will be living in cities.

United Nations Habitat: https://unhabitat.org
SUBURBANISATION: A EUROPEAN DREAM

Urbanisation is a well-known phenomenon, but in most of Europe, suburban growth actually outpaced urban growth by 54% between 1961 and 2011.

Urban growth - 23%
Suburban growth - 122%

Urban growth - 30%
Suburban growth - 13%
PEOPLE ARE MOVING FROM THE CITIES TO THE SUBURBS DUE TO ISSUES AROUND...

- Cost of housing per square metre is on average 42% higher in urban than in suburban areas.

- 48% more people report having problems related to outdoor pollution in urban areas as compared with suburban areas.

- 33% more people report shortage of space in urban vs suburban areas, and lack of space is a major cause of dissatisfaction with a person's dwelling.

- 39% more people report having problems related to noise in urban areas as compared with suburban areas.
ACCORDING TO EU SILC DATA, THE DESCRIPTION OF UNHEALTHY BUILDINGS IS BASED ON

- **Keep dwelling warm**: 26%
- **Dampness / Leaking roof**: 30%
- **Overheating problems**: 20%
- **Lack of daylight**: 31%

Residence in Europe who reports living in unhealthy buildings, i.e. buildings that have damp (leaking roof or damp floor, walls or foundation), lack of daylight, ‘inadequate’ heating during the winter or overheating problems, report poor health.
SINGLE-FAMILY HOMES ARE KEY TO ADDRESSING HEALTH 

In all cases, single-family homes (SFHs) with deficiencies are more likely to have a negative impact on health than multi-family homes (MFHs).

- Dampness: Single family homes (SFHs) have dampness 1.8x more likely compared to multi-family homes (MFHs), with LT 1.9x / LV 1.4x more likely.
- Darkness: MFHs have darkness 1.6x more likely than SFHs, with LT 1.6x / LV 1.2x more likely.
- Overheating: SFHs have overheating 1.6x more likely than MFHs, with LT 1.0x / LV 1.4x more likely.
- Cold: MFHs have cold 2.0x more likely than SFHs, with LT 1.9x / LV 1.9x more likely.

The ratios indicate a higher risk for health impacts in single-family homes due to dampness, darkness, overheating, and cold conditions.
The most damaging deficiency from a health perspective is having a home that is too cold in winter, which, if you live in a single-family home, means you are twice as likely to report poor health.

Twice as many Europeans report poor health
Twice as many Europeans report lack of daylight
Almost three times as many Europeans report dampness
Should we focus on the existing building stock which are unhealthy and start making healthy buildings?

- About 1/6 Latvians live in unhealthy buildings
- More than 1/4 Lithuanians live in unhealthy buildings

1/6 Europeans live in unhealthy buildings
PRIVATE HOMEOWNERS ARE KEY TO INCREASE RENOVATION RATE

110 million
is the number of single-family homes in Europe
- 500,000 in Lithuania
- 270,000 in Latvia

84%
of single-family homes are privately owned
- 95% in Lithuania
- 90% in Latvia
OLD RESIDENTIAL STOCK

In most EU countries, about two thirds of the residential stock was built before the first European thermal building regulations came into effect (i.e. before 1979). And, only 10% of current buildings have A or B class energy performance certificates.
THE RENOVATION CHALLENGE

Overcoming barriers

Renovations can be challenging at the best of times. In order to increase the renovation rate we must address the most common barriers faced by homeowners, while shaping effective policies.

Only 1-2% of the building stock is renovated each year

3 out of 4 European buildings are not energy efficient
BARRIERS TO RENOVATION

If we are to increase the renovation rate, we need to work to address these barriers.

- **Information failures**: lack of available and understandable information regarding the efficiency and comfort benefits resulting from renovation.
- **Split incentives**: especially in rented accommodation, tenants are unlikely to renovate because their incentive is time-limited; landlords are unlikely to renovate because they do not see themselves as immediate beneficiaries of the investment.
- **High transaction costs**: in smaller renovations, the costs involved in initiating the project and finding suitable contractors can be disproportionately large.
- **Capital market failures**: especially in light of the 2008 financial crisis, lenders are less active in facilitating this type of investment, and there is a lack of available information about financing.

SOCIAL AND AFFORDABLE HOUSING
Renovating for life

People with lower available income are more likely to be tenants than homeowners, or to live in social or municipal accommodation. Strategies that catalyse renovation in this sector are a win-win, with huge potential benefits for societies and individuals.
LEVELS OF SOCIAL HOUSING VARY HUGELY ACROSS DIFFERENT EUROPEAN COUNTRIES

% of population living in rented social, municipal, or non-profit housing

European Foundation for the Improvement of Living and Working Conditions
RENOVACTIVE: A CASE STUDY IN BUDGET-FOCUSED RENOVATION

- Improved health: residents state that they have better sleep quality, fewer sick days, and less need for medication.
- Indoor air quality, with controlled natural ventilation, is high – CO2 levels in all the main rooms remain below 1,150 ppm.
- No overheating in summer: indoor temperatures are usually below 26°C in all main rooms.
LOW DAYLIGHT PROVISION ACROSS EUROPE

- About 6% of all European households report living in a dark home
- And when the household is dark, they are 52% more likely to report poor health when compared to households not living in a dark home.

The proposal for a European Daylight Standard could bring a 'brighter' future and ensure that our homes have better daylight conditions.
@ WORK, LEARNING ...
Research has identified benefits of daylight and sunlight as well as view for worker health and well-being.

People believe that working under natural daylight is better for health and well-being\(^1\) than electric light.

Working in environments with natural elements are reported to increase level of well-being, productivity and creativity\(^2\).

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WORKPLACE PRODUCTIVITY

Mental Function & Memory
10-25% BETTER

Call Processing
6-12% FASTER

Hospital Stays
8.5% SHORTER

OUTSIDE VIEWS

DAYLIGHT

Students achieve
5-14% HIGHER TEST SCORES
and learn
20-26% FASTER

Workers are
18% MORE PRODUCTIVE

15-40% INCREASE in Retail Sales

SYSTEMS

Productivity Increases by
23% from better lighting
11% from better ventilation
3% from individual temperature control

People in industrialized countries might not be receiving sufficient daily light exposure to maintain optimal health (CIE, 2004)

Necessary daily light dose is not known and the describing optimal pattern of light exposure is in its early stages.

The implications for daylighting, architecture, and lighting design are unknown.
Light for the visual system is different than light for the circadian system.

≈ 80% of the neural fibers transmit signals to the visual cortex for vision.

≈ 20% of the neural fibers send their signals to other areas of the body and brain.
VISUAL AND NON-VISUAL EFFECTS

Each factor has a different effect visual and circadian system

**Intensity:** Most people are able to read and work with a daily light level of 500 lux, but one hour’s exposure to 500 lux may not be enough to trigger the circadian rhythm.

**Duration:** The visual system reacts to and processes light impulses in a fraction of a second, whilst the biological clock needs minutes or hours.

**Spectrum:** The light for our circadian rhythm is different than the for visual system.

**Timing:** Morning light entrain our biological clock. The visual system reacts identically whatever the time of day.
CEN Daylight Standard (EN 17037)

Daylight

View

Sunlight

Glare

Applies to all spaces (e.g. workplaces and dwellings)
CEN Daylight Standard (EN 17037)

Introduction, Scope, Terms and definitions, Symbols

Section 5 Assessment of Daylight in Interior Spaces
- Daylight provision
- View out
- Sunlight
- Glare
  - Criteria
  - Verification

Annex A : Recommendations

Annex B : Daylight
Annex C : View out
Annex D : Exposure to sunlight
Annex E : Glare

Annex D : Exposure to sunlight
The target Daylight Factor ($D_T$) is based on internal illuminance of 300 lux and the external diffuse horizontal illuminance at the location of interest.

Daylight design should achieve a target daylight factor ($D_T$) across a fraction of the relevant floor area (i.e. 50% vertical) and the minimum target daylight factor ($D_{TM}$) should be achieved across 95% of the area.

\[
D_T = \frac{\text{Internal}}{\text{External}} = \frac{300 \cdot 100}{13.600} = 2.2\%
\]

\[
D_{TM} = \frac{\text{Internal}}{\text{External}} = \frac{100 \cdot 100}{13.600} = 0.7\%
\]

<table>
<thead>
<tr>
<th>City</th>
<th>Internal lux</th>
<th>External lux</th>
<th>$D_T$ %</th>
<th>$D_{TM}$ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tallinn</td>
<td>300</td>
<td>13.600</td>
<td>2.2%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Paris</td>
<td>300</td>
<td>15.900</td>
<td>1.9%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Rome</td>
<td>300</td>
<td>19.200</td>
<td>1.6%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>
Daylight factor (DF) expresses (%) the amount of daylight available inside a room (on a work plane) compared to the amount of unobstructed daylight available outside under overcast sky conditions.

\[
DF = \left( \frac{\text{Internal (lux)}}{\text{External (lux)}} \right) \times 100
\]

Daylight distribution within a room

Distance from window

Cross section
The proposed methodology for daylight provision require only a modest enhancement to existing practice.
CEN Daylight Standard (EN 17037): $D_T \geq 2.0\%$
- Daylight recommendation for façade windows and roof windows

The examples show that daylight performance for the same window-to-floor ratio (1:8) can vary significantly, giving a percentage daylit area [$DF \geq 2.0\%$] from 21\% to 41\%.

And in this case; the window needs to be increased! (or the location of the space is more southern)
DEEP ROOMS ARE VULNERABLE TO LIMITED DAYLIGHT PENETRATION

Situation with 10% glazing to floor area ratio (façade window only)

A DF of 2%, only a few meters from the façade.
Only workplaces close to window can be considered daylit.

Situation with 30% glazing to floor area ratio (façade window only).

A DF of 2% approximately 4.5 meters from the facade.
First two workplaces can be considered daylit.

Situation with 20% glazing to floor area ratio (11% façade window + 9% RW).

A combination of facade and roof windows provides generous and useful DF levels over the entire work plane; all workplaces daylit.
## CEN Daylight Standard (EN 17037)
- View out (table method)

### Table A.5 — Assessment of the view outwards from a given position

<table>
<thead>
<tr>
<th>Level of recommendation for view-out</th>
<th>Horizontal sight angle</th>
<th>Outside distance of the view</th>
<th>Number of layers to be seen from at least 75% of utilized area:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>≥ 14°</td>
<td>≥ 6,0 m</td>
<td>Sky, landscape (urban and/or nature), ground</td>
</tr>
<tr>
<td>Medium</td>
<td>≥ 28°</td>
<td>≥ 20,0 m</td>
<td>Landscape layer and one additional</td>
</tr>
<tr>
<td>High</td>
<td>≥ 54°</td>
<td>≥ 50,0 m</td>
<td>All layers are included in the same view opening</td>
</tr>
</tbody>
</table>

a) For a space with room depth more than 4 m, it is recommended that the respective sum of the view opening(s) dimensions is at least 1,0m x 1,25m (width x height).
A.4 Recommendation for exposure to sunlight

The recommendation is that a space should receive possible sunlight for a duration according to Table A.6 (supposed to be cloudless) on a selected date between February 1st and March 21st. Table A.6 proposes three levels for sunlight exposure. See Annex D for further details.

When applying the recommendation to a whole dwelling, the proposal is that at least one room in the dwelling should have at least exposure to sunlight after Table A.6.

<table>
<thead>
<tr>
<th>Level of recommendation for exposure of sunlight</th>
<th>Sunlight exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>1,5 hours</td>
</tr>
<tr>
<td>Medium</td>
<td>3,0 hours</td>
</tr>
<tr>
<td>High</td>
<td>4,0 hours</td>
</tr>
</tbody>
</table>
A.5 Recommendation for glare protection

The Daylight Glare Probability (DGP) should not exceed a maximum value for more than the fraction $F_{DGP,\, exceed} = 5\%$ of the usage time of the space.

In Table A.7, $DGP_{e<5\%}$-threshold values for different levels of glare protection are proposed.

The minimum recommendation for glare protection is that the $DGP$ for the occupied space does not exceed a value of 0.45 in more than 5% of the occupation time of the relevant space.

<table>
<thead>
<tr>
<th>Level of recommendation for glare protection</th>
<th>$DGP_{e&lt;5%}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>0.45</td>
</tr>
<tr>
<td>Medium</td>
<td>0.40</td>
</tr>
<tr>
<td>High</td>
<td>0.35</td>
</tr>
</tbody>
</table>
Solar protection device where the curtain is made of textile, film or perforated opaque material
CEN Daylight Standard (FprEN 17037)  
- Minimum recommendation for Annual Glare evaluation

Solar protection device where the curtain is made of textile, film or perforated opaque material

### Table E.4 — Recommended glare classes according to EN 14501 to fulfil the glare criteria of $DGP_e < 5 \% \leq 0,45$

<table>
<thead>
<tr>
<th></th>
<th>Sunshine Zone L</th>
<th>Sunshine Zone H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$d_w$</td>
<td>$\tau_{\text{glazing}}$</td>
</tr>
<tr>
<td></td>
<td>$V_{D_P}/V_{D_f}$</td>
<td>$V_{D_P}/V_{D_f}$</td>
</tr>
<tr>
<td>small opening</td>
<td>1m</td>
<td>1 / 3</td>
</tr>
<tr>
<td></td>
<td>2m</td>
<td>1 / 1</td>
</tr>
<tr>
<td></td>
<td>3m</td>
<td>1 / 1</td>
</tr>
<tr>
<td>large opening</td>
<td>1m</td>
<td>1 / 3</td>
</tr>
<tr>
<td></td>
<td>2m</td>
<td>1 / 2</td>
</tr>
<tr>
<td></td>
<td>3m</td>
<td>1 / 1</td>
</tr>
</tbody>
</table>

VD_P is View Direction parallel with facade  
VD_f is View Direction 45° towards facade

### Influence on visual comfort

<table>
<thead>
<tr>
<th>Influence on visual comfort</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>very little effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>little effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>moderate effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>good effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>very good effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Maison Air et Lumière (2011) revolves around natural light and ventilation.

The window-to-floor ratio is 1:3.
MAISON AIR ET LUMIÈRE

Photographer: Adam Mørk
DAYLIGHT PERFORMANCE: prEN 17037

\[ D_T = \frac{\text{Internal}}{\text{External}} = \frac{300 \cdot 100}{15.900} = 1.9\% \]

\[ D_{TM} = \frac{\text{Internal}}{\text{External}} = \frac{100 \cdot 100}{15.900} = 0.7\% \]

<table>
<thead>
<tr>
<th>Maison Air et Lumière Daylight Analysis</th>
<th>Daylight factor results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>prEN 17037  ( D_{300} ) (France, Paris: ( D_{300} \geq 1.9% ))</td>
</tr>
<tr>
<td>Kitchen</td>
<td>5.2% ( D_{300} ) (pass)</td>
</tr>
<tr>
<td>Dining/living room</td>
<td>6.3% ( D_{300} ) (pass)</td>
</tr>
<tr>
<td>Study room</td>
<td>3.4% ( D_{300} ) (pass)</td>
</tr>
<tr>
<td>Bedroom 1</td>
<td>2.5% ( D_{300} ) (pass)</td>
</tr>
<tr>
<td>Bedroom 2</td>
<td>4.5% ( D_{300} ) (pass)</td>
</tr>
<tr>
<td>Bedroom 3</td>
<td>6.7% ( D_{300} ) (pass)</td>
</tr>
</tbody>
</table>

Vertical daylight opening

\[ D_{TM} = \frac{\text{Internal}}{\text{External}} = \frac{100 \cdot 100}{15.900} = 0.7\% \]
Daylight Visualizer – a free professional tool for daylight analysis
3D modeler

Create simple room or building models in a few minutes

The 3D Modeller permits quick and easy generation of 3D models in which façade and roof windows are freely inserted.

Most of the operations usually required to create a 3D model are automated within the modeller functionalities, such as the insertion of windows which is simply performed by dragging a window icon to a desired location in the model.

Can be used by anyone and does not require pre-existing knowledge of CAD software.

*Limited to one-storey buildings - and does not support complex shapes such as curved walls etc.

3D importer

Import 3D models for complex and large scale projects

The 3D Importer makes it possible to import 3D models generated by most CAD applications to permit the evaluation of a wide range of building designs without limitations to the complexity of geometry or scale of the building.

3D file formats supported:

.DWG/.DXF (AutoCAD, Revit, more)

.SKP (SketchUp)

.OBJ (3ds MAX, Rhino, Cinema 4D, more)

*Imported models geometry cannot be modified within Daylight Visualizer (f.x. adding new windows).
### Before renovation

<table>
<thead>
<tr>
<th>Class room 1</th>
<th>Class room 2</th>
<th>Class room 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average daylight factor</strong></td>
<td>Dav</td>
<td>1.50</td>
</tr>
<tr>
<td><strong>Median daylight factor</strong></td>
<td>Dm</td>
<td>1.11</td>
</tr>
<tr>
<td><strong>Minimum daylight factor</strong></td>
<td>Dmin</td>
<td>0.47</td>
</tr>
<tr>
<td><strong>Maximum daylight factor</strong></td>
<td>Dmax</td>
<td>10.54</td>
</tr>
<tr>
<td>Uniformity 1</td>
<td>Dmin/Dav</td>
<td>1 : 3.19 (0.31)</td>
</tr>
<tr>
<td>Uniformity 2</td>
<td>Dmin/Dm</td>
<td>1 : 22.38 (0.04)</td>
</tr>
<tr>
<td>Above 0.7%</td>
<td>87%</td>
<td></td>
</tr>
</tbody>
</table>

### After renovation

| **Average daylight factor** | Dav | 4.20 |
| **Median daylight factor** | Dm | 4.19 |
| **Minimum daylight factor** | Dmin | 1.94 |
| **Maximum daylight factor** | Dmax | 11.66 |
| Uniformity 1 | Dmin/Dav | 1 : 2.16 (0.46) |
| Uniformity 2 | Dmin/Dm | 1 : 6.00 (0.17) |
| Above 0.7% | 99% |

### Velux Daylight Evaluation 1

| **Average daylight factor** | Dav | 3.80 |
| **Median daylight factor** | Dm | 3.91 |
| **Minimum daylight factor** | Dmin | 0.52 |
| **Maximum daylight factor** | Dmax | 5.87 |
| Uniformity 1 | Dmin/Dav | 1 : 7.28 (0.14) |
| Uniformity 2 | Dmin/Dm | 1 : 11.23 (0.09) |
| Above 0.7% | 99% |
SUMMARY

▶ We should strive to help homeowners to see the "bigger picture" when it comes to their homes.

▶ Comfort, energy and environment combined will create a home that acts as an interconnected unit.

▶ Emphasize on homeowners’ drivers to renovation – energy efficiency, healthier spaces and aesthetics do go hand-in-hand.

▶ Active House as an example of best practice.

▶ We know that poor daylight and insufficient ventilation in homes affects our health.

▶ Overall long-term implications of better daylight and ventilation is high.

▶ We can improve peoples health by improving low quality buildings, as well as, designing buildings according to energy targets, health and well-being.
OTHER PLACES TO FIND INFORMATION
Daylight, Energy and Indoor Climate Book

A good indoor climate with generous daylight levels and provision of fresh air from outside is key to making homes, offices, kindergartens and schools healthy places to live and work in. This book is written to allow anyone working with building research and design to find facts and insights on the effects of windows in buildings and their occupants. It is meant to be equally relevant for architects, engineers, students and researchers.

https://www.velux.com/deic
VELUX Daylight Symposium

- The VELUX Daylight Symposium bring together participants from research and practice, fields who rarely meet at conferences. The symposium host daylight research, daylight practice and policymaking.

- You can find all the presentations, including video, from the previous events at: http://thedaylightsite.com
HOW TOMORROW’S BUILDINGS CAN BE BUILT USING TODAY’S TECHNOLOGY

https://www.velux.com/innovation/demo-buildings
A GOOD INDOOR ENVIRONMENT FEELS LIKE BEING OUTSIDE ON A MILD SUMMER'S DAY
A GUIDE TO DESIGNING HEALTHY HOMES
BUILDING BETTER SCHOOLS
SIX WAYS TO HELP OUR CHILDREN LEARN

https://vms.velux.com/building-better-schools