ES-SO vzw, European Solars-Shading Organization, non-profit association
Vilvoordelaan 192, 1930 Zaventem - Belgium.
contact: ann.vaneycken@es-so.com; www.es-so.com; European Transparency register: 839237410209-54

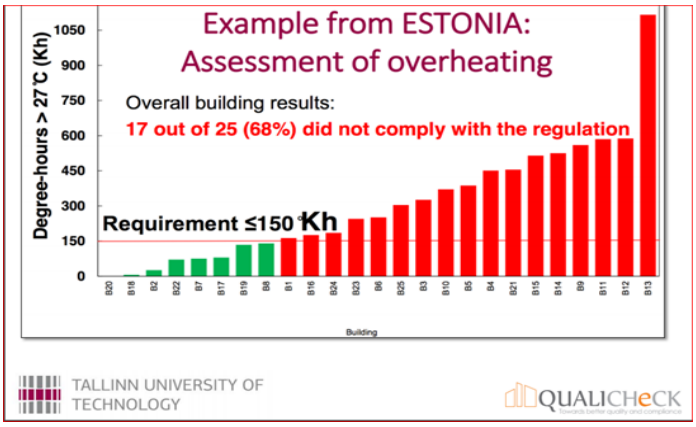
ES-SO White Paper EPBD
"Overheating risk in low energy buildings to combat",

The European Parliament voted overwhelmingly Tuesday 4th October 2016 to ratify the Paris climate accord, a move which means that the urgency to reach the goals becomes reality sooner than expected. Buildings in Europe account for about 40 % of the total energy consumption and of 36% of the CO2 emissions. Currently, about 35% of the EU's buildings are over 50 years old. By improving the energy efficiency of buildings, Europe could reduce total EU energy consumption by 6% and lower CO2 emissions by about 5%. (Source: http://ec.europa.eu/energy/en/topics/energy-efficiency/buildings)

ES-SO is strongly supporting the Energy Performance of Buildings Directive (EPBD) which has since its Recast in 2010 given to Member States a powerful means to improve the energy performance of their buildings.
ES-SO would like to stress a point of attention in order to strengthen the awareness of member states of a growing problem which is not sufficiently addressed in the current EPBD.

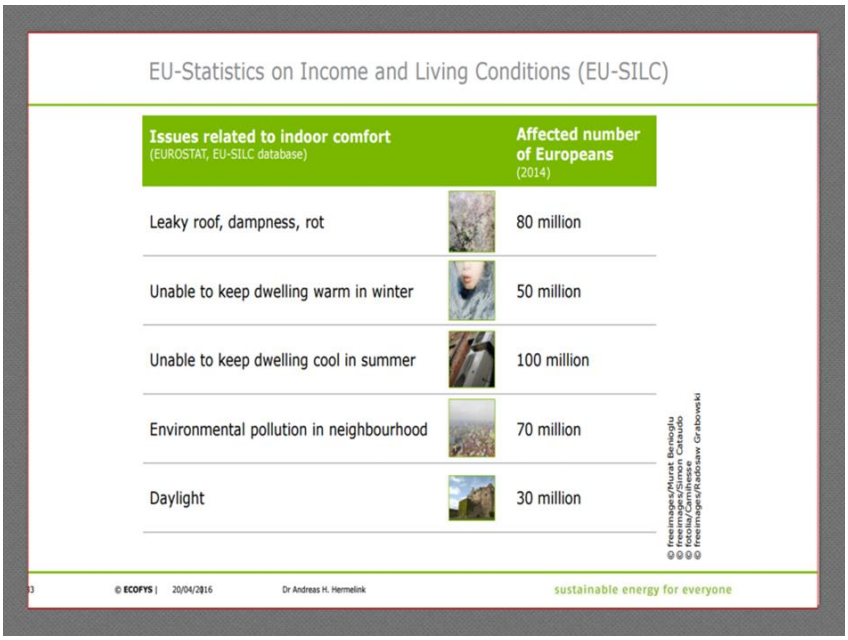
OVERHEATING: a new problem arising in new built and renovated low energy buildings. How come?

Since 2008 multiple reports are emerging in Northern, Mid and Eastern Europe demonstrating that low energy buildings are sensitive to overheating. The reports concern mainly new dwellings. Overheating is an unexpected side effect due to changing construction methods in order to reach energy performance in dwellings: high insulation levels, airtightness, maximizing free solar gains to reduce heat losses and the energy need for heating.



Source: Overheating of new built apartments in Estonia (Qualicheck Conference 2016, 10th May, Brussels - http://qualicheck-platform.eu/events/conferences

Overheating does not only have the effect of increased thermal discomfort and use of energy but also can cause serious health problems, especially to the more sensitive population groups.



Source: Ecofys 2014-2016: 100 million Europeans are unable to keep their dwelling cool in summer

(i) Scientific reports stress that due to the progressing global climate change the risk of overheating will occur even more, not only in high summer but also in shoulder seasons. They also predict that the risk of active cooling in developed countries will explode by up to 150 % by 2050 pushing up the price of energy and peak energy problems.

(i) Scientific and policy publications underline the importance of shading to combat overheating; www.es-so.com/news , among which

- "**Technology Road Map**", by IEA-International Energy Agency, 2013: energy consumption for cooling will increase by 150% in 2050 in Europe (increasing risk of energy peak power problems). Highly insulated windows and dynamic solar control, daylighting are crucial in transforming into NZEB buildings. Solar shading in Europe is a mature technology;
- "**The Comfort Houses** - Measurements and analysis of the indoor environment and energy consumption in 8 passive houses 2008-2011" and recent investigations by Aalborg university in Denmark: 'NZEB have an increased need for cooling to combat overheating, even in low seasons, due to high insulation and airtightness. Solar shading is one of the most energy efficient solutions available for solar and daylight control (dynamic façade)'.
- "**Indoor air quality, thermal comfort and daylight, Analysis of residential building regulations"**, BPIE Report 2015: 'Today still, between 50 and 125 million Europeans suffer from cold in winter (bpie.eu/fuel_poverty.html). However, there is an increasing risk of overheating which also has to be addressed. Thermal comfort should therefore be acknowledged in building regulations and the use of simple and efficient measures, e.g. solar shading, solar protective glazing and ventilative cooling should be encouraged'.

'Overheating risk in low energy buildings to combat', ES-SO White Paper, 22th November 2016

EPBD 2010 on overheating, what does it say ? - recital 9, 25 and annex 1,3,g :
"*Recital 9*: the energy performance should be calculated on the basis of … and that includes in addition to thermal characteristics other factors that play an increasingly important role, such as … passive heating and cooling elements, shading, adequate natural light.
Recital 25: priority should be given to strategies which enhance the thermal performance of buildings during the summer period. To that end, there should be focus on *measures which avoid overheating*, such as *shading and sufficient thermal capacity in the building construction, and further development and application of passive cooling techniques*.
Annex 1,3,g: the methodology shall be laid down at least taking into consideration the following aspects such as passive solar systems and solar protection".

ES-SO comments and recommendation:
Above cited European reports clearly demonstrate that the current "considerations" in the EPBD are not sufficiently addressed to member states to take the risk of overheating seriously into account. As new buildings make up only 1-1,5% of the yearly building stock, member states will increasingly focus on renovation of the building stock to become energy efficient, hereby following the same measures as increased insulation and airtightness of the building envelope. The overheating risk will therefore also occur in renovated dwellings.

The overheating risk in new built and renovated buildings will change the energy need for heating into more energy needed for cooling.

Reducing the need for cooling will become equally important as the need for heating. Therefore:

I. An explicit article on overheating has to be included in the EPBD review:

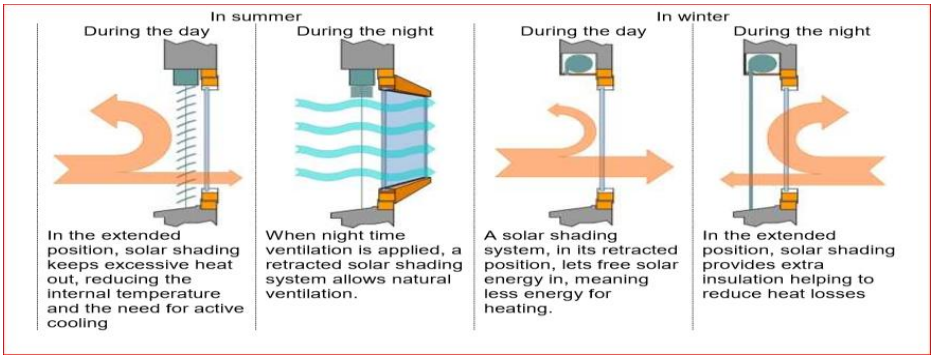
- A universally accepted definition of overheating in dwellings should be adopted, and member states should develop in the national building code robust national thresholds for dealing with overheating in new build and renovation for use by planners, designers, builders and authorities.
- In low energy buildings the cooling load has to be considered as equally important as the heating load and this for both summer and winter conditions.
- The evaluation of the risk of overheating in new and renovated buildings/dwellings shall be done not only at overall building level but also at individual room level for a situation as built.
- As energy efficiency is priority number one (the cheapest energy is the one you don't use) the building envelope (building shell) has to be considered first (before the use of mechanical systems).
- In the transparent part of the building envelope measures to avoid overheating have to be included among which dynamic (smart) shading to the glazing. Priority shall be given to passive measures such as shading before active cooling can be applied.

II. Innovation should be facilitated and acknowledged in EPBD: compliance should be given to validated actual energy performance data of energy efficiency measures prior to (conservative) default values.

Windows in low energy buildings to be based on its total energy balance including dynamic shading

Among various building components, windows are a static element, while weather conditions vary continuously. As people spend now nearly 90% of their day inside they expect to be comfortable indoors all year through.
The assessment of the energy performance of the transparent part of the building envelope in national cost-optimal calculation methods is merely based on insulation properties, i.e. the thermal transmittance (u-value), while there is also need to consider the heat gains (g-value). For this reason, windows' energy performance is best assessed by way of the 'energy balance', which is an equation computing heat losses and heat gains based on the climatic conditions.
Windows are more energy efficient by the use of smart solar shading to manage their energy balance. In the summer season shading reduces or eliminates thermal discomfort caused by overheating - and therefore reduces the need for active cooling by controlling the amount of solar energy entering through the windows.
In the heating season smart solar shading, operated by occupants and automated controls, allows harvesting of free energy sources through the windows. In both seasons, it offers additional insulation to the transparent parts of the building envelope, which helps to reduce heat loss in winter and limits heat gain in summer.

Solar shading will also manage and control daylight admittance to reduce glare and thus improve visual comfort, thereby creating better indoor environments.



Benefits of shading on the energy balance of the window system.

Recognition of solar shading and its CO2 footprint

Shading is a cost optimal energy savings technology as it delivers energy savings of up to 60 times its CO2 footprint over its 20 year life span (ii). For an energy end-use split of 50:50 between space heating and cooling the potential energy savings which can accrue from dynamic shading : 22% saving in heating and cooling energy use of 59Mtoe/y and a carbon emissions reduction of 22% equivalent to a saving of 137,5 MtCO2/y (if 70:30 energy split: 19% savings and CO2 reduction) (iii).
Innovation should be acknowledged in the EPB national regulation. ES-SO has established a database of validated solar shading energy performances (iv).

EU Annual Energy and CO_2 figures	Assumed Energy End-Use Split 50% Heating; 50% Cooling		Assumed Energy End-Use Split 70% Heating; 30% Cooling	
		% Savings		% Savings
Total Heating Energy (Mtoe)	131.37		183.92	
Total Cooling Energy (Mtoe)	131.37		78.82	
Heating savings (Mtoe)	18.15	14%	25.41	14%
Heating CO2 savings ($MtCO_2$)	43.07		60.29	
Cooling savings (Mtoe)	39.81	30%	23.88	30%
Cooling CO2 savings ($MtCO_2$)	94.46		56.67	
Total Energy Saving (Mtoe)	57.95	22%	49.29	19%
Total CO2 savings ($MtCO_2$)	137.52	22%	116.97	19%

Table 14. Estimated heating energy and cooling EU buildings energy savings resulting from use of dynamic solar shading systems.

(ii) Solar shading and cost optimality – scientific proof in ES-SO Position Paper 2015 - A new vision on solar shading (page 7)
(iii) ES-SO study Executive summary 2015
(iv) www.es-so.database.com