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Session: Monitoring and evaluation of programmes and policies

Evaluation of renovation programmes and policies

Results of a pan-European Study on energy savings due to window replacement

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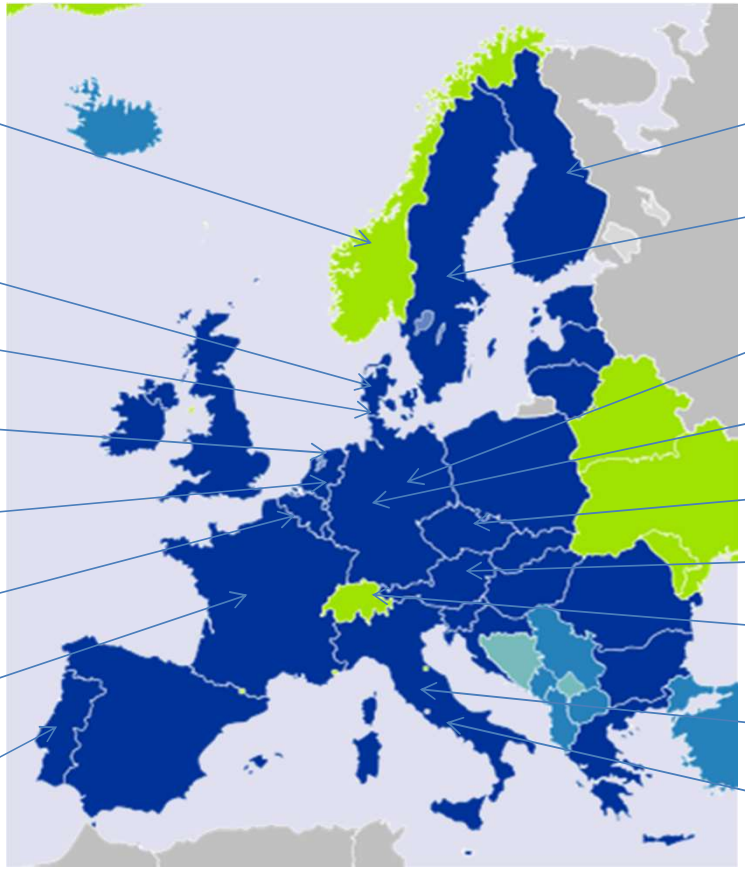
EuroWindoor member associations – who?



For more info

- www.eurowindoor.eu
- @Twitter #EuroWindoor_EU
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Remember the benefits of daylight, thermal comfort and indoor air quality

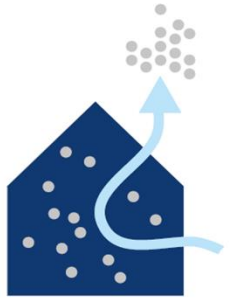
Having many large windows doesn't necessarily lead to overheating

Plenty of daylight eliminates your need for artificial lighting during the day

Good ventilation lowers the temperature during the night

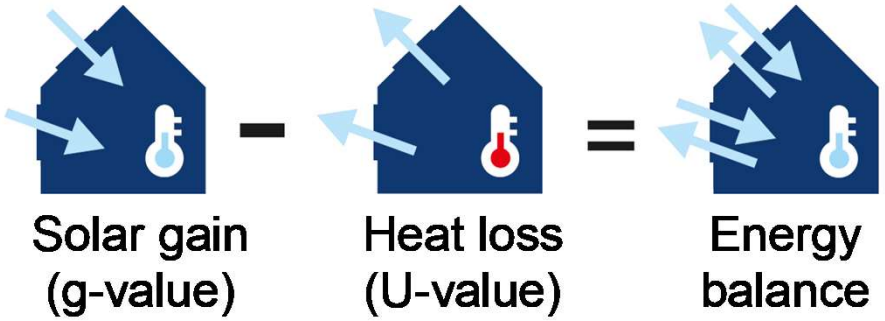
Solar screening and solar protected glazing protects your home from overheating

To get full effect, you need intelligent automation



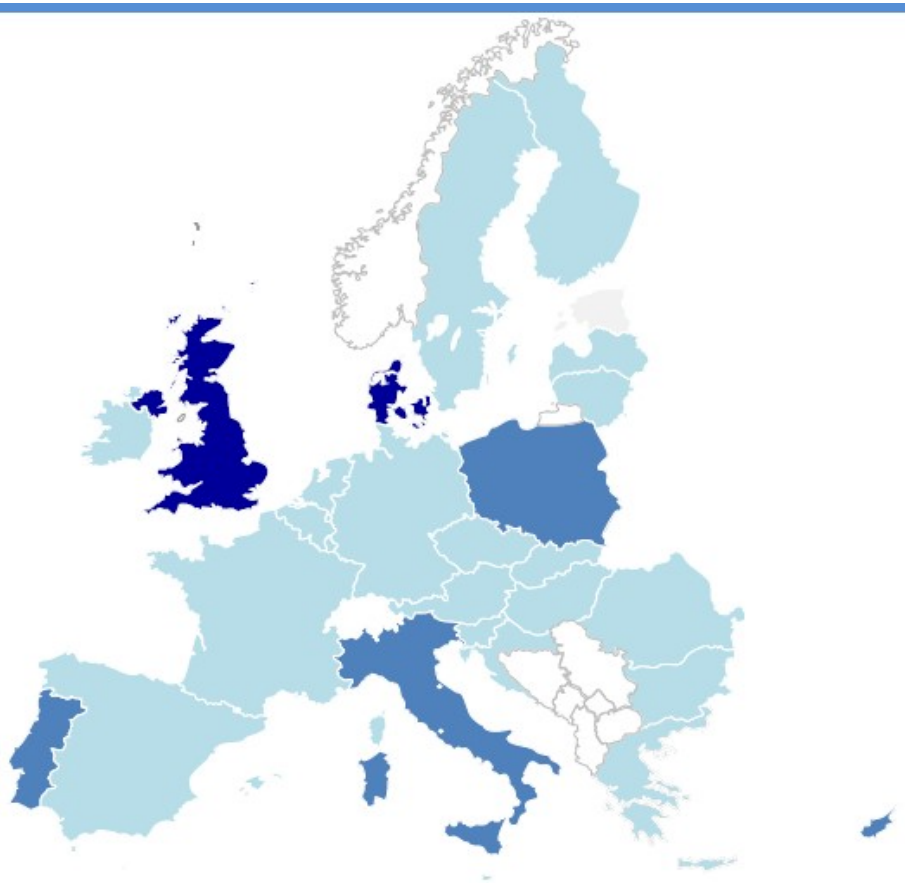
Natural ventilation provides good indoor air quality

What is Energy balance approach?



- The term ‘energy balance’ is used to describe the energy performance of a window
- Energy balance approach ‘balances’ the gains and the losses to a building
- Today mainly U-value (heat loss) focused building regulation
- Leaving out the solar gain only shows half of the picture
- Energy Balance approach to be defined in the specific heating, cooling and climatic context of Member States
- Guidance document from the European Commission would be helpful

Few Energy Balance based window replacement requirements in EU MS



Energy Balance based replacement requirements

U-value and g-value replacement requirements

U-value replacement requirements, only

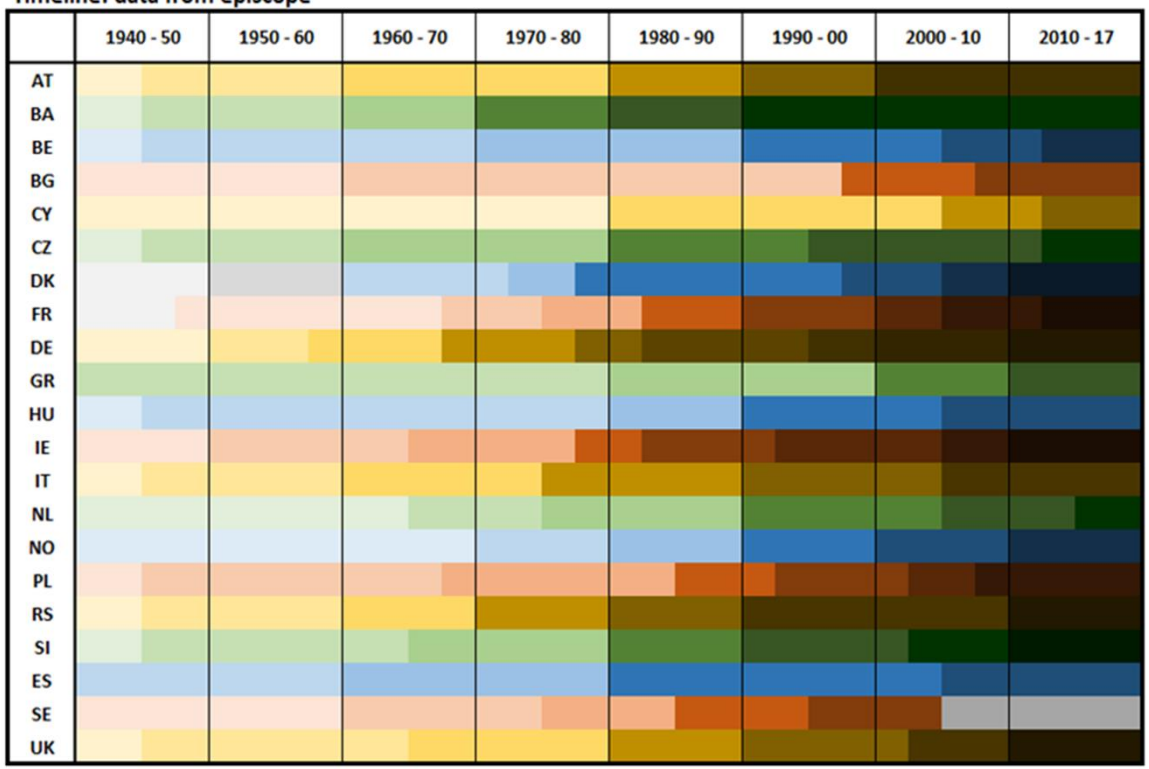
No information

How to change this picture? And what to achieve?

data basis: LOT32 – Task 1

Development of thermal insulation (mainly due to national restrictions)

Timeline: data from episcope



Source of data: episcope-database (country specific database regarding building stock and quality)

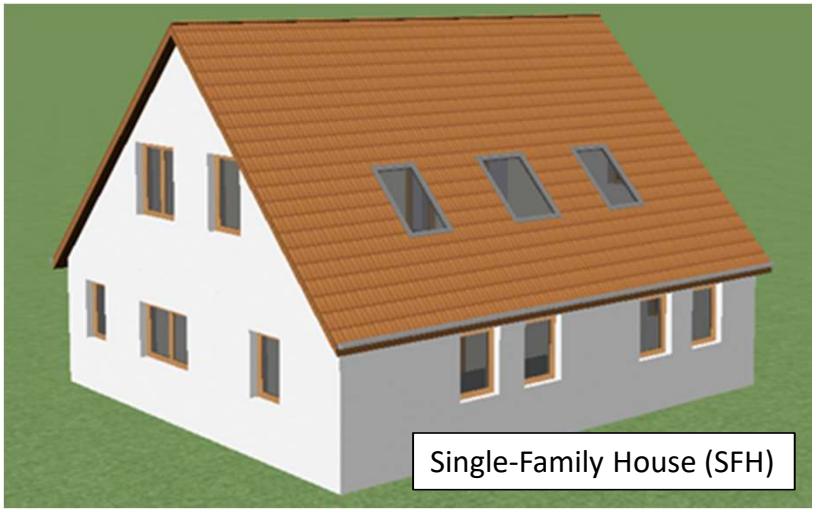
defined for calculations:
base case 1 represents time period 1970-1980, non- or poorly renovated older buildings

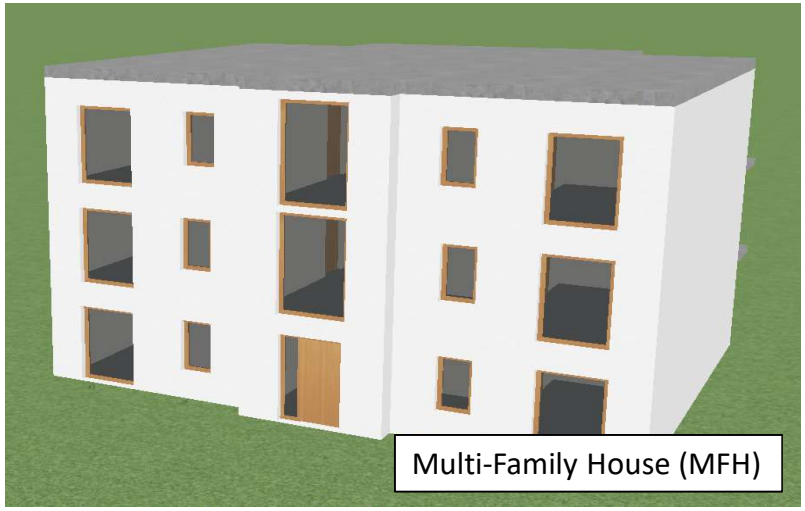
base case 2 represents time period 1990-2000 and moderately renovated older buildings

in both base cases the window quality is defined with U_W = 2,8 W/(m²K), g = 0,76

calculated renovation windows:
range U-value: 1,4 – 0,80 W/(m²K)
range g-value: 0,40 – 0,60

Fixation of "as typical as possible" building-geometries





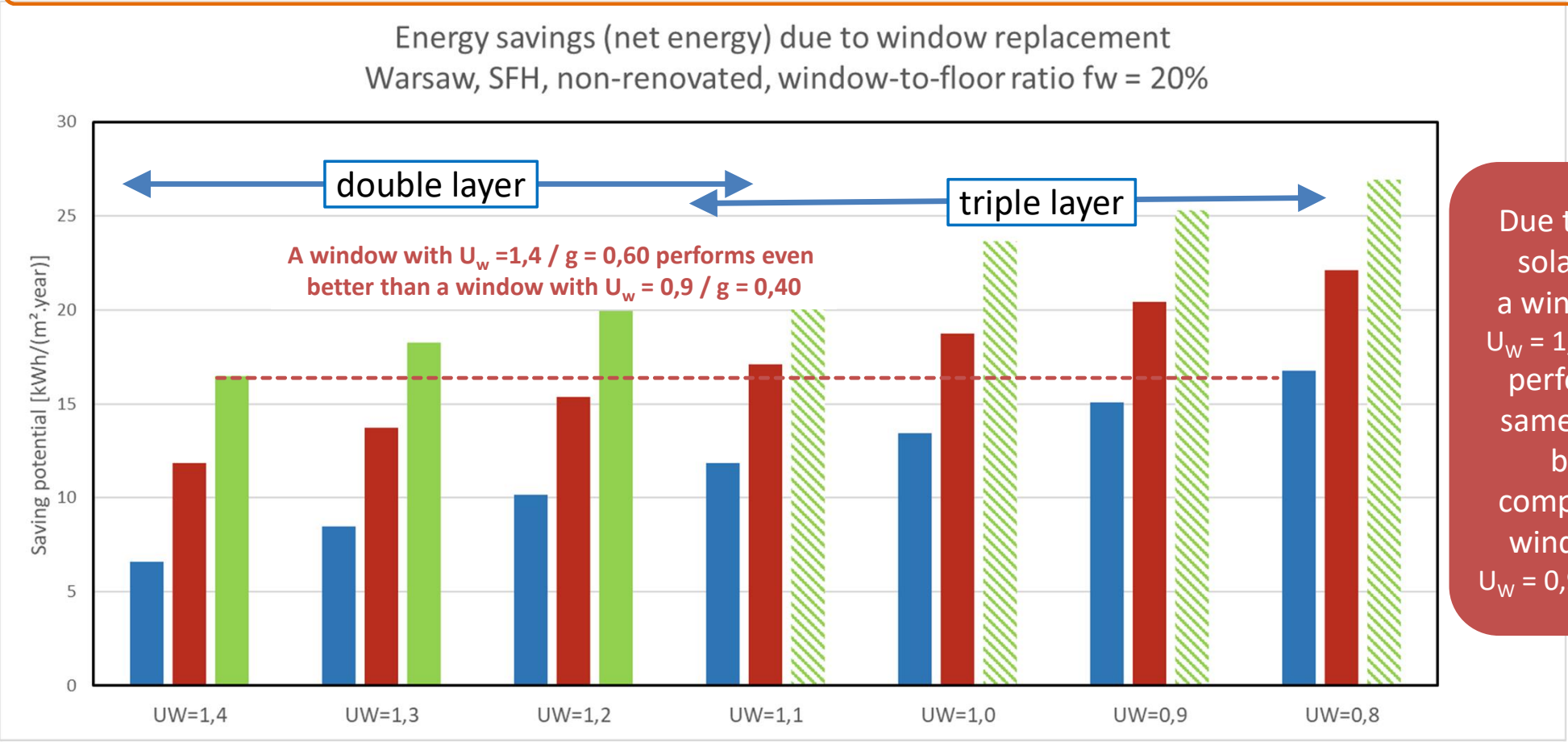
- choosen buildings SFH and MFH can be seen as typical representatives of the main part of the residential building stock
- regarding mainly energy savings due to window replacement, building geometry (envelope) is of minor importance

But: window fraction is of importance! → variation of window-to-floor ratio: 10 % / 20 % / 30 %

utilisation (of loads) is of importance! → variation between SFH and MFH regarding internal loads

Savings on a building-level

Example: Single-Family House in Poland (Warsaw)

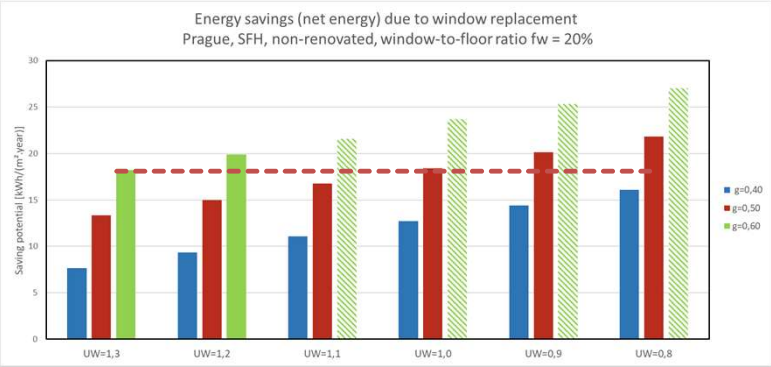


Due to its high solar factor, a window with U_W = 1,4 / g = 0,60 performs the same (or even better) compared to a window with U_W = 0,90 / g = 0,50

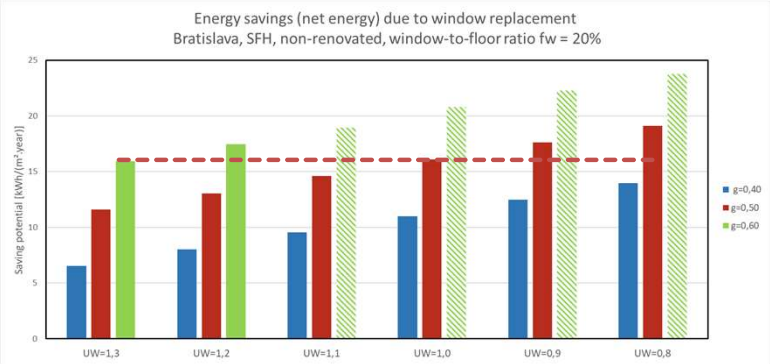
Savings on a building-level – same picture in other CEE countries

Example: Single-Family House with window-to-floor ratio f_W = 20 % in several other C4E countries

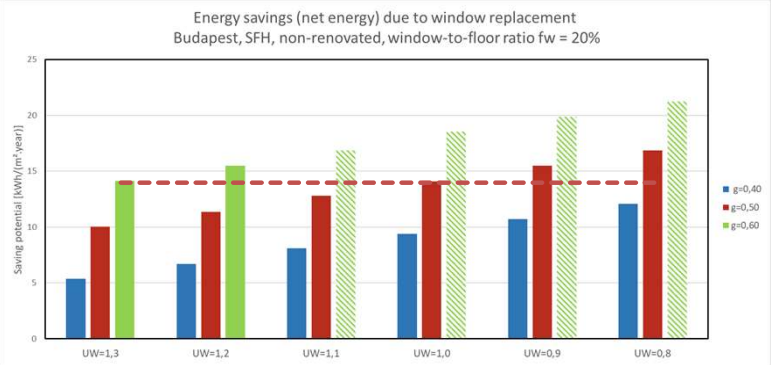
Czech Republic



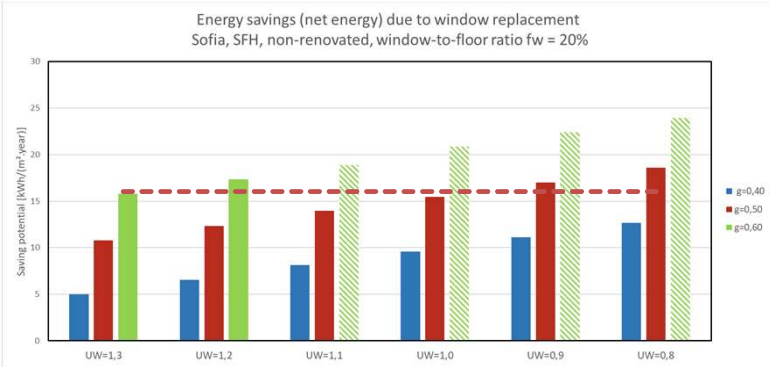
Slovakia



Hungary

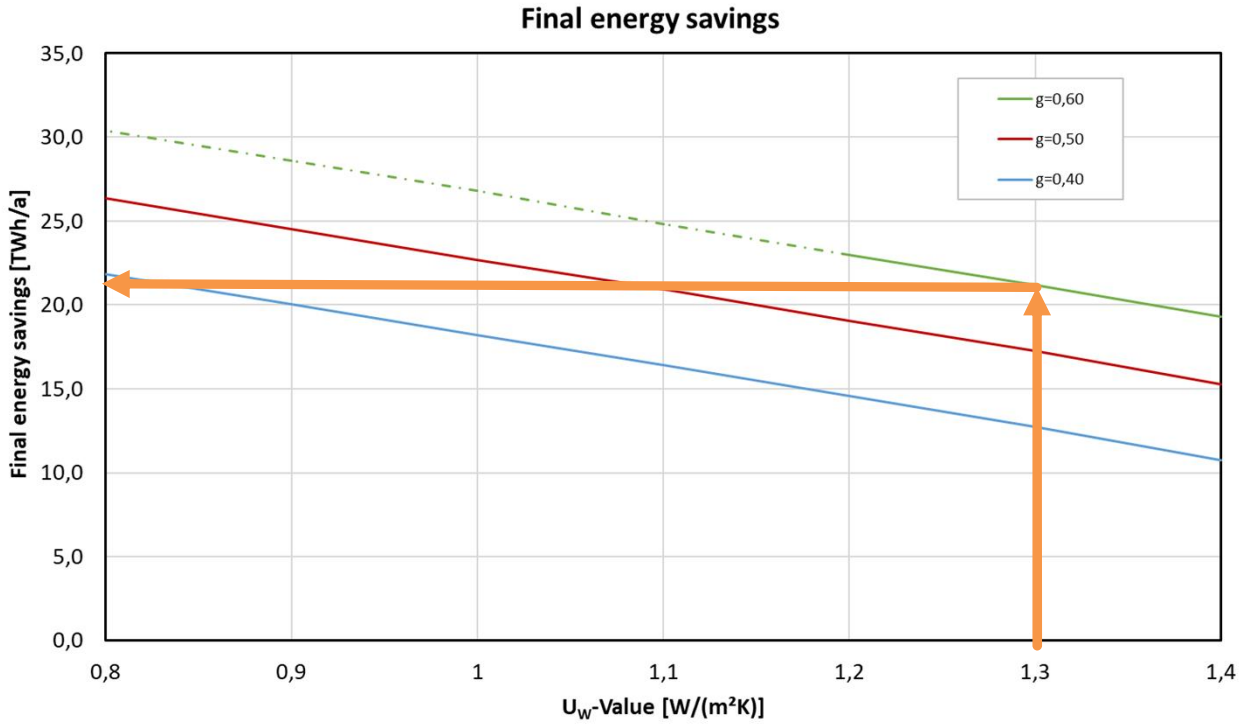


Bulgaria



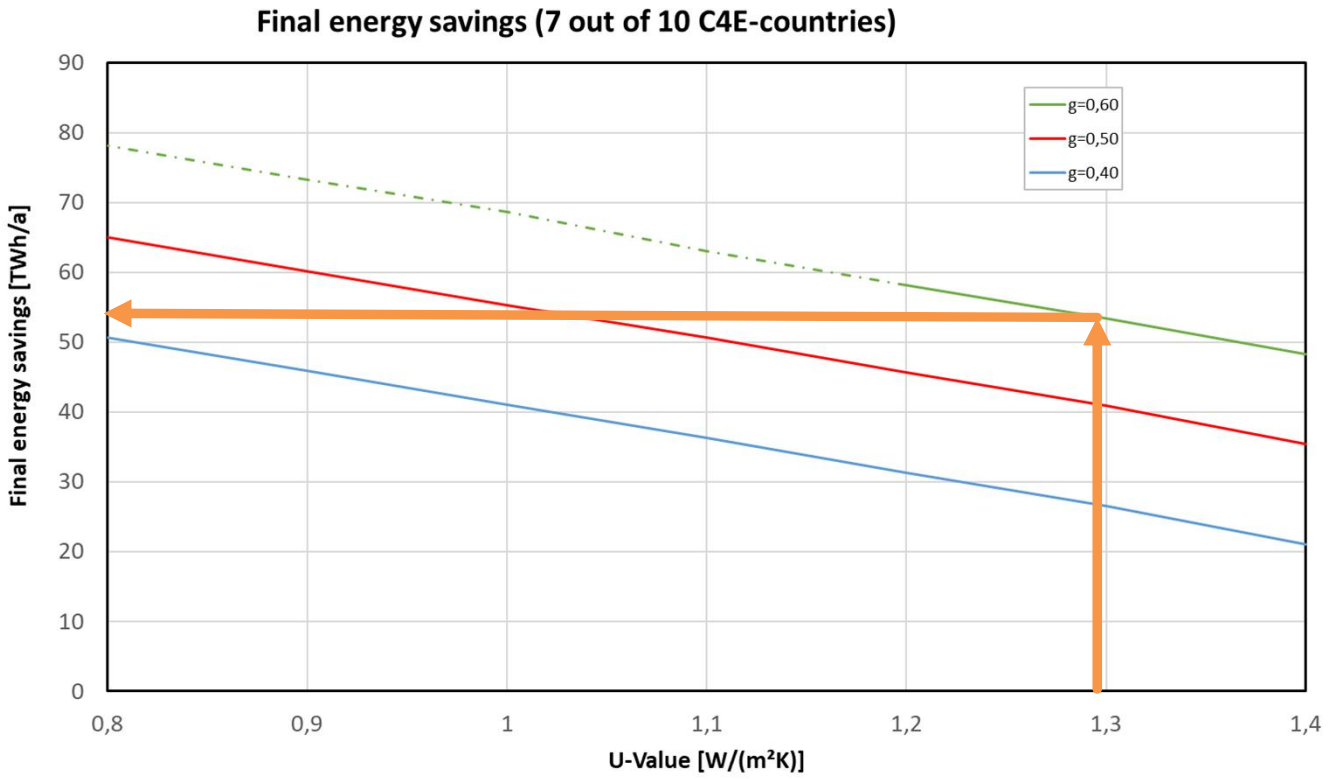
Savings on a national-level

example Poland – final energy



Due to its high solar factor, a window with U_W = 1,3; g = 0,60 can perform the same savings compared to a window with U_W = 0,80; g = 0,40

Results: Savings of final energy for heating



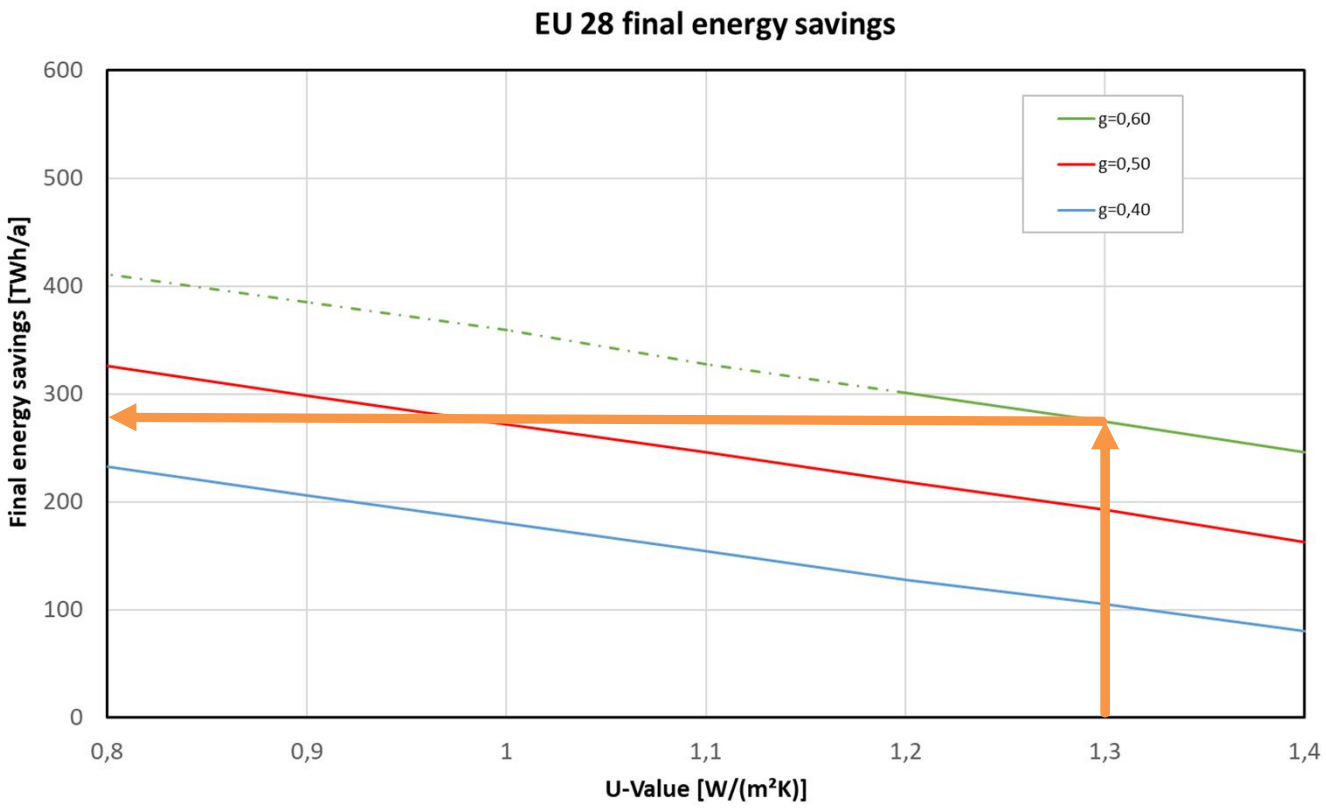
The C4E countries:

- *Bosnia and Herzegovina*
- Bulgaria
- Croatia
- Czech Republic
- Hungary
- Poland
- Romania
- *Serbia*
- Slovakia
- *Ukraine*

Renovation with U_W = 1,3 ; g = 0,60 could save more than 50 TWh/a.

Savings on an EU28-level

Results: Savings of final energy for heating



Renovation of the total European building stock with U_W = 1,3 ; g = 0,60 could save up to 280 TWh/a.

This

- **equals to 18.8 millions of average European households yearly consumptions**

Savings correspond to 67 Mt/a CO_2-emissions, which

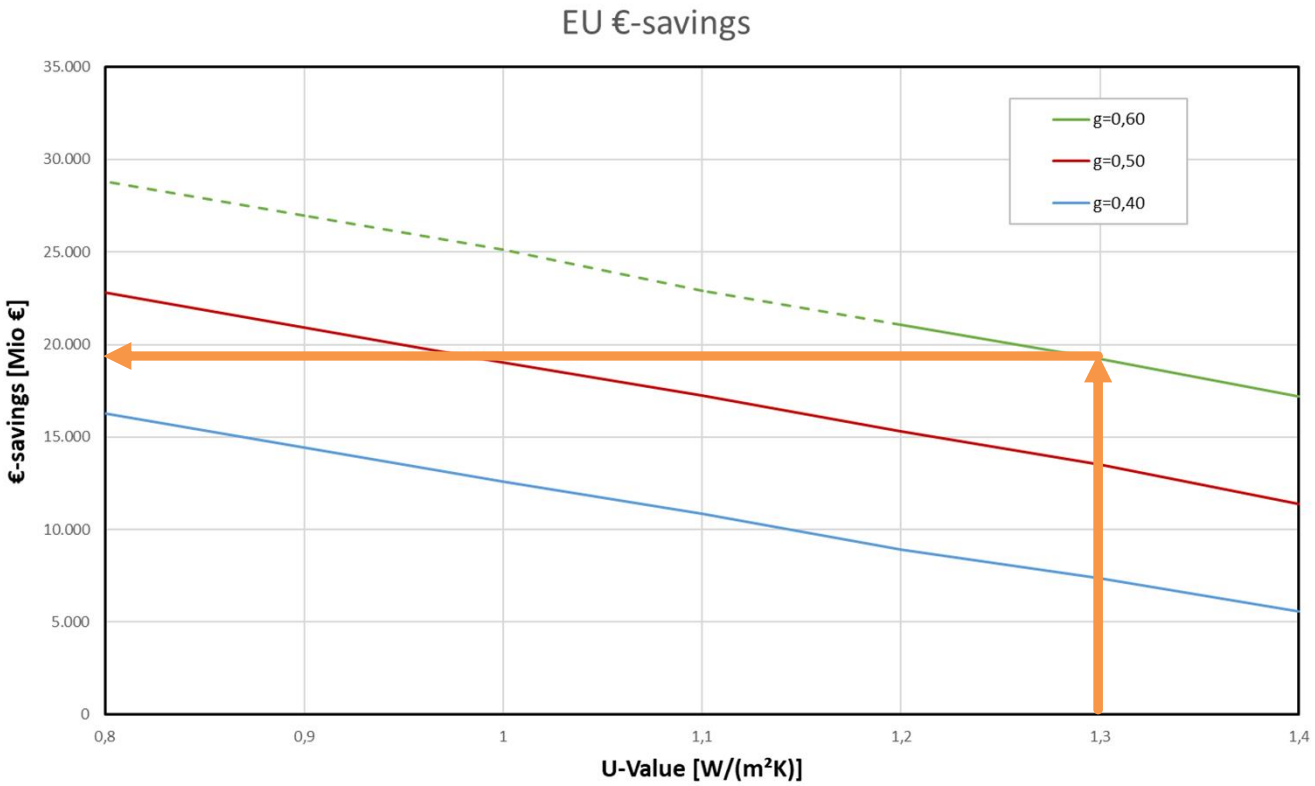
- **equals to 19 millions of average cars yearly emissions**

Key findings

- **Renovation of windows in the building stock covers a very high potential in terms of energy- and CO_2-saving**
- **The possible amount of energy savings is enormous compared to other measures**
- **For windows and other transparent building elements not only transmission losses (U-values) must be considered, solar gains (g-values) have to be taken into account as well**
- **The choice of a window with a higher U-Value but a higher g-value as well often results in a better energy performance**
- **In many cases a double-pane window with a high g-value is the better choice compared to a triple-pane window with a lower g-value for replacement**
- **Legal restrictions for windows only formulated on the basis of U-values in many cases may lead to suboptimal or even cost-intensive solutions**
- **All statements above can be confirmed on a building level as well as on a national or even EU-wide level**

Find the report here @EuroWindoor website

Results: Savings of money for heating



Renovation of the total European building stock with U_W = 1,3; g = 0,60 could save close to 20 Mrd. €/a

- **this is even more than what could be saved by using a window with U_w = 0,80 ; g = 0,4 (16,3 Mrd. €/a)**
- **for full economic and ecologic assessments with regards to grey energy additional aspects like transportation and installation costs and recycling potential have to be taken into account!**