

How to assess the thermal performance of windows?

**ENERGY
BALANCE
EQUATION**

SOLAR GAINS - HEAT LOSSES

How to optimise energy balances across seasons?



SOLAR GAINS - HEAT LOSSES



SOLAR GAINS - HEAT LOSSES



HEATING SEASON

ENERGY BALANCE

$$B \cdot g_w - A \cdot (U_w + H)$$

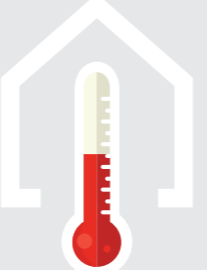
Solar gains to be maximised

Heat losses to be minimised

BUILDING TYPE



- Thermal mass
- Thermal loads
- Occupancy



Base T°
Below which building needs heating

A

Heating degree hours
How much and how long external temperature is lower than building base T°

LOCATION



Window orientation



Local climate



External T°



Solar irradiation

B

Usable solar radiation

WINDOW PRODUCT



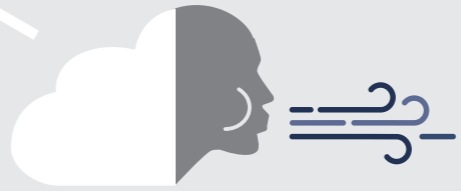
- Air permeability class**
- Thermal transmittance**
- Solar factor**

L

U_w or U_{w,eff} if shutter used during night

g_w

Wind



H

Air infiltration



COOLING SEASON

ENERGY BALANCE

$$Y \cdot g_w - X \cdot (U_w + H)$$

Solar gains to be minimised **Heat losses**

BUILDING TYPE



- Thermal mass
- Thermal loads
- Occupancy



Base T°
Above which building needs cooling

X

Cooling degree hours
How much and how long external temperature is higher than building base T°

LOCATION



Local climate

External T°



Solar irradiation

Y

Solar radiation leading to overheating

WINDOW PRODUCT



Ventilative cooling

Air permeability class **L**

Thermal transmittance **U_w**

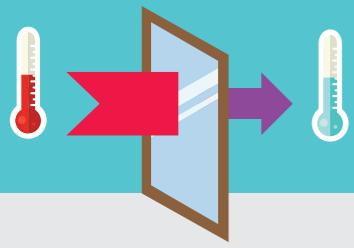
Solar factor **g_w** or **g_{w,eff}** if shading used during day



Wind

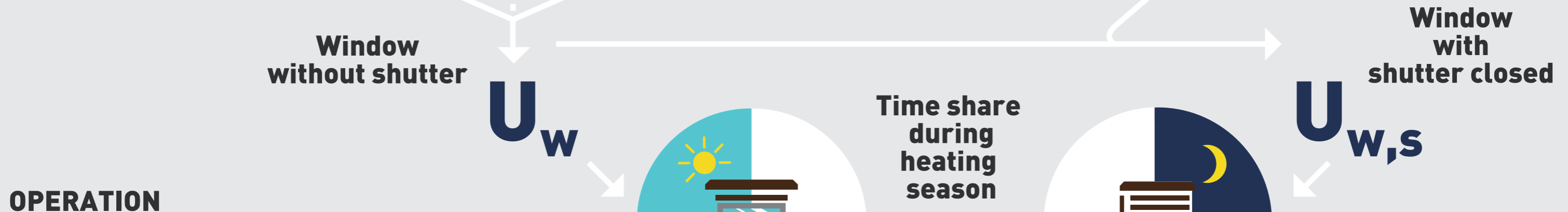
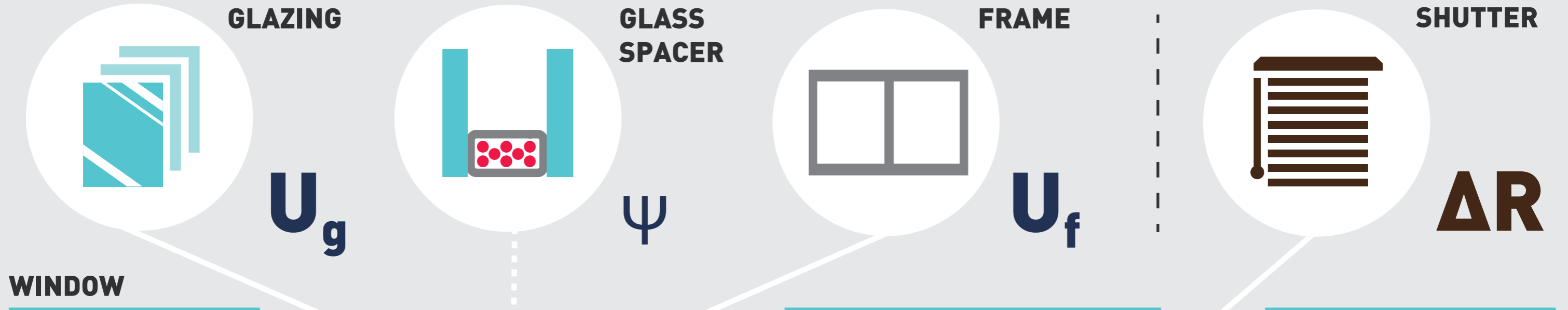
H

Air infiltration



THERMAL TRANSMITTANCE U

COMPONENTS



OPERATION

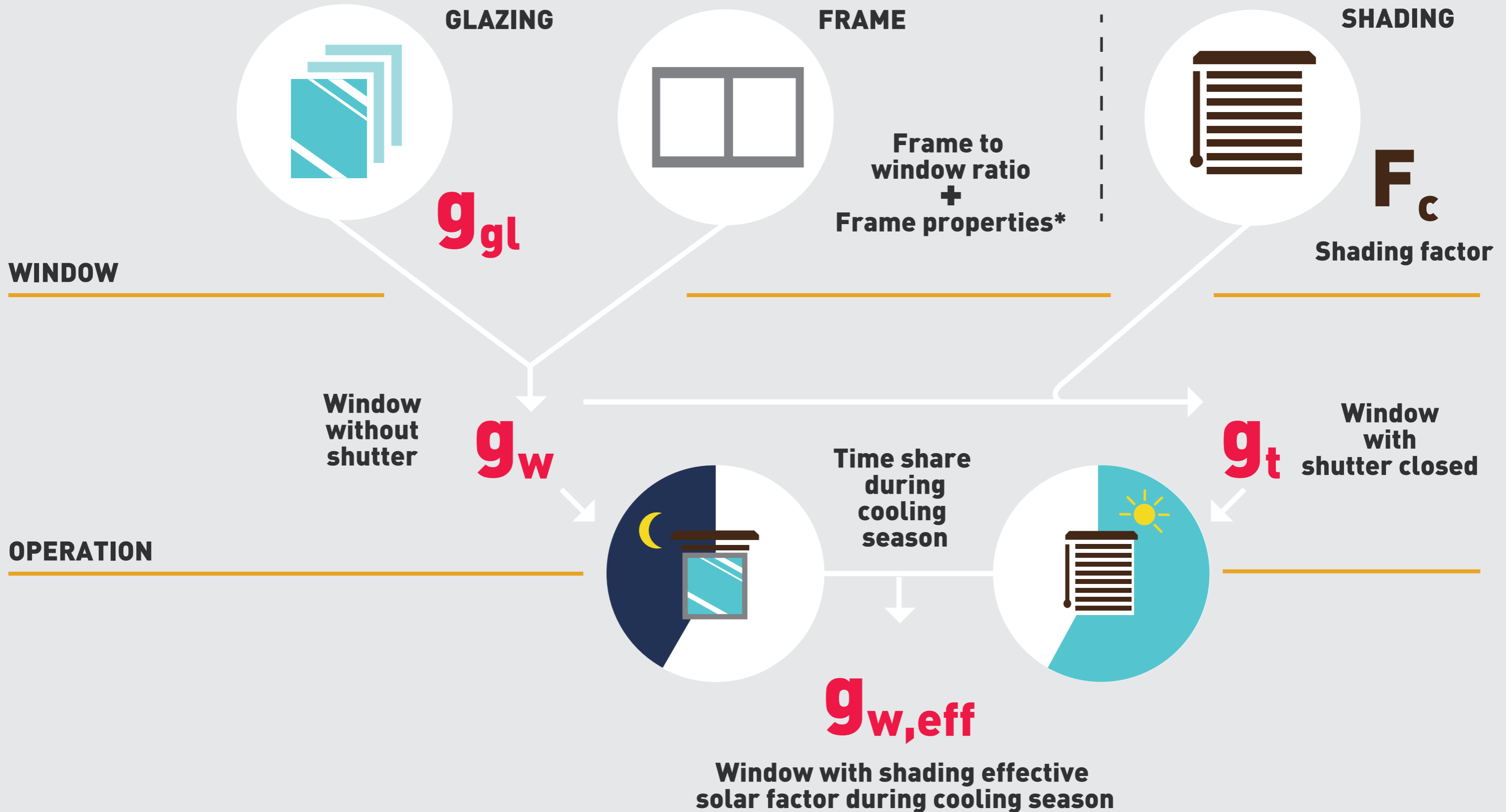


Window with shutter effective thermal transmittance during heating season



SOLAR FACTOR g

COMPONENTS



*Not included in EN yet, only in XP 50-777 in France