Thin-glass membranes for quadruple IG-units

European Smart Windows Conference

Ing. Leopold Mader / LiSEC Austria GmbH / 25.02.2015 / Wels

AGENDA

1. Welcome
2. Market potentials of thermally toughened thin glass
3. Feedback from manufacturing plant
4. Typical advantages of thin glass

LiSEC

CREATING VISIONS. PROVIDING SOLUTIONS.

Our approach to thin glass

Why does LiSEC support thin glass development?

- Improvement of Insulating Glass
  - Vakuumglass
  - Multiple insulation glass
  - Control of functional layer
- Solar glass
- Multifunctional glass

Market potentials

40% of total energy consumption of air conditioned buildings is lost through the building‘s hull.

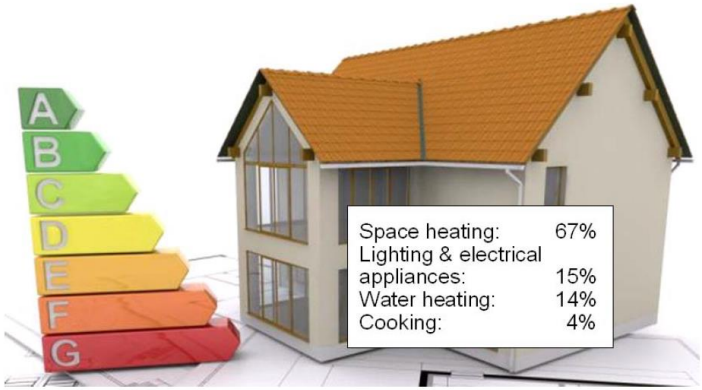
30 mio m² Insulation glass is manufactured yearly within Germany.

COMMUNICATION FROM THE COMMISSION TO THE
EUROPEAN PARLIAMENT, THE COUNCIL,
THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS

3. PAVING THE WAY TOWARDS LOW ENERGY CONSUMING BUILDINGS

Nearly 40%[27] of final energy consumption is in houses, public and private offices, shops and other buildings. As the figure shows, in residential homes, two thirds of this is for space heating.

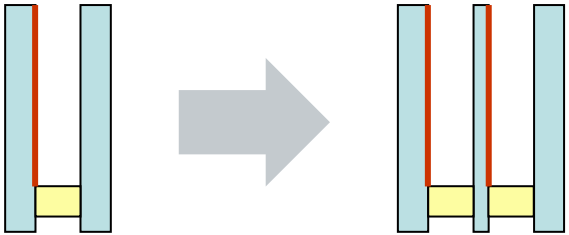
Figure: EU-27 households' energy consumption at home, %



Source: Odyssee indicators, www.buildup.eu

A large energy saving potential remains untapped. Techniques exist to cut existing buildings' consumption by half or three quarters[28] and to halve the energy consumption of typical

Energy saving potential of multiple insulation glass
Market potentials

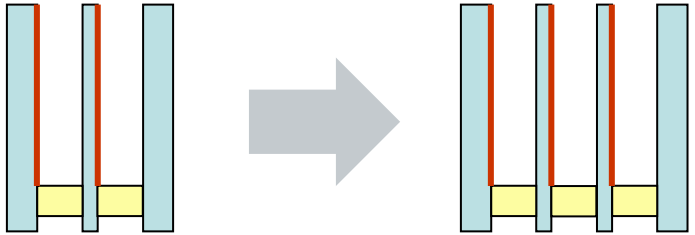


Comparison of 2 to 3-fold

Improvement of Ug-value from
1,1 to 0,6 = Δ **- 0,5 W/(m²K)**

Reduction of Heating consumption
per year and per m² by about 37 kWh

Reduction of primary energy consumption per year and per m² by about **47 kWh**



Forecast 3-fold to 4-fold

Improvement of Ug-value from
0,6 to 0,3 = Δ **- 0,3 W/(m²K)**

**Annahme: Zentralheizung mit Gas-Brennwertkessel.
Die Primärenergiebetrachtung beinhaltet alle Energieaufwendungen und Wandlungsverluste für die Bereitstellung des Brennstoffs von der Quelle bis zum Heizungsraum („kumulierter Energieaufwand“ KEA).

* Raumtemperatur 20°C
(Standardklima D entsprechend PHPP)

Berechnungen: Universität Kassel – CESR
Ug-Wert 4-fach Verglasung: Berechnung IFT

Energy input for the manufacture of additonal chamber

4mm Glass

3,85mm TVG+
49,8 kWh/m² Glass

Closing of IS element

Spacer+Butyl 18mm
4,9 kWh per peripheral meter

Filling of Argon for 18mm free volume
0,1 kWh/m²

Energy consumption of Iso Line
1 kWh/m² (Quelle TS-LiSEC)

Total Energy Input
70 kWh/m²

2mm Glas

1,85mm TVG+
27,8 kWh/m² Glas

Closing of IS element

Spacer+Butyl 18mm
4,9 kWh per peripheral meter

Filling of Argon for 18mm free volume
0,1 kWh/m²

Energy consumption of Iso Line
1 kWh/m² (Quelle TS-LiSEC)

Total Energy Input
48 kWh/m²

When using 2mm glass instead of 4mm glass the Total Energy Balance is leveled within 1 year

* Die Primärenergiebetrachtung beinhaltet alle Energieaufwendungen für die Herstellung des Produkts von der Bereitstellung der Rohstoffe bis zum fertigen Produkt am Werkstor („kumulierter Energieaufwand“ KEA)

Berechnungen: Universität Kassel - CESR

Feedback from manufacturing plant

Feedback from Winterglas GmbH (A) and Energy Glas (D):

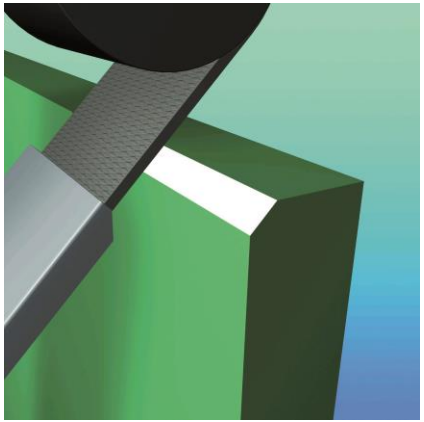
- Reduced breakage loss
- Reduced storage area → optimisation of glass storage possible

Feedback from overseas markets:

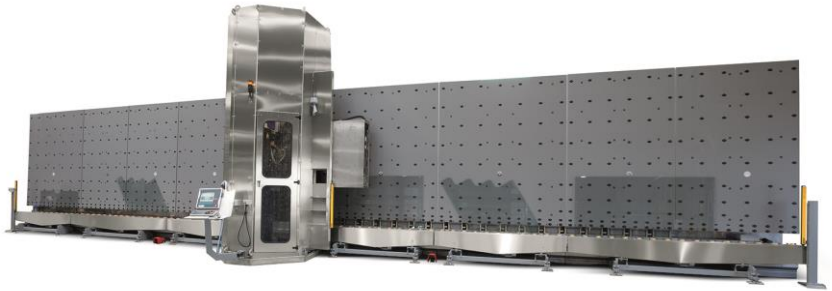
- 2,35mm glass becoming a standard thickeness in US

Edge Processing
Feedback from manufacturing plant

Edge seaming with belt



Edge Processing with peripheral wheel



Tempering
Feedback from manufacturing plant

- Air Cushion Tempering Process
- System details
- Properties of Glass

Air Cushion Tempering Process

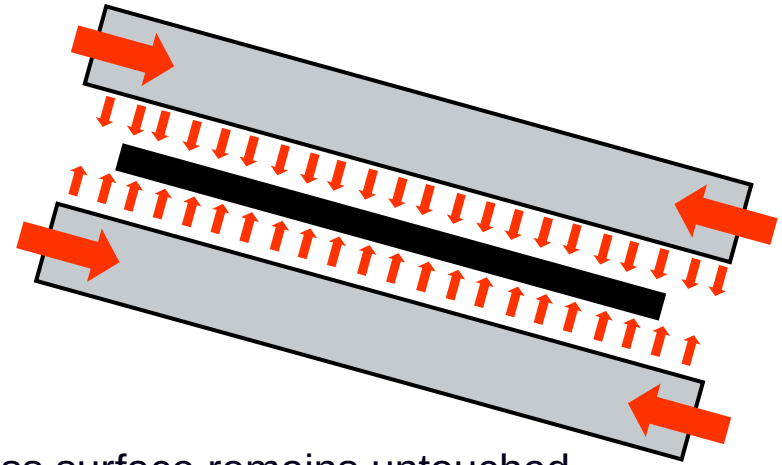
Tempering

The Air Cushion Tempering Process enables:

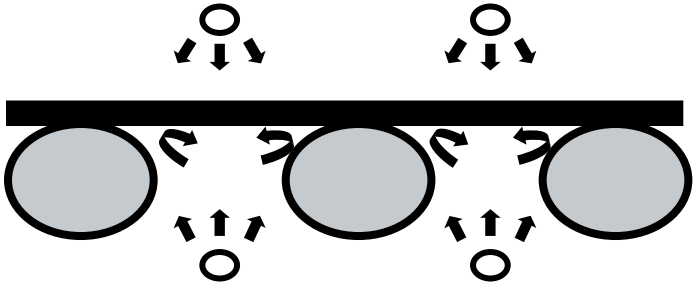
- Thin glass sheets to only 1.8mm thickness in perfect quality
- Thin glass sheets of enormous strength and flexibility
- Energy savings up to 40% in the tempering process
- Reliable high output
- Easy to operate

System Benefits
Air Cushion Tempering Process

The new LiSEC technology



Conventional technologies



- Glass surface remains untouched
- Air cushion instead of ceramic rollers
- Maximum convection in the circulation system
- Balanced energy input

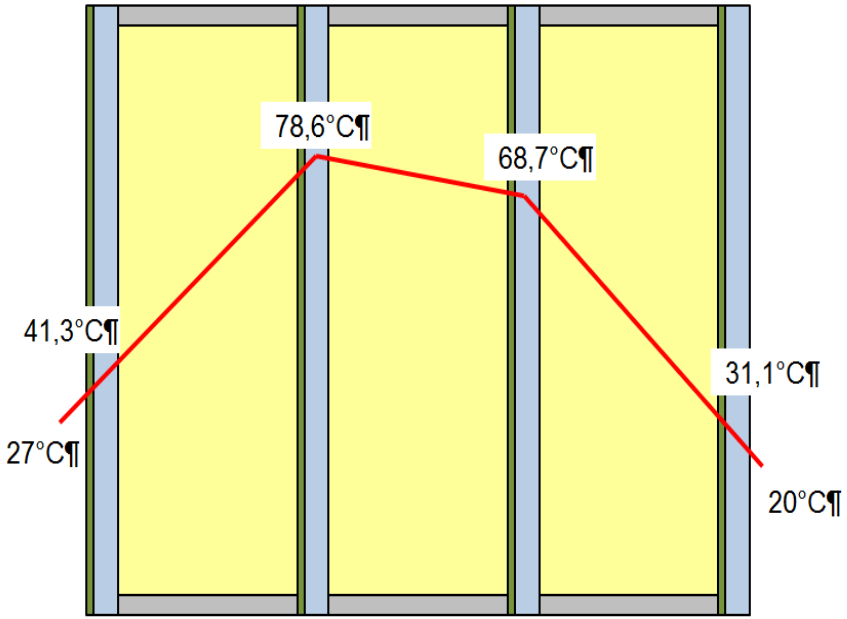
Typical advantages of thin glass

- **Improved absorption of climatic loads**
  - Wider unit configurations are possible
  - Lower load on the spacer bars
  - Improved Ug values
- **Improved working conditions for window construction employees, thanks to the ligther weight**
  - During production
  - When installing at the construction site
- **Excellent lamination properties**
  - Lower rejection rate due to air or other imperfections
  - Shapeable laminates
- **Optimisation in window construction**
  - Lower load on the fittings
  - Longer window service life
  - Reduced cost for fittings

Loading of glasses
Typical advantages of thin glass

Temperature: 4-fold / Moscow South-Autumn

- Stresses based on differences in the temperature profile result in deformation of the glass panes. (Membrane effect)
- When using thin glass, these stresses can be dealt with in a perfect manner.



Berechnung: Guardian

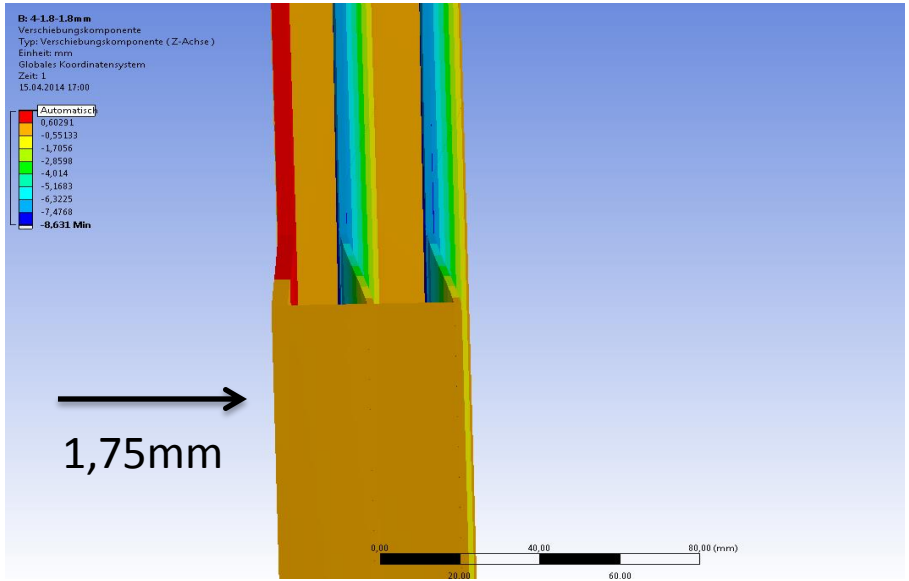
FE-Simulation of climate load

Typical advantages of thin glass

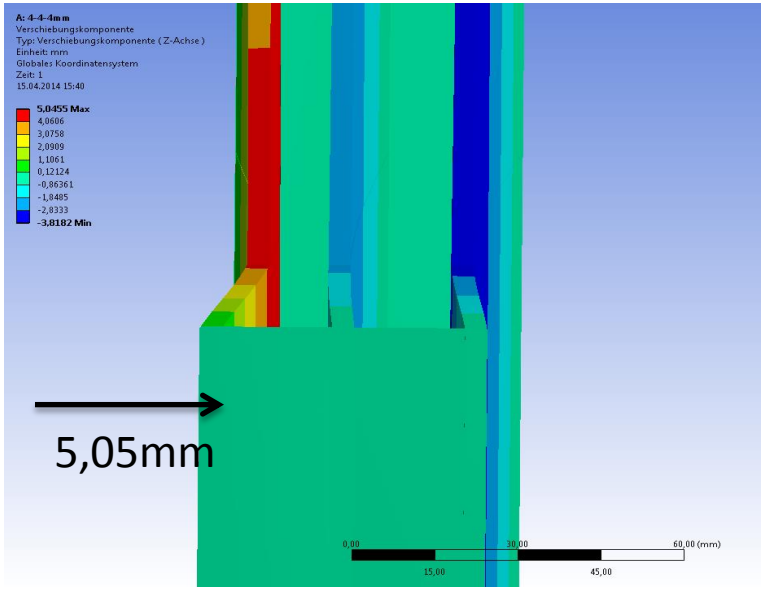
Calculation / Simulation of stresses & deformation inside the glass

- Room temperature = 20°C
- Outside temperature = -20°C

Combination **4**/20/**2**/20/**2**mm

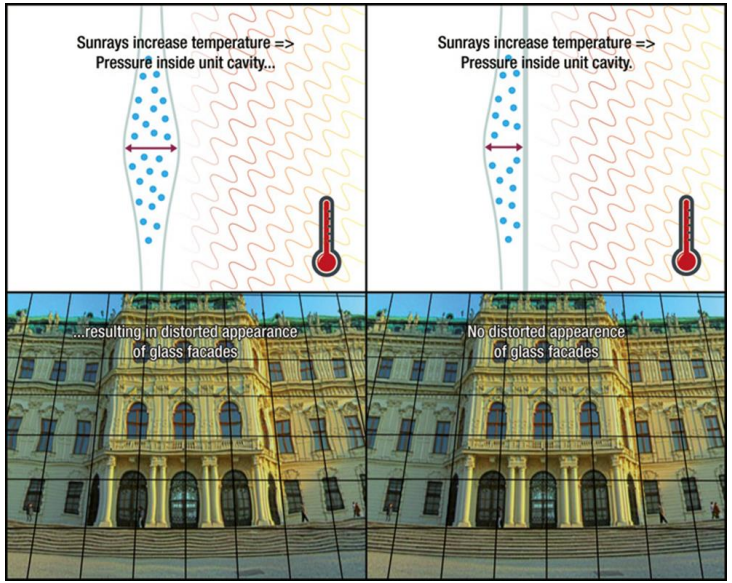


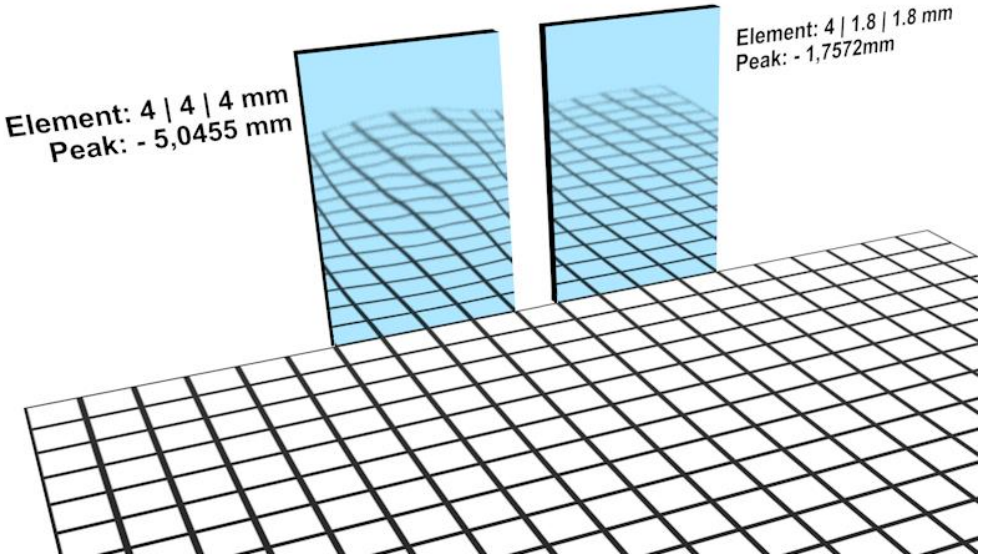
Combination **4**/20/**4**/20/**4**mm



Typical advantages of thin glass

Installed in standard Windows





Thank you for your attention!