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Façade integrated solar thermal collectors

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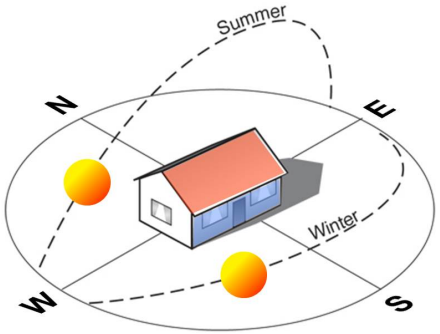
Outline



Basic principles

State of the art

New developments

Basic principles: Definition

- Solar collectors for hot water production or/and space heating
- Applied on the building façade

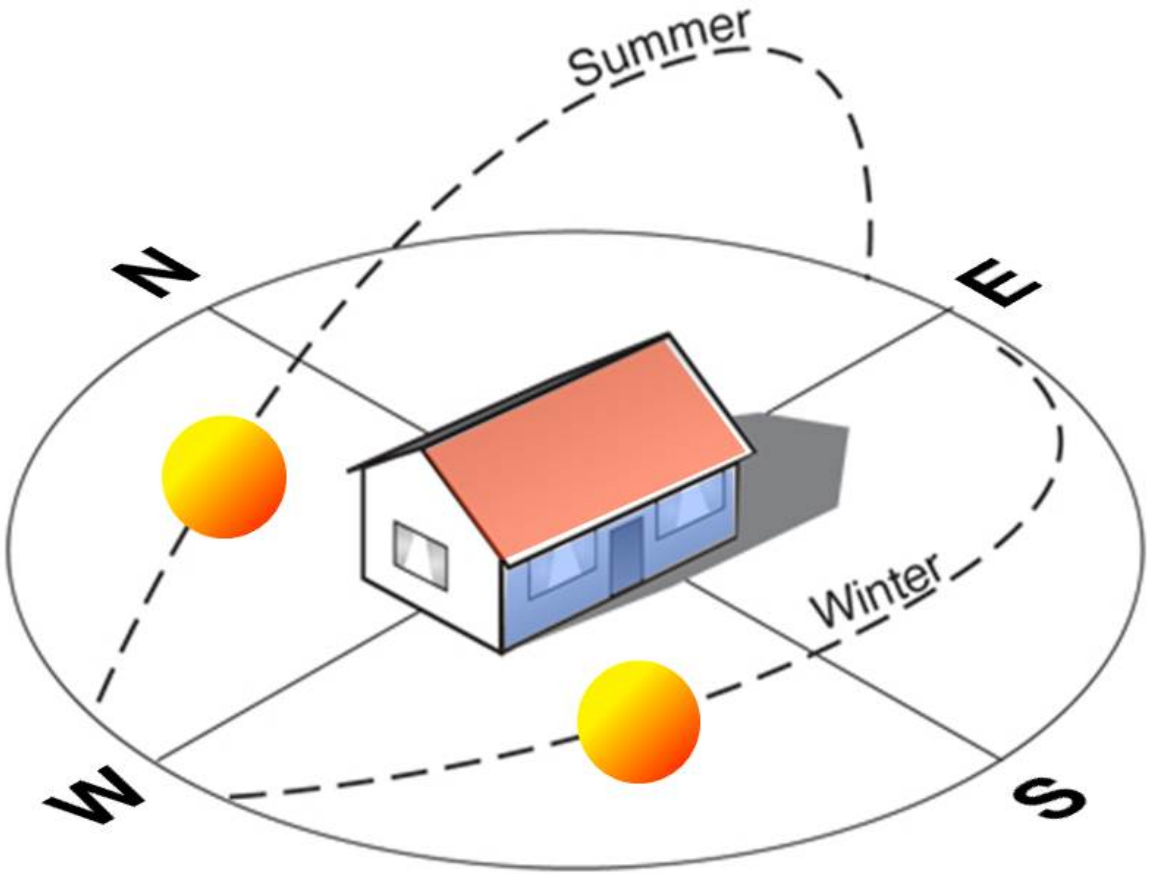
- Not just mounted on but part of the building envelope
- Different integration grades
- Different integration arts (ventilated / not-ventilated façade)

Advantages

- Alternative application by shortage of place on roof

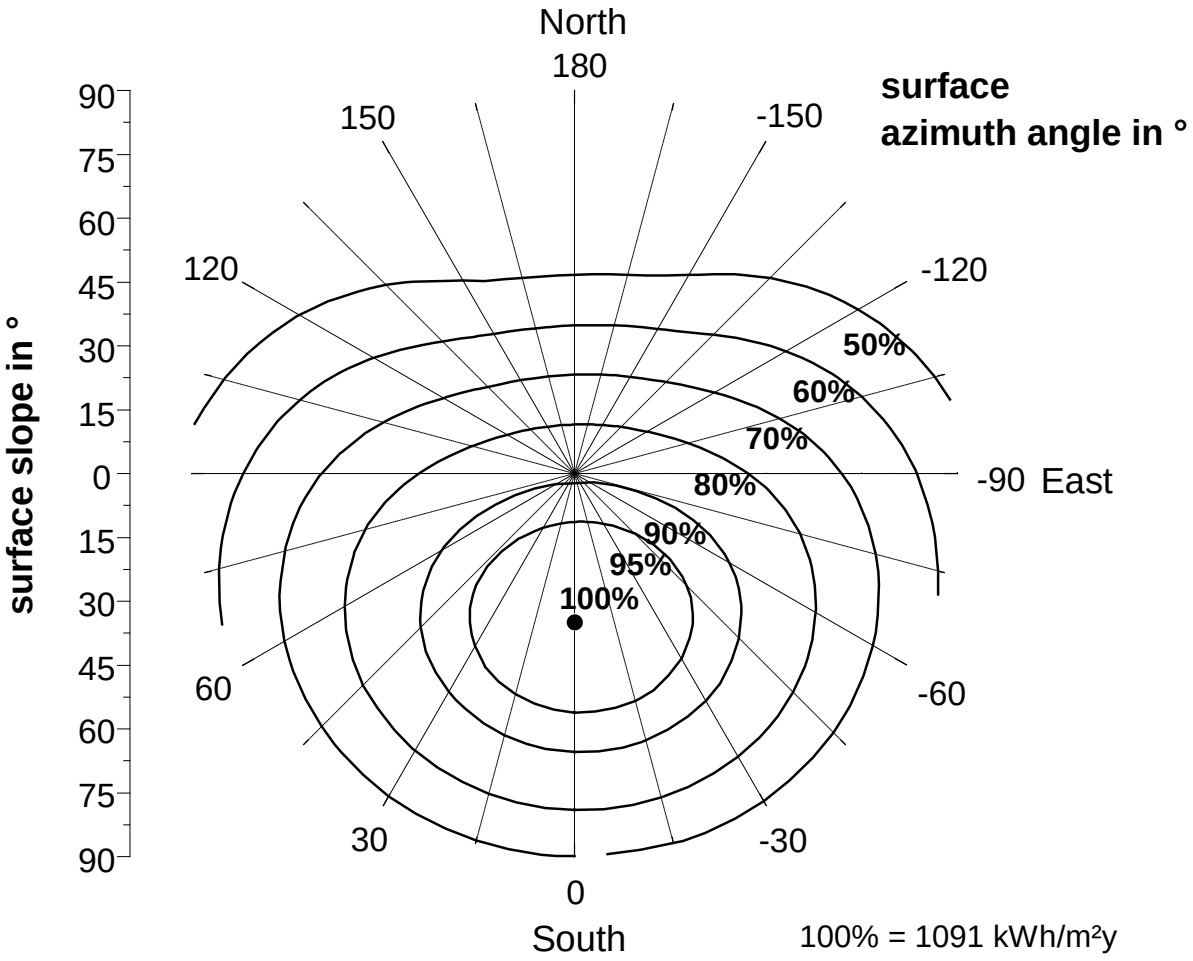
- Higher architectural quality
- Lower installation costs

Basic principles:
Collector slope and irradiation



Basic difference between roof and façade collectors

Basic principles: Yearly irradiation



Calculated yearly irradiation depending on collector orientation
Location: Hannover, calculation model: Hay-Davies, [1]

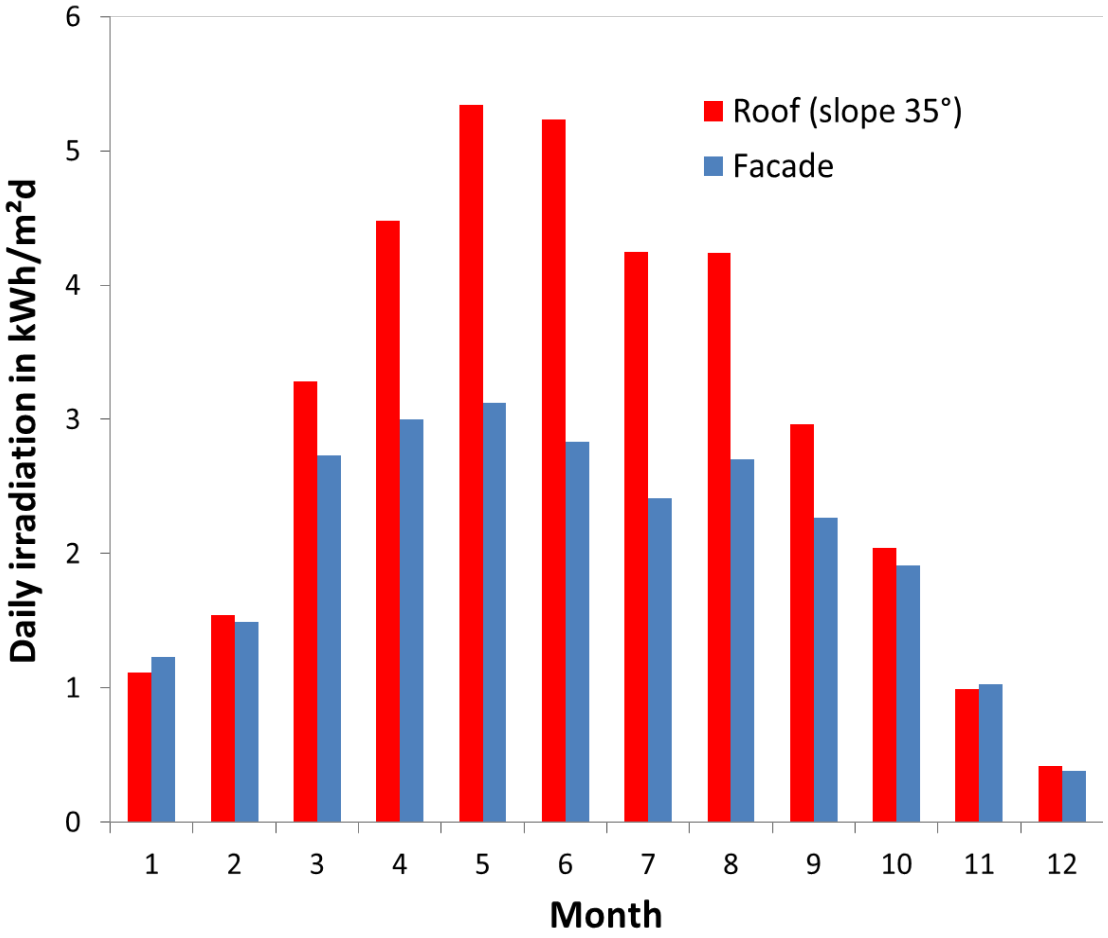
Compared to optimum orientation

Northern EU: - 25%

Central EU: - 30%

Southern EU: - 35%

Basic principles: Monthly irradiation

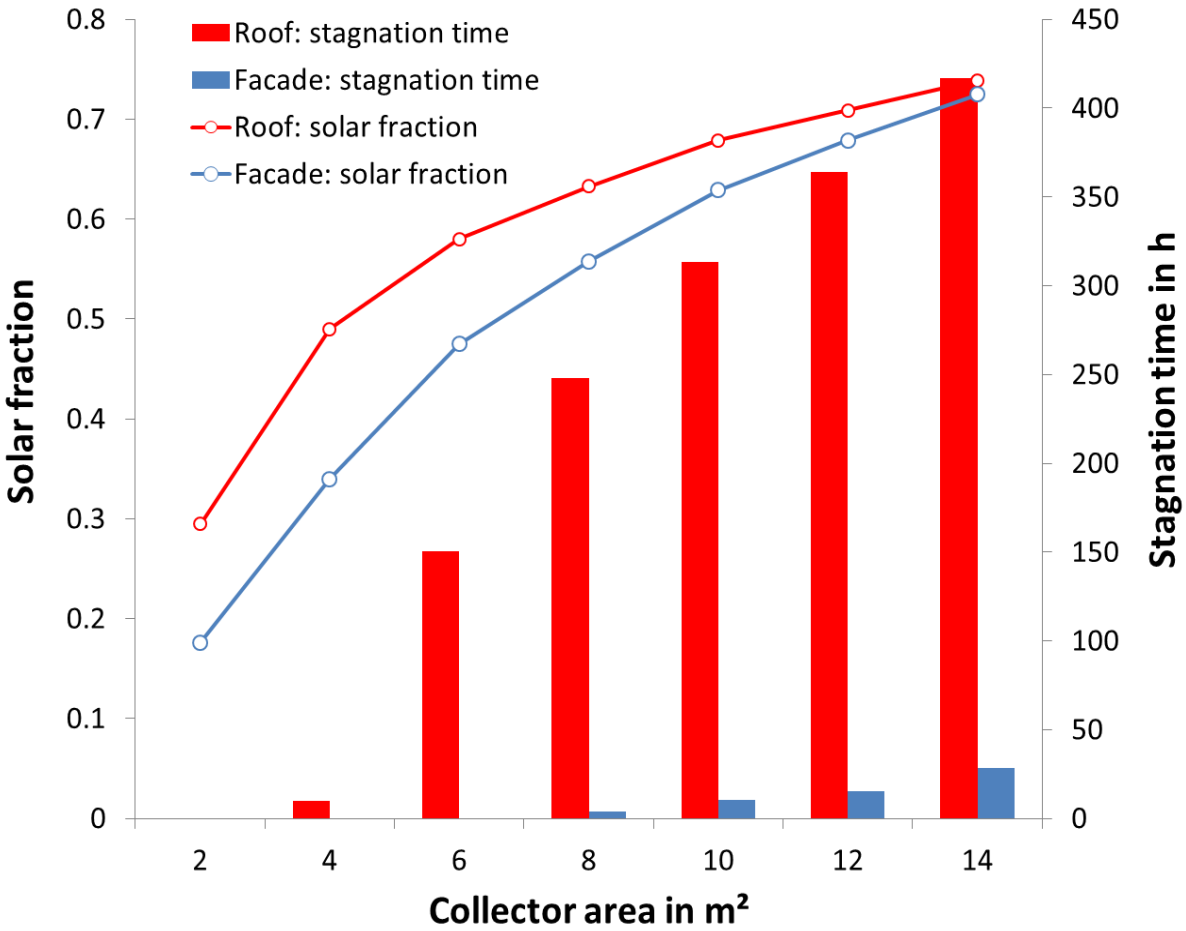


Annual profile of the average daily irradiation on south-oriented roof (slope 35°) and façade (slope 90°), [1]

Compared to optimum orientation

- Similar winter gains
- Lower summer gains
- Best suitable for space heating
- Reduced overheating

Basic principles:
Example solar water heating system



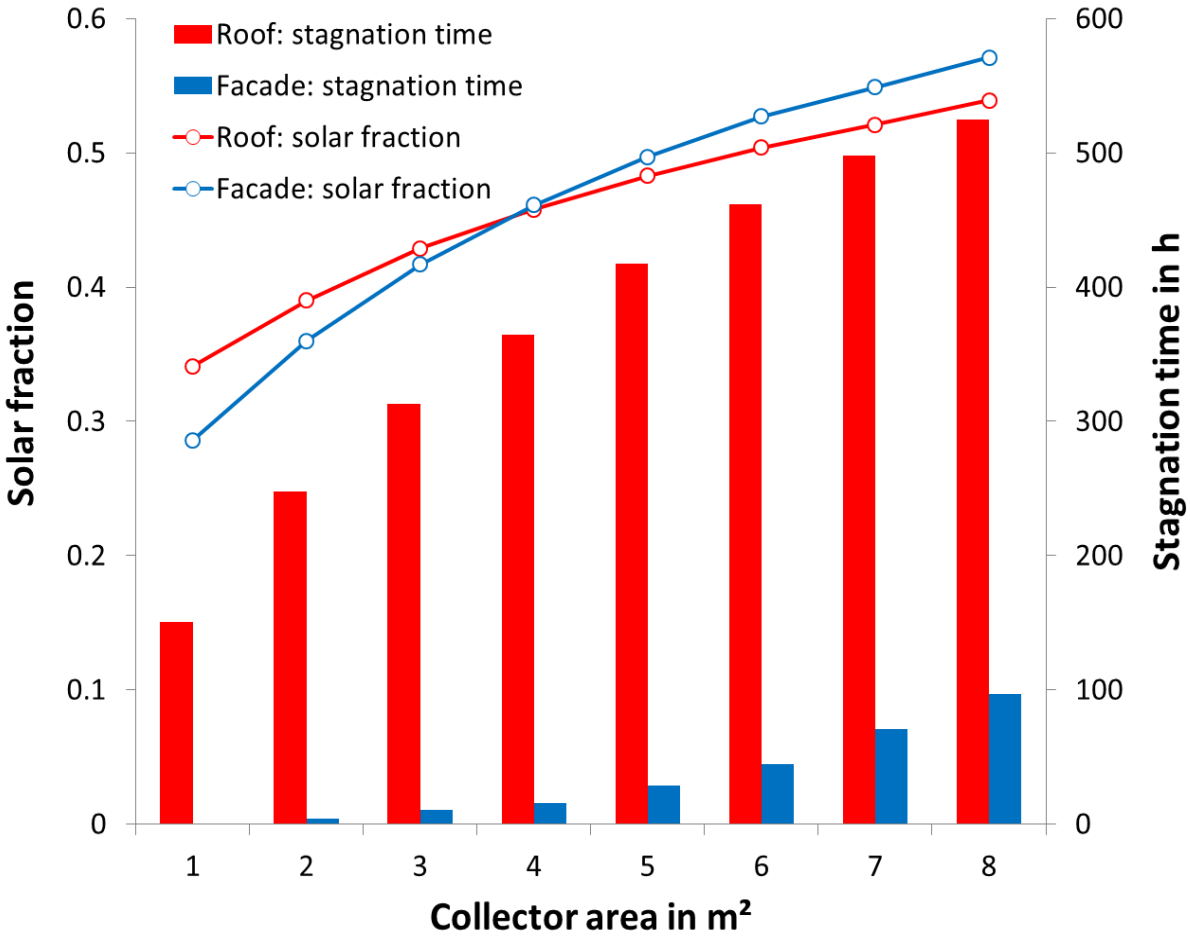
Simulated solar fraction and stagnation time for a solar domestic hot water system in a single family house [1]

Compared to roof-mounted collector

- Competitive at large solar fractions*
- Strong reduction of stagnation time

$$* \text{ Solar Fraction} = 1 - \frac{Q_{aux}}{Q_{use}}$$

Basic principles:
Example solar water + space heating



Simulated solar fraction and stagnation time for a solar combi system in a single family passive house [1]

Compared to roof-mounted collector

- Competitive at large solar fractions*
- Strong reduction of stagnation time

$$* \text{ Solar Fraction} = 1 - \frac{Q_{aux}}{Q_{use}}$$

State of the art

General approach

- Collector adapted for building integration

Market situation

- Many so-called façade collectors comm. available
- Few products featuring high integration grad

Building practice

- Several interesting projects
- Not yet established building practice

State of the art: Examples

Application in small buildings and single family houses

SFH, Nenzing (AT), source: Doma Solartecnik

SFH, Thüringen (AT), source: Doma Solartechnik

State of the art: Examples

Application in small buildings and single family houses

Source: Winker Solar

Source: Winker Solar

State of the art: Examples

Student hostel, source: Wagner Solar

Application in large buildings

Multifamily passive house, source: Wagner Solar

New developments

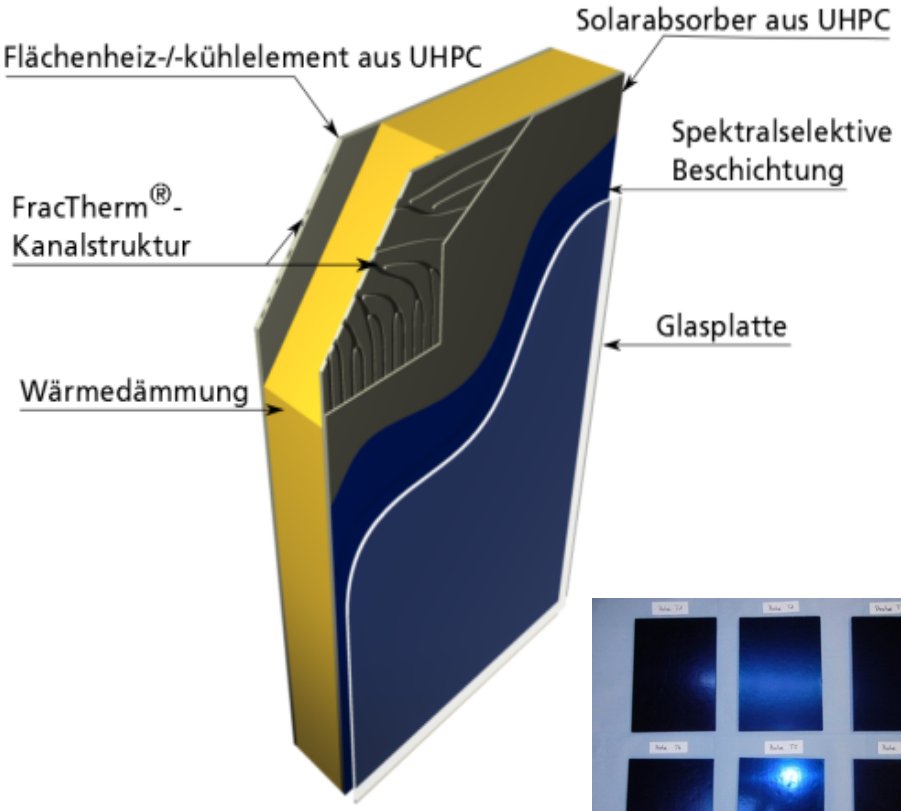
Development approach

- Current one: Collector adapted for building integration
- New one: Building adapted for solar energy use

Main goals

- Higher integration grad
- Higher architectural quality

New developments: Wall as solar collector



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Novel multifunctional building components

- Ultra-high performance concrete (UHPC)
- Integrated fluid channels
- Flexible geometry thanks to new manufacturing procedure
- High thermal efficiency
- Spectrally selective coating

Bundesministerium für Wirtschaft und Energie

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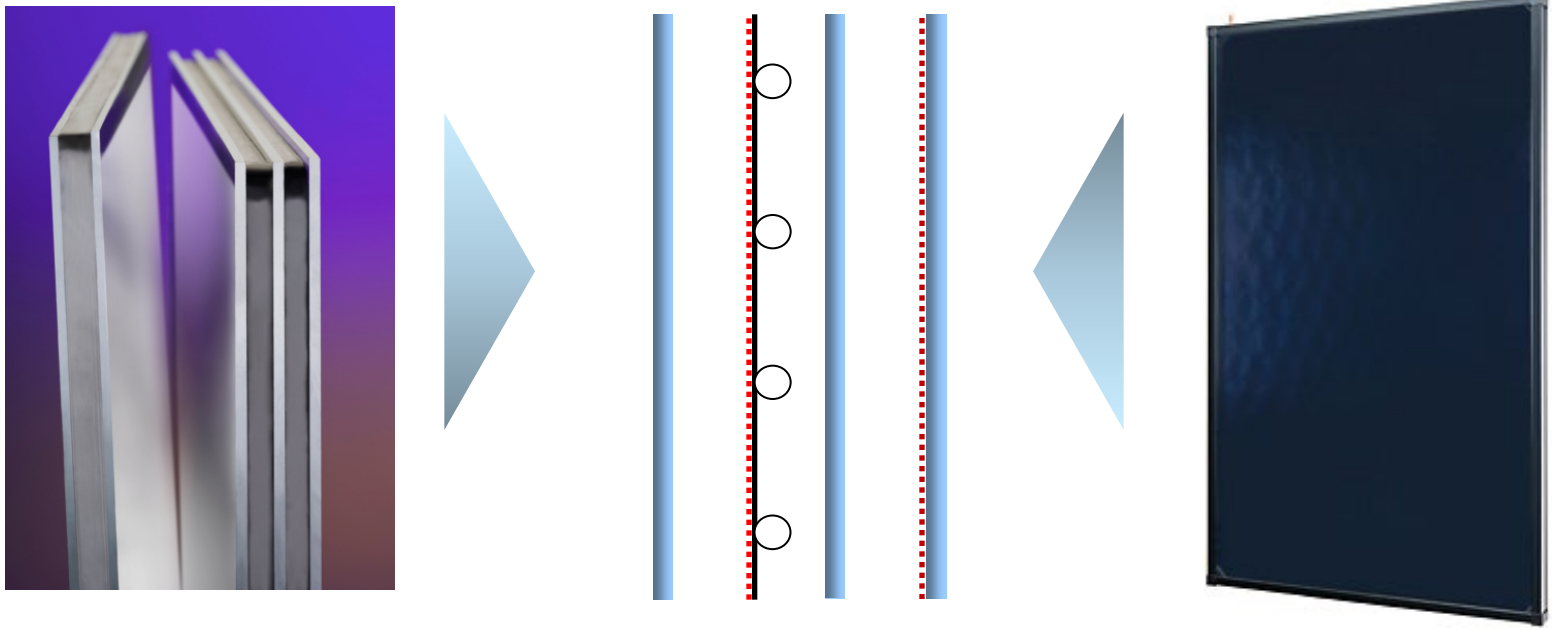
New developments:
Window as solar collector – Project 1



Combination of

architectural insulated glazing and flat plate collector

DBU Deutsche Bundesstiftung Umwelt

ENERGY GLAS

KBB SOLAR COLLECTORS

KÖMMERLING KÖMMERLING CHEMISCHE FABRIK GMBH

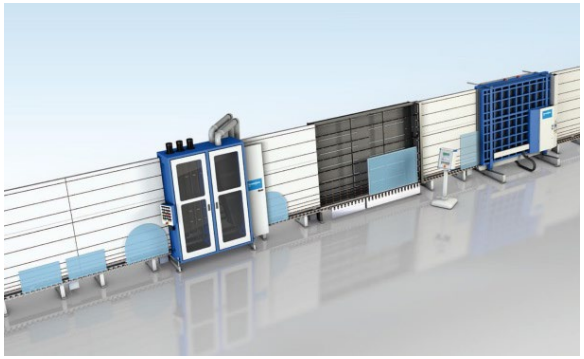
Bystronic glass

VEKA

New developments:
Window as solar collector – Project 1

Flexible, object-oriented design

Bystronic-Glass



Highly automated manufacturing

Energy Glas

Integration in common window frames

New developments:
Window as solar collector – Project 2

Mock-up of the new facade, Glasstec 2014, Düsseldorf

Multifunctional Quadruple IG-unit

- Thin glass pane (< 2 mm)
- Frameless openable window
- Solar thermal collector
- Energy/Daylighting control system

Façade integrated solar thermal collectors: Conclusion

Main features

- Attractive alternative to common roof collectors
- Best suitable for space heating
- Architectural chance and challenge

Status and perspective

- Many products and several projects
- Not yet established building practice
- New development approach trying to fill the gap

References and further reading

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