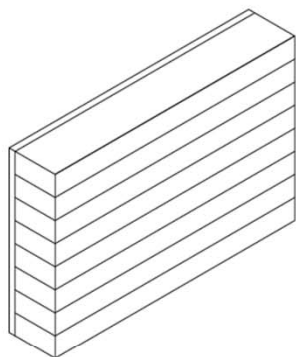




Workshop Energetisch Aktivierte Fassaden - Input-Lecture

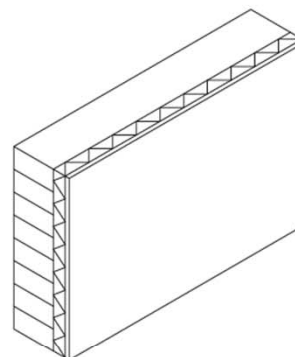
1. Wandkonstruktionen



1

Solid wall

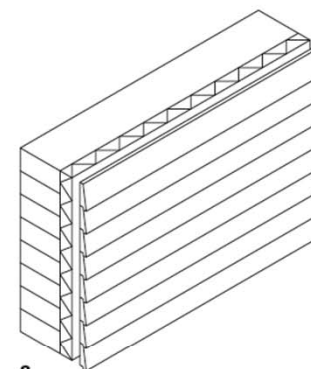
Solid wall constructed from monolithic or composite elements, with or without a separate layer to provide climatic protection (here in the form of exterior rendering).



2

Warm façade

Warm façades have a thermal insulation layer applied directly to the surface of the building. If the insulating layer is applied on the outside, it also has to be water-resistant to ensure that the insulating properties are not lost due to weathering. If the insulating layer is on the inside, the ability of the solid wall to store heat will no longer actively influence the interior environment.



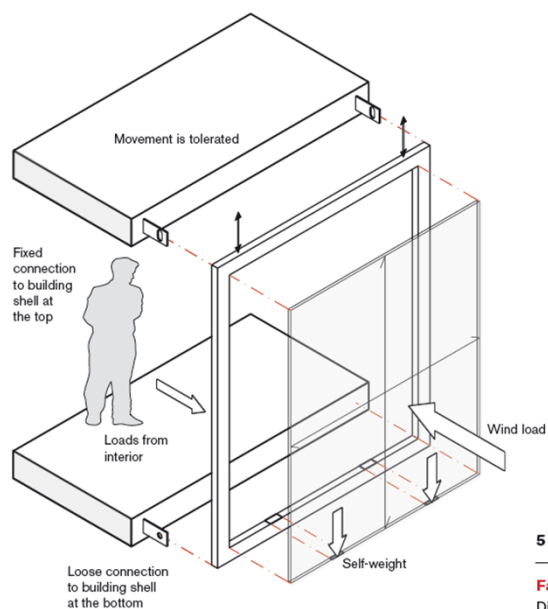
3

Cold façade

Cold façades are characterised by the presence of a cavity, ventilated internally, between the outer layer that offers protection against the weather and the thermal insulation layer.

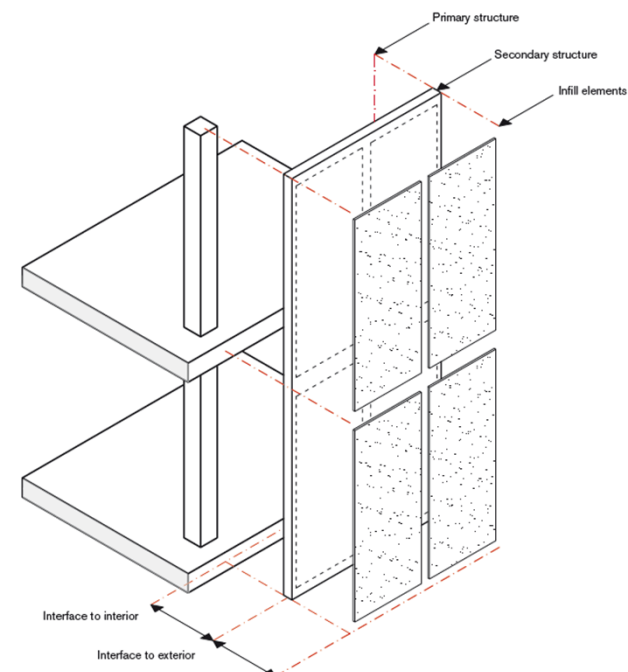
Entwicklungsschritt:

Auflösen der massiven Wand (solid wall) in Tragwerk und Fassade.



5

Façade load transfer
Different types of loads that need to be transferred.



2

Schematic representation of the elements of façade construction
In principle all façade constructions are based on this schematic design; however, different functional requirements can be combined into one component.

2. Fassadentypologien

2.1 Pfosten-Riegel-Fassade



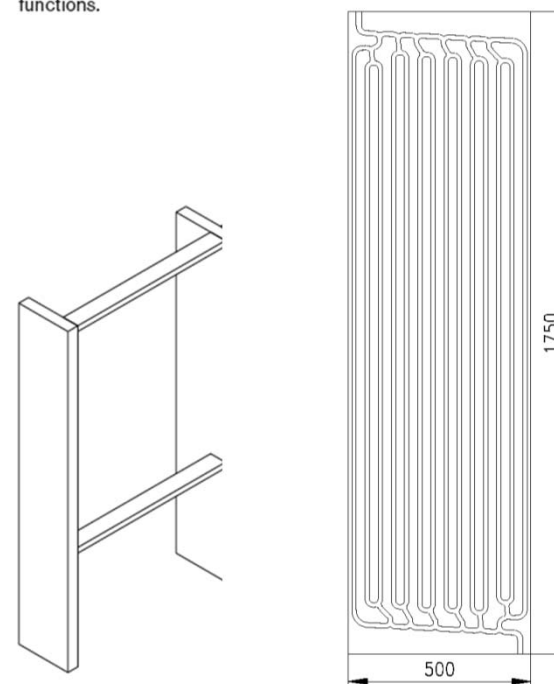
24

**Library, Delft University of Technology,
 Mecanoo, 1998**

Post-and-beam system used in the new library at Delft University of Technology, consisting of vertical post and horizontal beam elements. The panes of glass are mounted in external frames.

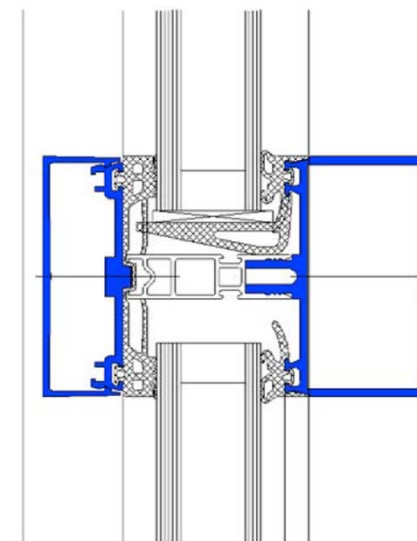
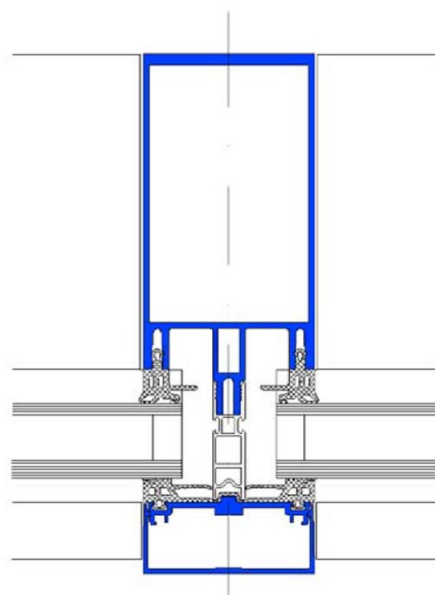
Post-and-beam façade

Post-and-beam façades consist of storey-high posts linked by horizontal beams. The spaces between these members functions.



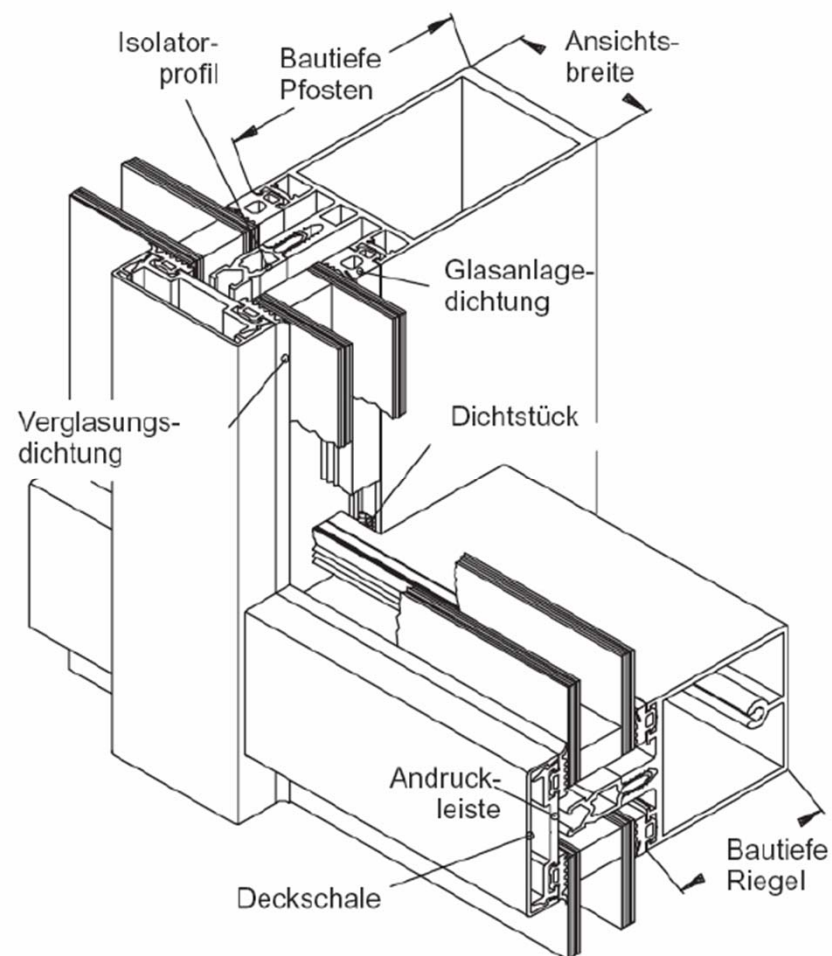
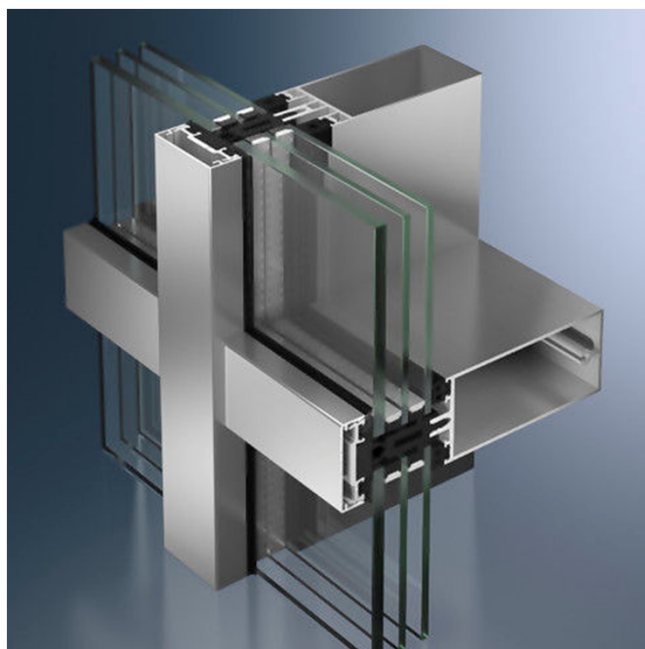
2. Fassadentypologien

2.1 Pfosten-Riegel-Fassade



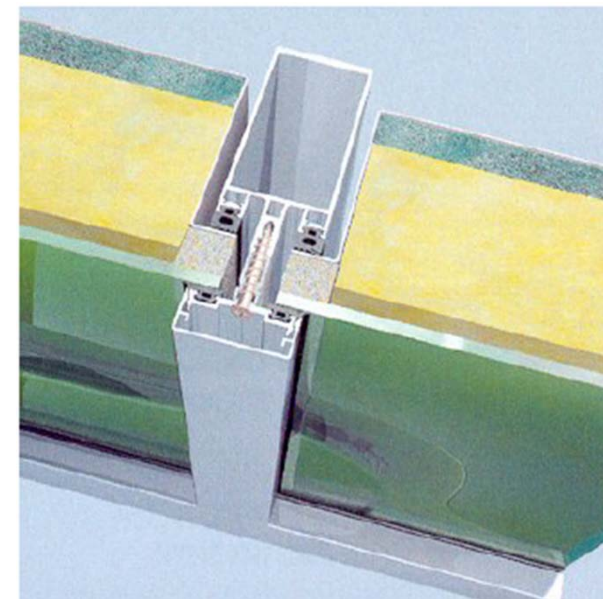
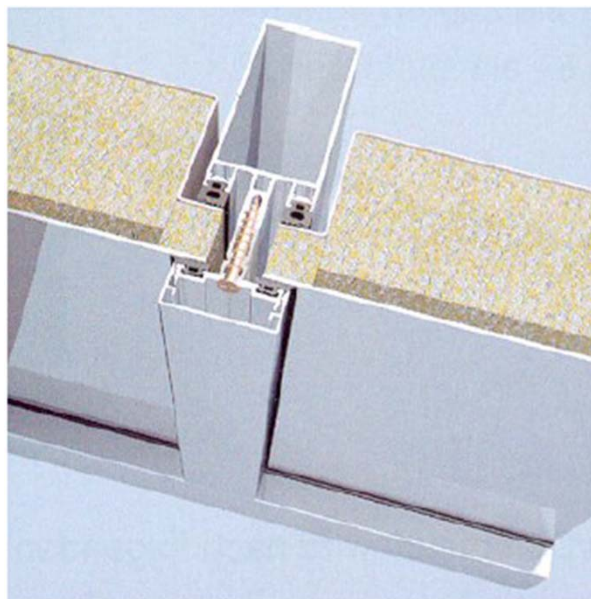
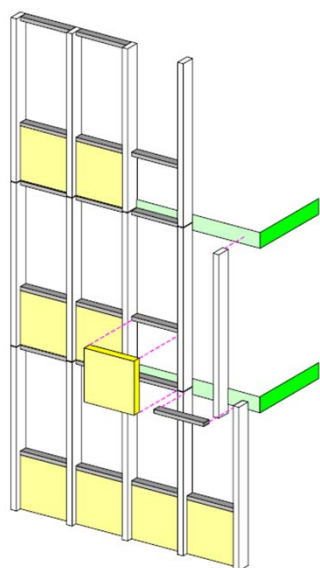
2. Fassadentypologien

2.1 Pfosten-Riegel-Fassade



2. Fassadentypologien

2.1 Pfosten-Riegel-Fassade : Paneele und Einsetzelemente





Interreg

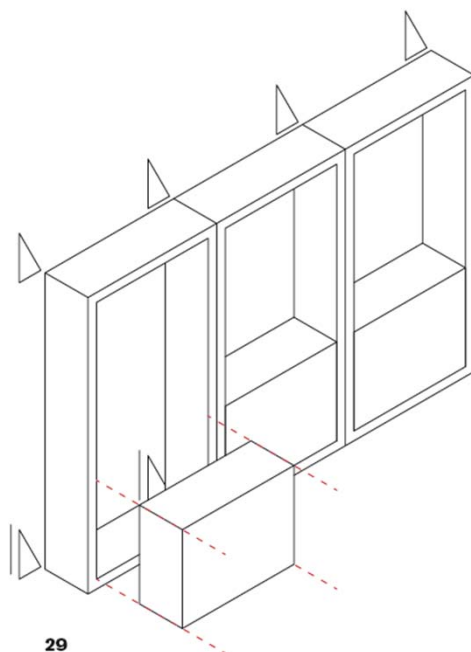


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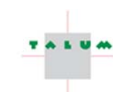
2.2 Vorhangfassade



29

Curtain wall

Unlike pure post-and-beam systems, curtain walls are suspended from above with the aid of tie rods. This approach has the advantages of avoiding buckling in the posts and of a large degree of independence from the main structure of the building.



Lahkota prihodnosti



27

Federal Center, Chicago, Ludwig Mies van der Rohe, 1964

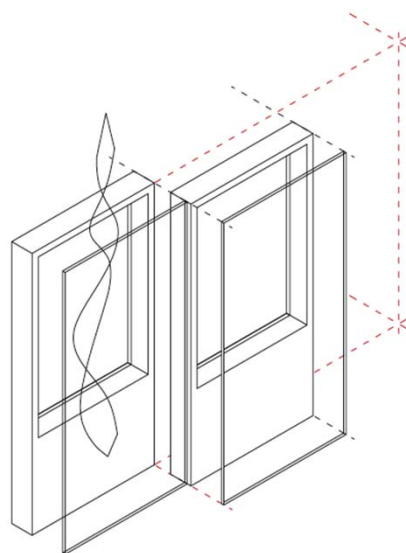
Mies van der Rohe's Federal Center in Chicago is an example of a curtain wall. It reflects the demand for industrially produced façades that at the same time satisfy architectural preferences: the façade is made up of pre-fabricated elements, assembled by craftsmen on site.

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2.3 Doppelfassaden

2.3.1 Double-Skin-Fassade



32

Double façade

A double façade is obtained by adding an extra layer of glazing outside the façade to provide the building with ventilation or additional sound-proofing. This system may be realised in various ways, depending on the functions desired and the requirements made on the façade.



33

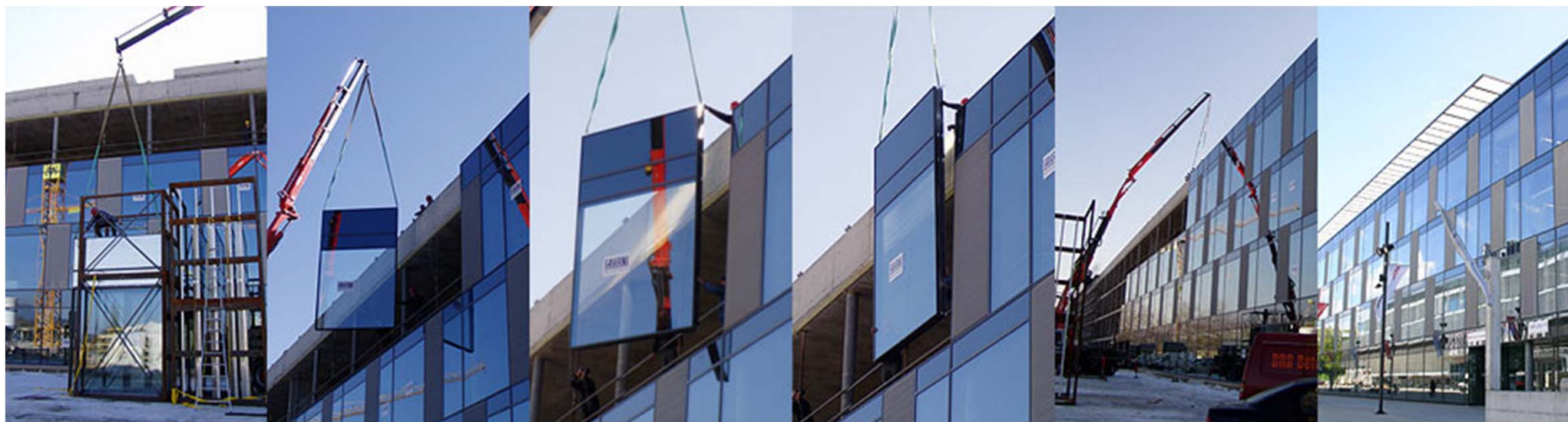
Single and double façade:

**Triangle Building, Cologne,
 Gatermann + Schossig, 2006**

An example of the façade for a high-rise building offering different functions depending on the requirements. The single façade may be seen on the right of the picture, while on the left an additional layer of glazing has been added to create a double façade with a ventilated space between the two layers.

2.3 Doppelfassaden

2.3.1 Double-Skin-Fassade - Montage einer Elementfassade





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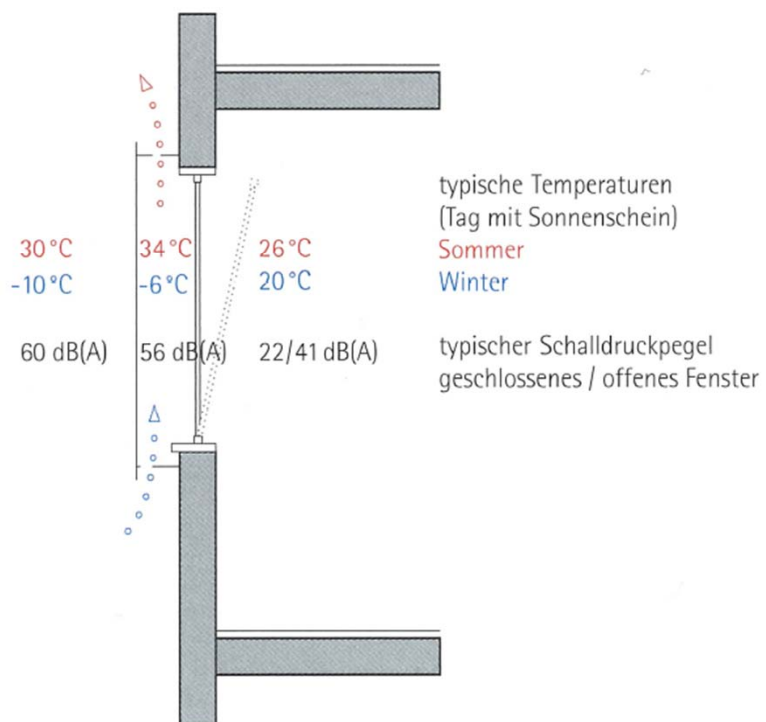
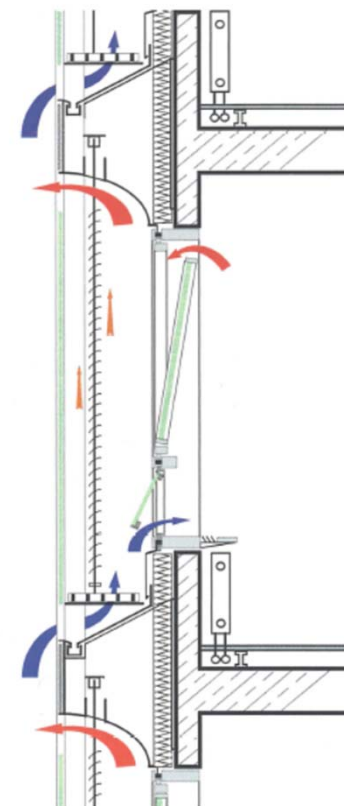
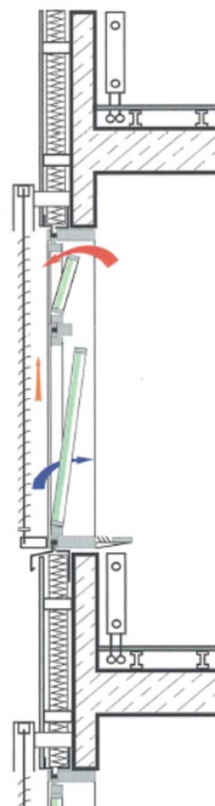


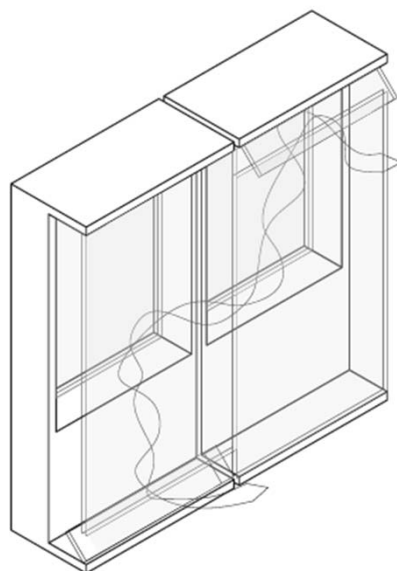
Abb. 3.17 Temperaturverhältnisse und Schalldruckpegel



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2.3.2 Korridorfassade



37

Corridor façade

Corridor façades connect neighbouring double-façade elements in order to permit staggered ventilation of the space between the two skins.



38

Stadttor Building, Düsseldorf, Petzinka Pink und Partner, 1998

An early example of a corridor façade: the storey-high façade elements have rotary timber baffles on the inside and a continuous glass skin on the outside.



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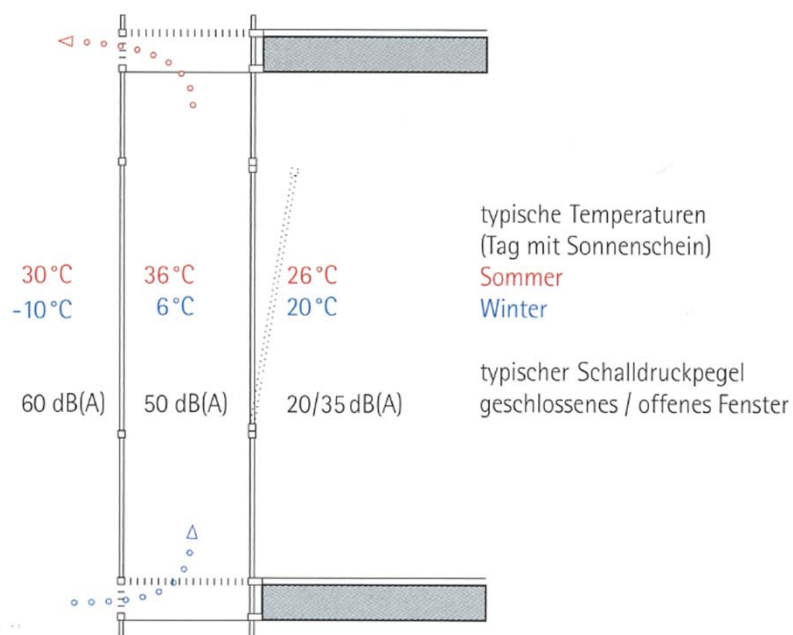


Abb. 3.23 Temperaturverhältnisse und Schalldruckpegel bei Korridorfassaden



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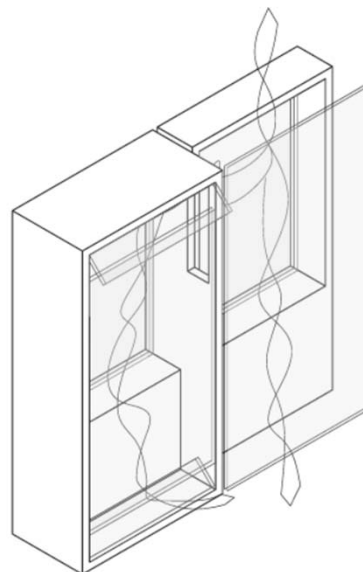


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2.3.3 Shaft-box-Fassaden



39

Shaft-box façade

Shaft-box façades, featuring box windows that release their exhaust air into a shaft that extends over several floors, offer a double façade system that requires complex installation but is highly effective.



40

Photonics Centre, Berlin, Sauerbruch Hutton Architects, 1998

Early variant of the shaft-box façade, consisting of vertically separated ventilation shafts in the plane of the façade which merge at the top for effective ventilation of the space enclosed by the double façade.



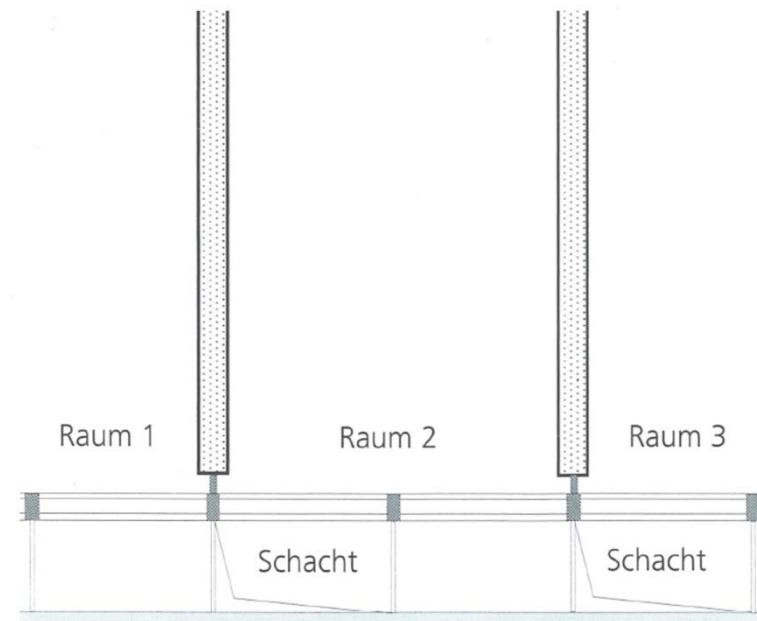
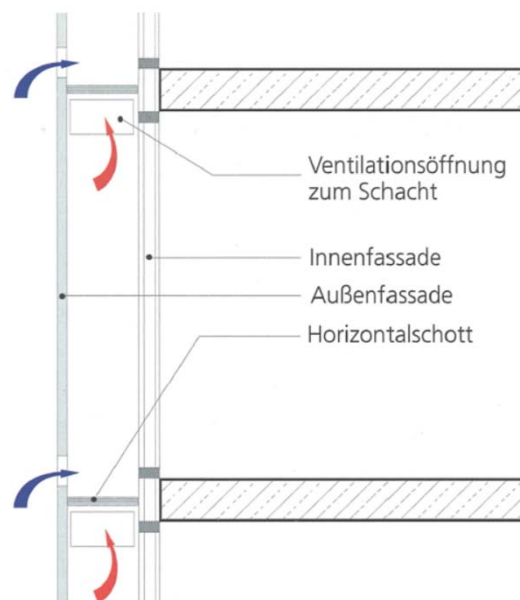
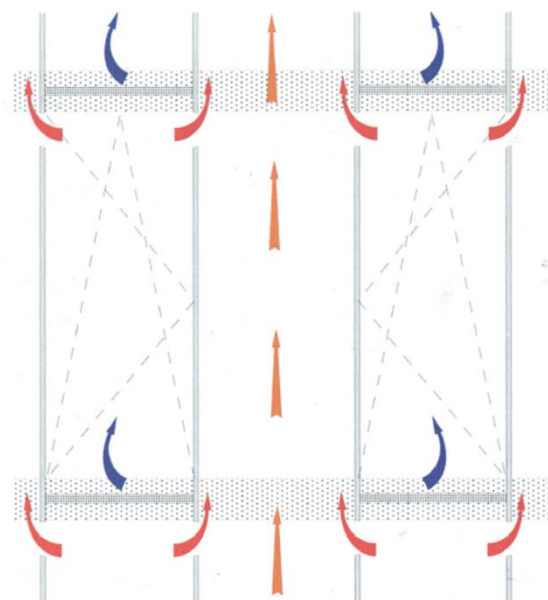


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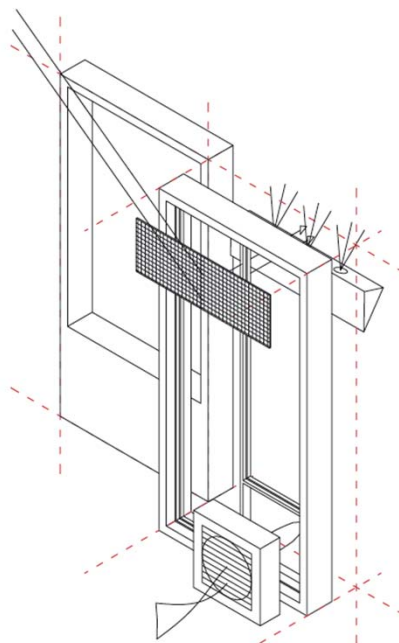
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2.3.4 Hybride Fassaden



38

Integrated façade

An integrated façade comprises numerous building services elements. The building process can be shortened because additional components can be integrated into the façade elements during the industrial manufacturing process.

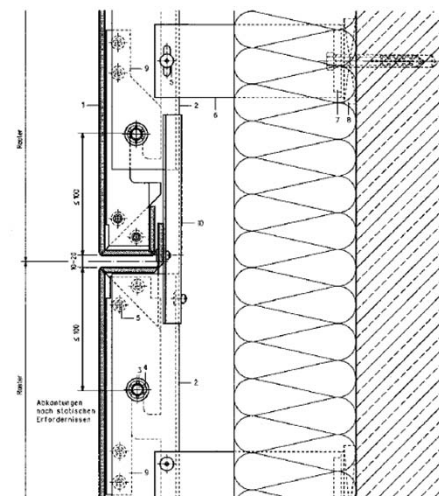
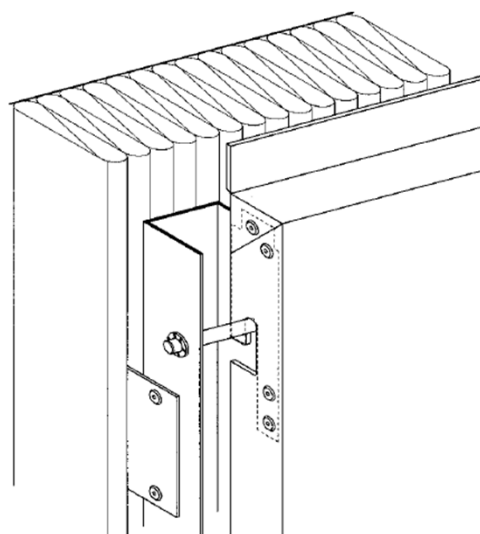
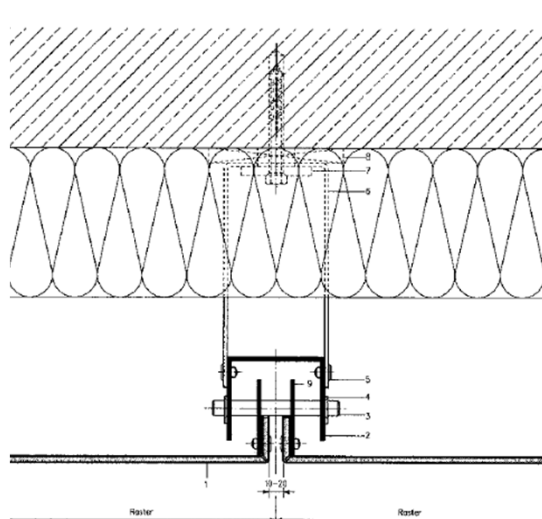


43

Post Tower, Bonn, Helmut Jahn, 2003

Helmut Jahn worked together with Transsolar Climate Engineering to develop one of the first hybrid façades for the Post Office Tower project in Bonn. Environmental-control modules built into the top part of the façade could be controlled locally as individual units.

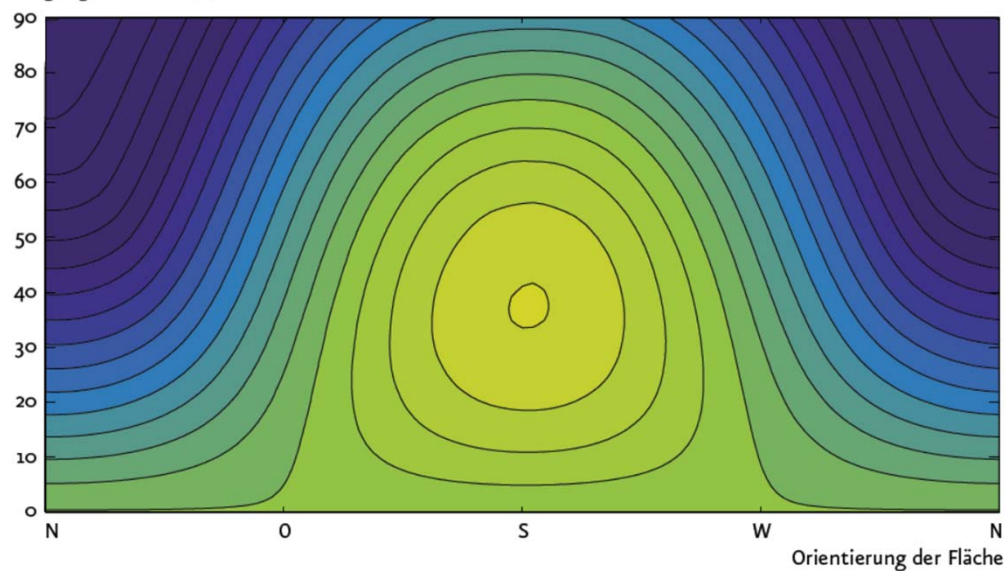
2.4 Vorgehängte hinterlüftete Fassaden



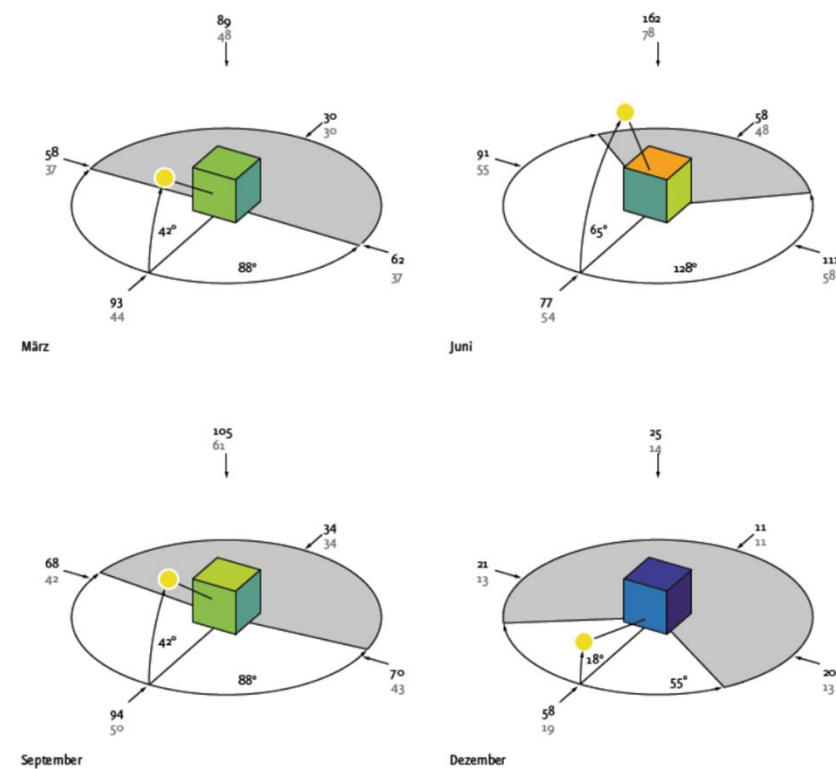
3.1 Solarstrahlung (gemäßigte Klimazone)

>600 >1.000 >1.500 >2.000
 Eingestrahlte Energie [kWh/m²a]

Neigung der Fläche [°]



>0 >40 >80 >120 >160 >200
 Eingestrahlte Energiemenge [kWh/m²Monat]

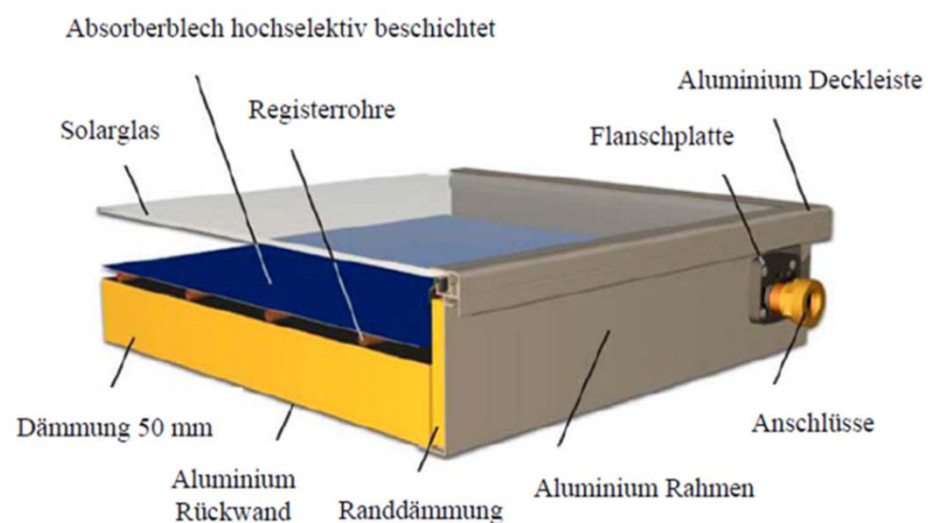


3.2 Mögliche Energiegewinne aus der Fassade

		Nordeuropa Helsinki		Mitteleuropa Ljubljana		Südeuropa Madrid	
		kaltes Jahr	warmes Jahr	kaltes Jahr	warmes Jahr	kaltes Jahr	warmes Jahr
Solar- strahlung [kWh/m²a]	horizontal	801	1117	947	1331	1475	1852
	Nord	357	366	354	391	421	402
	Ost	598	818	600	838	906	1138
	Süd	737	1159	685	1087	1035	1444
	West	616	837	591	836	874	1101
Ertrag Solarthermie [kWh _{th} /m²a]	horizontal	373	540	487	706	816	1038
	Nord	153	165	166	192	211	211
	Ost	284	414	303	443	490	642
	Süd	353	594	336	567	529	780
	West	299	433	303	450	479	635
Ertrag Photovoltaik [kWh _{el} /m²a]	horizontal	79	110	91	128	142	177
	Nord	32	31	30	33	36	34
	Ost	58	80	56	79	87	109
	Süd	73	115	65	106	100	140
	West	59	80	55	78	82	103
Verhältnis SOL/PV [kWh _{th} /m²a/ kWh _{el} /m²a]	horizontal	4,7	4,9	5,3	5,5	5,7	5,9
	Nord	4,8	5,3	5,5	5,8	5,8	6,3
	Ost	4,9	5,2	5,4	5,6	5,7	5,9
	Süd	4,9	5,1	5,2	5,4	5,3	5,6
	West	5,1	5,4	5,5	5,7	5,9	6,2

4. Energiegewinnung - übliche Systeme

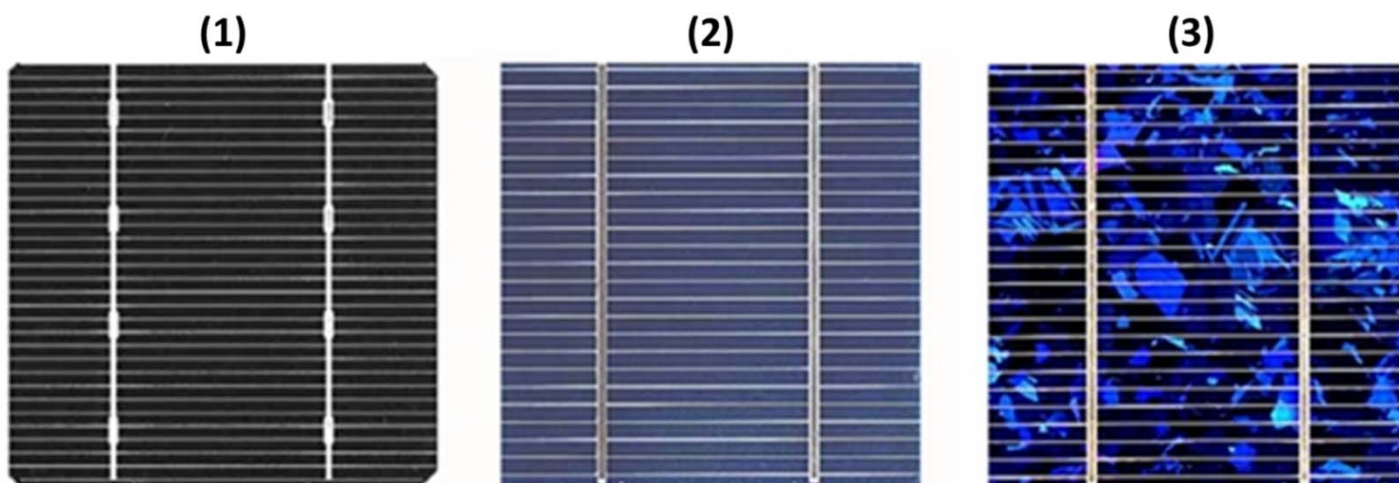
4.1 Solarthermische Systeme



4.2 Photovoltaiksysteme



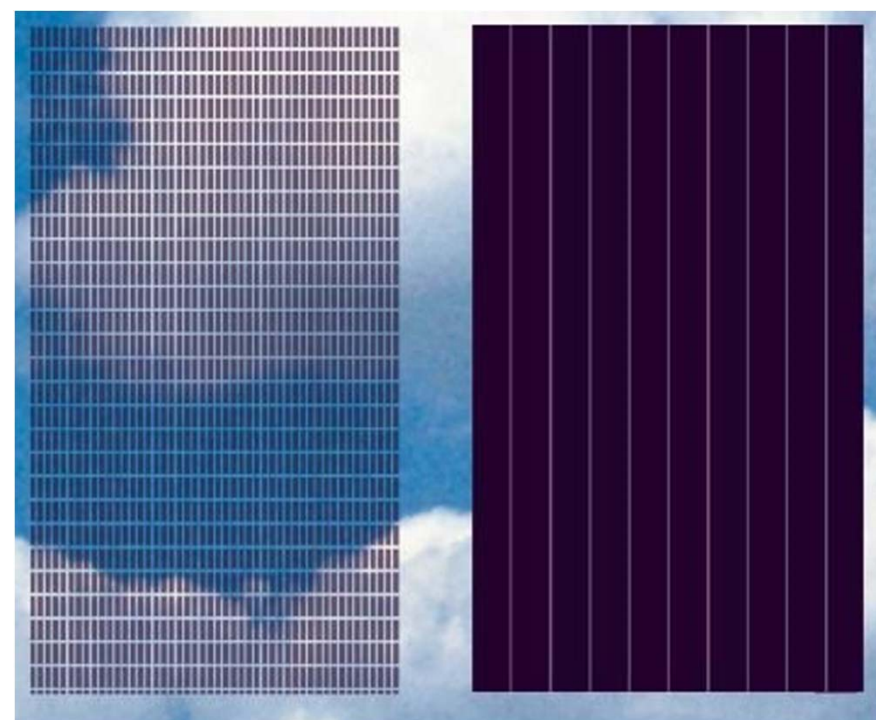
4.2 Photovoltaiksysteme - Arten von Siliziumzellen



(1) Monokristalline PV-Zelle schwarz, (2) Monokristalline PV-Zelle blau, (3) Polykristalline PV-Zelle

4.2 Photovoltaiksysteme - Dünnschicht-PV

Diese unterscheiden sich von den traditionellen (kristallinen) Solarzellen vor allem in ihren Produktionsverfahren, durch die Schichtdicken der eingesetzten Materialien und (zumeist) durch ihren Wirkungsgrad.



4.3 Hybridysteme (PVT-Kollektoren)



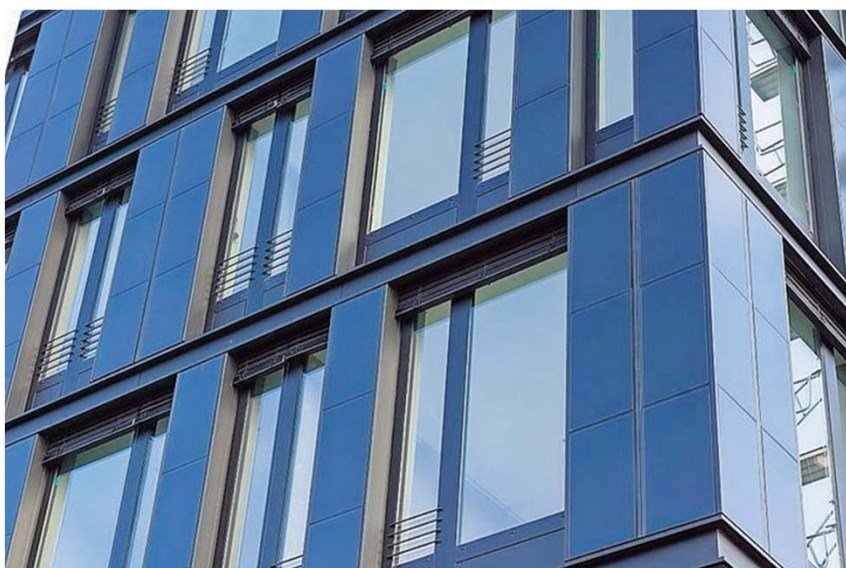
5.1 Architektonische Gestaltung ?

Ist-Situation: Zumeist nur unbefriedigende Lösungen!



5.2 Architektonische Gestaltung ?

Lösungsansatz: Unsichtbare Fassadenintegration durch neue Technologien!



CIGS-Dünnschichtphotovoltaik (Kupfer-Indium-Gallium-Diselenid)

STAF-Paneel als Solarthermiekollektor