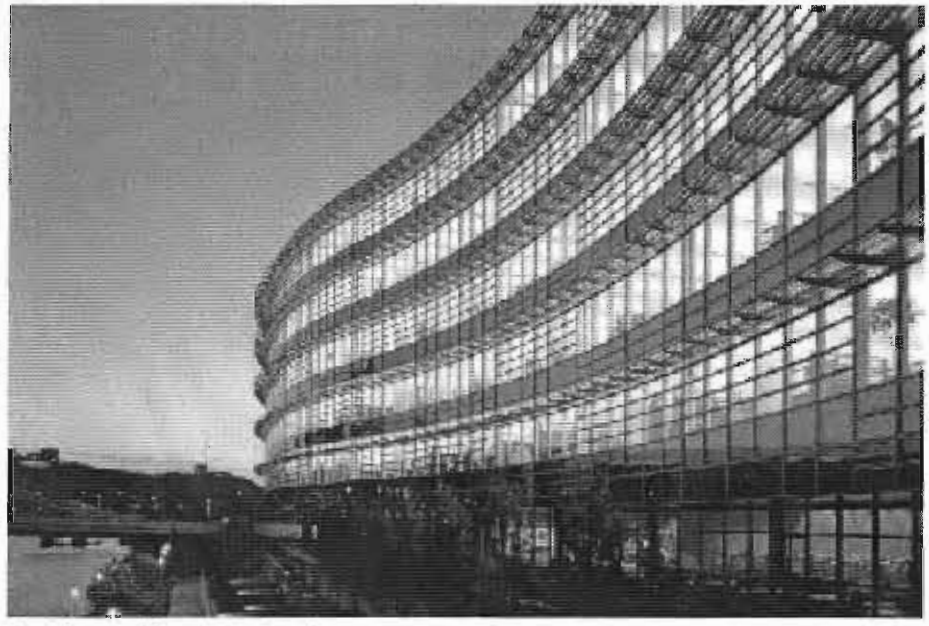
External Shading Devices in Commercial Buildings

The Impact on Energy Use, Peak Demand and Glare Control



The Alcoa Building in Pittsburgh, PA uses exterior shading devices. Architect: The Design Alliance Architects; Photo: Courtesy of Viracon

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The material in this report was prepared by John Carmody and Kerry Haglund from the Center for Sustainable Building Research at the University of Minnesota. The information is drawn from *Window Systems for High Performance Commercial Buildings* by John Carmody, Steve Selkowitz, Eleanor S. Lee, Dariush Arasteh and Todd Willmert (Norton, 2004).

Benefits of External Shading Devices

Exterior shading devices such as overhangs and vertical fins have a number of advantages that contribute to a more sustainable building. These include:

1. Exterior shading devices result in energy savings by reducing direct solar gain through windows. By using exterior shading devices with less expensive glazings, it is possible to obtain performance equivalent to unshaded higher performance glazings.
2. Peak electricity demand is reduced by exterior shading devices resulting in lower peak demand charges from utilities and reduced mechanical equipment costs.
3. Exterior shading devices have the ability to reduce glare in an interior space without the need to lower shades or close blinds. This means that daylight and view are not diminished by dark tinted glazings or blocked by interior shades. With exterior shading devices, glare control does not depend on user operation.

Using This Publication

This publication shows the impact of external shading devices on the energy use, peak demand, and glare conditions in commercial office buildings. The information is based on computer simulations of a wide range of conditions in order to give designers general guidance during early stages of design. This is intended to help the designer quickly narrow the range of possibilities and understand the approximate impacts. If there is more time and budget, this can be followed by a more detailed computer simulation of the specific building and the design conditions.

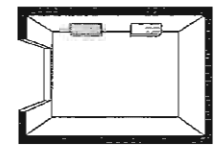
The impact is different depending on the building location, the window orientation, the window size, and the type of glazing and shading device used.

Results are presented for six cities with differing climates—Minneapolis, Chicago, Washington DC, Houston, Phoenix and Los Angeles. Within each climate, results are shown for east-, south-, and west-facing orientations. The north orientation is not shown since the impacts of external shading devices are small. Within each orientation, there are results for both moderate (WWR=0.30) and a large (WWR=0.60) window areas (WWR is the window-to-wall ratio). For each set of conditions, there are seven window types and five shading conditions shown in the figure at right.

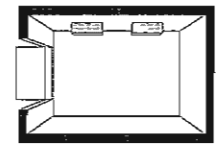
Reading the Tables

For each location, orientation and window area, there is a table summarizing the impacts of external shading devices. A portion of one of these tables is shown below. For a given glass type (clear single glazing in this case), there are five lines of data—one for each shading condition. The "Energy" column shows the actual energy use for each shading condition and the "Energy % Save" shows the percent savings compared to the unshaded case (none). Similarly, the "Peak" column shows actual peak demand and the "Peak % Save" shows the percent savings compared to the unshaded case (none). The "Glare" column shows the weighted glare index for each shading condition and the "Glare % Red." shows the percent glare reduction compared to the unshaded case (none).

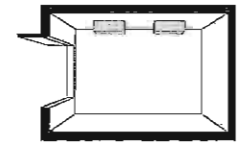
EXTERNAL SHADING TYPES



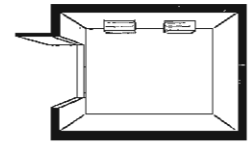
No Shading (none)



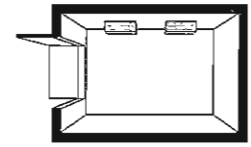
Vertical Fins (fins)



Shallow Overhang (ov1)



Deep Overhang (ov2)



Overhang and Fins (ov2f)

IMPACT OF EXTERIOR SHADING—CHICAGO, IL
South Orientation—Large Window Area (WWR=0.60)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	221.01	0.0%	11.11	0.0%	15.55	0.0%
fins	Clear (1)	0.72	0.71	1.25	208.88	5.5%	9.54	14.1%	14.04	9.8%
ov1	Clear (1)	0.72	0.71	1.25	181.28	18.0%	7.03	36.8%	14.33	7.9%
ov2	Clear (1)	0.72	0.71	1.25	169.81	23.2%	5.57	49.8%	13.98	10.1%
ov2f	Clear (1)	0.72	0.71	1.25	164.16	25.7%	4.52	59.3%	10.34	33.5%

Note: All cases are south-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices. SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

Minneapolis, Minnesota
East Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an east-facing facade with moderate window area in a commercial office building in Minneapolis, Minnesota.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

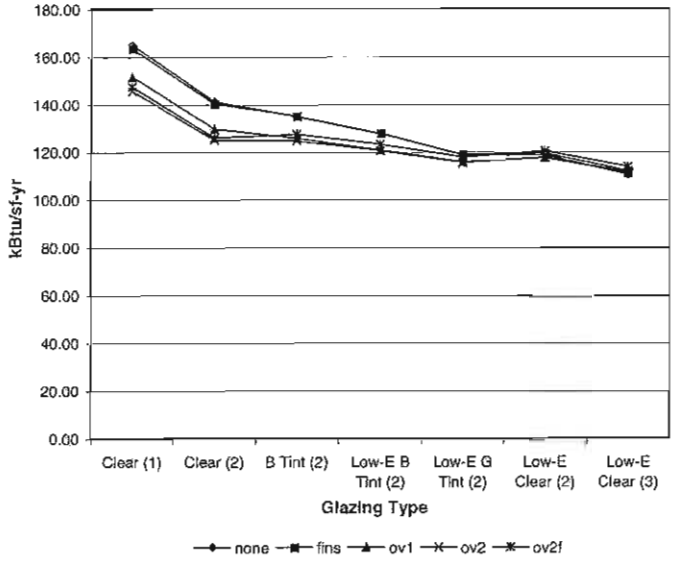
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

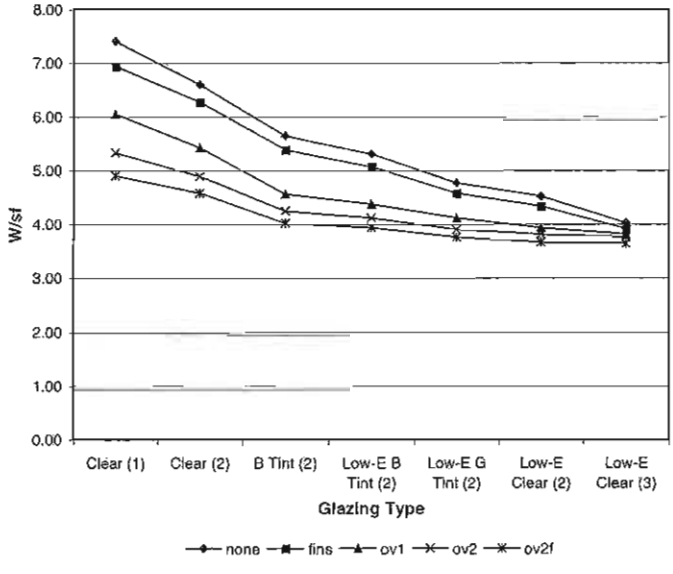
IMPACT OF EXTERIOR SHADING—MINNEAPOLIS, MN
East Orientation—Moderate Window Area (WWR=0.30)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	164.79	0.0%	7.40	0.0%	7.98	0.0%
fins	Clear (1)	0.72	0.71	1.25	163.31	0.9%	6.93	6.3%	7.00	12.3%
ov1	Clear (1)	0.72	0.71	1.25	151.35	8.2%	6.04	18.4%	7.00	12.3%
ov2	Clear (1)	0.72	0.71	1.25	145.41	11.8%	5.32	28.1%	7.00	12.3%
ov2f	Clear (1)	0.72	0.71	1.25	147.17	10.7%	4.89	33.9%	7.00	12.3%
none	Clear (2)	0.60	0.63	0.60	141.01	0.0%	6.59	0.0%	7.61	0.0%
fins	Clear (2)	0.60	0.63	0.60	140.16	0.6%	6.27	4.9%	7.00	8.1%
ov1	Clear (2)	0.60	0.63	0.60	129.54	8.1%	5.42	17.8%	7.00	8.1%
ov2	Clear (2)	0.60	0.63	0.60	124.81	11.5%	4.88	25.9%	7.00	8.1%
ov2f	Clear (2)	0.60	0.63	0.60	125.77	10.8%	4.57	30.6%	7.00	8.1%
none	B Tint (2)	0.42	0.38	0.60	134.83	0.0%	5.64	0.0%	7.00	0.0%
fins	B Tint (2)	0.42	0.38	0.60	134.99	-0.1%	5.38	4.6%	7.00	0.0%
ov1	B Tint (2)	0.42	0.38	0.60	125.67	6.8%	4.55	19.2%	7.00	0.0%
ov2	B Tint (2)	0.42	0.38	0.60	124.49	7.7%	4.24	24.8%	7.00	0.0%
ov2f	B Tint (2)	0.42	0.38	0.60	127.28	5.6%	4.02	28.8%	7.00	0.0%
none	Low-E B Tint (2)	0.39	0.36	0.49	127.44	0.0%	5.30	0.0%	7.00	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	127.66	-0.2%	5.06	4.5%	7.00	0.0%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	120.71	5.3%	4.36	17.7%	7.00	0.0%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	120.40	5.5%	4.11	22.4%	7.00	0.0%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	123.06	3.4%	3.93	25.8%	7.00	0.0%
none	Low-E Clear (2)	0.34	0.57	0.46	118.68	0.0%	4.75	0.0%	7.26	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	118.88	-0.2%	4.57	3.9%	7.00	3.6%
ov1	Low-E Clear (2)	0.34	0.57	0.46	115.71	2.5%	4.11	13.5%	7.00	3.6%
ov2	Low-E Clear (2)	0.34	0.57	0.46	115.42	2.8%	3.89	18.2%	7.00	3.6%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	117.69	0.8%	3.75	21.1%	7.00	3.6%
none	Low-E G Tint (2)	0.27	0.43	0.46	118.48	0.0%	4.51	0.0%	7.00	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	119.24	-0.6%	4.32	4.2%	7.00	0.0%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	117.49	0.8%	3.93	13.0%	7.00	0.0%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	117.53	0.8%	3.80	15.7%	7.00	0.0%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	120.16	-1.4%	3.65	19.0%	7.00	0.0%
none	Low-E Clear (3)	0.22	0.37	0.20	110.42	0.0%	4.02	0.0%	7.00	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	112.00	-1.4%	3.91	2.7%	7.00	0.0%
ov1	Low-E Clear (3)	0.22	0.37	0.20	111.11	-0.6%	3.81	5.3%	7.00	0.0%
ov2	Low-E Clear (3)	0.22	0.37	0.20	111.35	-0.9%	3.75	6.7%	7.00	0.0%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	113.75	-3.0%	3.63	9.7%	7.00	0.0%

ANNUAL ENERGY USE—MINNEAPOLIS, MN
East Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—MINNEAPOLIS, MN
East Orientation—Moderate Window Area (WWR=0.30)



Minneapolis, Minnesota
East Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an east-facing facade with a large window area in a commercial office building in Minneapolis, Minnesota.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

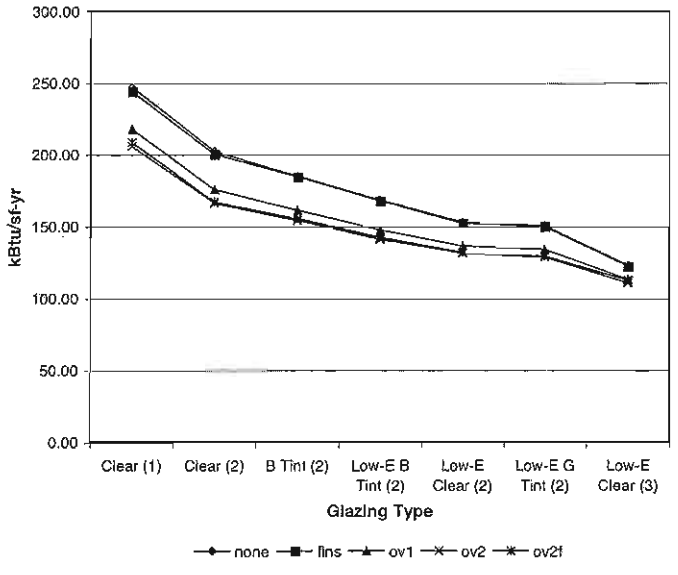
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

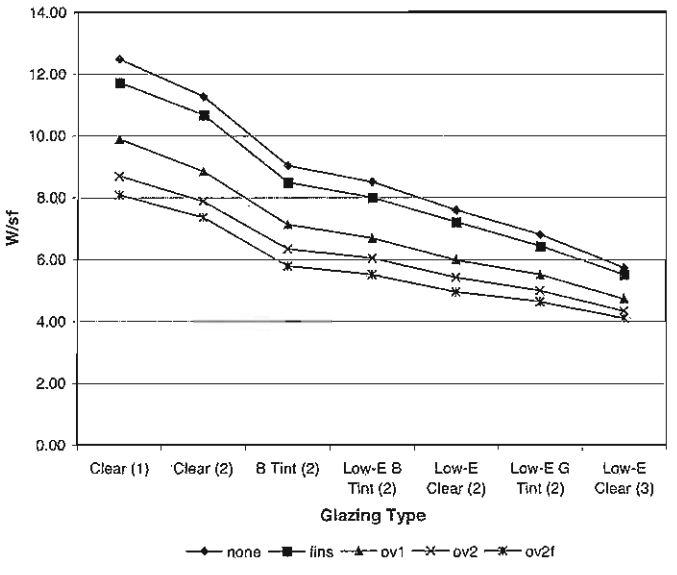
IMPACT OF EXTERIOR SHADING—MINNEAPOLIS, MN
East Orientation—Large Window Area (WWR=0.60)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	246.71	0.0%	12.46	0.0%	17.15	0.0%
fins	Clear (1)	0.72	0.71	1.25	243.67	1.2%	11.71	6.0%	14.02	18.3%
ov1	Clear (1)	0.72	0.71	1.25	217.59	11.8%	9.87	20.8%	16.68	2.8%
ov2	Clear (1)	0.72	0.71	1.25	205.76	16.6%	8.67	30.4%	16.52	3.7%
ov2f	Clear (1)	0.72	0.71	1.25	208.29	15.6%	8.06	35.3%	10.79	37.1%
none	Clear (2)	0.60	0.63	0.60	202.24	0.0%	11.26	0.0%	16.92	0.0%
fins	Clear (2)	0.60	0.63	0.60	200.03	1.1%	10.66	5.3%	13.66	19.3%
ov1	Clear (2)	0.60	0.63	0.60	175.62	13.2%	8.83	21.6%	16.51	2.4%
ov2	Clear (2)	0.60	0.63	0.60	166.01	17.9%	7.87	30.1%	16.41	3.0%
ov2f	Clear (2)	0.60	0.63	0.60	167.02	17.4%	7.34	34.8%	10.41	38.5%
none	B Tint (2)	0.42	0.38	0.60	184.88	0.0%	9.02	0.0%	16.52	0.0%
fins	B Tint (2)	0.42	0.38	0.60	184.44	0.2%	8.49	5.9%	12.10	26.8%
ov1	B Tint (2)	0.42	0.38	0.60	161.10	12.9%	7.11	21.2%	16.33	1.2%
ov2	B Tint (2)	0.42	0.38	0.60	153.81	16.8%	6.32	29.9%	16.26	1.6%
ov2f	B Tint (2)	0.42	0.38	0.60	155.43	15.9%	5.78	36.0%	8.77	46.9%
none	Low-E B Tint (2)	0.39	0.36	0.49	168.17	0.0%	8.49	0.0%	16.48	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	167.64	0.3%	7.97	6.1%	11.84	28.1%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	147.40	12.4%	6.67	21.4%	16.31	1.1%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	141.03	16.1%	6.03	29.0%	16.22	1.6%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	142.19	15.4%	5.49	35.3%	8.49	48.5%
none	Low-E Clear (2)	0.34	0.57	0.46	152.92	0.0%	7.57	0.0%	16.86	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	152.00	0.6%	7.18	5.0%	13.34	20.9%
ov1	Low-E Clear (2)	0.34	0.57	0.46	136.30	10.9%	5.96	21.2%	16.50	2.1%
ov2	Low-E Clear (2)	0.34	0.57	0.46	131.13	14.3%	5.40	28.7%	16.40	2.7%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	131.66	13.9%	4.94	34.8%	10.13	39.9%
none	Low-E G Tint (2)	0.27	0.43	0.46	150.16	0.0%	6.77	0.0%	16.60	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	149.78	0.3%	6.40	5.5%	12.45	25.0%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	133.72	10.9%	5.49	19.0%	16.33	1.6%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	128.36	14.5%	4.97	26.6%	16.25	2.1%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	129.21	13.9%	4.60	32.0%	9.20	44.5%
none	Low-E Clear (3)	0.22	0.37	0.20	122.63	0.0%	5.71	0.0%	16.46	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	121.90	0.6%	5.49	3.8%	11.87	27.9%
ov1	Low-E Clear (3)	0.22	0.37	0.20	113.10	7.8%	4.70	17.6%	16.29	1.0%
ov2	Low-E Clear (3)	0.22	0.37	0.20	110.61	9.8%	4.32	24.3%	16.22	1.4%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	112.30	8.4%	4.09	28.4%	8.54	48.1%

ANNUAL ENERGY USE—MINNEAPOLIS, MN
East Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—MINNEAPOLIS, MN
East Orientation—Large Window Area (WWR=0.60)



Minneapolis, Minnesota
South Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an south-facing facade with moderate window area in a commercial office building in Minneapolis, Minnesota.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

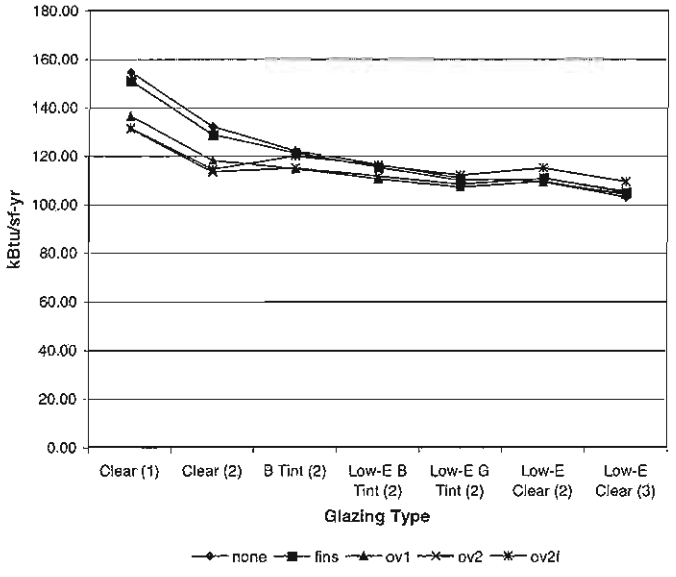
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

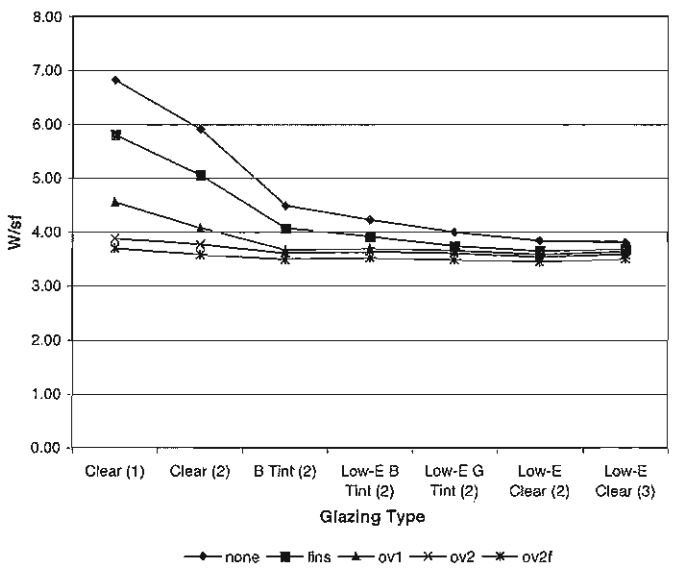
IMPACT OF EXTERIOR SHADING—MINNEAPOLIS, MN
South Orientation—Moderate Window Area (WWR=0.30)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	154.36	0.0%	6.81	0.0%	8.29	0.0%
fins	Clear (1)	0.72	0.71	1.25	150.76	2.3%	5.80	14.9%	7.21	13.0%
ov1	Clear (1)	0.72	0.71	1.25	136.22	11.8%	4.54	33.3%	7.00	15.6%
ov2	Clear (1)	0.72	0.71	1.25	130.77	15.3%	3.87	43.2%	7.00	15.6%
ov2f	Clear (1)	0.72	0.71	1.25	131.29	14.9%	3.68	46.0%	7.00	15.6%
none	Clear (2)	0.60	0.63	0.60	131.91	0.0%	5.90	0.0%	7.96	0.0%
fins	Clear (2)	0.60	0.63	0.60	128.44	2.6%	5.05	14.4%	7.00	12.1%
ov1	Clear (2)	0.60	0.63	0.60	117.98	10.6%	4.06	31.1%	7.00	12.1%
ov2	Clear (2)	0.60	0.63	0.60	113.10	14.3%	3.76	36.3%	7.00	12.1%
ov2f	Clear (2)	0.60	0.63	0.60	114.08	13.5%	3.57	39.5%	7.00	12.1%
none	B Tint (2)	0.42	0.38	0.60	121.99	0.0%	4.48	0.0%	7.00	0.0%
fins	B Tint (2)	0.42	0.38	0.60	120.97	0.8%	4.06	9.3%	7.00	0.0%
ov1	B Tint (2)	0.42	0.38	0.60	114.49	6.1%	3.66	18.4%	7.00	0.0%
ov2	B Tint (2)	0.42	0.38	0.60	114.84	5.9%	3.59	19.9%	7.00	0.0%
ov2f	B Tint (2)	0.42	0.38	0.60	119.79	1.8%	3.48	22.4%	7.00	0.0%
none	Low-E B Tint (2)	0.39	0.36	0.49	116.06	0.0%	4.22	0.0%	7.00	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	115.13	0.8%	3.90	7.4%	7.00	0.0%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	110.25	5.0%	3.68	12.7%	7.00	0.0%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	111.38	4.0%	3.63	14.0%	7.00	0.0%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	116.01	0.0%	3.51	16.6%	7.00	0.0%
none	Low-E Clear (2)	0.34	0.57	0.46	110.61	0.0%	3.98	0.0%	7.64	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	109.78	0.7%	3.72	6.3%	7.00	8.4%
ov1	Low-E Clear (2)	0.34	0.57	0.46	107.00	3.3%	3.64	8.5%	7.00	8.4%
ov2	Low-E Clear (2)	0.34	0.57	0.46	108.04	2.3%	3.58	9.9%	7.00	8.4%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	111.90	-1.2%	3.47	12.7%	7.00	8.4%
none	Low-E G Tint (2)	0.27	0.43	0.46	109.03	0.0%	3.83	0.0%	7.00	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	110.72	-1.6%	3.63	5.2%	7.00	0.0%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	109.28	-0.2%	3.57	6.8%	7.00	0.0%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	110.63	-1.5%	3.52	8.0%	7.00	0.0%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	114.85	-5.3%	3.43	10.3%	7.00	0.0%
none	Low-E Clear (3)	0.22	0.37	0.20	102.90	0.0%	3.79	0.0%	7.00	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	104.72	-1.8%	3.68	3.0%	7.00	0.0%
ov1	Low-E Clear (3)	0.22	0.37	0.20	103.93	-1.0%	3.62	4.6%	7.00	0.0%
ov2	Low-E Clear (3)	0.22	0.37	0.20	105.20	-2.2%	3.57	5.8%	7.00	0.0%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	109.03	-6.0%	3.49	8.0%	7.00	0.0%

ANNUAL ENERGY USE—MINNEAPOLIS, MN
South Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—MINNEAPOLIS, MN
South Orientation—Moderate Window Area (WWR=0.30)



Minneapolis, Minnesota
South Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an south-facing facade with a large window area in a commercial office building in Minneapolis, Minnesota.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

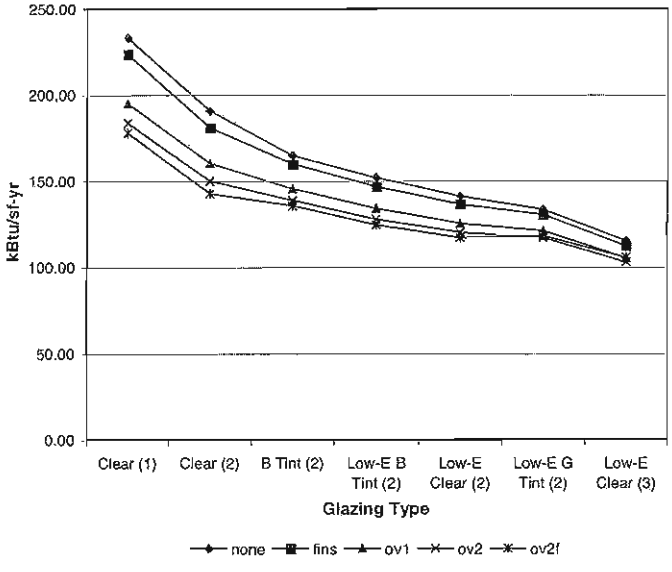
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-ºF, Tvis=visible transmittance

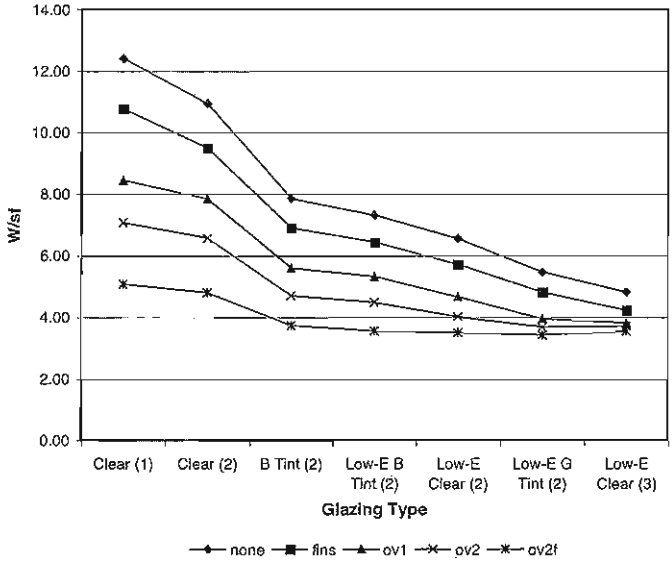
IMPACT OF EXTERIOR SHADING—MINNEAPOLIS, MN
South Orientation—Large Window Area (WWR=0.60)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	232.92	0.0%	12.39	0.0%	15.40	0.0%
fins	Clear (1)	0.72	0.71	1.25	223.48	4.1%	10.75	13.2%	13.89	9.8%
ov1	Clear (1)	0.72	0.71	1.25	194.82	16.4%	8.43	32.0%	14.17	8.0%
ov2	Clear (1)	0.72	0.71	1.25	183.53	21.2%	7.06	43.1%	13.81	10.3%
ov2f	Clear (1)	0.72	0.71	1.25	177.72	23.7%	5.06	59.2%	10.19	33.8%
none	Clear (2)	0.60	0.63	0.60	190.37	0.0%	10.92	0.0%	15.07	0.0%
fins	Clear (2)	0.60	0.63	0.60	180.80	5.0%	9.48	13.2%	13.55	10.1%
ov1	Clear (2)	0.60	0.63	0.60	160.05	15.9%	7.83	28.3%	13.84	8.2%
ov2	Clear (2)	0.60	0.63	0.60	149.65	21.4%	6.56	39.9%	13.48	10.6%
ov2f	Clear (2)	0.60	0.63	0.60	142.39	25.2%	4.78	56.2%	9.85	34.6%
none	B Tint (2)	0.42	0.38	0.60	164.63	0.0%	7.85	0.0%	13.63	0.0%
fins	B Tint (2)	0.42	0.38	0.60	159.56	3.1%	6.89	12.2%	12.05	11.6%
ov1	B Tint (2)	0.42	0.38	0.60	145.33	11.7%	5.59	28.8%	12.40	9.0%
ov2	B Tint (2)	0.42	0.38	0.60	138.50	15.9%	4.69	40.2%	12.01	11.9%
ov2f	B Tint (2)	0.42	0.38	0.60	135.32	17.8%	3.72	52.6%	8.29	39.2%
none	Low-E B Tint (2)	0.39	0.36	0.49	151.65	0.0%	7.30	0.0%	13.41	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	146.54	3.4%	6.42	12.1%	11.82	11.9%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	133.74	11.8%	5.30	27.5%	12.18	9.2%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	127.51	15.9%	4.47	38.8%	11.78	12.2%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	124.35	18.0%	3.54	51.5%	8.02	40.2%
none	Low-E Clear (2)	0.34	0.57	0.46	140.90	0.0%	6.54	0.0%	14.77	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	136.41	3.2%	5.70	12.8%	13.25	10.3%
ov1	Low-E Clear (2)	0.34	0.57	0.46	125.21	11.1%	4.65	28.9%	13.56	8.2%
ov2	Low-E Clear (2)	0.34	0.57	0.46	119.94	14.9%	4.01	38.8%	13.19	10.7%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	116.79	17.1%	3.49	46.7%	9.57	35.2%
none	Low-E G Tint (2)	0.27	0.43	0.46	133.15	0.0%	5.45	0.0%	13.96	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	130.06	2.3%	4.81	11.8%	12.39	11.2%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	120.90	9.2%	3.94	27.8%	12.74	8.7%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	116.83	12.3%	3.66	32.8%	12.36	11.5%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	117.88	11.5%	3.41	37.5%	8.71	37.6%
none	Low-E Clear (3)	0.22	0.37	0.20	115.20	0.0%	4.81	0.0%	13.44	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	112.03	2.7%	4.21	12.3%	11.84	11.9%
ov1	Low-E Clear (3)	0.22	0.37	0.20	105.16	8.7%	3.79	21.1%	12.20	9.2%
ov2	Low-E Clear (3)	0.22	0.37	0.20	102.86	10.7%	3.71	22.9%	11.80	12.2%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	105.45	8.5%	3.53	26.5%	8.05	40.1%

ANNUAL ENERGY USE—MINNEAPOLIS, MN
South Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—MINNEAPOLIS, MN
South Orientation—Large Window Area (WWR=0.60)



Minneapolis, Minnesota
West Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an west-facing facade with moderate window area in a commercial office building in Minneapolis, Minnesota.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

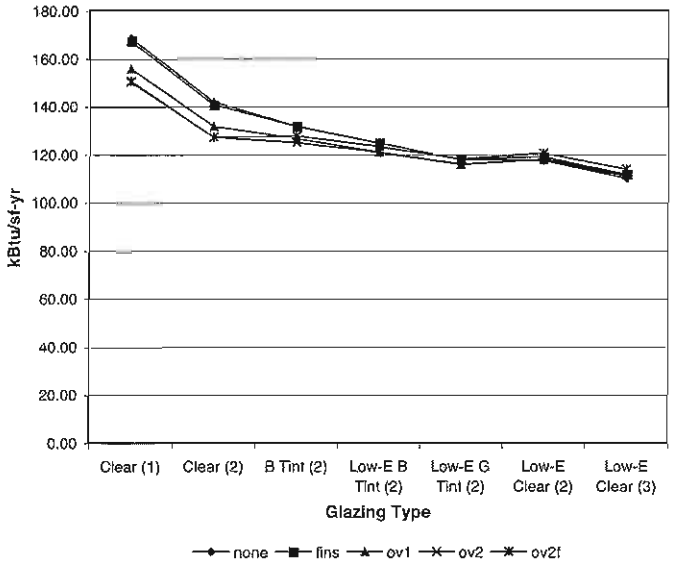
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

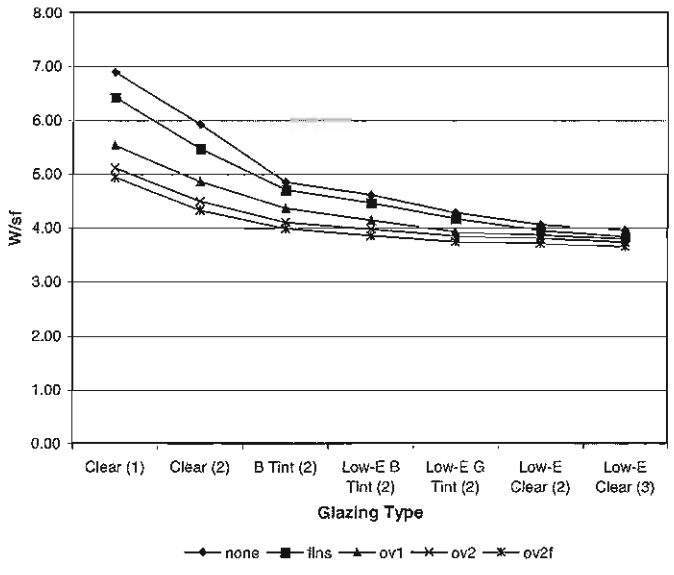
IMPACT OF EXTERIOR SHADING—MINNEAPOLIS, MN
West Orientation—Moderate Window Area (WWR=0.30)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	168.39	0.0%	6.89	0.0%	12.08	0.0%
fins	Clear (1)	0.72	0.71	1.25	167.24	0.7%	6.42	6.8%	11.98	0.9%
ov1	Clear (1)	0.72	0.71	1.25	155.60	7.6%	5.52	19.8%	11.96	1.0%
ov2	Clear (1)	0.72	0.71	1.25	150.02	10.9%	5.10	26.0%	11.93	1.2%
ov2f	Clear (1)	0.72	0.71	1.25	150.58	10.6%	4.93	28.4%	11.88	1.7%
none	Clear (2)	0.60	0.63	0.60	141.75	0.0%	5.92	0.0%	11.76	0.0%
fins	Clear (2)	0.60	0.63	0.60	140.55	0.8%	5.46	7.7%	11.66	0.9%
ov1	Clear (2)	0.60	0.63	0.60	131.55	7.2%	4.85	18.0%	11.65	1.0%
ov2	Clear (2)	0.60	0.63	0.60	127.02	10.4%	4.48	24.2%	11.62	1.2%
ov2f	Clear (2)	0.60	0.63	0.60	127.03	10.4%	4.32	27.1%	11.57	1.7%
none	B Tint (2)	0.42	0.38	0.60	131.74	0.0%	4.84	0.0%	10.45	0.0%
fins	B Tint (2)	0.42	0.38	0.60	131.60	0.1%	4.70	2.9%	10.35	0.9%
ov1	B Tint (2)	0.42	0.38	0.60	126.41	4.0%	4.36	9.9%	10.35	1.0%
ov2	B Tint (2)	0.42	0.38	0.60	124.96	5.1%	4.10	15.3%	10.32	1.2%
ov2f	B Tint (2)	0.42	0.38	0.60	127.69	3.1%	3.98	17.8%	10.27	1.7%
none	Low-E B Tint (2)	0.39	0.36	0.49	124.71	0.0%	4.60	0.0%	10.25	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	124.71	0.0%	4.45	3.1%	10.16	0.9%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	120.82	3.1%	4.13	10.1%	10.15	0.9%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	120.67	3.2%	3.96	13.7%	10.12	1.2%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	123.23	1.2%	3.84	16.4%	10.08	1.7%
none	Low-E Clear (2)	0.34	0.57	0.46	117.73	0.0%	4.27	0.0%	11.50	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	117.82	-0.1%	4.16	2.8%	11.39	1.0%
ov1	Low-E Clear (2)	0.34	0.57	0.46	115.75	1.7%	3.92	8.4%	11.39	1.0%
ov2	Low-E Clear (2)	0.34	0.57	0.46	115.61	1.8%	3.84	10.2%	11.36	1.2%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	117.89	-0.1%	3.73	12.7%	11.31	1.7%
none	Low-E G Tint (2)	0.27	0.43	0.46	117.29	0.0%	4.05	0.0%	10.74	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	118.82	-1.3%	3.94	2.7%	10.65	0.9%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	117.68	-0.3%	3.86	4.7%	10.64	1.0%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	117.87	-0.5%	3.79	6.3%	10.62	1.2%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	120.40	-2.6%	3.70	8.6%	10.56	1.7%
none	Low-E Clear (3)	0.22	0.37	0.20	110.05	0.0%	3.94	0.0%	10.34	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	111.65	-1.5%	3.83	2.9%	10.25	0.9%
ov1	Low-E Clear (3)	0.22	0.37	0.20	110.98	-0.8%	3.79	4.0%	10.24	0.9%
ov2	Low-E Clear (3)	0.22	0.37	0.20	111.33	-1.2%	3.73	5.5%	10.22	1.2%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	113.75	-3.4%	3.64	7.6%	10.16	1.7%

ANNUAL ENERGY USE—MINNEAPOLIS, MN
West Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—MINNEAPOLIS, MN
West Orientation—Moderate Window Area (WWR=0.30)



Minneapolis, Minnesota
West Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an west-facing facade with a large window area in a commercial office building in Minneapolis, Minnesota.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

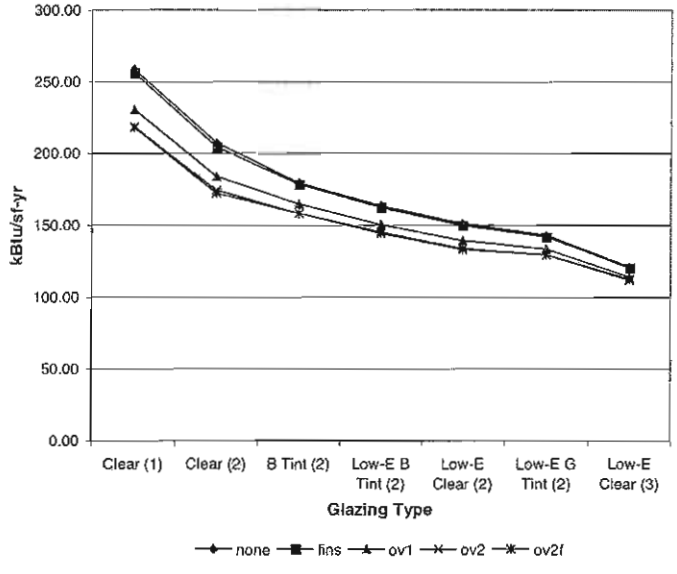
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

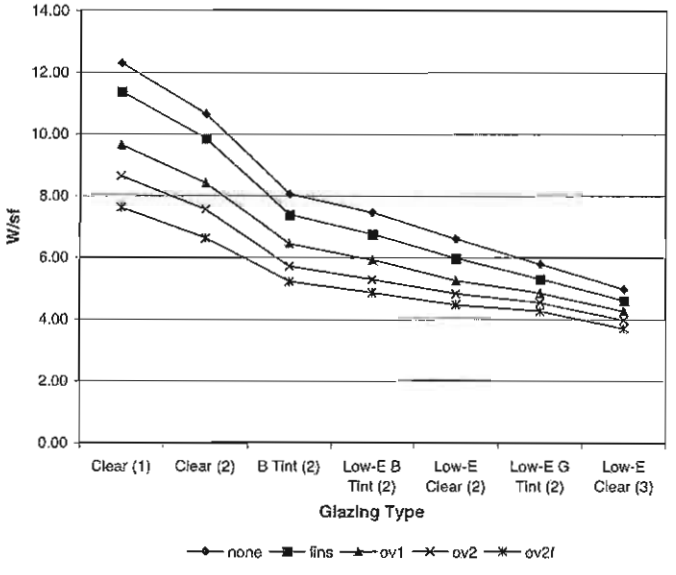
IMPACT OF EXTERIOR SHADING—MINNEAPOLIS, MN
West Orientation—Large Window Area (WWR=0.60)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	258.27	0.0%	12.28	0.0%	15.91	0.0%
fins	Clear (1)	0.72	0.71	1.25	255.76	1.0%	11.36	7.5%	15.11	5.0%
ov1	Clear (1)	0.72	0.71	1.25	230.37	10.8%	9.63	21.6%	15.11	5.0%
ov2	Clear (1)	0.72	0.71	1.25	218.09	15.6%	8.62	29.8%	14.89	6.4%
ov2f	Clear (1)	0.72	0.71	1.25	217.76	15.7%	7.60	38.1%	14.00	12.1%
none	Clear (2)	0.60	0.63	0.60	206.75	0.0%	10.64	0.0%	15.66	0.0%
fins	Clear (2)	0.60	0.63	0.60	203.93	1.4%	9.83	7.6%	14.91	4.8%
ov1	Clear (2)	0.60	0.63	0.60	183.33	11.3%	8.40	21.1%	14.92	4.7%
ov2	Clear (2)	0.60	0.63	0.60	173.74	16.0%	7.54	29.2%	14.72	6.0%
ov2f	Clear (2)	0.60	0.63	0.60	171.68	17.0%	6.62	37.8%	13.86	11.5%
none	B Tint (2)	0.42	0.38	0.60	178.90	0.0%	8.04	0.0%	14.86	0.0%
fins	B Tint (2)	0.42	0.38	0.60	177.76	0.6%	7.37	8.3%	14.51	2.4%
ov1	B Tint (2)	0.42	0.38	0.60	164.10	8.3%	6.44	19.9%	14.51	2.4%
ov2	B Tint (2)	0.42	0.38	0.60	157.73	11.8%	5.70	29.1%	14.39	3.1%
ov2f	B Tint (2)	0.42	0.38	0.60	157.75	11.8%	5.21	35.2%	14.16	4.7%
none	Low-E B Tint (2)	0.39	0.36	0.49	163.09	0.0%	7.44	0.0%	14.97	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	161.81	0.8%	6.75	9.4%	14.64	2.2%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	150.09	8.0%	5.91	20.7%	14.69	1.9%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	144.82	11.2%	5.27	29.2%	14.60	2.5%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	143.71	11.9%	4.85	34.8%	14.31	4.4%
none	Low-E Clear (2)	0.34	0.57	0.46	150.89	0.0%	6.59	0.0%	15.44	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	149.41	1.0%	5.97	9.4%	14.75	4.5%
ov1	Low-E Clear (2)	0.34	0.57	0.46	138.83	8.0%	5.25	20.3%	14.80	4.1%
ov2	Low-E Clear (2)	0.34	0.57	0.46	133.52	11.5%	4.82	26.9%	14.62	5.3%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	132.74	12.0%	4.46	32.4%	13.97	9.5%
none	Low-E G Tint (2)	0.27	0.43	0.46	142.45	0.0%	5.77	0.0%	14.88	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	141.48	0.7%	5.29	8.3%	14.28	4.1%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	132.93	6.7%	4.84	16.1%	14.28	4.0%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	128.86	9.5%	4.53	21.5%	14.12	5.1%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	128.70	9.6%	4.25	26.3%	13.67	8.1%
none	Low-E Clear (3)	0.22	0.37	0.20	120.67	0.0%	4.96	0.0%	14.94	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	119.67	0.8%	4.59	7.4%	14.56	2.5%
ov1	Low-E Clear (3)	0.22	0.37	0.20	113.40	6.0%	4.24	14.4%	14.57	2.5%
ov2	Low-E Clear (3)	0.22	0.37	0.20	111.23	7.8%	3.96	20.1%	14.48	3.1%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	112.07	7.1%	3.70	25.5%	14.22	4.8%

ANNUAL ENERGY USE—MINNEAPOLIS, MN
West Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—MINNEAPOLIS, MN
West Orientation—Low Window Area (WWR=0.60)



Chicago, Illinois
East Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an east-facing facade with moderate window area in a commercial office building in Chicago, Illinois.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

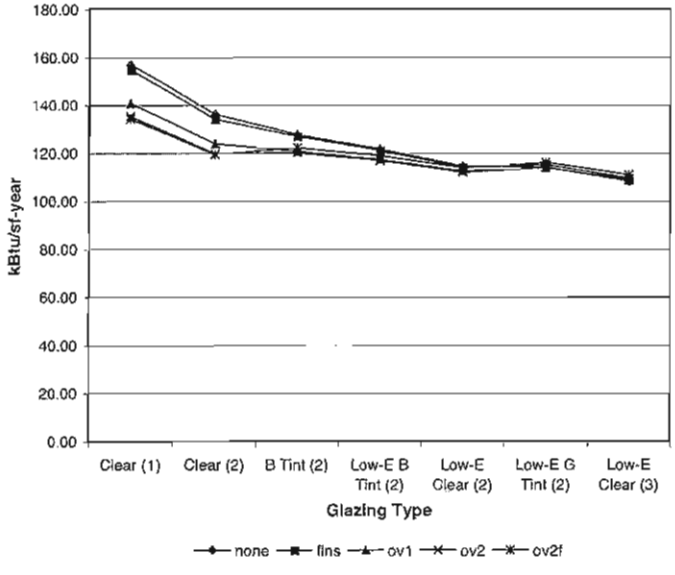
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

IMPACT OF EXTERIOR SHADING—CHICAGO, IL
East Orientation—Moderate Window Area (WWR=0.30)

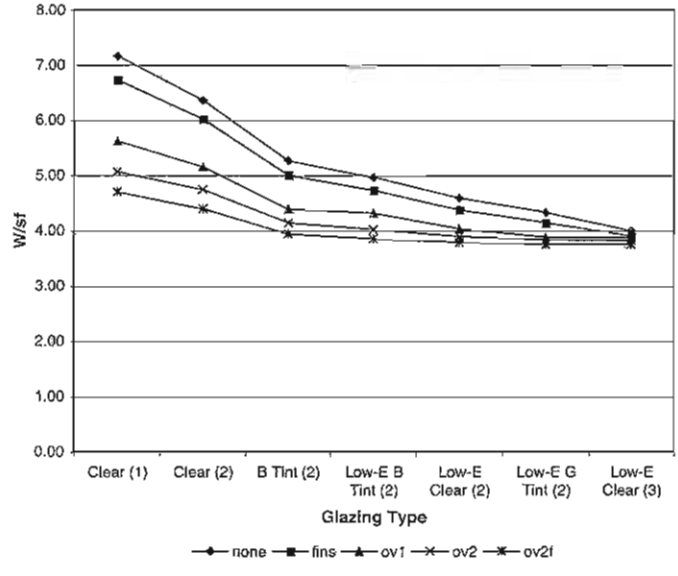
Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	156.73	0.0%	7.16	0.0%	8.18	0.0%
fins	Clear (1)	0.72	0.71	1.25	154.56	1.4%	6.73	6.1%	7.00	14.5%
ov1	Clear (1)	0.72	0.71	1.25	140.50	10.4%	5.62	21.5%	7.00	14.5%
ov2	Clear (1)	0.72	0.71	1.25	135.02	13.9%	5.06	29.3%	7.00	14.5%
ov2f	Clear (1)	0.72	0.71	1.25	134.07	14.5%	4.70	34.4%	7.00	14.5%
none	Clear (2)	0.60	0.63	0.60	136.04	0.0%	6.36	0.0%	7.82	0.0%
fins	Clear (2)	0.60	0.63	0.60	134.04	1.5%	6.01	5.4%	7.00	10.5%
ov1	Clear (2)	0.60	0.63	0.60	123.71	9.1%	5.15	19.0%	7.00	10.5%
ov2	Clear (2)	0.60	0.63	0.60	119.54	12.1%	4.74	25.4%	7.00	10.5%
ov2f	Clear (2)	0.60	0.63	0.60	119.24	12.3%	4.39	30.9%	7.00	10.5%
none	B Tint (2)	0.42	0.38	0.60	127.55	0.0%	5.26	0.0%	7.00	0.0%
fins	B Tint (2)	0.42	0.38	0.60	126.84	0.6%	5.00	5.0%	7.00	0.0%
ov1	B Tint (2)	0.42	0.38	0.60	120.59	5.5%	4.38	16.8%	7.00	0.0%
ov2	B Tint (2)	0.42	0.38	0.60	120.01	5.9%	4.14	21.4%	7.00	0.0%
ov2f	B Tint (2)	0.42	0.38	0.60	122.16	4.2%	3.93	25.2%	7.00	0.0%
none	Low-E B Tint (2)	0.39	0.36	0.49	121.43	0.0%	4.96	0.0%	7.00	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	120.80	0.5%	4.72	4.9%	7.00	0.0%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	117.13	3.5%	4.31	13.2%	7.00	0.0%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	116.68	3.9%	4.01	19.1%	7.00	0.0%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	118.76	2.2%	3.85	22.5%	7.00	0.0%
none	Low-E Clear (2)	0.34	0.57	0.46	114.38	0.0%	4.58	0.0%	7.47	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	114.00	0.3%	4.37	4.7%	7.00	6.3%
ov1	Low-E Clear (2)	0.34	0.57	0.46	112.23	1.9%	4.03	12.2%	7.00	6.3%
ov2	Low-E Clear (2)	0.34	0.57	0.46	111.81	2.2%	3.88	15.3%	7.00	6.3%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	113.58	0.7%	3.78	17.6%	7.00	6.3%
none	Low-E G Tint (2)	0.27	0.43	0.46	114.01	0.0%	4.32	0.0%	7.00	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	115.06	-0.9%	4.13	4.3%	7.00	0.0%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	113.84	0.2%	3.88	10.3%	7.00	0.0%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	113.75	0.2%	3.83	11.4%	7.00	0.0%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	115.89	-1.7%	3.74	13.3%	7.00	0.0%
none	Low-E Clear (3)	0.22	0.37	0.20	108.02	0.0%	3.99	0.0%	7.00	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	109.24	-1.1%	3.89	2.4%	7.00	0.0%
ov1	Low-E Clear (3)	0.22	0.37	0.20	108.56	-0.5%	3.86	3.2%	7.00	0.0%
ov2	Low-E Clear (3)	0.22	0.37	0.20	108.68	-0.6%	3.82	4.3%	7.00	0.0%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	110.72	-2.5%	3.74	6.2%	7.00	0.0%

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-ºF, Tvis=visible transmittance

ANNUAL ENERGY USE—CHICAGO, IL
East Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—CHICAGO, IL
East Orientation—Moderate Window Area (WWR=0.30)



Chicago, Illinois
East Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an east-facing facade with large window area in a commercial office building in Chicago, Illinois.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

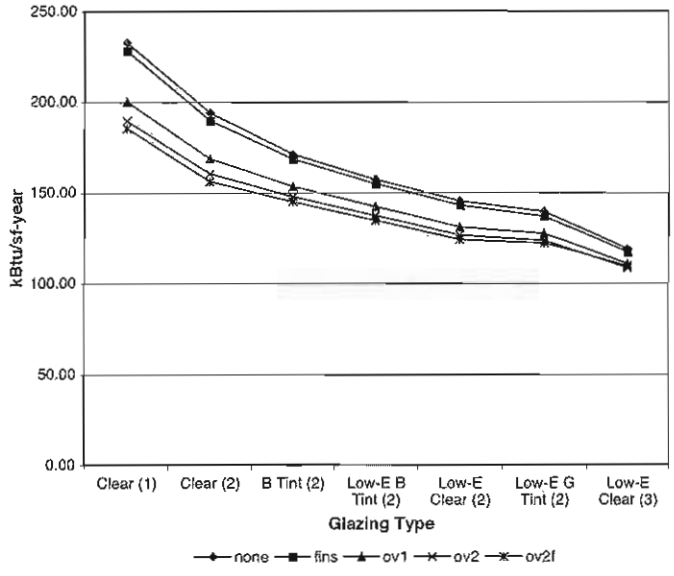
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

IMPACT OF EXTERIOR SHADING—CHICAGO, IL
East Orientation—Large Window Area (WWR=0.60)

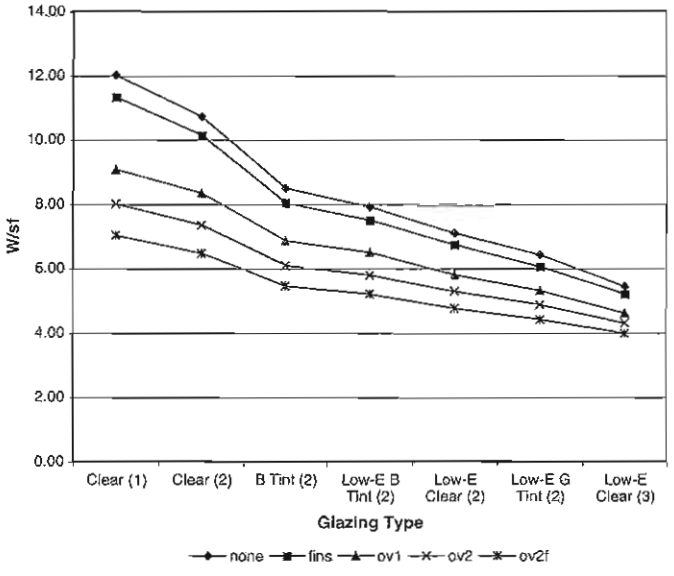
Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	232.43	0.0%	12.00	0.0%	17.14	0.0%
fins	Clear (1)	0.72	0.71	1.25	227.99	1.9%	11.33	5.7%	14.21	17.1%
ov1	Clear (1)	0.72	0.71	1.25	199.85	14.0%	9.07	24.4%	16.64	2.9%
ov2	Clear (1)	0.72	0.71	1.25	189.19	18.6%	8.00	33.4%	16.50	3.7%
ov2f	Clear (1)	0.72	0.71	1.25	185.19	20.3%	7.02	41.5%	11.02	35.7%
none	Clear (2)	0.60	0.63	0.60	193.68	0.0%	10.71	0.0%	16.94	0.0%
fins	Clear (2)	0.60	0.63	0.60	189.38	2.2%	10.12	5.5%	13.85	18.2%
ov1	Clear (2)	0.60	0.63	0.60	168.36	13.1%	8.33	22.2%	16.49	2.7%
ov2	Clear (2)	0.60	0.63	0.60	159.99	17.4%	7.34	31.5%	16.34	3.5%
ov2f	Clear (2)	0.60	0.63	0.60	155.69	19.6%	6.46	39.7%	10.65	37.1%
none	B Tint (2)	0.42	0.38	0.60	170.74	0.0%	8.49	0.0%	16.56	0.0%
fins	B Tint (2)	0.42	0.38	0.60	168.26	1.5%	8.03	5.4%	12.29	25.7%
ov1	B Tint (2)	0.42	0.38	0.60	153.04	10.4%	6.86	19.2%	16.32	1.5%
ov2	B Tint (2)	0.42	0.38	0.60	147.47	13.6%	6.09	28.2%	16.24	1.9%
ov2f	B Tint (2)	0.42	0.38	0.60	144.69	15.3%	5.46	35.7%	9.07	45.2%
none	Low-E B Tint (2)	0.39	0.36	0.49	156.90	0.0%	7.91	0.0%	16.54	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	154.52	1.5%	7.49	5.3%	12.04	27.2%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	142.09	9.4%	6.49	17.9%	16.36	1.1%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	136.98	12.7%	5.78	26.9%	16.29	1.5%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	134.38	14.4%	5.19	34.3%	8.80	46.8%
none	Low-E Clear (2)	0.34	0.57	0.46	145.12	0.0%	7.09	0.0%	16.79	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	142.77	1.6%	6.73	5.1%	13.53	19.4%
ov1	Low-E Clear (2)	0.34	0.57	0.46	130.89	9.8%	5.80	18.2%	16.39	2.4%
ov2	Low-E Clear (2)	0.34	0.57	0.46	126.35	12.9%	5.28	25.5%	16.26	3.2%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	123.82	14.7%	4.75	33.0%	10.38	38.2%
none	Low-E G Tint (2)	0.27	0.43	0.46	139.23	0.0%	6.41	0.0%	16.60	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	136.49	2.0%	6.05	5.6%	12.65	23.8%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	127.04	8.8%	5.30	17.3%	16.32	1.7%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	123.25	11.5%	4.86	24.3%	16.26	2.0%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	121.77	12.5%	4.40	31.3%	9.49	42.8%
none	Low-E Clear (3)	0.22	0.37	0.20	118.52	0.0%	5.44	0.0%	16.50	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	116.91	1.4%	5.20	4.4%	12.07	26.9%
ov1	Low-E Clear (3)	0.22	0.37	0.20	110.42	6.8%	4.61	15.2%	16.31	1.2%
ov2	Low-E Clear (3)	0.22	0.37	0.20	108.21	8.7%	4.30	21.1%	16.24	1.6%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	109.32	7.8%	3.98	26.9%	8.84	46.4%

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

ANNUAL ENERGY USE—CHICAGO, IL
East Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—CHICAGO, IL
East Orientation—Large Window Area (WWR=0.60)



Chicago, Illinois
South Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an south-facing facade with moderate window area in a commercial office building in Chicago, Illinois.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

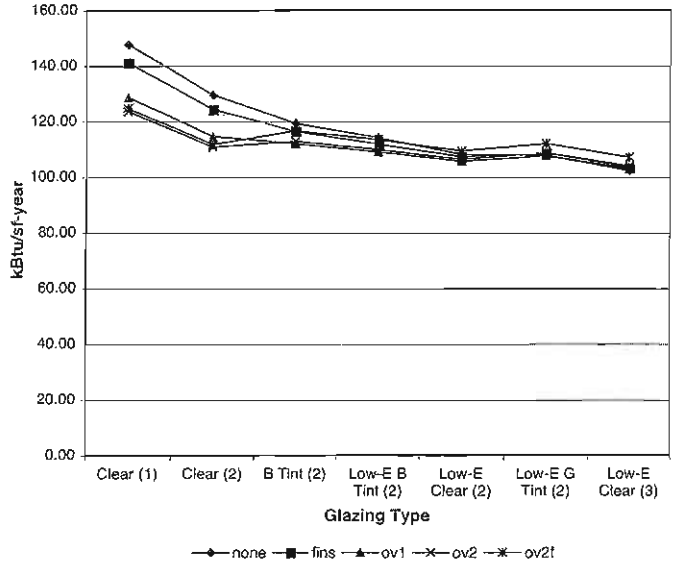
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

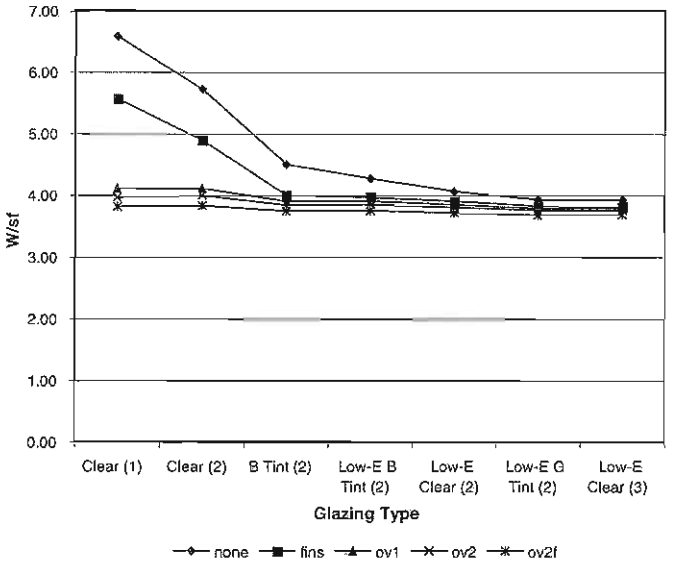
IMPACT OF EXTERIOR SHADING—CHICAGO, IL
South Orientation—Moderate Window Area (WWR=0.30)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	147.62	0.0%	6.58	0.0%	8.41	0.0%
fins	Clear (1)	0.72	0.71	1.25	140.99	4.5%	5.56	15.5%	7.33	12.9%
ov1	Clear (1)	0.72	0.71	1.25	128.60	12.9%	4.11	37.6%	7.00	16.8%
ov2	Clear (1)	0.72	0.71	1.25	123.41	16.4%	3.96	39.8%	7.00	16.8%
ov2f	Clear (1)	0.72	0.71	1.25	124.50	15.7%	3.81	42.1%	7.00	16.8%
none	Clear (2)	0.60	0.63	0.60	129.39	0.0%	5.72	0.0%	8.08	0.0%
fins	Clear (2)	0.60	0.63	0.60	124.08	4.1%	4.89	14.5%	7.00	13.4%
ov1	Clear (2)	0.60	0.63	0.60	114.43	11.6%	4.10	28.2%	7.00	13.4%
ov2	Clear (2)	0.60	0.63	0.60	110.62	14.5%	3.99	30.2%	7.00	13.4%
ov2f	Clear (2)	0.60	0.63	0.60	111.64	13.7%	3.82	33.1%	7.00	13.4%
none	B Tint (2)	0.42	0.38	0.60	119.24	0.0%	4.49	0.0%	7.00	0.0%
fins	B Tint (2)	0.42	0.38	0.60	116.29	2.5%	3.99	11.1%	7.00	0.0%
ov1	B Tint (2)	0.42	0.38	0.60	111.87	6.2%	3.89	13.4%	7.00	0.0%
ov2	B Tint (2)	0.42	0.38	0.60	112.73	5.5%	3.84	14.6%	7.00	0.0%
ov2f	B Tint (2)	0.42	0.38	0.60	116.49	2.3%	3.74	16.8%	7.00	0.0%
none	Low-E B Tint (2)	0.39	0.36	0.49	114.05	0.0%	4.26	0.0%	7.00	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	111.77	2.0%	3.96	7.1%	7.00	0.0%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	108.89	4.5%	3.90	8.6%	7.00	0.0%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	109.74	3.8%	3.84	9.9%	7.00	0.0%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	113.35	0.6%	3.75	12.2%	7.00	0.0%
none	Low-E Clear (2)	0.34	0.57	0.46	108.16	0.0%	4.06	0.0%	7.77	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	107.25	0.8%	3.90	4.0%	7.00	9.9%
ov1	Low-E Clear (2)	0.34	0.57	0.46	105.57	2.4%	3.84	5.4%	7.00	9.9%
ov2	Low-E Clear (2)	0.34	0.57	0.46	106.33	1.7%	3.80	6.3%	7.00	9.9%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	109.16	-0.9%	3.71	8.6%	7.00	9.9%
none	Low-E G Tint (2)	0.27	0.43	0.46	107.54	0.0%	3.93	0.0%	7.00	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	108.56	-0.9%	3.82	2.8%	7.00	0.0%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	107.46	0.1%	3.78	3.8%	7.00	0.0%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	108.50	-0.9%	3.75	4.6%	7.00	0.0%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	111.86	-4.0%	3.67	6.4%	7.00	0.0%
none	Low-E Clear (3)	0.22	0.37	0.20	102.07	0.0%	3.92	0.0%	7.00	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	103.32	-1.2%	3.81	2.8%	7.00	0.0%
ov1	Low-E Clear (3)	0.22	0.37	0.20	102.84	-0.8%	3.78	3.6%	7.00	0.0%
ov2	Low-E Clear (3)	0.22	0.37	0.20	103.84	-1.7%	3.75	4.4%	7.00	0.0%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	107.00	-4.8%	3.68	6.1%	7.00	0.0%

ANNUAL ENERGY USE—CHICAGO, IL
South Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—CHICAGO, IL
South Orientation—Moderate Window Area (WWR=0.30)



Chicago, Illinois
South Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an south-facing facade with a large window area in a commercial office building in Chicago, Illinois.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

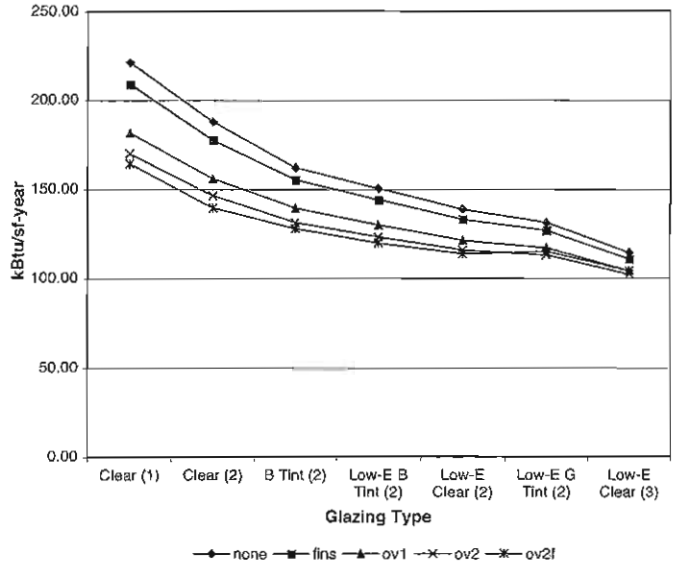
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

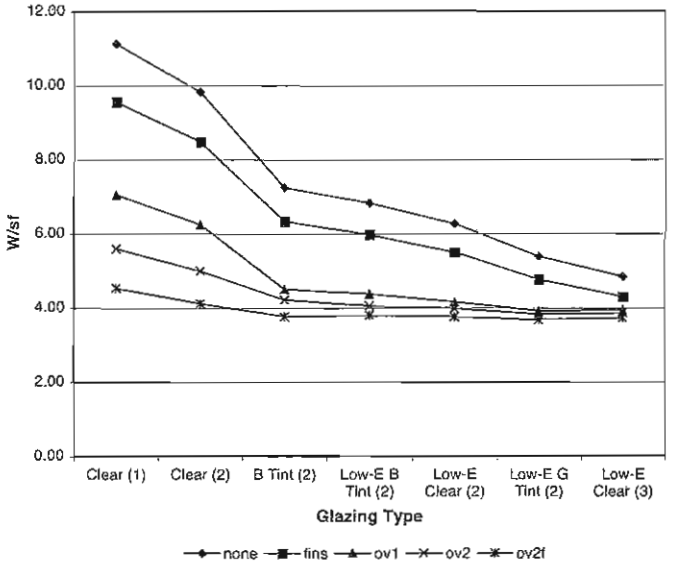
IMPACT OF EXTERIOR SHADING—CHICAGO, IL
South Orientation—Large Window Area (WWR=0.60)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	221.01	0.0%	11.11	0.0%	15.55	0.0%
fins	Clear (1)	0.72	0.71	1.25	208.88	5.5%	9.54	14.1%	14.04	9.8%
ov1	Clear (1)	0.72	0.71	1.25	181.28	18.0%	7.03	36.8%	14.33	7.9%
ov2	Clear (1)	0.72	0.71	1.25	169.81	23.2%	5.57	49.8%	13.98	10.1%
ov2f	Clear (1)	0.72	0.71	1.25	164.16	25.7%	4.52	59.3%	10.34	33.5%
none	Clear (2)	0.60	0.63	0.60	187.71	0.0%	9.81	0.0%	15.23	0.0%
fins	Clear (2)	0.60	0.63	0.60	177.12	5.6%	8.46	13.8%	13.69	10.1%
ov1	Clear (2)	0.60	0.63	0.60	155.66	17.1%	6.23	36.5%	14.00	8.0%
ov2	Clear (2)	0.60	0.63	0.60	145.96	22.2%	4.98	49.3%	13.64	10.4%
ov2f	Clear (2)	0.60	0.63	0.60	139.19	25.8%	4.10	58.2%	10.00	34.3%
none	B Tint (2)	0.42	0.38	0.60	161.75	0.0%	7.23	0.0%	13.79	0.0%
fins	B Tint (2)	0.42	0.38	0.60	155.03	4.2%	6.32	12.6%	12.19	11.6%
ov1	B Tint (2)	0.42	0.38	0.60	139.07	14.0%	4.49	37.9%	12.57	8.8%
ov2	B Tint (2)	0.42	0.38	0.60	131.01	19.0%	4.20	41.9%	12.19	11.6%
ov2f	B Tint (2)	0.42	0.38	0.60	127.63	21.1%	3.75	48.1%	8.46	38.6%
none	Low-E B Tint (2)	0.39	0.36	0.49	150.24	0.0%	6.81	0.0%	13.57	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	143.98	4.2%	5.96	12.4%	11.96	11.9%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	129.79	13.6%	4.36	36.0%	12.35	9.0%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	122.98	18.1%	4.04	40.7%	11.96	11.8%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	119.67	20.3%	3.79	44.3%	8.19	39.6%
none	Low-E Clear (2)	0.34	0.57	0.46	138.61	0.0%	6.25	0.0%	14.93	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	132.89	4.1%	5.48	12.5%	13.38	10.4%
ov1	Low-E Clear (2)	0.34	0.57	0.46	121.02	12.7%	4.14	33.8%	13.72	8.1%
ov2	Low-E Clear (2)	0.34	0.57	0.46	115.57	16.6%	3.96	36.7%	13.36	10.5%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	113.35	18.2%	3.74	40.2%	9.73	34.8%
none	Low-E G Tint (2)	0.27	0.43	0.46	130.89	0.0%	5.37	0.0%	14.11	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	126.53	3.3%	4.75	11.4%	12.53	11.2%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	116.67	10.9%	3.90	27.4%	12.91	8.5%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	112.72	13.9%	3.81	29.1%	12.53	11.2%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	114.61	12.4%	3.66	31.7%	8.87	37.1%
none	Low-E Clear (3)	0.22	0.37	0.20	114.15	0.0%	4.83	0.0%	13.59	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	110.40	3.3%	4.29	11.1%	11.98	11.9%
ov1	Low-E Clear (3)	0.22	0.37	0.20	104.07	8.8%	3.93	18.7%	12.37	9.0%
ov2	Low-E Clear (3)	0.22	0.37	0.20	102.21	10.5%	3.85	20.3%	11.99	11.8%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	104.05	8.9%	3.71	23.2%	8.23	39.4%

ANNUAL ENERGY USE—CHICAGO, IL
South Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—CHICAGO, IL
South Orientation—Large Window Area (WWR=0.60)



Chicago, Illinois
West Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an west-facing facade with moderate window area in a commercial office building in Chicago, Illinois.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

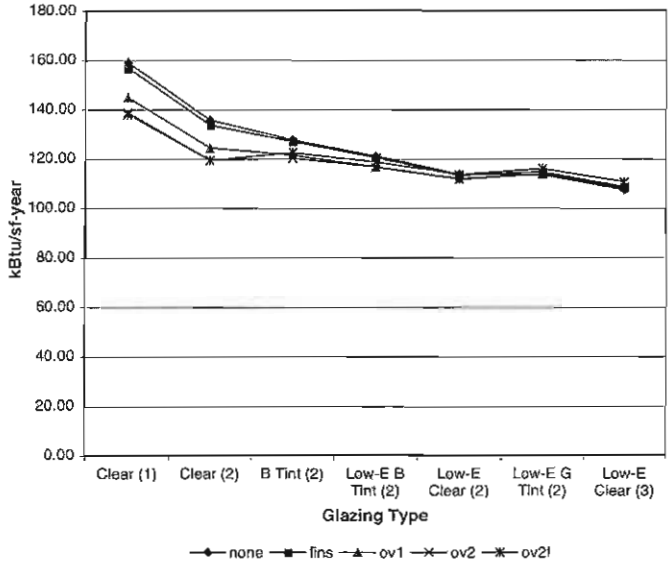
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

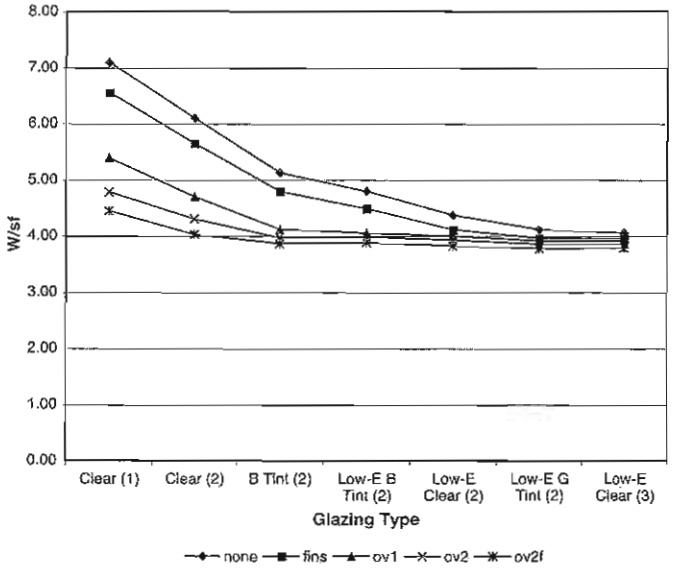
IMPACT OF EXTERIOR SHADING—CHICAGO, IL
West Orientation—Moderate Window Area (WWR=0.30)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	158.84	0.0%	7.08	0.0%	13.32	0.0%
fins	Clear (1)	0.72	0.71	1.25	156.54	1.4%	6.55	7.5%	13.25	0.5%
ov1	Clear (1)	0.72	0.71	1.25	144.59	9.0%	5.38	24.1%	13.25	0.5%
ov2	Clear (1)	0.72	0.71	1.25	138.44	12.8%	4.77	32.6%	13.23	0.7%
ov2f	Clear (1)	0.72	0.71	1.25	137.68	13.3%	4.44	37.3%	13.20	0.9%
none	Clear (2)	0.60	0.63	0.60	135.49	0.0%	6.09	0.0%	13.01	0.0%
fins	Clear (2)	0.60	0.63	0.60	133.46	1.5%	5.65	7.4%	12.94	0.5%
ov1	Clear (2)	0.60	0.63	0.60	124.26	8.3%	4.69	23.0%	12.94	0.5%
ov2	Clear (2)	0.60	0.63	0.60	119.23	12.0%	4.30	29.4%	12.92	0.6%
ov2f	Clear (2)	0.60	0.63	0.60	119.03	12.1%	4.02	34.0%	12.88	0.9%
none	B Tint (2)	0.42	0.38	0.60	127.45	0.0%	5.13	0.0%	11.71	0.0%
fins	B Tint (2)	0.42	0.38	0.60	126.69	0.6%	4.79	6.5%	11.64	0.6%
ov1	B Tint (2)	0.42	0.38	0.60	121.13	5.0%	4.11	19.8%	11.65	0.5%
ov2	B Tint (2)	0.42	0.38	0.60	119.99	5.9%	3.97	22.6%	11.63	0.7%
ov2f	B Tint (2)	0.42	0.38	0.60	122.18	4.1%	3.85	24.8%	11.59	1.0%
none	Low-E B Tint (2)	0.39	0.36	0.49	120.89	0.0%	4.79	0.0%	11.52	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	120.31	0.5%	4.48	6.4%	11.45	0.6%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	116.61	3.5%	4.05	15.5%	11.45	0.6%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	116.44	3.7%	3.98	17.0%	11.43	0.8%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	118.57	1.9%	3.87	19.2%	11.40	1.1%
none	Low-E Clear (2)	0.34	0.57	0.46	113.49	0.0%	4.36	0.0%	12.75	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	113.08	0.4%	4.10	5.9%	12.68	0.5%
ov1	Low-E Clear (2)	0.34	0.57	0.46	111.69	1.6%	3.99	8.5%	12.68	0.5%
ov2	Low-E Clear (2)	0.34	0.57	0.46	111.52	1.7%	3.92	10.1%	12.66	0.7%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	113.37	0.1%	3.82	12.5%	12.62	1.0%
none	Low-E G Tint (2)	0.27	0.43	0.46	113.23	0.0%	4.10	0.0%	12.00	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	114.41	-1.0%	3.96	3.6%	11.94	0.5%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	113.53	-0.3%	3.91	4.8%	11.94	0.5%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	113.67	-0.4%	3.85	6.2%	11.92	0.7%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	115.83	-2.3%	3.77	8.2%	11.89	0.9%
none	Low-E Clear (3)	0.22	0.37	0.20	107.16	0.0%	4.05	0.0%	11.60	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	108.49	-1.2%	3.95	2.4%	11.54	0.6%
ov1	Low-E Clear (3)	0.22	0.37	0.20	108.05	-0.8%	3.90	3.6%	11.54	0.5%
ov2	Low-E Clear (3)	0.22	0.37	0.20	108.34	-1.1%	3.85	4.8%	11.53	0.7%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	110.42	-3.0%	3.77	6.8%	11.49	1.0%

ANNUAL ENERGY USE—CHICAGO, IL
West Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—CHICAGO, IL
West Orientation—Moderate Window Area (WWR=0.30)



Chicago, Illinois
West Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an west-facing facade with a large window area in a commercial office building in Chicago, Illinois.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

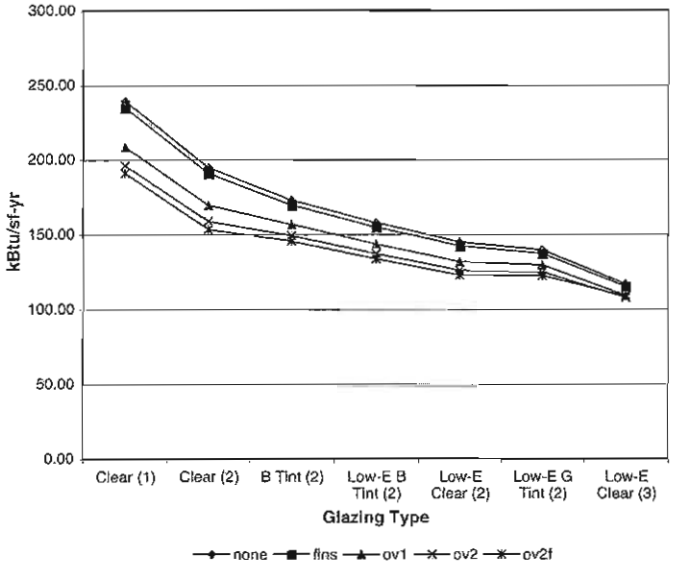
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

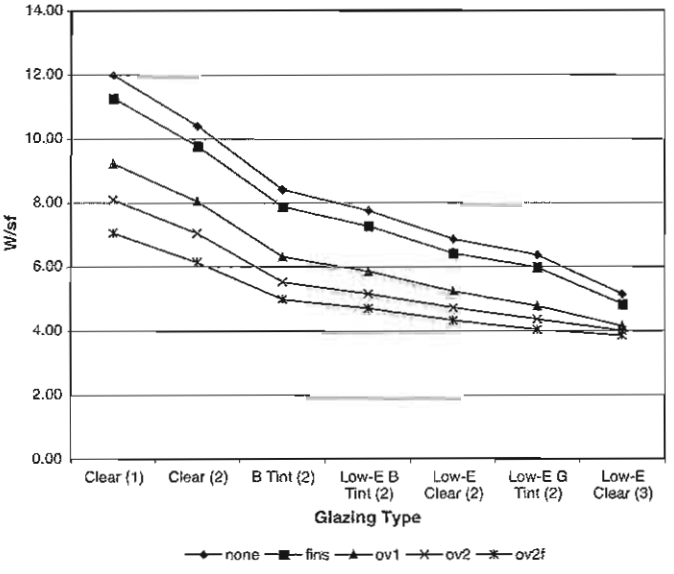
IMPACT OF EXTERIOR SHADING—CHICAGO, IL
West Orientation—Large Window Area (WWR=0.60)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	239.00	0.0%	11.97	0.0%	16.24	0.0%
fins	Clear (1)	0.72	0.71	1.25	234.60	1.8%	11.25	6.0%	15.47	4.8%
ov1	Clear (1)	0.72	0.71	1.25	208.34	12.8%	9.20	23.2%	15.53	4.4%
ov2	Clear (1)	0.72	0.71	1.25	195.87	18.0%	8.06	32.7%	15.34	5.5%
ov2f	Clear (1)	0.72	0.71	1.25	190.62	20.2%	7.03	41.2%	14.63	10.0%
none	Clear (2)	0.60	0.63	0.60	194.47	0.0%	10.37	0.0%	16.07	0.0%
fins	Clear (2)	0.60	0.63	0.60	190.30	2.1%	9.75	6.0%	15.41	4.1%
ov1	Clear (2)	0.60	0.63	0.60	169.10	13.0%	8.02	22.7%	15.45	3.8%
ov2	Clear (2)	0.60	0.63	0.60	158.46	18.5%	7.03	32.3%	15.25	5.1%
ov2f	Clear (2)	0.60	0.63	0.60	152.93	21.4%	6.12	41.0%	14.69	8.6%
none	B Tint (2)	0.42	0.38	0.60	172.63	0.0%	8.39	0.0%	15.08	0.0%
fins	B Tint (2)	0.42	0.38	0.60	169.34	1.9%	7.85	6.4%	14.57	3.3%
ov1	B Tint (2)	0.42	0.38	0.60	156.45	9.4%	6.29	25.0%	14.66	2.8%
ov2	B Tint (2)	0.42	0.38	0.60	149.08	13.6%	5.51	34.3%	14.55	3.5%
ov2f	B Tint (2)	0.42	0.38	0.60	145.36	15.8%	4.96	40.9%	14.31	5.1%
none	Low-E B Tint (2)	0.39	0.36	0.49	157.51	0.0%	7.73	0.0%	15.05	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	154.55	1.9%	7.25	6.2%	14.61	2.9%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	143.25	9.1%	5.83	24.5%	14.68	2.5%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	136.76	13.2%	5.13	33.6%	14.59	3.1%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	133.31	15.4%	4.69	39.4%	14.18	5.8%
none	Low-E Clear (2)	0.34	0.57	0.46	144.46	0.0%	6.84	0.0%	15.89	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	142.14	1.6%	6.40	6.4%	15.24	4.0%
ov1	Low-E Clear (2)	0.34	0.57	0.46	131.38	9.1%	5.21	23.8%	15.29	3.7%
ov2	Low-E Clear (2)	0.34	0.57	0.46	125.78	12.9%	4.69	31.4%	15.15	4.6%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	122.45	15.2%	4.31	37.0%	14.52	8.6%
none	Low-E G Tint (2)	0.27	0.43	0.46	139.38	0.0%	6.35	0.0%	15.32	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	136.85	1.8%	5.96	6.3%	14.75	3.8%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	129.11	7.4%	4.76	25.1%	14.84	3.2%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	124.46	10.7%	4.34	31.7%	14.72	4.0%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	122.03	12.5%	4.02	36.8%	14.26	7.0%
none	Low-E Clear (3)	0.22	0.37	0.20	116.63	0.0%	5.12	0.0%	15.03	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	115.06	1.4%	4.81	6.1%	14.66	2.5%
ov1	Low-E Clear (3)	0.22	0.37	0.20	108.96	6.6%	4.14	19.3%	14.70	2.2%
ov2	Low-E Clear (3)	0.22	0.37	0.20	107.36	7.9%	3.98	22.2%	14.61	2.8%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	108.61	6.9%	3.83	25.3%	14.25	5.2%

ANNUAL ENERGY USE—CHICAGO, IL
West Orientation—Low Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—CHICAGO, IL
West Orientation—Low Window Area (WWR=0.60)



Washington, DC
East Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an east-facing facade with moderate window area in a commercial office building in Washington, DC.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

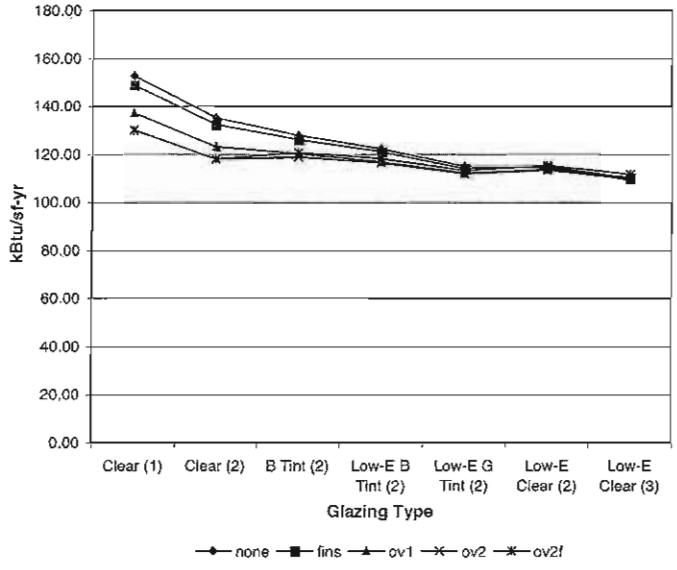
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

IMPACT OF EXTERIOR SHADING—WASHINGTON, DC
East Orientation—Moderate Window Area (WWR=0.30)

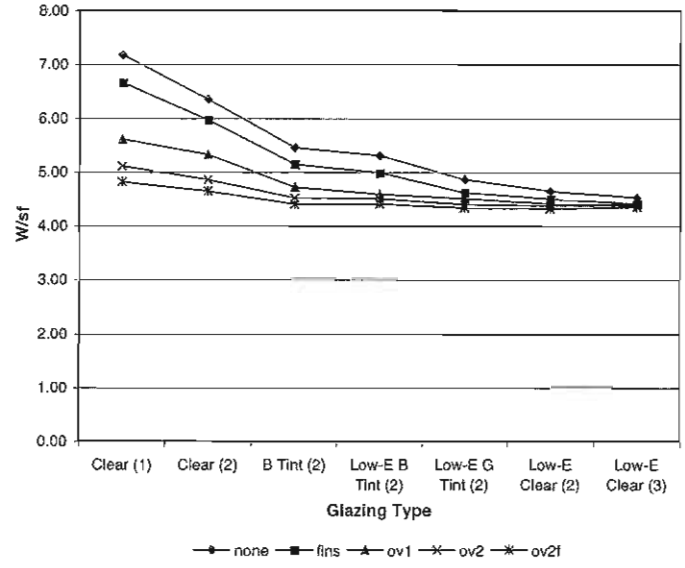
Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	152.47	0.0%	7.17	0.0%	8.43	0.0%
fins	Clear (1)	0.72	0.71	1.25	148.55	2.6%	6.65	7.2%	7.27	13.8%
ov1	Clear (1)	0.72	0.71	1.25	136.96	10.2%	5.60	21.9%	7.00	16.9%
ov2	Clear (1)	0.72	0.71	1.25	130.01	14.7%	5.10	28.9%	7.00	16.9%
ov2f	Clear (1)	0.72	0.71	1.25	129.69	14.9%	4.81	33.0%	7.00	16.9%
none	Clear (2)	0.60	0.63	0.60	134.93	0.0%	6.34	0.0%	8.07	0.0%
fins	Clear (2)	0.60	0.63	0.60	132.14	2.1%	5.96	6.0%	7.00	13.3%
ov1	Clear (2)	0.60	0.63	0.60	122.88	8.9%	5.32	16.1%	7.00	13.3%
ov2	Clear (2)	0.60	0.63	0.60	117.59	12.9%	4.84	23.6%	7.00	13.3%
ov2f	Clear (2)	0.60	0.63	0.60	117.72	12.8%	4.63	26.9%	7.00	13.3%
none	B Tint (2)	0.42	0.38	0.60	127.67	0.0%	5.45	0.0%	7.00	0.0%
fins	B Tint (2)	0.42	0.38	0.60	125.88	1.4%	5.13	5.8%	7.00	0.0%
ov1	B Tint (2)	0.42	0.38	0.60	119.95	6.0%	4.71	13.5%	7.00	0.0%
ov2	B Tint (2)	0.42	0.38	0.60	118.57	7.1%	4.51	17.3%	7.00	0.0%
ov2f	B Tint (2)	0.42	0.38	0.60	120.49	5.6%	4.39	19.4%	7.00	0.0%
none	Low-E B Tint (2)	0.39	0.36	0.49	122.02	0.0%	5.29	0.0%	7.00	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	120.67	1.1%	4.98	6.0%	7.00	0.0%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	116.53	4.5%	4.58	13.5%	7.00	0.0%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	116.06	4.9%	4.49	15.1%	7.00	0.0%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	117.96	3.3%	4.40	16.9%	7.00	0.0%
none	Low-E Clear (2)	0.34	0.57	0.46	114.68	0.0%	4.86	0.0%	7.73	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	113.79	0.8%	4.61	5.1%	7.00	9.4%
ov1	Low-E Clear (2)	0.34	0.57	0.46	111.88	2.4%	4.49	7.5%	7.00	9.4%
ov2	Low-E Clear (2)	0.34	0.57	0.46	111.42	2.8%	4.39	9.7%	7.00	9.4%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	112.89	1.6%	4.32	11.0%	7.00	9.4%
none	Low-E G Tint (2)	0.27	0.43	0.46	114.11	0.0%	4.63	0.0%	7.00	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	114.53	-0.4%	4.49	3.1%	7.00	0.0%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	113.30	0.7%	4.40	5.1%	7.00	0.0%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	113.16	0.8%	4.36	5.9%	7.00	0.0%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	115.10	-0.9%	4.31	7.0%	7.00	0.0%
none	Low-E Clear (3)	0.22	0.37	0.20	108.92	0.0%	4.52	0.0%	7.00	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	109.87	-0.9%	4.40	2.5%	7.00	0.0%
ov1	Low-E Clear (3)	0.22	0.37	0.20	109.24	-0.3%	4.39	2.7%	7.00	0.0%
ov2	Low-E Clear (3)	0.22	0.37	0.20	109.32	-0.4%	4.37	3.1%	7.00	0.0%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	111.27	-2.2%	4.33	4.0%	7.00	0.0%

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

ANNUAL ENERGY USE—WASHINGTON, DC
East Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—WASHINGTON, DC
East Orientation—Moderate Window Area (WWR=0.30)



Washington, DC
East Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an east-facing facade with a large window area in a commercial office building in Washington, DC.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

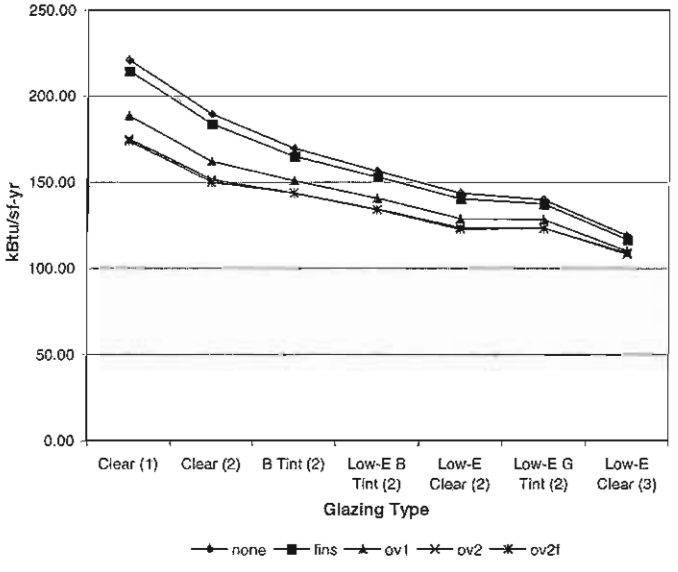
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

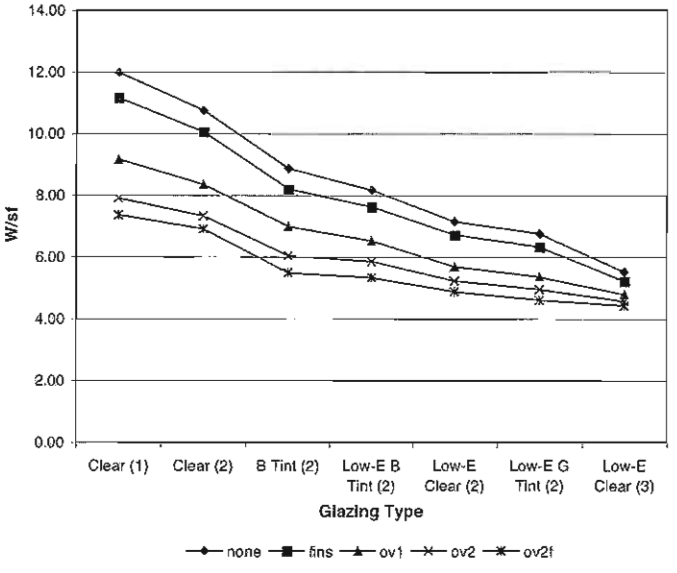
IMPACT OF EXTERIOR SHADING—WASHINGTON, DC
East Orientation—Large Window Area (WWR=0.60)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	220.58	0.0%	11.96	0.0%	17.16	0.0%
fins	Clear (1)	0.72	0.71	1.25	214.08	2.9%	11.14	6.9%	14.46	15.7%
ov1	Clear (1)	0.72	0.71	1.25	188.22	14.7%	9.14	23.6%	16.65	2.9%
ov2	Clear (1)	0.72	0.71	1.25	174.71	20.8%	7.89	34.1%	16.49	3.9%
ov2f	Clear (1)	0.72	0.71	1.25	173.38	21.4%	7.35	38.5%	11.16	34.9%
none	Clear (2)	0.60	0.63	0.60	189.21	0.0%	10.74	0.0%	16.95	0.0%
fins	Clear (2)	0.60	0.63	0.60	183.36	3.1%	10.03	6.6%	14.11	16.8%
ov1	Clear (2)	0.60	0.63	0.60	161.67	14.6%	8.33	22.4%	16.48	2.8%
ov2	Clear (2)	0.60	0.63	0.60	151.12	20.1%	7.32	31.9%	16.33	3.7%
ov2f	Clear (2)	0.60	0.63	0.60	149.48	21.0%	6.89	35.9%	10.79	36.3%
none	B Tint (2)	0.42	0.38	0.60	169.10	0.0%	8.84	0.0%	16.51	0.0%
fins	B Tint (2)	0.42	0.38	0.60	164.63	2.6%	8.19	7.4%	12.58	23.8%
ov1	B Tint (2)	0.42	0.38	0.60	150.60	10.9%	6.98	21.1%	16.22	1.8%
ov2	B Tint (2)	0.42	0.38	0.60	143.36	15.2%	6.03	31.9%	16.14	2.3%
ov2f	B Tint (2)	0.42	0.38	0.60	143.37	15.2%	5.48	38.1%	9.21	44.2%
none	Low-E B Tint (2)	0.39	0.36	0.49	156.06	0.0%	8.15	0.0%	16.43	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	152.51	2.3%	7.61	6.6%	12.33	24.9%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	140.23	10.1%	6.51	20.2%	16.21	1.3%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	133.77	14.3%	5.84	28.4%	16.17	1.5%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	133.60	14.4%	5.32	34.7%	8.94	45.6%
none	Low-E Clear (2)	0.34	0.57	0.46	143.24	0.0%	7.13	0.0%	16.74	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	140.14	2.2%	6.71	5.9%	13.79	17.6%
ov1	Low-E Clear (2)	0.34	0.57	0.46	128.49	10.3%	5.67	20.4%	16.29	2.7%
ov2	Low-E Clear (2)	0.34	0.57	0.46	123.23	14.0%	5.21	26.9%	16.15	3.6%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	122.36	14.6%	4.86	31.9%	10.52	37.1%
none	Low-E G Tint (2)	0.27	0.43	0.46	139.47	0.0%	6.73	0.0%	16.64	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	136.93	1.8%	6.30	6.4%	12.92	22.4%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	127.78	8.4%	5.34	20.7%	16.35	1.8%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	122.81	11.9%	4.94	26.7%	16.25	2.3%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	122.73	12.0%	4.58	32.0%	9.63	42.2%
none	Low-E Clear (3)	0.22	0.37	0.20	118.62	0.0%	5.49	0.0%	16.42	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	116.49	1.8%	5.20	5.3%	12.36	24.7%
ov1	Low-E Clear (3)	0.22	0.37	0.20	109.80	7.4%	4.78	13.1%	16.20	1.3%
ov2	Low-E Clear (3)	0.22	0.37	0.20	107.81	9.1%	4.55	17.2%	16.12	1.8%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	108.59	8.5%	4.41	19.7%	8.99	45.3%

ANNUAL ENERGY USE—WASHINGTON, DC
East Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—WASHINGTON, DC
East Orientation—Low Window Area (WWR=0.60)



Washington, DC
South Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an south-facing facade with moderate window area in a commercial office building in Washington, DC.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

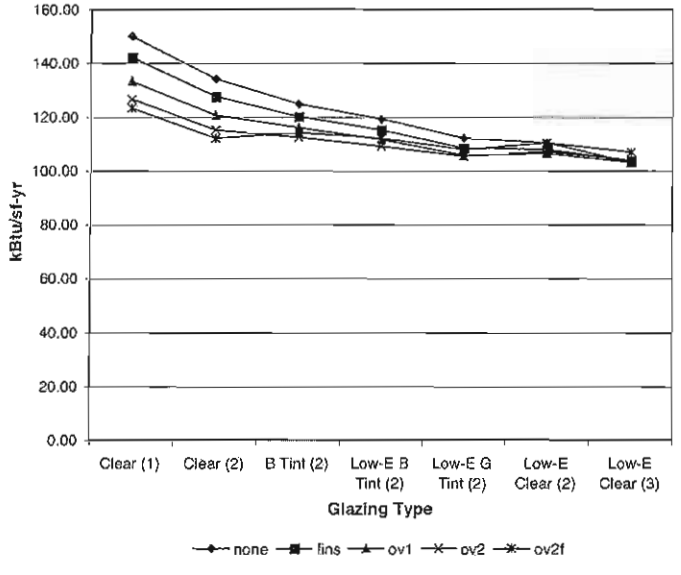
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

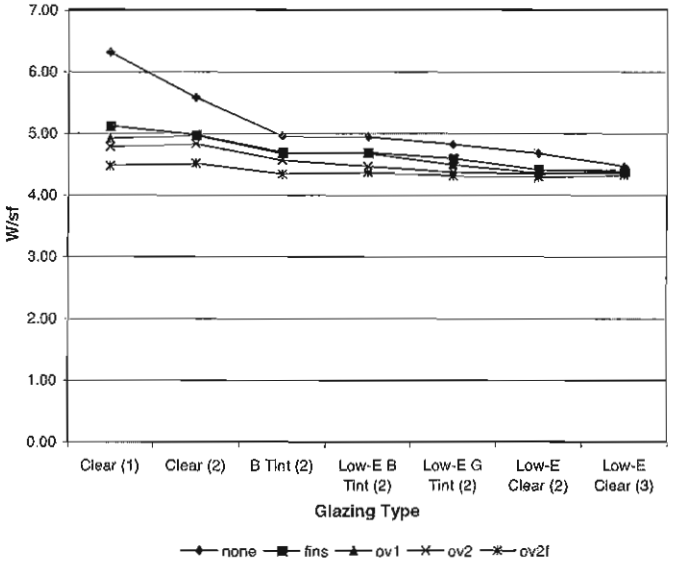
IMPACT OF EXTERIOR SHADING—WASHINGTON, DC
South Orientation—Moderate Window Area (WWR=0.30)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	149.77	0.0%	6.30	0.0%	8.64	0.0%
fins	Clear (1)	0.72	0.71	1.25	141.92	5.2%	5.11	18.9%	7.57	12.3%
ov1	Clear (1)	0.72	0.71	1.25	133.06	11.2%	4.91	22.1%	7.13	17.4%
ov2	Clear (1)	0.72	0.71	1.25	126.45	15.6%	4.77	24.3%	7.00	18.9%
ov2f	Clear (1)	0.72	0.71	1.25	123.10	17.8%	4.46	29.2%	7.00	18.9%
none	Clear (2)	0.60	0.63	0.60	133.91	0.0%	5.57	0.0%	8.31	0.0%
fins	Clear (2)	0.60	0.63	0.60	127.41	4.9%	4.97	10.9%	7.21	13.2%
ov1	Clear (2)	0.60	0.63	0.60	120.50	10.0%	4.96	11.0%	7.00	15.7%
ov2	Clear (2)	0.60	0.63	0.60	114.92	14.2%	4.82	13.5%	7.00	15.7%
ov2f	Clear (2)	0.60	0.63	0.60	111.85	16.5%	4.50	19.2%	7.00	15.7%
none	B Tint (2)	0.42	0.38	0.60	124.57	0.0%	4.95	0.0%	7.00	0.0%
fins	B Tint (2)	0.42	0.38	0.60	119.99	3.7%	4.69	5.2%	7.00	0.0%
ov1	B Tint (2)	0.42	0.38	0.60	115.79	7.0%	4.67	5.7%	7.00	0.0%
ov2	B Tint (2)	0.42	0.38	0.60	112.23	9.9%	4.56	7.9%	7.00	0.0%
ov2f	B Tint (2)	0.42	0.38	0.60	114.01	8.5%	4.33	12.5%	7.00	0.0%
none	Low-E B Tint (2)	0.39	0.36	0.49	119.03	0.0%	4.93	0.0%	7.00	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	114.99	3.4%	4.68	5.2%	7.00	0.0%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	111.45	6.4%	4.66	5.4%	7.00	0.0%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	108.97	8.4%	4.45	9.7%	7.00	0.0%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	111.79	6.1%	4.36	11.7%	7.00	0.0%
none	Low-E Clear (2)	0.34	0.57	0.46	111.97	0.0%	4.81	0.0%	7.98	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	108.22	3.3%	4.58	4.7%	7.00	12.3%
ov1	Low-E Clear (2)	0.34	0.57	0.46	105.50	5.8%	4.48	6.9%	7.00	12.3%
ov2	Low-E Clear (2)	0.34	0.57	0.46	105.23	6.0%	4.36	9.4%	7.00	12.3%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	107.69	3.8%	4.30	10.6%	7.00	12.3%
none	Low-E G Tint (2)	0.27	0.43	0.46	110.10	0.0%	4.66	0.0%	7.09	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	107.80	2.1%	4.40	5.6%	7.00	1.2%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	106.26	3.5%	4.35	6.8%	7.00	1.2%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	107.06	2.8%	4.33	7.2%	7.00	1.2%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	110.17	-0.1%	4.28	8.3%	7.00	1.2%
none	Low-E Clear (3)	0.22	0.37	0.20	102.79	0.0%	4.46	0.0%	7.00	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	103.45	-0.6%	4.37	2.0%	7.00	0.0%
ov1	Low-E Clear (3)	0.22	0.37	0.20	102.91	-0.1%	4.36	2.2%	7.00	0.0%
ov2	Low-E Clear (3)	0.22	0.37	0.20	103.75	-0.9%	4.34	2.5%	7.00	0.0%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	106.78	-3.9%	4.31	3.3%	7.00	0.0%

ANNUAL ENERGY USE—WASHINGTON, DC
South Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—WASHINGTON, DC
South Orientation—Moderate Window Area (WWR=0.30)



Washington, DC
South Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an south-facing facade with a large window area in a commercial office building in Washington, DC.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

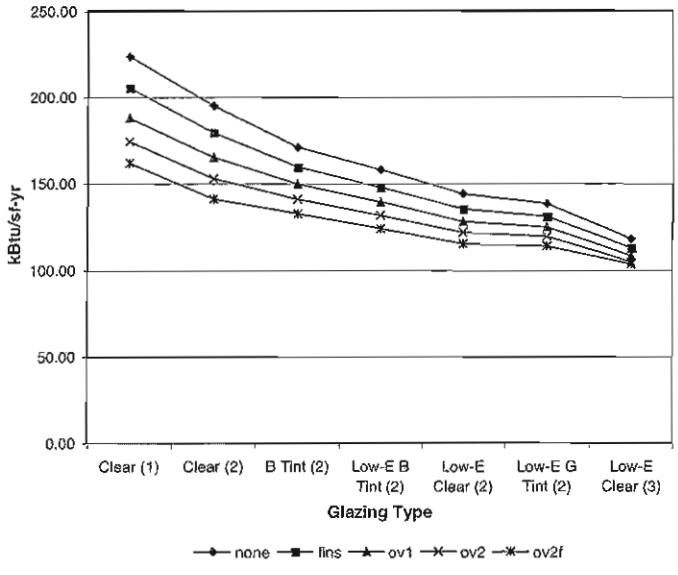
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

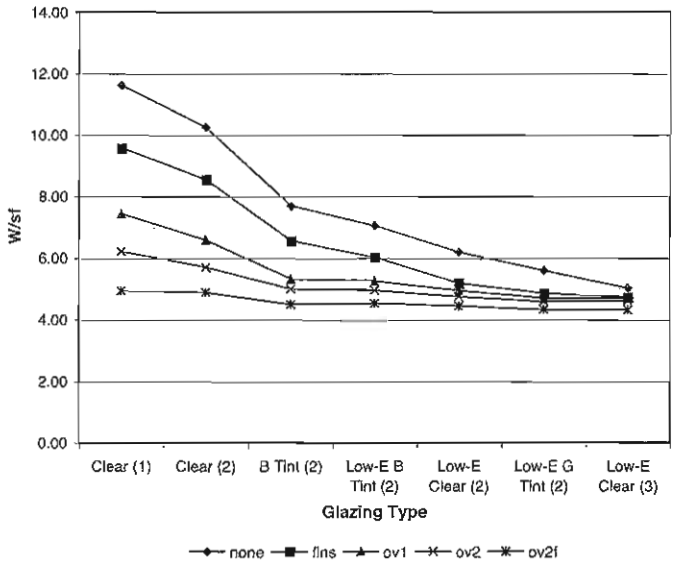
IMPACT OF EXTERIOR SHADING—WASHINGTON, DC
South Orientation—Large Window Area (WWR=0.60)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	223.33	0.0%	11.60	0.0%	15.78	0.0%
fins	Clear (1)	0.72	0.71	1.25	205.27	8.1%	9.57	17.5%	14.31	9.3%
ov1	Clear (1)	0.72	0.71	1.25	187.76	15.9%	7.43	36.0%	14.51	8.1%
ov2	Clear (1)	0.72	0.71	1.25	174.01	22.1%	6.21	46.5%	14.15	10.3%
ov2f	Clear (1)	0.72	0.71	1.25	161.73	27.6%	4.93	57.5%	10.52	33.3%
none	Clear (2)	0.60	0.63	0.60	194.89	0.0%	10.24	0.0%	15.45	0.0%
fins	Clear (2)	0.60	0.63	0.60	179.32	8.0%	8.54	16.6%	13.97	9.6%
ov1	Clear (2)	0.60	0.63	0.60	164.97	15.4%	6.57	35.8%	14.18	8.2%
ov2	Clear (2)	0.60	0.63	0.60	152.73	21.6%	5.68	44.5%	13.81	10.6%
ov2f	Clear (2)	0.60	0.63	0.60	140.87	27.7%	4.88	52.3%	10.18	34.1%
none	B Tint (2)	0.42	0.38	0.60	170.66	0.0%	7.68	0.0%	14.02	0.0%
fins	B Tint (2)	0.42	0.38	0.60	159.20	6.7%	6.56	14.7%	12.48	11.0%
ov1	B Tint (2)	0.42	0.38	0.60	149.52	12.4%	5.31	30.8%	12.75	9.1%
ov2	B Tint (2)	0.42	0.38	0.60	140.63	17.6%	4.99	35.1%	12.35	11.9%
ov2f	B Tint (2)	0.42	0.38	0.60	132.38	22.4%	4.49	41.6%	8.65	38.3%
none	Low-E B Tint (2)	0.39	0.36	0.49	157.91	0.0%	7.03	0.0%	13.80	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	147.57	6.5%	6.01	14.5%	12.25	11.3%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	139.20	11.9%	5.25	25.4%	12.52	9.3%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	131.35	16.8%	4.94	29.8%	12.13	12.1%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	123.78	21.6%	4.52	35.8%	8.38	39.3%
none	Low-E Clear (2)	0.34	0.57	0.46	143.77	0.0%	6.18	0.0%	15.16	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	135.05	6.1%	5.17	16.3%	13.66	9.9%
ov1	Low-E Clear (2)	0.34	0.57	0.46	127.82	11.1%	4.93	20.2%	13.89	8.3%
ov2	Low-E Clear (2)	0.34	0.57	0.46	121.48	15.5%	4.73	23.4%	13.52	10.8%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	114.93	20.1%	4.42	28.4%	9.91	34.6%
none	Low-E G Tint (2)	0.27	0.43	0.46	138.10	0.0%	5.59	0.0%	14.34	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	130.55	5.5%	4.84	13.4%	12.81	10.7%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	124.59	9.8%	4.69	16.1%	13.08	8.8%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	119.12	13.7%	4.58	18.0%	12.70	11.5%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	113.57	17.8%	4.31	22.8%	9.05	36.9%
none	Low-E Clear (3)	0.22	0.37	0.20	117.69	0.0%	5.01	0.0%	13.83	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	112.30	4.6%	4.73	5.7%	12.27	11.3%
ov1	Low-E Clear (3)	0.22	0.37	0.20	108.06	8.2%	4.69	6.4%	12.55	9.2%
ov2	Low-E Clear (3)	0.22	0.37	0.20	104.43	11.3%	4.60	8.3%	12.15	12.1%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	103.14	12.4%	4.30	14.2%	8.42	39.1%

ANNUAL ENERGY USE—WASHINGTON, DC
South Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—WASHINGTON, DC
South Orientation—Large Window Area (WWR=0.60)



Washington, DC
West Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an west-facing facade with moderate window area in a commercial office building in Washington, DC.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

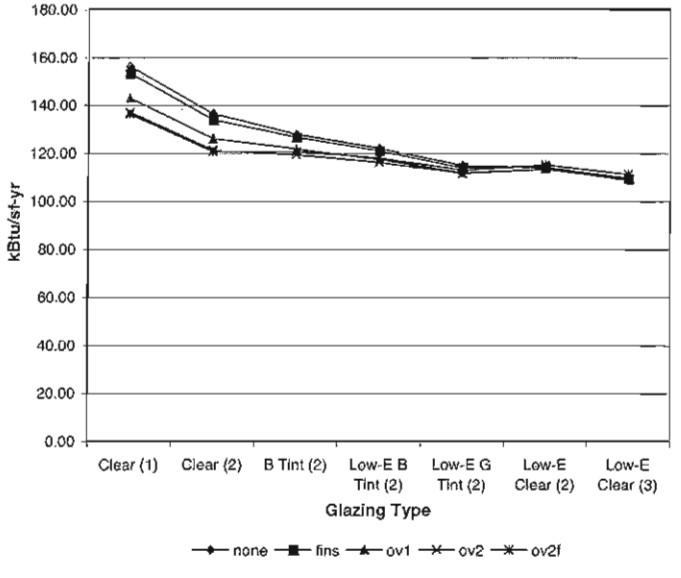
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

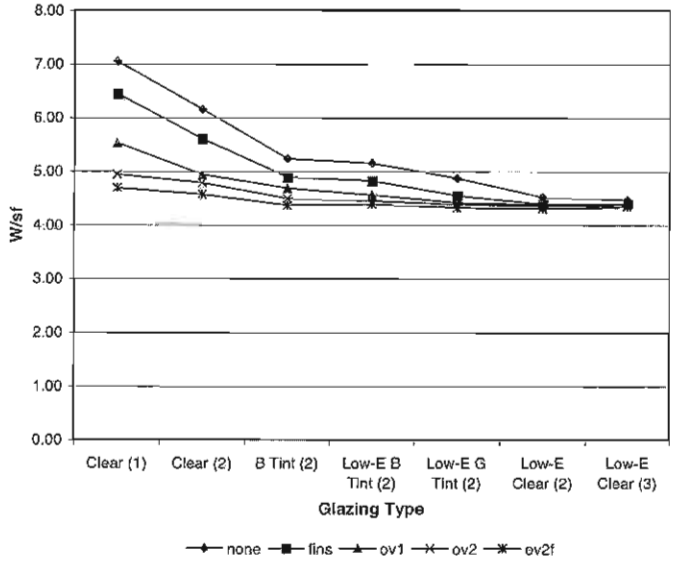
IMPACT OF EXTERIOR SHADING—WASHINGTON, DC
West Orientation—Moderate Window Area (WWR=0.30)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	156.12	0.0%	7.04	0.0%	12.86	0.0%
fins	Clear (1)	0.72	0.71	1.25	153.11	1.9%	6.43	8.6%	12.76	0.7%
ov1	Clear (1)	0.72	0.71	1.25	142.85	8.5%	5.51	21.7%	12.75	0.8%
ov2	Clear (1)	0.72	0.71	1.25	136.96	12.3%	4.93	29.9%	12.73	1.0%
ov2f	Clear (1)	0.72	0.71	1.25	136.18	12.8%	4.68	33.6%	12.68	1.4%
none	Clear (2)	0.60	0.63	0.60	136.20	0.0%	6.14	0.0%	12.54	0.0%
fins	Clear (2)	0.60	0.63	0.60	133.62	1.9%	5.60	8.8%	12.45	0.7%
ov1	Clear (2)	0.60	0.63	0.60	125.82	7.6%	4.93	19.7%	12.43	0.8%
ov2	Clear (2)	0.60	0.63	0.60	121.08	11.1%	4.78	22.2%	12.41	1.0%
ov2f	Clear (2)	0.60	0.63	0.60	120.23	11.7%	4.56	25.7%	12.36	1.4%
none	B Tint (2)	0.42	0.38	0.60	127.71	0.0%	5.23	0.0%	11.24	0.0%
fins	B Tint (2)	0.42	0.38	0.60	126.38	1.0%	4.88	6.6%	11.15	0.8%
ov1	B Tint (2)	0.42	0.38	0.60	121.53	4.8%	4.67	10.6%	11.14	0.9%
ov2	B Tint (2)	0.42	0.38	0.60	119.16	6.7%	4.48	14.3%	11.12	1.1%
ov2f	B Tint (2)	0.42	0.38	0.60	120.46	5.7%	4.35	16.7%	11.07	1.6%
none	Low-E B Tint (2)	0.39	0.36	0.49	121.87	0.0%	5.14	0.0%	11.04	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	120.69	1.0%	4.81	6.4%	10.96	0.8%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	117.11	3.9%	4.55	11.6%	10.96	0.8%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	115.95	4.9%	4.44	13.6%	10.93	1.1%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	117.74	3.4%	4.38	14.9%	10.88	1.5%
none	Low-E Clear (2)	0.34	0.57	0.46	114.68	0.0%	4.86	0.0%	12.28	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	113.81	0.8%	4.53	6.7%	12.19	0.7%
ov1	Low-E Clear (2)	0.34	0.57	0.46	111.60	2.7%	4.40	9.4%	12.18	0.8%
ov2	Low-E Clear (2)	0.34	0.57	0.46	111.24	3.0%	4.37	10.0%	12.16	1.0%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	112.73	1.7%	4.31	11.3%	12.11	1.3%
none	Low-E G Tint (2)	0.27	0.43	0.46	113.39	0.0%	4.52	0.0%	11.53	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	114.09	-0.6%	4.38	2.9%	11.44	0.8%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	113.12	0.2%	4.37	3.3%	11.44	0.8%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	113.09	0.3%	4.34	3.8%	11.42	1.0%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	114.99	-1.4%	4.29	4.9%	11.36	1.5%
none	Low-E Clear (3)	0.22	0.37	0.20	108.37	0.0%	4.45	0.0%	11.13	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	109.33	-0.9%	4.39	1.3%	11.04	0.8%
ov1	Low-E Clear (3)	0.22	0.37	0.20	108.85	-0.4%	4.38	1.6%	11.04	0.8%
ov2	Low-E Clear (3)	0.22	0.37	0.20	109.04	-0.6%	4.36	1.9%	11.01	1.1%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	110.98	-2.4%	4.33	2.7%	10.96	1.5%

ANNUAL ENERGY USE—WASHINGTON, DC
West Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—WASHINGTON, DC
West Orientation—Moderate Window Area (WWR=0.30)



Washington, DC
West Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an west-facing facade with a large window area in a commercial office building in Washington, DC.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

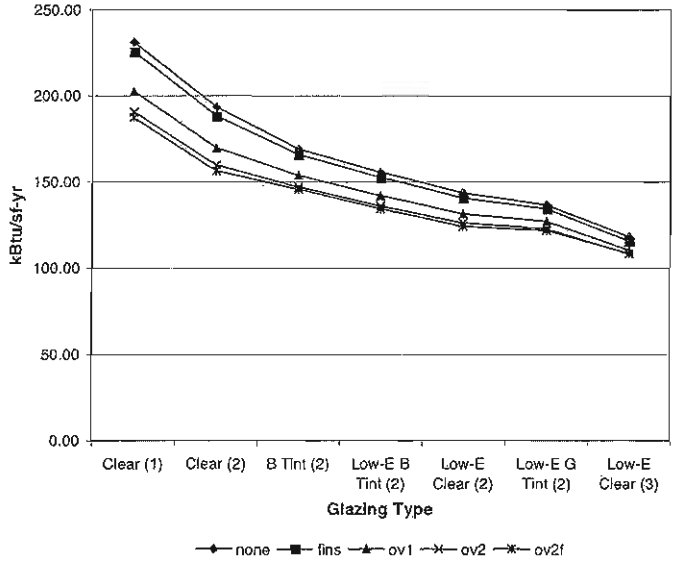
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

IMPACT OF EXTERIOR SHADING—WASHINGTON, DC
West Orientation—Large Window Area (WWR=0.60)

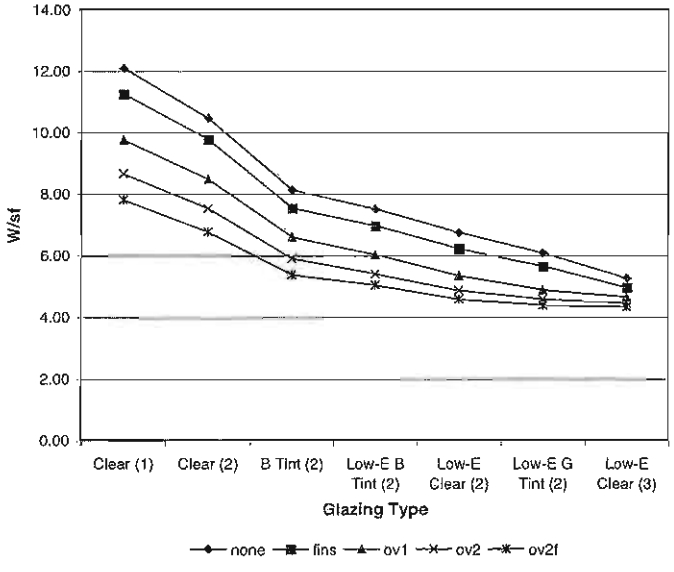
Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	230.83	0.0%	12.08	0.0%	16.27	0.0%
fins	Clear (1)	0.72	0.71	1.25	225.19	2.4%	11.24	6.9%	15.47	4.9%
ov1	Clear (1)	0.72	0.71	1.25	202.18	12.4%	9.74	19.3%	15.44	5.1%
ov2	Clear (1)	0.72	0.71	1.25	190.12	17.6%	8.64	28.4%	14.63	10.1%
ov2f	Clear (1)	0.72	0.71	1.25	187.04	19.0%	7.80	35.4%	12.88	20.8%
none	Clear (2)	0.60	0.63	0.60	193.08	0.0%	10.45	0.0%	16.00	0.0%
fins	Clear (2)	0.60	0.63	0.60	187.91	2.7%	9.77	6.6%	15.18	5.1%
ov1	Clear (2)	0.60	0.63	0.60	169.38	12.3%	8.47	18.9%	15.23	4.8%
ov2	Clear (2)	0.60	0.63	0.60	159.11	17.6%	7.52	28.0%	14.34	10.3%
ov2f	Clear (2)	0.60	0.63	0.60	155.95	19.2%	6.75	35.4%	12.69	20.7%
none	B Tint (2)	0.42	0.38	0.60	168.66	0.0%	8.11	0.0%	15.14	0.0%
fins	B Tint (2)	0.42	0.38	0.60	165.47	1.9%	7.53	7.2%	14.64	3.3%
ov1	B Tint (2)	0.42	0.38	0.60	153.43	9.0%	6.58	18.9%	14.69	3.0%
ov2	B Tint (2)	0.42	0.38	0.60	146.62	13.1%	5.89	27.4%	13.44	11.2%
ov2f	B Tint (2)	0.42	0.38	0.60	145.17	13.9%	5.36	34.0%	12.44	17.9%
none	Low-E B Tint (2)	0.39	0.36	0.49	155.18	0.0%	7.49	0.0%	15.14	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	152.05	2.0%	6.95	7.2%	14.66	3.2%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	141.56	8.8%	6.01	19.7%	14.71	2.9%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	135.56	12.6%	5.38	28.1%	13.41	11.5%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	134.07	13.6%	5.03	32.9%	12.69	16.2%
none	Low-E Clear (2)	0.34	0.57	0.46	143.27	0.0%	6.74	0.0%	15.77	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	140.19	2.1%	6.22	7.7%	14.99	4.9%
ov1	Low-E Clear (2)	0.34	0.57	0.46	131.11	8.5%	5.34	20.7%	15.05	4.6%
ov2	Low-E Clear (2)	0.34	0.57	0.46	125.84	12.2%	4.86	27.9%	14.05	10.9%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	123.84	13.6%	4.56	32.3%	12.43	21.2%
none	Low-E G Tint (2)	0.27	0.43	0.46	136.10	0.0%	6.08	0.0%	15.35	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	133.89	1.6%	5.64	7.2%	14.72	4.1%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	126.64	7.0%	4.87	19.9%	14.78	3.7%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	122.50	10.0%	4.57	24.8%	13.40	12.7%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	121.45	10.8%	4.37	28.1%	12.03	21.6%
none	Low-E Clear (3)	0.22	0.37	0.20	117.91	0.0%	5.26	0.0%	15.12	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	115.38	2.1%	4.95	5.9%	14.72	2.7%
ov1	Low-E Clear (3)	0.22	0.37	0.20	109.98	6.7%	4.63	11.8%	14.72	2.6%
ov2	Low-E Clear (3)	0.22	0.37	0.20	107.77	8.6%	4.45	15.4%	13.45	11.0%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	108.12	8.3%	4.32	17.9%	12.62	16.6%

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-ºF, Tvis=visible transmittance

ANNUAL ENERGY USE—WASHINGTON, DC
West Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—WASHINGTON, DC
West Orientation—Large Window Area (WWR=0.60)



Houston, Texas
East Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an east-facing facade with moderate window area in a commercial office building in Houston, Texas.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

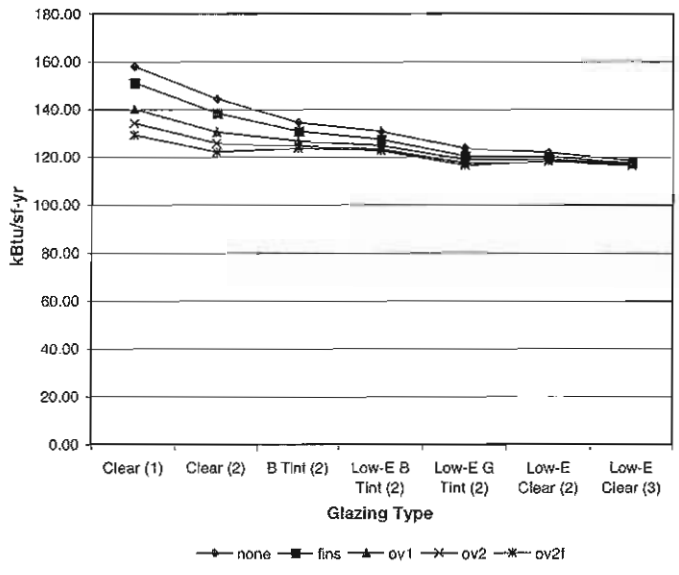
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

IMPACT OF EXTERIOR SHADING—HOUSTON, TX
East Orientation—Moderate Window Area (WWR=0.30)

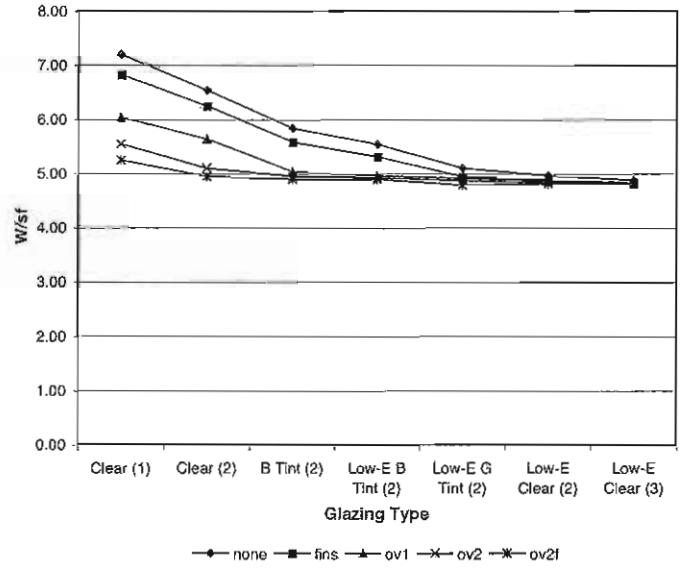
Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	157.63	0.0%	7.19	0.0%	8.62	0.0%
fins	Clear (1)	0.72	0.71	1.25	150.92	4.3%	6.82	5.2%	7.48	13.3%
ov1	Clear (1)	0.72	0.71	1.25	139.86	11.3%	6.03	16.1%	7.09	17.8%
ov2	Clear (1)	0.72	0.71	1.25	133.91	15.0%	5.54	22.9%	7.00	18.8%
ov2f	Clear (1)	0.72	0.71	1.25	129.11	18.1%	5.24	27.1%	7.00	18.8%
none	Clear (2)	0.60	0.63	0.60	144.04	0.0%	6.53	0.0%	8.27	0.0%
fins	Clear (2)	0.60	0.63	0.60	138.18	4.1%	6.24	4.5%	7.09	14.3%
ov1	Clear (2)	0.60	0.63	0.60	130.34	9.5%	5.63	13.8%	7.00	15.4%
ov2	Clear (2)	0.60	0.63	0.60	125.62	12.8%	5.08	22.1%	7.00	15.4%
ov2f	Clear (2)	0.60	0.63	0.60	121.93	15.4%	4.94	24.4%	7.00	15.4%
none	B Tint (2)	0.42	0.38	0.60	134.26	0.0%	5.82	0.0%	7.00	0.0%
fins	B Tint (2)	0.42	0.38	0.60	130.67	2.7%	5.57	4.3%	7.00	0.0%
ov1	B Tint (2)	0.42	0.38	0.60	126.52	5.8%	5.02	13.7%	7.00	0.0%
ov2	B Tint (2)	0.42	0.38	0.60	124.54	7.2%	4.93	15.3%	7.00	0.0%
ov2f	B Tint (2)	0.42	0.38	0.60	123.66	7.9%	4.88	16.2%	7.00	0.0%
none	Low-E B Tint (2)	0.39	0.36	0.49	130.52	0.0%	5.53	0.0%	7.00	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	127.24	2.5%	5.30	4.2%	7.00	0.0%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	124.64	4.5%	4.95	10.5%	7.00	0.0%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	123.10	5.7%	4.92	11.1%	7.00	0.0%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	122.46	6.2%	4.88	11.7%	7.00	0.0%
none	Low-E Clear (2)	0.34	0.57	0.46	123.60	0.0%	5.09	0.0%	7.93	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	120.33	2.6%	4.94	3.1%	7.00	11.8%
ov1	Low-E Clear (2)	0.34	0.57	0.46	118.66	4.0%	4.90	3.8%	7.00	11.8%
ov2	Low-E Clear (2)	0.34	0.57	0.46	117.20	5.2%	4.86	4.6%	7.00	11.8%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	116.34	5.9%	4.78	6.2%	7.00	11.8%
none	Low-E G Tint (2)	0.27	0.43	0.46	121.73	0.0%	4.95	0.0%	7.00	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	120.01	1.4%	4.88	1.5%	7.00	0.0%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	118.94	2.3%	4.86	1.9%	7.00	0.0%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	118.01	3.1%	4.82	2.6%	7.00	0.0%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	118.13	3.0%	4.80	3.0%	7.00	0.0%
none	Low-E Clear (3)	0.22	0.37	0.20	118.23	0.0%	4.88	0.0%	7.00	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	117.20	0.9%	4.81	1.4%	7.00	0.0%
ov1	Low-E Clear (3)	0.22	0.37	0.20	116.79	1.2%	4.82	1.1%	7.00	0.0%
ov2	Low-E Clear (3)	0.22	0.37	0.20	116.21	1.7%	4.82	1.3%	7.00	0.0%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	116.73	1.3%	4.80	1.6%	7.00	0.0%

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

ANNUAL ENERGY USE—HOUSTON, TX
East Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—HOUSTON, TX
East Orientation—Moderate Window Area (WWR=0.30)



Houston, Texas
East Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an east-facing facade with a large window area in a commercial office building in Houston, Texas.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

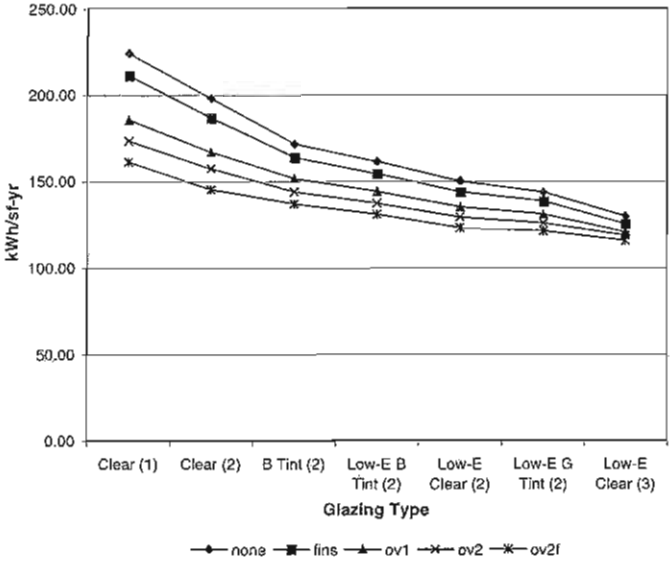
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

IMPACT OF EXTERIOR SHADING—HOUSTON,TX
East Orientation—Large Window Area (WWR=0.60)

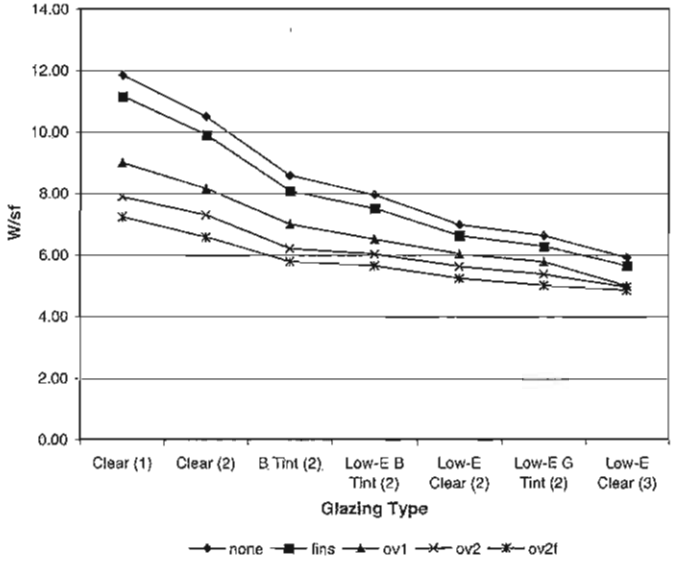
Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	223.76	0.0%	11.83	0.0%	17.20	0.0%
fins	Clear (1)	0.72	0.71	1.25	211.01	5.7%	11.15	5.8%	14.62	15.0%
ov1	Clear (1)	0.72	0.71	1.25	185.24	17.2%	8.97	24.2%	16.72	2.8%
ov2	Clear (1)	0.72	0.71	1.25	173.11	22.6%	7.88	33.4%	16.55	3.8%
ov2f	Clear (1)	0.72	0.71	1.25	160.72	28.2%	7.21	39.0%	11.33	34.2%
none	Clear (2)	0.60	0.63	0.60	197.74	0.0%	10.49	0.0%	17.11	0.0%
fins	Clear (2)	0.60	0.63	0.60	186.59	5.6%	9.89	5.7%	14.27	16.6%
ov1	Clear (2)	0.60	0.63	0.60	166.53	15.8%	8.15	22.3%	16.69	2.4%
ov2	Clear (2)	0.60	0.63	0.60	157.02	20.6%	7.29	30.5%	16.54	3.3%
ov2f	Clear (2)	0.60	0.63	0.60	144.97	26.7%	6.57	37.4%	10.96	35.9%
none	B Tint (2)	0.42	0.38	0.60	171.26	0.0%	8.56	0.0%	16.65	0.0%
fins	B Tint (2)	0.42	0.38	0.60	163.52	4.5%	8.07	5.8%	12.76	23.3%
ov1	B Tint (2)	0.42	0.38	0.60	151.33	11.6%	6.99	18.4%	16.40	1.5%
ov2	B Tint (2)	0.42	0.38	0.60	143.55	16.2%	6.19	27.7%	16.32	2.0%
ov2f	B Tint (2)	0.42	0.38	0.60	136.68	20.2%	5.77	32.6%	9.40	43.5%
none	Low-E B Tint (2)	0.39	0.36	0.49	161.26	0.0%	7.93	0.0%	16.74	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	154.14	4.4%	7.49	5.6%	12.52	25.2%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	143.81	10.8%	6.50	18.1%	16.56	1.1%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	137.01	15.0%	6.01	24.3%	16.50	1.4%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	130.64	19.0%	5.64	28.9%	9.13	45.5%
none	Low-E Clear (2)	0.34	0.57	0.46	149.94	0.0%	6.96	0.0%	16.96	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	143.57	4.3%	6.61	5.1%	13.96	17.7%
ov1	Low-E Clear (2)	0.34	0.57	0.46	134.76	10.1%	6.01	13.6%	16.63	1.9%
ov2	Low-E Clear (2)	0.34	0.57	0.46	129.18	13.8%	5.60	19.6%	16.52	2.6%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	122.79	18.1%	5.21	25.1%	10.70	37.0%
none	Low-E G Tint (2)	0.27	0.43	0.46	143.31	0.0%	6.60	0.0%	16.70	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	138.14	3.6%	6.26	5.2%	13.10	21.6%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	130.51	8.9%	5.76	12.7%	16.42	1.7%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	125.52	12.4%	5.34	19.0%	16.33	2.2%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	120.86	15.7%	4.99	24.4%	9.82	41.2%
none	Low-E Clear (3)	0.22	0.37	0.20	129.56	0.0%	5.90	0.0%	16.69	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	125.06	3.5%	5.64	4.3%	12.54	24.8%
ov1	Low-E Clear (3)	0.22	0.37	0.20	120.46	7.0%	4.98	15.6%	16.55	0.9%
ov2	Low-E Clear (3)	0.22	0.37	0.20	118.27	8.7%	4.94	16.3%	16.47	1.3%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	115.46	10.9%	4.83	18.1%	9.18	45.0%

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

ANNUAL ENERGY USE—HOUSTON, TX
East Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—HOUSTON, TX
East Orientation—Large Window Area (WWR=0.60)



Houston, Texas
South Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an south-facing facade with moderate window area in a commercial office building in Houston, Texas.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

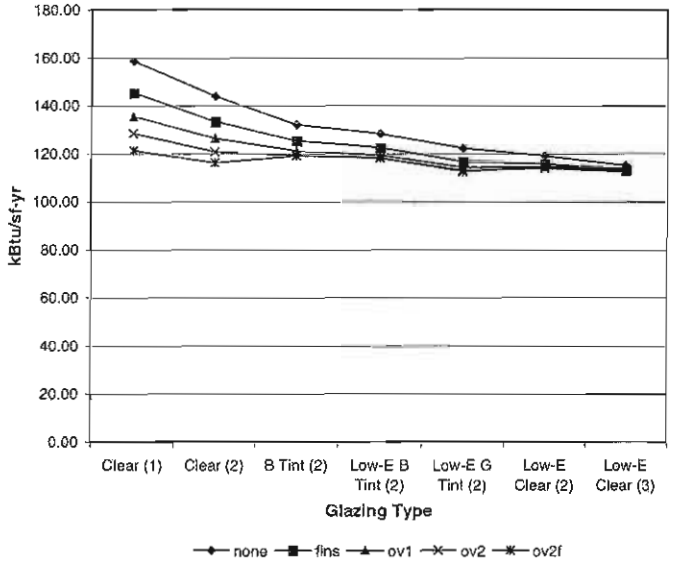
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

IMPACT OF EXTERIOR SHADING—HOUSTON, TX
South Orientation—Moderate Window Area (WWR=0.30)

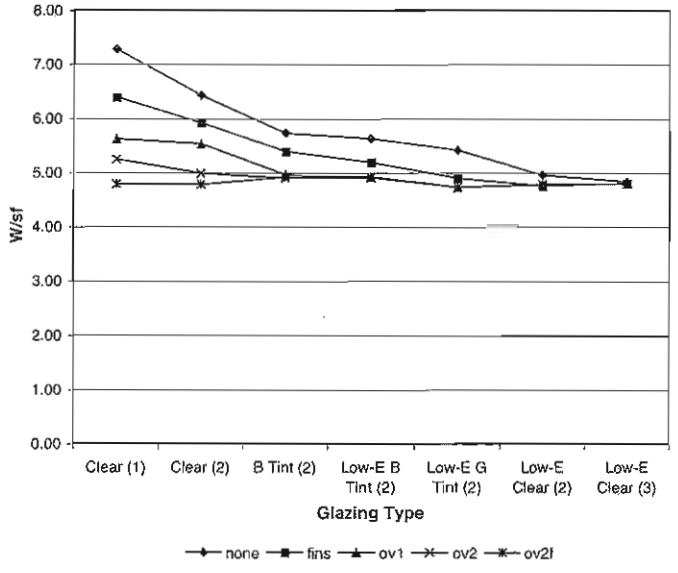
Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	158.36	0.0%	7.27	0.0%	8.55	0.0%
fins	Clear (1)	0.72	0.71	1.25	145.17	8.3%	6.38	12.2%	7.49	12.5%
ov1	Clear (1)	0.72	0.71	1.25	135.25	14.6%	5.61	22.8%	7.00	18.2%
ov2	Clear (1)	0.72	0.71	1.25	128.08	19.1%	5.24	28.0%	7.00	18.2%
ov2f	Clear (1)	0.72	0.71	1.25	121.02	23.6%	4.78	34.3%	7.00	18.2%
none	Clear (2)	0.60	0.63	0.60	143.80	0.0%	6.42	0.0%	8.22	0.0%
fins	Clear (2)	0.60	0.63	0.60	133.28	7.3%	5.91	8.0%	7.12	13.5%
ov1	Clear (2)	0.60	0.63	0.60	126.29	12.2%	5.53	13.9%	7.00	14.9%
ov2	Clear (2)	0.60	0.63	0.60	120.63	16.1%	4.98	22.4%	7.00	14.9%
ov2f	Clear (2)	0.60	0.63	0.60	116.00	19.3%	4.78	25.6%	7.00	14.9%
none	B Tint (2)	0.42	0.38	0.60	131.80	0.0%	5.72	0.0%	7.00	0.0%
fins	B Tint (2)	0.42	0.38	0.60	125.20	5.0%	5.38	5.9%	7.00	0.0%
ov1	B Tint (2)	0.42	0.38	0.60	120.86	8.3%	4.96	13.4%	7.00	0.0%
ov2	B Tint (2)	0.42	0.38	0.60	118.99	9.7%	4.89	14.6%	7.00	0.0%
ov2f	B Tint (2)	0.42	0.38	0.60	118.79	9.9%	4.91	14.2%	7.00	0.0%
none	Low-E B Tint (2)	0.39	0.36	0.49	128.06	0.0%	5.62	0.0%	7.00	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	122.26	4.5%	5.18	7.8%	7.00	0.0%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	119.14	7.0%	4.91	12.7%	7.00	0.0%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	117.87	8.0%	4.90	12.9%	7.00	0.0%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	118.03	7.8%	4.91	12.6%	7.00	0.0%
none	Low-E Clear (2)	0.34	0.57	0.46	122.16	0.0%	5.41	0.0%	7.90	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	116.35	4.8%	4.89	9.6%	7.00	11.4%
ov1	Low-E Clear (2)	0.34	0.57	0.46	114.15	6.6%	4.72	12.8%	7.00	11.4%
ov2	Low-E Clear (2)	0.34	0.57	0.46	112.86	7.6%	4.72	12.7%	7.00	11.4%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	112.25	8.1%	4.72	12.7%	7.00	11.4%
none	Low-E G Tint (2)	0.27	0.43	0.46	118.85	0.0%	4.95	0.0%	7.00	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	115.49	2.8%	4.74	4.2%	7.00	0.0%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	114.16	3.9%	4.78	3.6%	7.00	0.0%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	113.57	4.4%	4.78	3.5%	7.00	0.0%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	114.45	3.7%	4.78	3.6%	7.00	0.0%
none	Low-E Clear (3)	0.22	0.37	0.20	114.91	0.0%	4.83	0.0%	7.00	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	113.09	1.6%	4.80	0.5%	7.00	0.0%
ov1	Low-E Clear (3)	0.22	0.37	0.20	112.48	2.1%	4.79	0.7%	7.00	0.0%
ov2	Low-E Clear (3)	0.22	0.37	0.20	112.29	2.3%	4.79	0.8%	7.00	0.0%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	113.73	1.0%	4.79	0.7%	7.00	0.0%

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

ANNUAL ENERGY USE—HOUSTON, TX
South Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—HOUSTON, TX
South Orientation—Moderate Window Area (WWR=0.30)



Houston, Texas
South Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an south-facing facade with a large window area in a commercial office building in Houston, Texas.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

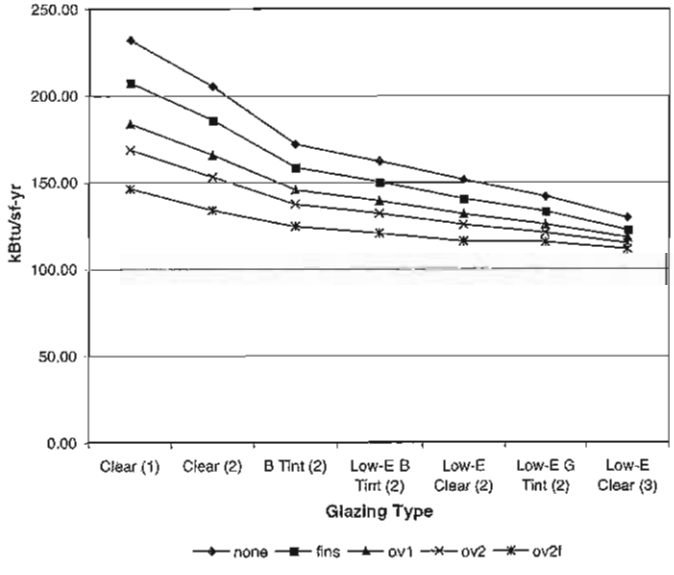
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

IMPACT OF EXTERIOR SHADING—HOUSTON, TX
South Orientation—Large Window Area (WWR=0.60)

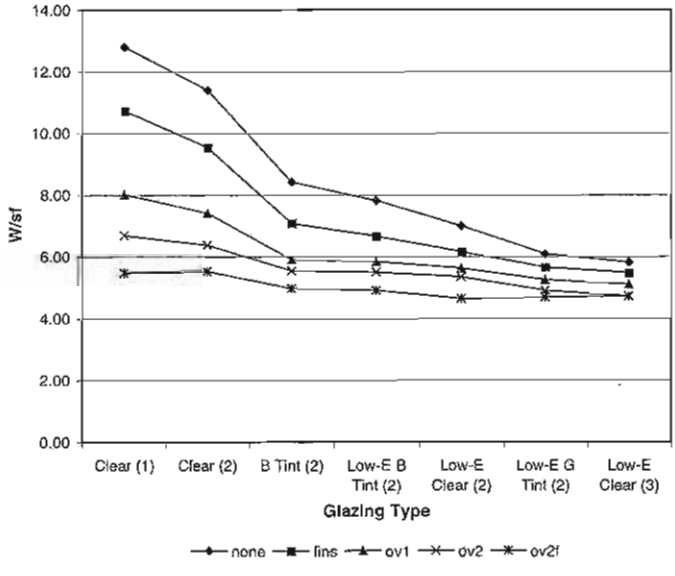
Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	231.94	0.0%	12.78	0.0%	15.75	0.0%
fins	Clear (1)	0.72	0.71	1.25	207.13	10.7%	10.71	16.2%	14.27	9.4%
ov1	Clear (1)	0.72	0.71	1.25	183.43	20.9%	7.99	37.5%	14.44	8.3%
ov2	Clear (1)	0.72	0.71	1.25	168.27	27.4%	6.67	47.8%	14.08	10.6%
ov2f	Clear (1)	0.72	0.71	1.25	145.87	37.1%	5.46	57.3%	10.35	34.3%
none	Clear (2)	0.60	0.63	0.60	204.88	0.0%	11.39	0.0%	15.42	0.0%
fins	Clear (2)	0.60	0.63	0.60	185.47	9.5%	9.52	16.4%	13.93	9.7%
ov1	Clear (2)	0.60	0.63	0.60	165.40	19.3%	7.40	35.0%	14.12	8.4%
ov2	Clear (2)	0.60	0.63	0.60	152.47	25.6%	6.36	44.1%	13.74	10.9%
ov2f	Clear (2)	0.60	0.63	0.60	133.52	34.8%	5.51	51.6%	10.01	35.1%
none	B Tint (2)	0.42	0.38	0.60	171.52	0.0%	8.40	0.0%	13.99	0.0%
fins	B Tint (2)	0.42	0.38	0.60	158.20	7.8%	7.07	15.8%	12.44	11.1%
ov1	B Tint (2)	0.42	0.38	0.60	145.24	15.3%	5.89	29.9%	12.68	9.3%
ov2	B Tint (2)	0.42	0.38	0.60	137.01	20.1%	5.53	34.2%	12.27	12.3%
ov2f	B Tint (2)	0.42	0.38	0.60	124.05	27.7%	4.96	41.0%	8.40	40.0%
none	Low-E B Tint (2)	0.39	0.36	0.49	161.77	0.0%	7.80	0.0%	13.77	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	149.74	7.4%	6.66	14.7%	12.20	11.4%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	138.80	14.2%	5.83	25.3%	12.45	9.5%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	131.61	18.6%	5.48	29.7%	12.03	12.6%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	120.38	25.6%	4.90	37.2%	8.10	41.2%
none	Low-E Clear (2)	0.34	0.57	0.46	151.12	0.0%	6.98	0.0%	15.13	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	140.08	7.3%	6.13	12.1%	13.62	9.9%
ov1	Low-E Clear (2)	0.34	0.57	0.46	131.32	13.1%	5.61	19.6%	13.84	8.5%
ov2	Low-E Clear (2)	0.34	0.57	0.46	125.16	17.2%	5.33	23.6%	13.45	11.0%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	115.54	23.5%	4.62	33.7%	9.73	35.7%
none	Low-E G Tint (2)	0.27	0.43	0.46	141.50	0.0%	6.07	0.0%	14.31	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	132.69	6.1%	5.65	7.0%	12.77	10.7%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	125.33	11.4%	5.23	13.9%	13.02	9.0%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	120.54	14.8%	4.89	19.5%	12.62	11.8%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	115.19	18.6%	4.69	22.8%	8.84	38.2%
none	Low-E Clear (3)	0.22	0.37	0.20	129.23	0.0%	5.80	0.0%	13.80	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	122.29	5.4%	5.47	5.7%	12.22	11.4%
ov1	Low-E Clear (3)	0.22	0.37	0.20	117.70	8.9%	5.09	12.3%	12.48	9.5%
ov2	Low-E Clear (3)	0.22	0.37	0.20	114.62	11.3%	4.71	18.6%	12.06	12.6%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	111.12	14.0%	4.70	19.0%	8.16	40.8%

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-ºF, Tvis=visible transmittance

ANNUAL ENERGY USE—HOUSTON, TX
South Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—HOUSTON, TX
South Orientation—Large Window Area (WWR=0.60)



Houston, Texas
West Orientation—Moderate Window Area

The table and graphs on this page show the impact of external shading devices on an west-facing facade with moderate window area in a commercial office building in Houston, Texas.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

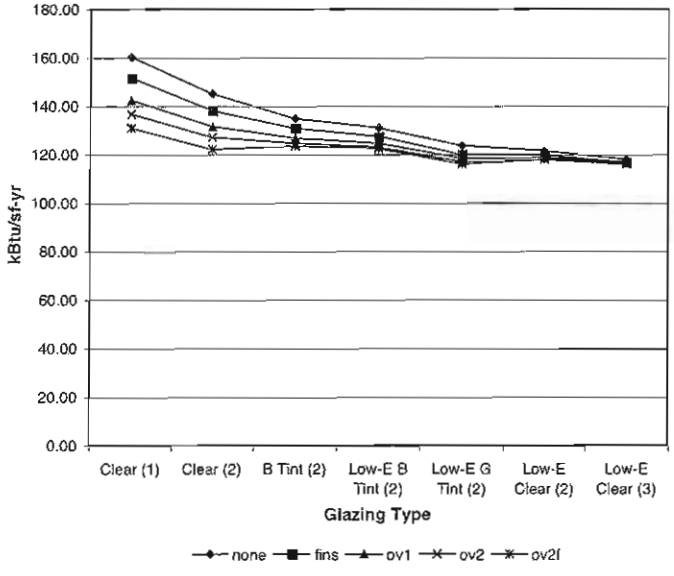
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

Note: All cases are east-facing with a 0.30 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-ºF, Tvis=visible transmittance

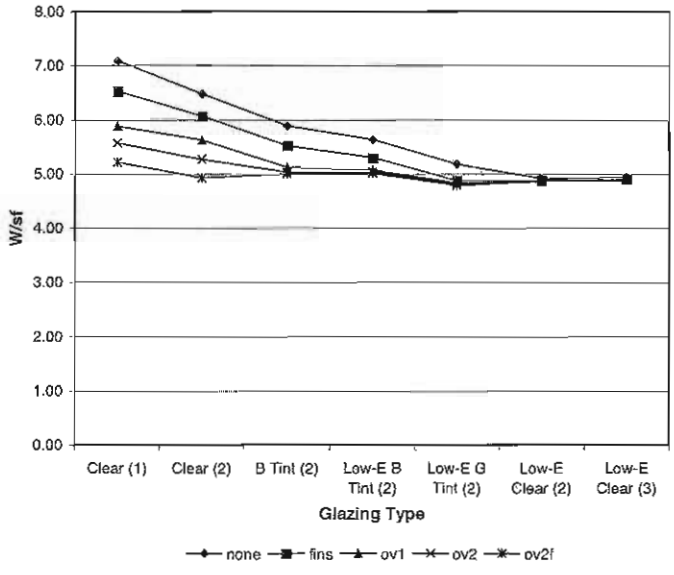
IMPACT OF EXTERIOR SHADING—HOUSTON, TX
West Orientation—Moderate Window Area (WWR=0.30)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	159.98	0.0%	7.08	0.0%	13.88	0.0%
fins	Clear (1)	0.72	0.71	1.25	151.45	5.3%	6.52	7.9%	13.81	0.5%
ov1	Clear (1)	0.72	0.71	1.25	142.16	11.1%	5.87	17.1%	13.80	0.5%
ov2	Clear (1)	0.72	0.71	1.25	136.39	14.7%	5.56	21.5%	8.42	39.3%
ov2f	Clear (1)	0.72	0.71	1.25	130.60	18.4%	5.20	26.5%	8.07	41.8%
none	Clear (2)	0.60	0.63	0.60	144.80	0.0%	6.47	0.0%	13.56	0.0%
fins	Clear (2)	0.60	0.63	0.60	137.94	4.7%	6.06	6.4%	13.50	0.5%
ov1	Clear (2)	0.60	0.63	0.60	131.42	9.2%	5.62	13.2%	13.49	0.5%
ov2	Clear (2)	0.60	0.63	0.60	126.96	12.3%	5.26	18.8%	8.09	40.3%
ov2f	Clear (2)	0.60	0.63	0.60	121.91	15.8%	4.91	24.1%	7.74	42.9%
none	B Tint (2)	0.42	0.38	0.60	134.65	0.0%	5.88	0.0%	12.26	0.0%
fins	B Tint (2)	0.42	0.38	0.60	130.58	3.0%	5.51	6.3%	12.20	0.5%
ov1	B Tint (2)	0.42	0.38	0.60	126.52	6.0%	5.12	13.0%	12.20	0.5%
ov2	B Tint (2)	0.42	0.38	0.60	124.31	7.7%	5.02	14.6%	7.00	42.9%
ov2f	B Tint (2)	0.42	0.38	0.60	123.37	8.4%	4.99	15.1%	7.00	42.9%
none	Low-E B Tint (2)	0.39	0.36	0.49	130.76	0.0%	5.62	0.0%	12.08	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	127.13	2.8%	5.29	5.9%	12.02	0.5%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	124.37	4.9%	5.06	9.9%	12.01	0.5%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	122.79	6.1%	5.03	10.6%	7.00	42.0%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	122.16	6.6%	5.00	11.1%	7.00	42.0%
none	Low-E Clear (2)	0.34	0.57	0.46	123.42	0.0%	5.17	0.0%	13.30	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	119.78	2.9%	4.87	5.8%	13.24	0.4%
ov1	Low-E Clear (2)	0.34	0.57	0.46	118.16	4.3%	4.81	6.9%	13.24	0.4%
ov2	Low-E Clear (2)	0.34	0.57	0.46	116.67	5.5%	4.79	7.4%	7.82	41.2%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	115.84	6.1%	4.77	7.7%	7.48	43.8%
none	Low-E G Tint (2)	0.27	0.43	0.46	121.33	0.0%	4.90	0.0%	12.56	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	119.52	1.5%	4.87	0.7%	12.49	0.5%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	118.57	2.3%	4.86	0.7%	12.49	0.6%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	117.63	3.0%	4.85	1.1%	7.00	44.3%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	117.79	2.9%	4.85	1.0%	7.00	44.3%
none	Low-E Clear (3)	0.22	0.37	0.20	117.64	0.0%	4.93	0.0%	12.16	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	116.60	0.9%	4.89	0.8%	12.10	0.5%
ov1	Low-E Clear (3)	0.22	0.37	0.20	116.26	1.2%	4.89	0.8%	12.10	0.5%
ov2	Low-E Clear (3)	0.22	0.37	0.20	115.74	1.6%	4.87	1.2%	7.00	42.4%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	116.38	1.1%	4.87	1.2%	7.00	42.4%

ANNUAL ENERGY USE—HOUSTON, TX
West Orientation—Moderate Window Area (WWR=0.30)



PEAK ELECTRICITY DEMAND—HOUSTON, TX
West Orientation—Moderate Window Area (WWR=0.30)



Houston, Texas
West Orientation—Large Window Area

The table and graphs on this page show the impact of external shading devices on an west-facing facade with a large window area in a commercial office building in Houston, Texas.

The impact is different depending on the type of glazing and shading device used. Seven typical commercial glazings with different solar heat gain coefficients are analyzed.

The five shading conditions analyzed include no shading (none), vertical fins (fins), shallow overhang (ov1), deep overhang (ov2), and deep overhang with fins, (ov2f).

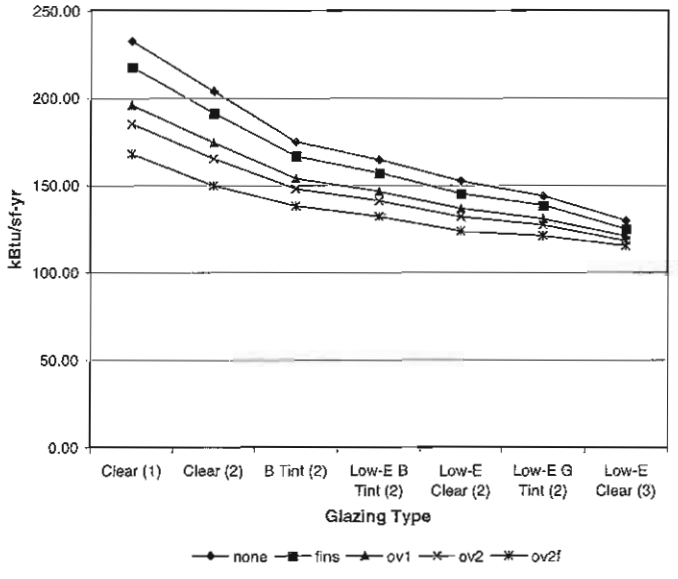
For each combination of glazing and shading condition, the table shows the annual energy use, peak demand and glare index as well as the percent savings compared to the unshaded condition.

IMPACT OF EXTERIOR SHADING—HOUSTON, TX
West Orientation—Large Window Area (WWR=0.60)

Shading	Glass	SHGC	Tvis	U-value	Energy	Energy % Save	Peak	Peak % Save	Glare	Glare % Red.
none	Clear (1)	0.72	0.71	1.25	232.21	0.0%	11.85	0.0%	16.47	0.0%
fins	Clear (1)	0.72	0.71	1.25	217.34	6.4%	11.00	7.1%	15.73	4.5%
ov1	Clear (1)	0.72	0.71	1.25	195.52	15.8%	9.28	21.7%	15.69	4.7%
ov2	Clear (1)	0.72	0.71	1.25	184.67	20.5%	8.09	31.7%	14.86	9.8%
ov2f	Clear (1)	0.72	0.71	1.25	167.52	27.9%	7.03	40.7%	13.40	18.7%
none	Clear (2)	0.60	0.63	0.60	203.27	0.0%	10.34	0.0%	16.26	0.0%
fins	Clear (2)	0.60	0.63	0.60	190.89	6.1%	9.54	7.8%	15.61	4.0%
ov1	Clear (2)	0.60	0.63	0.60	173.82	14.5%	8.12	21.5%	15.64	3.8%
ov2	Clear (2)	0.60	0.63	0.60	164.67	19.0%	7.07	31.6%	14.65	9.9%
ov2f	Clear (2)	0.60	0.63	0.60	149.36	26.5%	6.10	41.0%	13.44	17.4%
none	B Tint (2)	0.42	0.38	0.60	174.56	0.0%	8.31	0.0%	15.40	0.0%
fins	B Tint (2)	0.42	0.38	0.60	166.39	4.7%	7.75	6.7%	14.86	3.5%
ov1	B Tint (2)	0.42	0.38	0.60	153.62	12.0%	6.45	22.4%	14.90	3.3%
ov2	B Tint (2)	0.42	0.38	0.60	147.63	15.4%	5.80	30.2%	13.81	10.3%
ov2f	B Tint (2)	0.42	0.38	0.60	137.84	21.0%	5.33	35.9%	13.03	15.4%
none	Low-E B Tint (2)	0.39	0.36	0.49	164.07	0.0%	7.67	0.0%	15.25	0.0%
fins	Low-E B Tint (2)	0.39	0.36	0.49	156.63	4.5%	7.14	7.0%	14.79	3.1%
ov1	Low-E B Tint (2)	0.39	0.36	0.49	145.89	11.1%	6.00	21.8%	14.82	2.8%
ov2	Low-E B Tint (2)	0.39	0.36	0.49	140.60	14.3%	5.73	25.4%	13.68	10.3%
ov2f	Low-E B Tint (2)	0.39	0.36	0.49	131.69	19.7%	5.30	30.9%	12.83	15.9%
none	Low-E Clear (2)	0.34	0.57	0.46	152.01	0.0%	6.85	0.0%	16.10	0.0%
fins	Low-E Clear (2)	0.34	0.57	0.46	144.87	4.7%	6.39	6.7%	15.49	3.8%
ov1	Low-E Clear (2)	0.34	0.57	0.46	136.38	10.3%	5.77	15.8%	15.53	3.6%
ov2	Low-E Clear (2)	0.34	0.57	0.46	131.74	13.3%	5.52	19.4%	14.41	10.5%
ov2f	Low-E Clear (2)	0.34	0.57	0.46	123.42	18.8%	5.01	26.9%	13.28	17.5%
none	Low-E G Tint (2)	0.27	0.43	0.46	143.42	0.0%	6.31	0.0%	15.62	0.0%
fins	Low-E G Tint (2)	0.27	0.43	0.46	137.96	3.8%	5.91	6.3%	15.06	3.6%
ov1	Low-E G Tint (2)	0.27	0.43	0.46	130.49	9.0%	5.52	12.5%	15.10	3.4%
ov2	Low-E G Tint (2)	0.27	0.43	0.46	126.86	11.5%	5.21	17.4%	13.99	10.4%
ov2f	Low-E G Tint (2)	0.27	0.43	0.46	120.63	15.9%	4.80	23.8%	13.11	16.1%
none	Low-E Clear (3)	0.22	0.37	0.20	129.35	0.0%	5.87	0.0%	15.27	0.0%
fins	Low-E Clear (3)	0.22	0.37	0.20	124.65	3.6%	5.52	6.0%	14.72	3.6%
ov1	Low-E Clear (3)	0.22	0.37	0.20	120.71	6.7%	4.99	14.9%	14.80	3.1%
ov2	Low-E Clear (3)	0.22	0.37	0.20	117.99	8.8%	4.86	17.3%	13.65	10.6%
ov2f	Low-E Clear (3)	0.22	0.37	0.20	114.87	11.2%	4.77	18.7%	12.90	15.5%

Note: All cases are east-facing with a 0.60 window-to-wall ratio and include daylighting controls. Annual energy use is expressed in kBtu per square foot of floor area within a 15-foot-deep perimeter zone. Peak demand is expressed in Watts per square foot of floor area within a 15-foot-deep perimeter zone. Glare index is calculated at a point 5 feet from the window for a person facing the side wall. A lower index is better. All results were computed using DOE-2.1E for a typical office building. See Appendix A for assumptions and dimensions of external shading devices.
SHGC=solar heat gain coefficient, U-value=heat transmission in Btu/hr-sf-°F, Tvis=visible transmittance

ANNUAL ENERGY USE—HOUSTON, TX
West Orientation—Large Window Area (WWR=0.60)



PEAK ELECTRICITY DEMAND—HOUSTON, TX
West Orientation—Large Window Area (WWR=0.60)