Awnings in Residential Buildings
The Impact on Energy Use and Peak Demand

Version 2.0

John Carmody and Kerry Haglund
Center for Sustainable Building Research, University of Minnesota
Yu Joe Huang
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Acknowledgments

This report was developed with support from the Professional Awning Manufacturers Association (PAMA). In particular, we appreciate the input from Michelle Sahlin, Managing Director of PAMA, who initiated and shaped the project.

The Windows and Glazings Program at Lawrence Berkeley National Laboratory (LBNL) was a significant partner in conducting the study. Joe Huang devoted considerable effort to the computer simulations using the RESFEN calculation tool. We also appreciated the input and guidance of Steve Selkowtiz and Robin Mitchell.

At the Center for Sustainable Building Research (CSBR), graduate student Dan Handeen assisted with computer simulations and analysis.

Introduction

The Benefits of Awnings

Awnings have advantages that contribute to more sustainable buildings. First, awnings result in cooling energy savings by reducing direct solar gain through windows. This directly reduces the impact of global warming from greenhouse gas emissions. A second benefit is that peak electricity demand is also reduced by awnings potentially resulting in reduced mechanical equipment costs. Reduced peak demand may also result in energy cost savings in the future if residential customers are charged higher rates during peak periods. Another outcome of peak demand reduction is the overall savings to utility companies and the public from a decreased need to build new generating capacity.

Photo courtesy PAMA.

Cooling Energy Savings and Peak Demand Reduction

Tables 1 and 2 show the impact of awnings on reducing cooling energy and peak demand in twelve U.S. cities with different climates. The cities are listed starting with the lowest cooling energy use (Seattle) up to the highest (Phoenix). For each city, results are shown for two typical houses. The first house has windows equally distributed on all four orientations while the second house has 80 percent of the windows facing west (the case with the highest cooling energy use from heat gain). The results in Tables 1 and 2 represent the best case for savings when awnings are applied to clear double-glazed windows and operated seasonally (details appear in later sections of the report).

Table 1 shows cooling energy savings in all cities for all orientations, while Table 2 shows peak demand savings in most cities. In all cases, the cooling energy and peak demand savings from awnings are greater in the house with predominately west-facing windows. The highest percentage savings do not necessarily produce the highest actual savings. This occurs because some of the warmer cities with lower percentage savings have greater actual cooling energy and peak demand savings than colder climate cities with higher percentage savings and lower actual savings. Surprisingly, there can be little or no peak demand savings from awnings in some hot, humid cities. This is due to climatic variations that influence whether peak demand is driven more by solar gain through windows or by factors such as temperature and humidity. It is important to remember that these results are for a 2000 sq ft house and should be interpolated for larger houses. In addition, the energy prices may rise in the future increasing the savings and shortening the payback for investing in awnings.

Tables 3 and 4 show more extensive set of impacts from awnings for two cities: a predominantly cold climate (Boston) and a predominantly hot climate (Phoenix). Window types shown are clear double glazing, high-solar-gain low-E glazing, and low-solar-gain low-E glazing. Shading conditions include: no shading, awnings deployed 12 months a year, and awnings deployed in the summer only.

Cold Climate Impacts

Table 3 shows the impact of awnings on a typical house in Boston, Massachusetts, a predominantly cold climate. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four sides, Table 2 shows the annual heating and cooling energy use and the peak electricity demand for each combination of glazing and shading condition. Table 2 also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

As shown in Table 3, the awnings reduce the cooling energy 23–24 percent compared to a completely unshaded case. The actual savings are greater with the clear glass (A) and less with the low-solar-gain low-E glass (C). Because awnings block passive solar gain in winter, heating energy increases by 6–9 percent if the awnings remain in place 12 months a year. By removing or retracting the awnings in winter while keeping them in place in the

TABLE 1: SUMMARY OF AWNING IMPACTS ON COOLING ENERGY IN TWELVE U.S. CITIES

CITY	EQUAL WINDOW ORIENTATION				MOSTLY WEST WINDOW ORIENTATION			
	Cooling Energy No Awnings (kWh)	Cooling Energy With Awnings (kWh)	Cooling Energy Savings With Awnings (kWh)	Cooling Energy With Awnings % Savings	Cooling Energy No Awnings (kWh)	Cooling Energy With Awnings (kWh)	Cooling Energy Savings With Awnings (kWh)	Cooling Energy With Awnings % Savings
Seattle	252	98	154	61%	358	110	248	69%
Boston	855	651	204	24%	965	677	288	30%
Minneapolis	1097	817	280	26%	1172	850	321	27%
Washington	1736	1534	202	12%	1822	1567	255	14%
Sacramento	1787	1083	704	39%	2196	1148	1048	48%
Albuquerque	1881	1297	584	31%	2168	1333	836	39%
St.Louis	2366	1970	396	17%	2614	2022	592	23%
Atlanta	2422	2126	296	12%	2618	2154	464	18%
Jacksonville	4270	3835	435	10%	4477	3875	602	13%
Houston	4459	4096	363	8%	4774	4022	752	16%
Miami	7151	6609	542	8%	7392	6644	748	10%
Phoenix	7438	5905	1533	21%	8122	6046	2076	26%

TABLE 2: SUMMARY OF AWNING IMPACTS ON PEAK DEMAND IN TWELVE U.S. CITIES

CITY	EQUAL WINDOW ORIENTATION				MOSTLY WEST WINDOW ORIENTATION			
	Peak Demand No Awnings (kW)	Peak Demand With Awnings (kW)	Peak Demand Savings With Awnings (kW)	Peak Demand With Awnings % Savings	Peak Demand No Awnings (kW)	Peak Demand With Awnings (kW)	Peak Demand Savings With Awnings (kW)	Peak Demand With Awnings % Savings
Seattle	2.94	1.79	1.16	39%	4.00	2.06	1.95	49%
Boston	2.66	2.08	0.57	21%	3.74	2.23	1.51	40%
Minneapolis	2.86	2.59	0.28	10%	3.88	2.63	1.25	32%
Washington	3.60	3.50	0.11	3%	4.68	3.52	1.16	25%
Sacramento	3.51	2.75	0.75	21%	4.62	2.83	1.79	39%
Albuquerque	2.66	2.22	0.45	17%	3.93	2.25	1.68	43%
St.Louis	3.87	3.26	0.61	16%	4.95	3.33	1.62	33%
Atlanta	3.12	3.00	0.16	5%	3.80	3.00	0.83	22%
Jacksonville	3.41	3.46	-0.05	-1%	4.48	3.47	1.00	23%
Houston	3.43	3.25	0.18	5%	4.25	3.11	1.14	27%
Miami	3.39	3.38	0.00	0%	4.00	3.39	0.62	15%
Phoenix	5.55	4.85	0.70	13%	7.00	4.88	2.15	31%

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. In the first case, the windows are equally distributed on all four sides of the house. Where windows are predominately on the west side, the distribution is 240 sq ft on that side and 20 sq ft on the others. Clear double glazed windows are used in all cases. For all cities, the awning deployment shown is either a 12-month or summer only condition, whichever produces the best result. RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen)

summer, the lowest total energy use is achieved.

The total cost of heating and cooling is about equal in Boston when awnings are only used in the summer, but the total cost is increased if they remain in place 12 months a year.

Table 3 also shows that awnings reduce peak electricity demand by 17–22 percent in Boston. This may contribute to the ability to downsize the mechanical cooling system. The actual reduction is greater with the clear glass (A).

Hot Climate Impacts

Table 4 shows the impact of awnings on a typical house in Phoenix, Arizona with different orientation conditions. The same window orientation, window types, and shading conditions used for Boston are applied in Phoenix.

In Phoenix, the awnings reduce the cooling energy 14–20 percent compared to a completely unshaded case. As in Boston, because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Of course, the relative importance of the heating versus the cooling season impacts varies by climate. In predominantly warm climates like Phoenix, the impact of awnings on reducing passive solar gain is less of a concern.

The total cost of heating and cooling is reduced 13–18 percent in Phoenix when awnings are only used in the summer. Table 4 also shows that awnings reduce peak electricity demand by 9–12 percent in Phoenix, potentially contributing to the ability to downsize the mechanical cooling system. The actual savings are greater with the clear glass (A) and less with the low-solar-gain low-E glass (C).

In comparing Tables 3 and 4, it is clear that the impacts of awnings are different depending on the building location and whether the awnings are deployed year-round or only in the summer. A very important consideration in assessing the benefits of awnings is window orientation. A house in any climate with the windows predominantly facing to the east, south, and west will have greater cooling energy use and cooling peak demand than the equal orientation case. This is particularly true with peak demand in the west orientation. Generally, this means energy and cost savings from using awnings is greater with predominantly east, south, and west orientations than when windows are equally distributed. Specific energy and cost savings multiple orientation conditions can be found in the rest of the report.

TABLE 3: IMPACT OF AWNINGS ON A HOUSE—BOSTON, MASSACHUSETTS

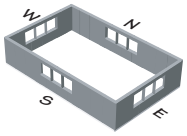
WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	ANNUAL ENERGY Energy Saved	ANNUAL ENERGY Energy % Saved	HEATING Energy (MBTU)	HEATING Energy Saved	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost Saved	HEAT+COOL Cost % Saved	COOLING PEAK Peak (kW)	COOLING PEAK Peak Saved	COOLING PEAK Peak % Saved
A	none	855	–	–	68.1	–	–	$1,254	–	–	2.66	–	–
A	12 month	651	204	23.8%	74.4	-6.2	-9.1%	$1,319	-$65	-5.2%	2.08	0.57	21.5%
A	summer	651	204	23.8%	70.3	-2.1	-3.1%	$1,253	$1	0.1%	2.08	0.57	21.5%
B	none	822	–	–	63.3	–	–	$1,170	–	–	2.54	–	–
B	12 month	631	191	23.2%	69.0	-5.7	-9.0%	$1,228	-$58	-5.0%	1.99	0.55	21.6%
B	summer	631	191	23.2%	65.1	-1.8	-2.9%	$1,166	$4	0.4%	1.99	0.55	21.6%
C	none	449	–	–	70.4	–	–	$1,220	–	–	1.90	–	–
C	12 month	343	107	23.7%	74.3	-3.9	-5.5%	$1,264	-$44	-3.6%	1.57	0.33	17.3%
C	summer	343	107	23.7%	72.1	-1.7	-2.4%	$1,228	-$8	-0.7%	1.57	0.33	17.3%

TABLE 4: IMPACT OF AWNINGS—PHOENIX, ARIZONA

WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	ANNUAL ENERGY Energy Saved	ANNUAL ENERGY Energy % Saved	HEATING Energy (MBTU)	HEATING Energy Saved	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost Saved	HEAT+COOL Cost % Saved	COOLING PEAK Peak (kW)	COOLING PEAK Peak Saved	COOLING PEAK Peak % Saved
A	none	7438	–	–	5.4	–	–	$992	–	–	5.55	–	–
A	12 month	5905	1533	20.6%	7.6	-2.1	-39.0%	$829	$163	16.4%	4.85	0.70	12.6%
A	summer	6011	1428	19.2%	5.5	-0.1	-1.1%	$816	$176	17.8%	4.85	0.70	12.6%
B	none	7171	–	–	4.8	–	–	$950	–	–	5.33	–	–
B	12 month	5739	1432	20.0%	6.6	-1.9	-38.9%	$796	$154	16.2%	4.67	0.66	12.4%
B	summer	5838	1333	18.6%	4.8	0.0	-0.2%	$785	$165	17.4%	4.67	0.66	12.4%
C	none	5708	–	–	6.3	–	–	$789	–	–	4.60	–	–
C	12 month	4837	870	15.2%	8.1	-1.8	-28.0%	$704	$85	10.8%	4.18	0.41	9.0%
C	summer	4884	824	14.4%	6.5	-0.1	-2.1%	$689	$101	12.7%	4.18	0.41	9.0%

	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.



The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.18 per kWh in Boston and $0.12 per kWh per in Phoenix. Natural gas costs used in the analysis are $16.20 per MBTU in Boston and $12.84 per MBTU in Phoenix. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

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Efficient Windows Collaborative Web Site: www.efficientwindows.org

Seattle, Washington

HDD65: 4867 / CDD65: 127

Tables 5–8 show the impact of awnings on a typical house in Seattle, Washington with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 5 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the actual and percent savings compared to the unshaded condition.

As shown in Table 5, the awnings reduce the cooling energy 61–70 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

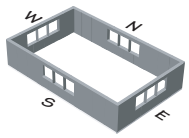
The total cost of heating and cooling is reduced 1–4 percent in Seattle when awnings are only used in the summer, but the savings from awnings are diminished if they remain in place 12 months a year.

Table 5 also shows that awnings reduce peak electricity demand by 35–39 percent in Seattle. This may contribute to the ability to downsize the mechanical cooling system. The actual savings are greatest with clear double glazing (A) and least with low-solar-gain low-E windows (C).

Tables 6, 7 and 8 show results for houses in Seattle with the windows predominantly facing to the east, south, and west, respectively. The cooling energy savings and peak demand reduction from awnings is greatest on the south- and west-facing orientations.

TABLE 5: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Seattle, Washington

Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	252	–	–	49.5	–	–	$636	–	–	2.94	–	–
A	12 month	98	154	61.1%	51.5	-2.0	-4.0%	$633	$3	0.5%	1.79	1.16	39.3%
A	summer	98	154	61.1%	50.0	-0.4	-0.9%	$615	$22	3.4%	1.79	1.16	39.3%
B	none	240	–	–	45.6	–	–	$587	–	–	2.79	–	–
B	12 month	96	144	60.0%	47.2	-1.6	-3.6%	$581	$6	0.9%	1.71	1.09	38.8%
B	summer	96	144	60.0%	45.8	-0.2	-0.4%	$564	$23	3.9%	1.71	1.09	38.8%
C	none	107	–	–	50.5	–	–	$623	–	–	1.97	–	–
C	12 month	32	74	69.7%	52.2	-1.7	-3.3%	$630	-$7	-1.1%	1.28	0.69	35.2%
C	summer	32	74	69.7%	51.3	-0.8	-1.6%	$620	$3	0.5%	1.28	0.69	35.2%

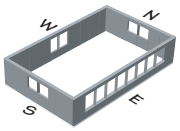
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.17 per kWh in Seattle. Natural gas costs used in the analysis are $11.96 per MBTU in Seattle. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 6: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: Seattle, Washington

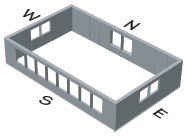
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	214	–	–	49.9	–	–	$635	–	–	2.23	–	–
A	12 month	103	112	52.1%	51.3	-1.3	-2.7%	$631	$4	0.6%	1.71	0.52	23.3%
A	summer	103	112	52.1%	50.1	-0.2	-0.4%	$617	$17	2.7%	1.71	0.52	23.3%
B	none	204	–	–	46.0	–	–	$586	–	–	2.13	–	–
B	12 month	100	104	51.0%	47.0	-1.0	-2.3%	$580	$6	1.0%	1.64	0.49	23.1%
B	summer	100	104	51.0%	46.0	0.0	0.1%	$567	$19	3.2%	1.64	0.49	23.1%
C	none	108	–	–	50.8	–	–	$626	–	–	1.63	–	–
C	12 month	34	74	68.6%	52.0	-1.3	-2.5%	$628	-$2	-0.4%	1.26	0.37	22.6%
C	summer	34	74	68.6%	51.4	-0.6	-1.3%	$621	$5	0.8%	1.26	0.37	22.6%

TABLE 7: IMPACT OF AWNINGS ON A HOUSE WITH SOUTH ORIENTED WINDOWS
Location: Seattle, Washington

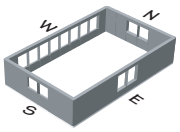
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	336	–	–	46.4	–	–	$613	–	–	3.79	–	–
A	12 month	94	242	72.0%	50.6	-4.2	-8.9%	$621	-$7	-1.2%	1.83	1.96	51.6%
A	summer	89	247	73.4%	47.5	-1.1	-2.4%	$584	$29	4.8%	1.78	2.02	53.2%
B	none	320	–	–	42.6	–	–	$565	–	–	3.58	–	–
B	12 month	92	228	71.3%	46.3	-3.7	-8.7%	$570	-$5	-0.8%	1.75	1.84	51.2%
B	summer	87	233	72.8%	43.5	-0.9	-2.0%	$535	$30	5.3%	1.69	1.89	52.8%
C	none	135	–	–	48.6	–	–	$604	–	–	2.32	–	–
C	12 month	30	105	78.1%	51.8	-3.2	-6.7%	$625	-$20	-3.4%	1.30	1.02	44.0%
C	summer	28	107	79.5%	50.2	-1.6	-3.3%	$605	$0	-0.1%	1.27	1.05	45.4%

TABLE 8: IMPACT OF AWNINGS ON A HOUSE WITH WEST ORIENTED WINDOWS
Location: Seattle, Washington

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	358	–	–	51.3	–	–	$675	–	–	4.00	–	–
A	12 month	110	248	69.4%	51.7	-0.5	-0.9%	$637	$38	5.6%	2.06	1.95	48.7%
A	summer	110	248	69.4%	50.7	0.6	1.1%	$625	$50	7.4%	2.06	1.95	48.7%
B	none	338	–	–	47.2	–	–	$623	–	–	3.80	–	–
B	12 month	103	235	69.5%	47.4	-0.2	-0.4%	$585	$39	6.2%	1.96	1.84	48.4%
B	summer	103	235	69.5%	46.4	0.8	1.7%	$573	$50	8.1%	1.96	1.84	48.4%
C	none	133	–	–	51.6	–	–	$640	–	–	2.46	–	–
C	12 month	37	96	72.0%	52.2	-0.7	-1.3%	$631	$9	1.3%	1.41	1.05	42.8%
C	summer	37	96	72.0%	51.7	-0.1	-0.2%	$624	$15	2.4%	1.41	1.05	42.8%

Boston, Massachusetts

HDD65: 5840 / CDD65: 646

Tables 9–12 show the impact of awnings on a typical house in Boston, Massachusetts with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 9 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the annual percent savings compared to the unshaded condition.

As shown in Table 9, the awnings reduce the cooling energy 23–24 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

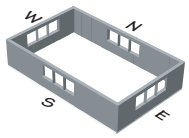
Compared to no awnings, the total cost of heating and cooling does not change significantly when awnings are only used in the summer, but the total cost is increased if they remain in place 12 months a year.

Table 9 also shows that awnings reduce peak electricity demand by 17–22 percent in Boston. This may contribute to the ability to downsize the mechanical cooling system. The actual savings are greatest with clear double glazing (A) and least with low-solar-gain low-E windows (C).

Tables 10, 11 and 12 show results for houses in Boston with the windows predominantly facing to the east, south, and west, respectively. The cooling energy savings from awnings is greatest on the east- and west-facing orientations. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 9: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Boston, Massachusetts

Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	855	–	–	68.1	–	–	$1,254	–	–	2.66	–	–
A	12 month	651	204	23.8%	74.4	-6.2	-9.1%	$1,319	-$65	-5.2%	2.08	0.57	21.5%
A	summer	651	204	23.8%	70.3	-2.1	-3.1%	$1,253	$1	0.1%	2.08	0.57	21.5%
B	none	822	–	–	63.3	–	–	$1,170	–	–	2.54	–	–
B	12 month	631	191	23.2%	69.0	-5.7	-9.0%	$1,228	-$58	-5.0%	1.99	0.55	21.6%
B	summer	631	191	23.2%	65.1	-1.8	-2.9%	$1,166	$4	0.4%	1.99	0.55	21.6%
C	none	449	–	–	70.4	–	–	$1,220	–	–	1.90	–	–
C	12 month	343	107	23.7%	74.3	-3.9	-5.5%	$1,264	-$44	-3.6%	1.57	0.33	17.3%
C	summer	343	107	23.7%	72.1	-1.7	-2.4%	$1,228	-$8	-0.7%	1.57	0.33	17.3%

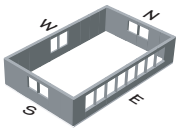
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.18 per kWh in Boston. Natural gas costs used in the analysis are $16.20 per MBTU in Boston. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 10: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: Boston, Massachusetts

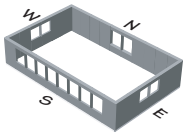
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	981	–	–	68.8	–	–	$1,286	–	–	3.29	–	–
A	12 month	670	311	31.7%	74.1	-5.4	-7.8%	$1,319	-$32	-2.5%	2.07	1.23	37.3%
A	summer	670	311	31.7%	71.0	-2.3	-3.3%	$1,268	$18	1.4%	2.07	1.23	37.3%
B	none	941	–	–	64.0	–	–	$1,203	–	–	3.14	–	–
B	12 month	652	290	30.8%	68.8	-4.8	-7.5%	$1,229	-$27	-2.2%	1.97	1.17	37.2%
B	summer	652	290	30.8%	65.9	-1.9	-2.9%	$1,182	$20	1.7%	1.97	1.17	37.2%
C	none	505	–	–	70.8	–	–	$1,236	–	–	2.13	–	–
C	12 month	351	153	30.3%	74.2	-3.4	-4.8%	$1,264	-$28	-2.3%	1.54	0.59	27.6%
C	summer	351	153	30.3%	72.5	-1.7	-2.4%	$1,237	-$1	-0.1%	1.54	0.59	27.6%

TABLE 11: IMPACT OF AWNINGS ON A HOUSE WITH SOUTH ORIENTED WINDOWS
Location: Boston, Massachusetts

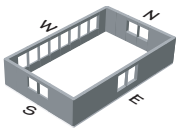
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	868	–	–	60.1	–	–	$1,127	–	–	3.15	–	–
A	12 month	631	237	27.3%	72.1	-11.9	-19.8%	$1,278	-$151	-13.4%	2.11	1.04	33.0%
A	summer	585	283	32.6%	63.5	-3.4	-5.6%	$1,132	-$5	-0.4%	2.00	1.15	36.6%
B	none	834	–	–	55.8	–	–	$1,050	–	–	3.00	–	–
B	12 month	617	216	26.0%	66.9	-11.1	-19.9%	$1,192	-$141	-13.5%	2.02	0.98	32.8%
B	summer	572	262	31.4%	58.8	-3.0	-5.4%	$1,053	-$3	-0.2%	1.91	1.09	36.3%
C	none	446	–	–	65.6	–	–	$1,141	–	–	2.01	–	–
C	12 month	337	109	24.4%	73.2	-7.7	-11.7%	$1,246	-$105	-9.2%	1.56	0.44	22.1%
C	summer	316	131	29.3%	68.3	-2.7	-4.2%	$1,162	-$21	-1.9%	1.48	0.53	26.2%

TABLE 12: IMPACT OF AWNINGS ON A HOUSE WITH WEST ORIENTED WINDOWS
Location: Boston, Massachusetts

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	965	–	–	70.3	–	–	$1,308	–	–	3.74	–	–
A	12 month	677	288	29.8%	74.7	-4.4	-6.2%	$1,329	-$21	-1.6%	2.23	1.51	40.5%
A	summer	677	288	29.8%	71.7	-1.4	-2.0%	$1,281	$27	2.1%	2.23	1.51	40.5%
B	none	919	–	–	65.3	–	–	$1,220	–	–	3.57	–	–
B	12 month	658	261	28.4%	69.2	-3.9	-6.0%	$1,237	-$17	-1.4%	2.14	1.43	40.1%
B	summer	658	261	28.4%	66.4	-1.1	-1.7%	$1,192	$28	2.3%	2.14	1.43	40.1%
C	none	512	–	–	71.6	–	–	$1,250	–	–	2.51	–	–
C	12 month	363	149	29.1%	74.4	-2.8	-3.9%	$1,269	-$19	-1.5%	1.67	0.83	33.2%
C	summer	363	149	29.1%	72.8	-1.2	-1.7%	$1,243	$7	0.5%	1.67	0.83	33.2%

Minneapolis, Minnesota

HDD65: 7985 / CDD65: 634

Tables 13–16 show the impact of awnings on a typical house in Minneapolis, Minnesota with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 13 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

As shown in Table 13, the awnings reduce the cooling energy 25–26 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

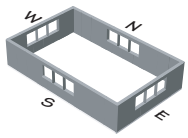
Compared to no awnings, the total cost of heating and cooling does not change significantly when awnings are only used in the summer, but the total cost is increased if they remain in place 12 months a year.

Table 13 also shows that awnings reduce peak electricity demand by 9–10 percent in Minneapolis. This may contribute to the ability to downsize the mechanical cooling system. The actual savings are greatest with clear double glazing (A) and least with low-solar-gain low-E windows (C).

Tables 14, 15 and 16 show results for houses in Minneapolis with the windows predominantly facing to the east, south, and west, respectively. Compared to the equal orientation case, the cooling energy savings from awnings are greater on the east-, south- and west-facing orientations. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 13: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Minneapolis, Minnesota

Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	1097	–	–	94.0	–	–	$1,169	–	–	2.86	–	–
A	12 month	817	280	25.5%	100.5	-6.6	-7.0%	$1,208	-$40	-3.4%	2.59	0.28	9.6%
A	summer	817	280	25.5%	96.3	-2.4	-2.5%	$1,162	$7	0.6%	2.59	0.28	9.6%
B	none	1063	–	–	87.6	–	–	$1,094	–	–	2.76	–	–
B	12 month	794	269	25.3%	93.6	-6.0	-6.9%	$1,129	-$35	-3.2%	2.49	0.27	9.8%
B	summer	794	269	25.3%	89.7	-2.1	-2.4%	$1,085	$9	0.8%	2.49	0.27	9.8%
C	none	599	–	–	94.5	–	–	$1,117	–	–	2.15	–	–
C	12 month	450	149	24.9%	98.8	-4.3	-4.5%	$1,146	-$30	-2.7%	1.95	0.19	8.9%
C	summer	450	149	24.9%	96.5	-2.0	-2.1%	$1,121	-$4	-0.4%	1.95	0.19	8.9%

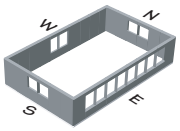
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.12 per kWh in Minneapolis. Natural gas costs used in the analysis are $11.07 per MBTU in Minneapolis. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 14: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY EAST ORIENTED WINDOWS
Location: Minneapolis, Minnesota

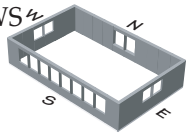
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	1217	–	–	94.7	–	–	$1,190	–	–	3.32	–	–
A	12 month	845	372	30.5%	100.4	-5.7	-6.0%	$1,210	-$20	-1.6%	2.56	0.76	22.9%
A	summer	845	372	30.5%	97.2	-2.6	-2.7%	$1,175	$15	1.3%	2.56	0.76	22.9%
B	none	1170	–	–	88.3	–	–	$1,115	–	–	3.16	–	–
B	12 month	824	347	29.6%	93.5	-5.1	-5.8%	$1,131	-$16	-1.5%	2.47	0.69	21.9%
B	summer	823	347	29.6%	90.5	-2.2	-2.5%	$1,099	$16	1.5%	2.47	0.69	21.9%
C	none	648	–	–	94.8	–	–	$1,125	–	–	1.94	–	–
C	12 month	459	188	29.1%	98.7	-3.9	-4.1%	$1,146	-$21	-1.9%	1.94	0.00	0.3%
C	summer	459	189	29.1%	97.0	-2.2	-2.4%	$1,128	-$3	-0.2%	1.94	0.00	0.3%

TABLE 15: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY SOUTH ORIENTED WINDOWS
Location: Minneapolis, Minnesota

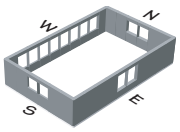
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	1123	–	–	85.0	–	–	$1,072	–	–	3.17	–	–
A	12 month	798	325	28.9%	98.0	-13.0	-15.3%	$1,178	-$106	-9.9%	2.60	0.58	18.1%
A	summer	739	384	34.2%	88.9	-4.0	-4.6%	$1,071	$1	0.1%	2.49	0.69	21.7%
B	none	1076	–	–	79.1	–	–	$1,002	–	–	3.04	–	–
B	12 month	775	300	27.9%	91.2	-12.1	-15.3%	$1,101	-$99	-9.9%	2.50	0.53	17.6%
B	summer	716	360	33.5%	82.7	-3.6	-4.5%	$999	$3	0.3%	2.39	0.64	21.2%
C	none	599	–	–	89.1	–	–	$1,057	–	–	2.07	–	–
C	12 month	440	160	26.6%	97.6	-8.5	-9.5%	$1,132	-$75	-7.1%	1.96	0.11	5.1%
C	summer	406	194	32.3%	92.5	-3.3	-3.7%	$1,071	-$14	-1.3%	1.87	0.20	9.6%

TABLE 16: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY WEST ORIENTED WINDOWS
Location: Minneapolis, Minnesota

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	1172	–	–	95.9	–	–	$1,199	–	–	3.88	–	–
A	12 month	850	321	27.4%	100.9	-5.0	-5.2%	$1,216	-$17	-1.4%	2.63	1.25	32.2%
A	summer	850	321	27.4%	97.8	-1.9	-2.0%	$1,182	$17	1.4%	2.63	1.25	32.2%
B	none	1125	–	–	89.5	–	–	$1,122	–	–	3.71	–	–
B	12 month	827	298	26.5%	93.9	-4.4	-5.0%	$1,136	-$14	-1.3%	2.53	1.18	31.7%
B	summer	827	298	26.5%	91.0	-1.5	-1.7%	$1,104	$18	1.6%	2.53	1.18	31.7%
C	none	629	–	–	95.4	–	–	$1,130	–	–	2.64	–	–
C	12 month	467	161	25.6%	98.9	-3.5	-3.6%	$1,149	-$19	-1.7%	1.98	0.67	25.2%
C	summer	467	161	25.6%	97.2	-1.8	-1.9%	$1,131	-$1	-0.1%	1.98	0.67	25.2%

Washington, DC

Tables 17–20 show the impact of awnings on a typical house in Washington, DC with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 17 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

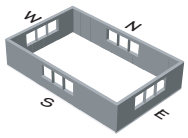
As shown in Table 17, the awnings reduce the cooling energy 10–12 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

Compared to no awnings, the total cost of heating and cooling does not change significantly when awnings are only used in the summer, but the total cost is increased if they remain in place 12 months a year.

Table 17 also shows that awnings reduce peak electricity demand by 3–6 percent in Washington. This may contribute to the ability to downsize the mechanical cooling system. The actual savings are greatest with clear double glazing (A) and least with low-solar-gain low-E windows (C).

Tables 18, 19 and 20 show results for houses in Washington with the windows predominantly facing to the east, south, and west, respectively. The cooling energy savings from awnings is greatest on the east- and west-facing orientations. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 17: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Washington, DC
Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	1736	–	–	50.3	–	–	$913	–	–	3.60	–	–
A	12 month	1534	202	11.6%	56.0	-5.6	-11.2%	$964	-$52	-5.6%	3.50	0.11	3.0%
A	summer	1534	202	11.6%	51.6	-1.3	-2.6%	$905	$8	0.8%	3.50	0.11	3.0%
B	none	1684	–	–	46.5	–	–	$853	–	–	3.46	–	–
B	12 month	1495	190	11.3%	51.6	-5.2	-11.1%	$900	-$47	-5.5%	3.35	0.12	3.4%
B	summer	1495	190	11.3%	47.6	-1.1	-2.3%	$844	$9	1.1%	3.35	0.12	3.4%
C	none	1048	–	–	52.7	–	–	$857	–	–	2.79	–	–
C	12 month	939	109	10.4%	56.3	-3.7	-6.9%	$893	-$36	-4.2%	2.62	0.17	6.2%
C	summer	939	109	10.4%	53.9	-1.3	-2.4%	$860	-$3	-0.4%	2.62	0.17	6.2%

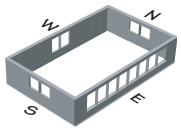
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.13 per kWh in Washington. Natural gas costs used in the analysis are $13.72 per MBTU in Minneapolis. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 18: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY EAST ORIENTED WINDOWS
Location: Washington, DC

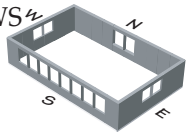
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	ANNUAL ENERGY Energy Saved	ANNUAL ENERGY Energy % Saved	HEATING Energy (MBTU)	HEATING Energy Saved	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost Saved	HEAT+COOL Cost % Saved	COOLING PEAK Peak (kW)	COOLING PEAK Peak Saved	COOLING PEAK Peak % Saved
A	none	1889	–	–	51.2	–	–	$944	–	–	3.69	–	–
A	12 month	1558	331	17.5%	55.8	-4.6	-9.0%	$965	-$21	-2.2%	3.48	0.20	5.5%
A	summer	1558	331	17.5%	52.4	-1.2	-2.4%	$918	$26	2.7%	3.48	0.20	5.5%
B	none	1824	–	–	47.4	–	–	$884	–	–	3.53	–	–
B	12 month	1517	307	16.8%	51.5	-4.1	-8.7%	$901	-$17	-2.0%	3.33	0.20	5.6%
B	summer	1517	307	16.8%	48.3	-0.9	-2.0%	$857	$26	3.0%	3.33	0.20	5.6%
C	none	1129	–	–	53.2	–	–	$874	–	–	2.56	–	–
C	12 month	947	182	16.1%	56.2	-3.0	-5.7%	$893	-$18	-2.1%	2.60	-0.04	-1.7%
C	summer	947	182	16.1%	54.4	-1.2	-2.2%	$867	$7	0.8%	2.60	-0.04	-1.7%

TABLE 19: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY SOUTH ORIENTED WINDOWS
Location: Washington, DC

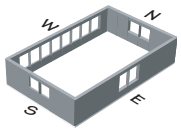
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	ANNUAL ENERGY Energy Saved	ANNUAL ENERGY Energy % Saved	HEATING Energy (MBTU)	HEATING Energy Saved	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost Saved	HEAT+COOL Cost % Saved	COOLING PEAK Peak (kW)	COOLING PEAK Peak Saved	COOLING PEAK Peak % Saved
A	none	1608	–	–	44.0	–	–	$810	–	–	3.27	–	–
A	12 month	1507	101	6.3%	54.1	-10.1	-22.9%	$935	-$125	-15.5%	3.49	-0.22	-6.7%
A	summer	1390	218	13.6%	46.0	-1.9	-4.4%	$808	$2	0.2%	3.25	0.02	0.7%
B	none	1554	–	–	40.5	–	–	$755	–	–	3.12	–	–
B	12 month	1469	86	5.5%	49.9	-9.4	-23.2%	$873	-$118	-15.6%	3.34	-0.22	-7.1%
B	summer	1355	200	12.8%	42.2	-1.7	-4.1%	$752	$3	0.4%	3.11	0.01	0.4%
C	none	967	–	–	48.4	–	–	$788	–	–	2.46	–	–
C	12 month	927	40	4.1%	55.5	-7.0	-14.5%	$880	-$91	-11.6%	2.61	-0.15	-6.3%
C	summer	860	107	11.1%	50.5	-2.1	-4.3%	$803	-$15	-1.9%	2.44	0.02	0.6%

TABLE 20: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY WEST ORIENTED WINDOWS
Location: Washington, DC

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	ANNUAL ENERGY Energy Saved	ANNUAL ENERGY Energy % Saved	HEATING Energy (MBTU)	HEATING Energy Saved	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost Saved	HEAT+COOL Cost % Saved	COOLING PEAK Peak (kW)	COOLING PEAK Peak Saved	COOLING PEAK Peak % Saved
A	none	1822	–	–	52.1	–	–	$948	–	–	4.68	–	–
A	12 month	1567	255	14.0%	56.1	-4.0	-7.7%	$970	-$22	-2.3%	3.52	1.16	24.8%
A	summer	1567	255	14.0%	52.8	-0.7	-1.4%	$926	$23	2.4%	3.52	1.16	24.8%
B	none	1759	–	–	48.2	–	–	$886	–	–	4.48	–	–
B	12 month	1527	232	13.2%	51.8	-3.6	-7.4%	$905	-$19	-2.2%	3.36	1.12	25.0%
B	summer	1527	232	13.2%	48.7	-0.5	-1.0%	$863	$23	2.6%	3.36	1.12	25.0%
C	none	1093	–	–	53.8	–	–	$878	–	–	3.36	–	–
C	12 month	960	134	12.2%	56.4	-2.6	-4.8%	$896	-$19	-2.1%	2.63	0.73	21.7%
C	summer	960	134	12.2%	54.5	-0.8	-1.4%	$871	$7	0.7%	2.63	0.73	21.7%

Sacramento, California

HDD65: 2793 / CDD65: 1144

Tables 25–28 show the impact of awnings on a typical house in Sacramento, California with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 25 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

As shown in Table 25, the awnings reduce the cooling energy 37–39 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

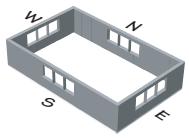
The total cost of heating and cooling is reduced 13–21 percent in when awnings are only used in the summer, but the savings from awnings are diminished if they remain in place 12 months a year.

Table 25 also shows that awnings reduce peak electricity demand by 15–22 percent in Sacramento. This may contribute to the ability to downsize the mechanical cooling system. The actual savings are greatest with clear double glazing (A) and least with low-solar-gain low-E windows (C).

Tables 26, 27 and 28 show results for houses in Sacramento with the windows predominantly facing to the east, south, and west, respectively. The cooling energy savings from awnings is greatest on the south- and west-facing orientations. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 25: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Sacramento, California

Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	1787	–	–	19.0	–	–	$530	–	–	3.51	–	–
A	12 month	1082	704	39.4%	22.2	-3.2	-16.9%	$454	$76	14.4%	2.75	0.75	21.5%
A	summer	1082	704	39.4%	19.6	-0.6	-3.1%	$421	$109	20.5%	2.75	0.75	21.5%
B	none	1708	–	–	17.2	–	–	$494	–	–	3.35	–	–
B	12 month	1060	648	37.9%	20.0	-2.8	-16.5%	$422	$72	14.5%	2.64	0.71	21.1%
B	summer	1060	648	37.9%	17.6	-0.4	-2.2%	$392	$102	20.7%	2.64	0.71	21.1%
C	none	1070	–	–	21.4	–	–	$441	–	–	2.71	–	–
C	12 month	671	399	37.3%	23.8	-2.4	-11.4%	$405	$36	8.1%	2.29	0.42	15.4%
C	summer	671	399	37.3%	22.2	-0.8	-3.8%	$385	$56	12.6%	2.29	0.42	15.4%

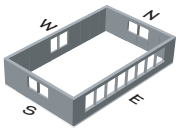
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.17 per kWh in Sacramento. Natural gas costs used in the analysis are $12.37 per MBTU in Sacramento. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 26: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: Sacramento, California

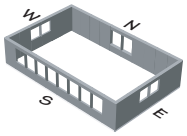
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	1814	–	–	19.8	–	–	$544	–	–	3.14	–	–
A	12 month	1100	714	39.4%	22.2	-2.4	-12.0%	$456	$88	16.2%	2.72	0.42	13.4%
A	summer	1100	714	39.4%	20.2	-0.4	-2.0%	$431	$113	20.8%	2.72	0.42	13.4%
B	none	1727	–	–	17.9	–	–	$506	–	–	3.00	–	–
B	12 month	1072	655	37.9%	20.0	-2.1	-11.5%	$424	$83	16.3%	2.61	0.39	13.0%
B	summer	1072	655	37.9%	18.1	-0.2	-1.2%	$401	$105	20.8%	2.61	0.39	13.0%
C	none	1059	–	–	21.9	–	–	$445	–	–	2.47	–	–
C	12 month	680	379	35.8%	23.7	-1.9	-8.6%	$406	$39	8.8%	2.24	0.23	9.3%
C	summer	680	379	35.8%	22.6	-0.7	-3.2%	$391	$54	12.1%	2.24	0.23	9.3%

TABLE 27: IMPACT OF AWNINGS ON A HOUSE WITH SOUTH ORIENTED WINDOWS
Location: Sacramento, California

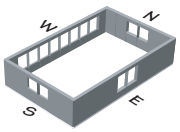
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	1907	–	–	16.1	–	–	$514	–	–	3.71	–	–
A	12 month	1054	854	44.8%	21.3	-5.1	-31.8%	$437	$77	15.1%	2.75	0.96	25.9%
A	summer	1054	854	44.8%	16.9	-0.8	-4.9%	$383	$131	25.5%	2.75	0.96	25.9%
B	none	1822	–	–	14.4	–	–	$479	–	–	3.53	–	–
B	12 month	1027	796	43.7%	19.1	-4.7	-32.2%	$406	$74	15.4%	2.63	0.91	25.7%
B	summer	1027	795	43.6%	15.0	-0.6	-4.0%	$355	$124	25.9%	2.63	0.91	25.7%
C	none	1095	–	–	19.2	–	–	$418	–	–	2.54	–	–
C	12 month	657	439	40.1%	23.4	-4.3	-22.2%	$398	$20	4.7%	2.28	0.26	10.3%
C	summer	657	439	40.1%	20.2	-1.0	-5.2%	$358	$60	14.4%	2.28	0.26	10.3%

TABLE 28: IMPACT OF AWNINGS ON A HOUSE WITH WEST ORIENTED WINDOWS
Location: Sacramento, California

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2196	–	–	20.3	–	–	$614	–	–	4.62	–	–
A	12 month	1148	1048	47.7%	22.3	-2.0	-9.8%	$466	$148	24.1%	2.83	1.79	38.8%
A	summer	1148	1048	47.7%	20.3	0.1	0.2%	$440	$173	28.3%	2.83	1.79	38.8%
B	none	2102	–	–	18.4	–	–	$574	–	–	4.41	–	–
B	12 month	1120	981	46.7%	20.1	-1.7	-9.2%	$434	$141	24.5%	2.71	1.70	38.5%
B	summer	1120	981	46.7%	18.2	0.2	1.3%	$410	$165	28.7%	2.71	1.70	38.5%
C	none	1240	–	–	22.4	–	–	$481	–	–	3.32	–	–
C	12 month	702	538	43.4%	23.8	-1.5	-6.6%	$411	$71	14.7%	2.33	0.98	29.6%
C	summer	702	538	43.4%	22.6	-0.2	-1.0%	$395	$86	17.9%	2.33	0.98	29.6%

Albuquerque, New Mexico

HDD65: 4361 / CDD65: 1210

Tables 25–28 show the impact of awnings on a typical house in Albuquerque, New Mexico with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 25 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

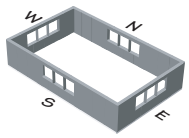
As shown in Table 25, the awnings reduce the cooling energy 28–31 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

The total cost of heating and cooling is reduced 2–8 percent when awnings are only used in the summer, but the savings from awnings are diminished if they remain in place 12 months a year.

Table 25 also shows that awnings reduce peak electricity demand by 11–17 percent in Albuquerque. This may contribute to the ability to downsize the mechanical cooling system. The actual savings are greatest with clear double glazing (A) and least with low-solar-gain low-E windows (C).

Tables 26, 27 and 28 show results for houses in Albuquerque with the windows predominantly facing to the east, south, and west, respectively. The cooling energy savings from awnings is greatest on the east- and west-facing orientations. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 25: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Albuquerque, New Mexico
Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	1881	–	–	29.7	–	–	$572	–	–	2.66	–	–
A	12 month	1297	584	31.0%	39.3	-9.6	-32.5%	$610	-$38	-6.6%	2.22	0.45	16.7%
A	summer	1297	584	31.0%	32.5	-2.8	-9.3%	$531	$41	7.1%	2.22	0.45	16.7%
B	none	1805	–	–	26.9	–	–	$531	–	–	2.57	–	–
B	12 month	1260	545	30.2%	35.7	-8.8	-32.9%	$564	-$33	-6.3%	2.16	0.41	16.1%
B	summer	1260	545	30.2%	29.2	-2.4	-8.8%	$490	$40	7.6%	2.16	0.41	16.1%
C	none	1144	–	–	34.3	–	–	$533	–	–	1.96	–	–
C	12 month	820	324	28.3%	40.7	-6.5	-18.8%	$566	-$33	-6.3%	1.74	0.22	11.3%
C	summer	820	324	28.3%	36.7	-2.4	-7.0%	$520	$13	2.4%	1.74	0.22	11.3%

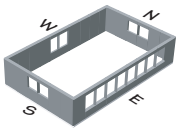
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.12 per kWh in Albuquerque. Natural gas costs used in the analysis are $11.42 per MBTU in Albuquerque. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 26: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: Albuquerque, New Mexico

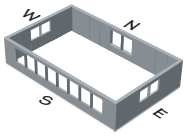
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2159	–	–	30.4	–	–	$615	–	–	3.01	–	–
A	12 month	1326	833	38.6%	38.9	-8.5	-27.9%	$609	$6	1.0%	2.21	0.80	26.7%
A	summer	1326	833	38.6%	33.1	-2.7	-8.9%	$543	$72	11.7%	2.21	0.80	26.7%
B	none	2058	–	–	27.6	–	–	$571	–	–	2.90	–	–
B	12 month	1286	772	37.5%	35.4	-7.7	-28.0%	$563	$7	1.3%	2.15	0.76	26.1%
B	summer	1286	772	37.5%	29.9	-2.3	-8.3%	$501	$70	12.2%	2.15	0.76	26.1%
C	none	1268	–	–	34.7	–	–	$553	–	–	1.96	–	–
C	12 month	837	431	34.0%	40.5	-5.8	-16.7%	$566	-$13	-2.3%	1.72	0.23	11.9%
C	summer	837	431	34.0%	37.1	-2.5	-7.2%	$528	$25	4.5%	1.72	0.23	11.9%

TABLE 27: IMPACT OF AWNINGS ON A HOUSE WITH SOUTH ORIENTED WINDOWS
Location: Albuquerque, New Mexico

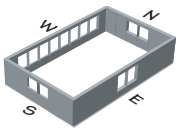
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	1844	–	–	23.9	–	–	$502	–	–	2.73	–	–
A	12 month	1259	585	31.7%	37.1	-13.1	-55.0%	$579	-$78	-15.5%	2.21	0.52	19.1%
A	summer	1236	608	33.0%	26.8	-2.9	-12.2%	$460	$42	8.4%	2.20	0.52	19.2%
B	none	1769	–	–	21.4	–	–	$464	–	–	2.60	–	–
B	12 month	1221	549	31.0%	33.6	-12.2	-57.0%	$535	-$71	-15.3%	2.14	0.46	17.6%
B	summer	1201	568	32.1%	23.9	-2.5	-11.8%	$422	$42	9.0%	2.11	0.49	19.0%
C	none	1106	–	–	28.9	–	–	$467	–	–	1.90	–	–
C	12 month	802	304	27.5%	39.7	-10.8	-37.3%	$552	-$85	-18.3%	1.73	0.17	9.2%
C	summer	788	318	28.8%	31.9	-3.1	-10.6%	$462	$5	1.0%	1.69	0.21	10.9%

TABLE 28: IMPACT OF AWNINGS ON A HOUSE WITH WEST ORIENTED WINDOWS
Location: Albuquerque, New Mexico

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2168	–	–	32.2	–	–	$637	–	–	3.93	–	–
A	12 month	1333	836	38.5%	39.4	-7.2	-22.3%	$615	$22	3.4%	2.25	1.68	42.8%
A	summer	1333	836	38.5%	34.1	-1.9	-5.9%	$555	$82	12.9%	2.25	1.68	42.8%
B	none	2072	–	–	29.3	–	–	$591	–	–	3.79	–	–
B	12 month	1295	778	37.5%	35.8	-6.5	-22.2%	$569	$22	3.7%	2.17	1.62	42.8%
B	summer	1295	778	37.5%	30.8	-1.5	-5.2%	$512	$79	13.4%	2.17	1.62	42.8%
C	none	1275	–	–	35.7	–	–	$566	–	–	2.67	–	–
C	12 month	839	436	34.2%	40.6	-4.9	-13.8%	$568	-$2	-0.4%	1.74	0.92	34.6%
C	summer	839	436	34.2%	37.5	-1.8	-5.0%	$532	$34	6.0%	1.74	0.92	34.6%

St. Louis, Missouri

HDD65: 5021 / CDD65: 1437

Tables 29–32 show the impact of awnings on a typical house in St. Louis, Missouri with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 29 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

As shown in Table 29, the awnings reduce the cooling energy 14–17 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

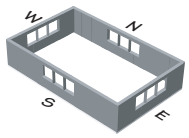
The total cost of heating and cooling is reduced 1–3 percent in St. Louis when awnings are only used in the summer, but the savings from awnings are diminished if they remain in place 12 months a year.

Table 29 also shows that awnings reduce peak electricity demand by 11–16 percent in St. Louis. This may contribute to the ability to downsize the mechanical cooling system. The actual savings are greatest with clear double glazing (A) and least with low-solar-gain low-E windows (C).

Tables 42, 43 and 44 show results for houses in St. Louis with the windows predominantly facing to the east, south, and west, respectively. The cooling energy savings from awnings is greatest on the east- and west-facing orientations. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 29: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: St. Louis, Missouri

Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2366	–	–	54.8	–	–	$927	–	–	3.87	–	–
A	12 month	1970	396	16.7%	60.0	-5.1	-9.3%	$950	-$23	-2.5%	3.26	0.61	15.9%
A	summer	1970	396	16.7%	55.9	-1.0	-1.9%	$899	$28	3.0%	3.26	0.61	15.9%
B	none	2283	–	–	50.8	–	–	$867	–	–	3.71	–	–
B	12 month	1918	365	16.0%	55.4	-4.7	-9.2%	$888	-$20	-2.4%	3.13	0.57	15.5%
B	summer	1918	365	16.0%	51.6	-0.8	-1.6%	$840	$28	3.2%	3.13	0.57	15.5%
C	none	1571	–	–	56.3	–	–	$863	–	–	3.01	–	–
C	12 month	1358	213	13.6%	59.8	-3.5	-6.2%	$885	-$22	-2.5%	2.68	0.34	11.2%
C	summer	1358	213	13.6%	57.5	-1.2	-2.2%	$856	$7	0.8%	2.68	0.34	11.2%

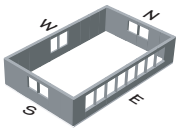
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.10 per kWh in St. Louis. Natural gas costs used in the analysis are $12.46 per MBTU in St. Louis. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 30: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: St. Louis, Missouri

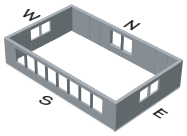
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2538	–	–	55.4	–	–	$952	–	–	4.18	–	–
A	12 month	2013	526	20.7%	59.7	-4.3	-7.8%	$951	$1	0.1%	3.21	0.97	23.3%
A	summer	2013	526	20.7%	56.4	-1.0	-1.8%	$910	$42	4.4%	3.21	0.97	23.3%
B	none	2448	–	–	51.4	–	–	$892	–	–	3.99	–	–
B	12 month	1960	488	19.9%	55.2	-3.8	-7.5%	$890	$3	0.3%	3.08	0.91	22.8%
B	summer	1960	488	19.9%	52.1	-0.7	-1.3%	$851	$42	4.7%	3.08	0.91	22.8%
C	none	1683	–	–	56.6	–	–	$879	–	–	3.03	–	–
C	12 month	1372	311	18.5%	59.6	-3.0	-5.3%	$884	-$6	-0.6%	2.64	0.39	12.8%
C	summer	1372	311	18.5%	57.8	-1.2	-2.0%	$861	$18	2.0%	2.64	0.39	12.8%

TABLE 31: IMPACT OF AWNINGS ON A HOUSE WITH SOUTH ORIENTED WINDOWS
Location: St. Louis, Missouri

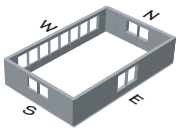
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2223	–	–	49.2	–	–	$842	–	–	4.47	–	–
A	12 month	1934	289	13.0%	58.1	-9.0	-18.2%	$923	-$82	-9.7%	3.29	1.18	26.4%
A	summer	1826	397	17.9%	50.7	-1.5	-3.1%	$820	$22	2.6%	3.11	1.36	30.4%
B	none	2133	–	–	45.4	–	–	$786	–	–	4.26	–	–
B	12 month	1883	250	11.7%	53.7	-8.3	-18.3%	$863	-$78	-9.9%	3.16	1.11	26.0%
B	summer	1777	356	16.7%	46.8	-1.3	-2.9%	$766	$20	2.6%	2.97	1.29	30.3%
C	none	1453	–	–	52.4	–	–	$802	–	–	3.22	–	–
C	12 month	1335	118	8.1%	58.9	-6.6	-12.5%	$872	-$70	-8.7%	2.69	0.54	16.7%
C	summer	1260	193	13.3%	54.4	-2.0	-3.8%	$807	-$5	-0.6%	2.51	0.71	22.1%

TABLE 32: IMPACT OF AWNINGS ON A HOUSE WITH WEST ORIENTED WINDOWS
Location: St. Louis, Missouri

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2614	–	–	56.7	–	–	$976	–	–	4.95	–	–
A	12 month	2022	592	22.6%	60.2	-3.5	-6.1%	$958	$18	1.8%	3.33	1.62	32.6%
A	summer	2022	592	22.6%	57.2	-0.4	-0.8%	$920	$55	5.7%	3.33	1.62	32.6%
B	none	2514	–	–	52.6	–	–	$914	–	–	4.74	–	–
B	12 month	1965	549	21.9%	55.6	-3.1	-5.8%	$895	$18	2.0%	3.20	1.53	32.4%
B	summer	1965	549	21.9%	52.8	-0.2	-0.4%	$860	$54	5.9%	3.20	1.53	32.4%
C	none	1681	–	–	57.4	–	–	$888	–	–	3.39	–	–
C	12 month	1383	299	17.8%	59.8	-2.5	-4.3%	$888	$0	0.0%	2.72	0.67	19.7%
C	summer	1383	298	17.8%	58.1	-0.7	-1.3%	$866	$22	2.4%	2.72	0.67	19.7%

Atlanta, Georgia

HDD65: 3089 / CDD65: 1611

Tables 33–36 show the impact of awnings on a typical house in Atlanta, Georgia with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 33 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

As shown in Table 33, the awnings reduce the cooling energy 11–12 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

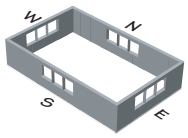
The total cost of heating and cooling is reduced 1–4 percent in Atlanta when awnings are only used in the summer, but the savings from awnings are diminished if they remain in place 12 months a year.

Table 33 also shows that awnings reduce peak electricity demand by 4–5 percent in Atlanta. This may contribute to the ability to downsize the mechanical cooling system. The actual savings are greatest with clear double glazing (A) and least with low-solar-gain low-E windows (C).

Tables 34, 35 and 36 show results for houses in Atlanta with the windows predominantly facing to the east, south, and west, respectively. The cooling energy savings from awnings is greatest on the east- and west-facing orientations. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 33: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Atlanta, Georgia

Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2422	–	–	24.6	–	–	$697	–	–	3.12	–	–
A	12 month	2126	296	12.2%	29.0	-4.4	-18.0%	$733	-$37	-5.3%	2.96	0.16	5.0%
A	summer	2126	296	12.2%	25.1	-0.5	-2.0%	$669	$28	4.0%	2.96	0.16	5.0%
B	none	2360	–	–	22.4	–	–	$653	–	–	2.99	–	–
B	12 month	2085	275	11.7%	26.4	-4.0	-17.9%	$686	-$33	-5.0%	2.85	0.14	4.7%
B	summer	2085	275	11.7%	22.7	-0.3	-1.5%	$625	$28	4.3%	2.85	0.14	4.7%
C	none	1609	–	–	27.0	–	–	$637	–	–	2.43	–	–
C	12 month	1435	174	10.8%	30.1	-3.1	-11.4%	$667	-$29	-4.6%	2.34	0.08	3.5%
C	summer	1435	174	10.8%	27.7	-0.7	-2.5%	$627	$10	1.6%	2.34	0.08	3.5%

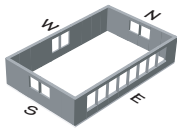
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.12 per kWh in Atlanta. Natural gas costs used in the analysis are 16.40 per MBTU in Atlanta. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 34: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY EAST ORIENTED WINDOWS
Location: Atlanta, Georgia

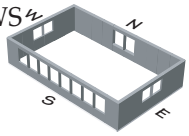
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2628	–	–	24.9	–	–	$727	–	–	3.00	–	–
A	12 month	2163	465	17.7%	28.8	-3.9	-15.4%	$734	-$7	-0.9%	2.95	0.05	1.8%
A	summer	2163	465	17.7%	25.4	-0.4	-1.6%	$677	$50	6.8%	2.95	0.05	1.8%
B	none	2558	–	–	22.8	–	–	$683	–	–	2.87	–	–
B	12 month	2118	440	17.2%	26.2	-3.5	-15.2%	$686	-$4	-0.5%	2.84	0.03	1.1%
B	summer	2118	440	17.2%	23.0	-0.2	-1.1%	$634	$49	7.2%	2.84	0.03	1.1%
C	none	1728	–	–	27.3	–	–	$656	–	–	2.32	–	–
C	12 month	1450	278	16.1%	29.9	-2.6	-9.7%	$666	-$10	-1.5%	2.33	0.00	-0.2%
C	summer	1450	278	16.1%	27.9	-0.6	-2.2%	$632	$24	3.7%	2.33	0.00	-0.2%

TABLE 35: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY SOUTH ORIENTED WINDOWS
Location: Atlanta, Georgia

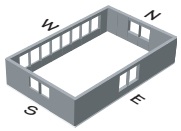
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2307	–	–	21.0	–	–	$623	–	–	2.89	–	–
A	12 month	2092	215	9.3%	27.8	-6.8	-32.3%	$708	-$85	-13.6%	2.96	-0.06	-2.2%
A	summer	1991	315	13.7%	21.7	-0.7	-3.4%	$597	$27	4.3%	2.82	0.07	2.3%
B	none	2248	–	–	19.0	–	–	$584	–	–	2.78	–	–
B	12 month	2051	197	8.7%	25.3	-6.2	-32.7%	$662	-$78	-13.4%	2.84	-0.07	-2.4%
B	summer	1953	295	13.1%	19.6	-0.5	-2.9%	$557	$27	4.6%	2.72	0.06	2.1%
C	none	1537	–	–	24.0	–	–	$580	–	–	2.29	–	–
C	12 month	1414	123	8.0%	29.5	-5.5	-22.8%	$654	-$75	-12.9%	2.34	-0.05	-2.3%
C	summer	1355	182	11.8%	25.1	-1.1	-4.4%	$575	$5	0.8%	2.24	0.04	2.0%

TABLE 36: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY WEST ORIENTED WINDOWS
Location: Atlanta, Georgia

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	2618	–	–	26.2	–	–	$746	–	–	3.80	–	–
A	12 month	2154	464	17.7%	29.2	-3.0	-11.4%	$739	$7	1.0%	2.96	0.83	21.9%
A	summer	2155	463	17.7%	26.2	0.0	-0.2%	$691	$55	7.4%	2.96	0.83	21.9%
B	none	2542	–	–	23.9	–	–	$700	–	–	3.64	–	–
B	12 month	2110	432	17.0%	26.6	-2.6	-11.0%	$691	$9	1.3%	2.85	0.79	21.6%
B	summer	2111	431	16.9%	23.8	0.1	0.5%	$646	$54	7.7%	2.85	0.79	21.6%
C	none	1698	–	–	28.0	–	–	$664	–	–	2.77	–	–
C	12 month	1448	250	14.7%	30.1	-2.1	-7.6%	$669	-$5	-0.7%	2.34	0.43	15.6%
C	summer	1448	250	14.7%	28.3	-0.3	-1.1%	$639	$25	3.8%	2.34	0.43	15.6%

Miami, Florida

HDD65: 141 / CDD65: 4126

Tables 37–40 show the impact of awnings on a typical house in Miami, Florida with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 3 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

As shown in Table 37, the awnings reduce the cooling energy 2–8 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year, but heating is a small concern in Miami.

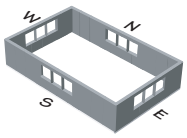
The total cost of heating and cooling is reduced 2–3 percent in Miami when awnings are only used in the summer, and the cost is reduced even further (5–7 percent) if they remain in place 12 months a year.

Table 37 also shows that awnings reduce peak electricity demand by 0–1 percent in Miami. The peak demand in Miami is not driven by direct solar radiation.

Tables 38, 39 and 40 show results for houses in Miami with the windows predominantly facing to the east, south, and west, respectively. Compared to the equal orientation case, the cooling energy savings from awnings are greater on the east-, south- and west-facing orientations. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 37: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Miami, Florida

Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	7151	–	–	0.4	–	–	$917	–	–	3.39	–	–
A	12 month	6609	542	7.6%	0.5	-0.1	-28.6%	$851	$66	7.2%	3.38	0.00	0.1%
A	summer	6945	206	2.9%	0.4	0.0	-4.8%	$891	$26	2.8%	3.38	0.00	0.1%
B	none	6998	–	–	0.3	–	–	$896	–	–	3.29	–	–
B	12 month	6496	502	7.2%	0.4	-0.1	-29.4%	$834	$62	6.9%	3.28	0.00	0.1%
B	summer	6820	178	2.5%	0.4	0.0	-2.9%	$873	$22	2.5%	3.28	0.00	0.1%
C	none	5554	–	–	0.4	–	–	$714	–	–	2.78	–	–
C	12 month	5252	302	5.4%	0.6	-0.1	-30.2%	$679	$36	5.0%	2.75	0.03	1.3%
C	summer	5428	126	2.3%	0.5	0.0	-9.3%	$699	$15	2.1%	2.75	0.03	1.3%

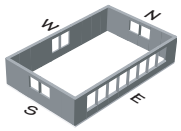
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.13 per kWh in Miami. Natural gas costs used in the analysis are $20.79 per MBTU in Miami. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 38: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY EAST ORIENTED WINDOWS
Location: Miami, Florida

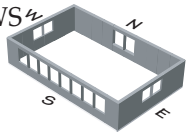
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	7554	–	–	0.4	–	–	$967	–	–	3.40	–	–
A	12 month	6699	855	11.3%	0.5	-0.1	-30.6%	$861	$106	11.0%	3.38	0.02	0.6%
A	summer	6955	600	7.9%	0.4	0.0	0.0%	$891	$76	7.9%	3.29	0.12	3.4%
B	none	7382	–	–	0.3	–	–	$943	–	–	3.29	–	–
B	12 month	6581	801	10.8%	0.4	-0.1	-31.0%	$844	$100	10.6%	3.28	0.01	0.2%
B	summer	6824	557	7.6%	0.3	0.0	0.0%	$873	$71	7.5%	3.19	0.10	3.0%
C	none	5786	–	–	0.4	–	–	$743	–	–	2.72	–	–
C	12 month	5288	498	8.6%	0.5	-0.1	-33.3%	$682	$60	8.1%	2.74	-0.02	-0.6%
C	summer	5420	366	6.3%	0.4	0.0	-5.1%	$697	$46	6.2%	2.72	0.00	0.1%

TABLE 39: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY SOUTH ORIENTED WINDOWS
Location: Miami, Florida

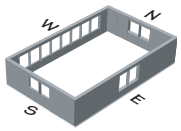
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	7358	–	–	0.4	–	–	$943	–	–	3.51	–	–
A	12 month	6611	747	10.2%	0.5	-0.1	-33.3%	$850	$92	9.8%	3.38	0.13	3.6%
A	summer	7171	186	2.5%	0.4	0.0	-2.6%	$919	$23	2.5%	3.32	0.18	5.2%
B	none	7182	–	–	0.3	–	–	$919	–	–	3.38	–	–
B	12 month	6494	688	9.6%	0.4	-0.1	-38.7%	$834	$85	9.2%	3.28	0.10	2.9%
B	summer	7025	157	2.2%	0.3	0.0	-3.2%	$899	$20	2.1%	3.23	0.16	4.6%
C	none	5646	–	–	0.4	–	–	$725	–	–	2.75	–	–
C	12 month	5243	403	7.1%	0.5	-0.1	-35.0%	$677	$48	6.6%	2.74	0.01	0.4%
C	summer	5521	125	2.2%	0.4	0.0	-10.0%	$710	$15	2.1%	2.69	0.06	2.2%

TABLE 40: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY WEST ORIENTED WINDOWS
Location: Miami, Florida

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	7392	–	–	0.5	–	–	$950	–	–	4.01	–	–
A	12 month	6644	748	10.1%	0.6	-0.1	-11.3%	$856	$94	9.9%	3.39	0.62	15.5%
A	summer	6770	622	8.4%	0.5	0.0	1.9%	$871	$79	8.3%	3.28	0.73	18.1%
B	none	7225	–	–	0.4	–	–	$927	–	–	3.88	–	–
B	12 month	6533	692	9.6%	0.5	0.0	-9.3%	$839	$87	9.4%	3.29	0.59	15.2%
B	summer	6648	578	8.0%	0.4	0.0	4.7%	$853	$74	8.0%	3.18	0.69	17.9%
C	none	5679	–	–	0.5	–	–	$732	–	–	3.10	–	–
C	12 month	5258	420	7.4%	0.6	0.0	-9.6%	$680	$52	7.2%	2.75	0.35	11.2%
C	summer	5299	380	6.7%	0.5	0.0	-1.9%	$684	$48	6.6%	2.67	0.43	13.9%

Houston, Texas

HDD65: 1552 / CDD65: 2810

Tables 41–44 show the impact of awnings on a typical house in Houston, Texas with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 41 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

As shown in Table 41, the awnings reduce the cooling energy 5–8 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

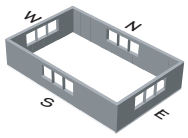
The total cost of heating and cooling is reduced 4–6 percent in Houston when awnings are only used in the summer, but the savings from awnings are diminished if they remain in place 12 months a year.

Table 41 also shows that awnings reduce peak electricity demand by 5–8 percent in Houston. This may contribute to the ability to downsize the mechanical cooling system. The actual savings are greatest with clear double glazing (A) and least with low-solar-gain low-E windows (C).

Tables 42, 43 and 44 show results for houses in Houston with the windows predominantly facing to the east, south, and west, respectively. The cooling energy savings from awnings is greatest on the east- and west-facing orientations. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 41: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Houston, Texas

Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	4459	–	–	12.5	–	–	$820	–	–	3.43	–	–
A	12 month	4096	363	8.1%	14.2	-1.7	-13.5%	$788	$32	3.9%	3.25	0.19	5.4%
A	summer	4165	294	6.6%	12.3	0.2	1.4%	$774	$46	5.6%	3.25	0.19	5.4%
B	none	4338	–	–	11.4	–	–	$788	–	–	3.33	–	–
B	12 month	4012	326	7.5%	12.9	-1.5	-13.2%	$759	$29	3.7%	3.14	0.19	5.8%
B	summer	4078	260	6.0%	11.2	0.2	2.0%	$747	$41	5.3%	3.14	0.19	5.8%
C	none	3315	–	–	13.5	–	–	$664	–	–	2.88	–	–
C	12 month	3120	195	5.9%	14.8	-1.3	-9.5%	$651	$12	1.9%	2.65	0.24	8.2%
C	summer	3144	172	5.2%	13.5	0.0	-0.2%	$639	$25	3.8%	2.65	0.24	8.2%

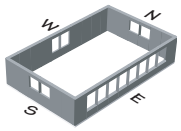
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.15 per kWh in Houston. Natural gas costs used in the analysis are $12.83 per MBTU in Houston. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 42: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY EAST ORIENTED WINDOWS
Location: Houston, Texas

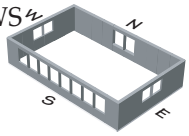
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	4624	–	–	12.6	–	–	$846	–	–	3.31	–	–
A	12 month	4131	493	10.7%	14.0	-1.5	-11.6%	$791	$54	6.4%	3.24	0.07	2.1%
A	summer	4175	450	9.7%	12.4	0.2	1.5%	$777	$69	8.2%	3.24	0.07	2.1%
B	none	4494	–	–	11.5	–	–	$812	–	–	3.18	–	–
B	12 month	4043	451	10.0%	12.8	-1.3	-11.2%	$762	$50	6.2%	3.14	0.05	1.5%
B	summer	4086	408	9.1%	11.2	0.3	2.2%	$749	$64	7.8%	3.14	0.05	1.5%
C	none	3401	–	–	13.6	–	–	$677	–	–	2.67	–	–
C	12 month	3131	270	7.9%	14.7	-1.1	-8.3%	$652	$26	3.8%	2.64	0.03	1.1%
C	summer	3148	253	7.4%	13.6	0.0	-0.1%	$640	$37	5.5%	2.64	0.03	1.1%

TABLE 43: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY SOUTH ORIENTED WINDOWS
Location: Houston, Texas

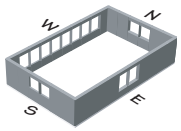
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	4344	–	–	11.2	–	–	$787	–	–	3.48	–	–
A	12 month	4069	276	6.3%	13.7	-2.5	-22.5%	$778	$8	1.1%	3.25	0.24	6.8%
A	summer	4068	277	6.4%	11.1	0.1	0.6%	$745	$42	5.3%	3.13	0.35	10.2%
B	none	4228	–	–	10.2	–	–	$756	–	–	3.37	–	–
B	12 month	3984	244	5.8%	12.5	-2.3	-22.6%	$750	$7	0.9%	3.14	0.23	6.9%
B	summer	3973	255	6.0%	10.1	0.1	1.0%	$717	$39	5.2%	3.03	0.35	10.3%
C	none	3210	–	–	12.3	–	–	$633	–	–	2.75	–	–
C	12 month	3101	108	3.4%	14.6	-2.3	-18.3%	$646	-$13	-2.0%	2.65	0.10	3.7%
C	summer	3049	161	5.0%	12.4	-0.1	-1.0%	$611	$22	3.5%	2.55	0.20	7.4%

TABLE 44: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY WEST ORIENTED WINDOWS
Location: Houston, Texas

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	4774	–	–	13.3	–	–	$877	–	–	4.25	–	–
A	12 month	4150	624	13.1%	14.3	-1.0	-7.3%	$797	$80	9.1%	3.25	1.00	23.6%
A	summer	4022	752	15.7%	12.9	0.4	2.7%	$761	$116	13.2%	3.11	1.14	26.7%
B	none	4641	–	–	12.1	–	–	$843	–	–	4.10	–	–
B	12 month	4058	584	12.6%	13.0	-0.8	-6.8%	$767	$76	9.0%	3.14	0.96	23.4%
B	summer	3932	710	15.3%	11.7	0.4	3.4%	$732	$110	13.1%	3.01	1.09	26.5%
C	none	3483	–	–	14.0	–	–	$695	–	–	3.26	–	–
C	12 month	3139	344	9.9%	14.8	-0.8	-5.6%	$654	$41	5.9%	2.68	0.58	17.8%
C	summer	3028	455	13.1%	13.9	0.1	0.9%	$626	$69	9.9%	2.55	0.72	21.9%

Jacksonville, Florida

HDD65: 1436 / CDD65: 2637

Tables 45–48 show the impact of awnings on a typical house in Jacksonville, Florida with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 45 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

As shown in Table 45, the awnings reduce the cooling energy 7–10 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

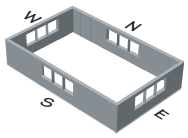
The total cost of heating and cooling is reduced 4–6 percent when awnings are only used in the summer, but the savings from awnings are diminished if they remain in place 12 months a year.

Table 45 also shows that awnings increase peak electricity demand by 0–2 percent in Jacksonville.

Tables 46, 47 and 48 show results for houses in Jacksonville with the windows predominantly facing to the east, south, and west, respectively. The cooling energy savings from awnings is greatest on the east- and west-facing orientations. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 45: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Jacksonville, Florida

Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	4270	–	–	9.7	–	–	$745	–	–	3.41	–	–
A	12 month	3835	435	10.2%	12.1	-2.3	-24.0%	$738	$7	0.9%	3.46	-0.05	-1.5%
A	summer	3896	374	8.8%	9.8	0.0	-0.2%	$698	$47	6.3%	3.46	-0.05	-1.5%
B	none	4166	–	–	8.8	–	–	$712	–	–	3.30	–	–
B	12 month	3759	407	9.8%	10.9	-2.1	-23.9%	$704	$8	1.1%	3.34	-0.04	-1.1%
B	summer	3819	347	8.3%	8.7	0.0	0.6%	$667	$45	6.3%	3.34	-0.04	-1.1%
C	none	3121	–	–	11.2	–	–	$628	–	–	2.78	–	–
C	12 month	2884	237	7.6%	12.9	-1.8	-15.9%	$635	-$7	-1.1%	2.78	0.00	-0.1%
C	summer	2906	214	6.9%	11.4	-0.2	-1.9%	$605	$23	3.6%	2.78	0.00	-0.1%

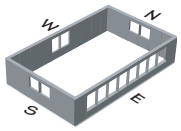
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.13 per kWh in Jacksonville. Natural gas costs used in the analysis are $20.79 per MBTU in Jacksonville. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 46: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY EAST ORIENTED WINDOWS
Location: Jacksonville, Florida

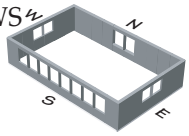
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	4519	–	–	9.9	–	–	$779	–	–	3.46	–	–
A	12 month	3880	639	14.1%	11.9	-2.0	-20.4%	$740	$39	5.0%	3.46	0.00	-0.1%
A	summer	3928	592	13.1%	9.8	0.1	1.1%	$702	$77	9.9%	3.46	0.00	-0.1%
B	none	4394	–	–	8.9	–	–	$743	–	–	3.33	–	–
B	12 month	3803	591	13.5%	10.7	-1.8	-20.3%	$706	$37	5.0%	3.33	0.00	0.0%
B	summer	3848	546	12.4%	8.8	0.2	1.8%	$671	$73	9.8%	3.33	0.00	0.0%
C	none	3246	–	–	11.4	–	–	$649	–	–	2.72	–	–
C	12 month	2889	356	11.0%	12.8	-1.5	-12.9%	$634	$15	2.3%	2.77	-0.05	-2.0%
C	summer	2906	340	10.5%	11.4	-0.1	-0.4%	$606	$42	6.5%	2.77	-0.05	-2.0%

TABLE 47: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY SOUTH ORIENTED WINDOWS
Location: Jacksonville, Florida

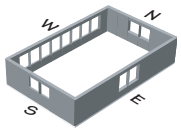
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	4118	–	–	8.3	–	–	$696	–	–	3.20	–	–
A	12 month	3798	320	7.8%	11.5	-3.2	-38.0%	$720	-$25	-3.6%	3.47	-0.27	-8.4%
A	summer	3773	346	8.4%	8.4	-0.1	-1.7%	$655	$41	5.9%	3.33	-0.13	-3.9%
B	none	4010	–	–	7.5	–	–	$664	–	–	3.09	–	–
B	12 month	3724	286	7.1%	10.3	-2.9	-38.2%	$687	-$23	-3.5%	3.34	-0.25	-8.2%
B	summer	3691	318	7.9%	7.5	0.0	-0.7%	$625	$39	5.9%	3.20	-0.12	-3.7%
C	none	2981	–	–	9.8	–	–	$583	–	–	2.60	–	–
C	12 month	2862	119	4.0%	12.7	-2.8	-28.9%	$627	-$44	-7.5%	2.78	-0.18	-6.9%
C	summer	2784	197	6.6%	10.1	-0.3	-2.5%	$563	$20	3.4%	2.66	-0.06	-2.3%

TABLE 48: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY WEST ORIENTED WINDOWS
Location: Jacksonville, Florida

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	4477	–	–	10.8	–	–	$792	–	–	4.48	–	–
A	12 month	3875	602	13.5%	12.2	-1.4	-13.4%	$746	$47	5.9%	3.47	1.01	22.5%
A	summer	3927	550	12.3%	10.4	0.4	3.3%	$715	$77	9.7%	3.47	1.01	22.5%
B	none	4356	–	–	9.7	–	–	$755	–	–	4.31	–	–
B	12 month	3798	558	12.8%	11.0	-1.3	-13.0%	$711	$45	5.9%	3.35	0.96	22.3%
B	summer	3849	507	11.6%	9.3	0.4	4.1%	$683	$73	9.6%	3.35	0.96	22.3%
C	none	3230	–	–	12.0	–	–	$659	–	–	3.25	–	–
C	12 month	2903	327	10.1%	13.0	-1.0	-8.4%	$638	$21	3.1%	2.78	0.47	14.5%
C	summer	2924	306	9.5%	11.8	0.2	1.8%	$616	$43	6.6%	2.78	0.47	14.5%

Phoenix, Arizona

HDD65: 1153 / CDD65: 3814

Tables 49–52 show the impact of awnings on a typical house in Phoenix, Arizona with different orientation conditions. The impact varies depending on the type of window glazing and whether the awnings are in place 12 months per year or only in the summer.

For a house with windows equally distributed on the four orientations, Table 49 shows the annual heating and cooling energy use as well as the peak electricity demand for each combination of glazing and shading condition. The table also shows the impact on the total cost of heating and cooling. In each case, the table shows the percent savings compared to the unshaded condition.

As shown in Table 49, the awnings reduce the cooling energy 14–21 percent compared to a completely unshaded case. The actual savings are greatest with clear glazing (A) and least with low-solar-gain low-E windows (C). Because awnings block passive solar gain in winter, heating energy increases if the awnings remain in place 12 months a year. Removing or retracting the awnings in winter while deploying them in summer results in the lowest energy use.

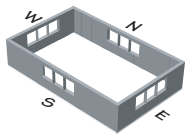
The total cost of heating and cooling is reduced 13–18 percent when awnings are only used in the summer, but the savings from awnings are diminished if they remain in place 12 months a year.

Table 49 also shows that awnings reduce peak electricity demand by 9–13 percent in Phoenix. This may contribute to the ability to downsize the mechanical cooling system. The actual savings are greatest with clear double glazing (A) and least with low-solar-gain low-E windows (C).

Tables 50, 51 and 52 show results for houses in Phoenix with the windows predominantly facing to the east, south, and west, respectively. The cooling energy savings from awnings is greatest on the west-facing orientation. The peak demand reduction from awnings is greatest on the west-facing orientation.

TABLE 49: IMPACT OF AWNINGS ON A HOUSE WITH EQUALLY ORIENTED WINDOWS
Location: Phoenix, Arizona

Note: The 300 sq ft of window area is distributed equally on the north, east west and south orientations.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	7438	–	–	5.4	–	–	$992	–	–	5.55	–	–
A	12 month	5905	1533	20.6%	7.6	-2.1	-39.0%	$829	$163	16.4%	4.85	0.70	12.6%
A	summer	6011	1428	19.2%	5.5	-0.1	-1.1%	$816	$176	17.8%	4.85	0.70	12.6%
B	none	7171	–	–	4.8	–	–	$950	–	–	5.33	–	–
B	12 month	5739	1432	20.0%	6.6	-1.9	-38.9%	$796	$154	16.2%	4.67	0.66	12.4%
B	summer	5838	1333	18.6%	4.8	0.0	-0.2%	$785	$165	17.4%	4.67	0.66	12.4%
C	none	5708	–	–	6.3	–	–	$789	–	–	4.60	–	–
C	12 month	4837	870	15.2%	8.1	-1.8	-28.0%	$704	$85	10.8%	4.18	0.41	9.0%
C	summer	4884	824	14.4%	6.5	-0.1	-2.1%	$689	$101	12.7%	4.18	0.41	9.0%

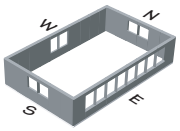
	GLAZING	FRAME	U-FACTOR	SHGC
A	Double, Clear	Wood/vinyl	0.49	0.56
B	Double, High-solar-gain Low-E	Wood/vinyl	0.37	0.53
C	Double, Low-solar-gain Low-E	Wood/vinyl	0.34	0.30

Note: The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000 sq ft house with 300 sq ft of window area. All cases in this report assume that there are no other shading devices such as overhangs or blinds and that the house is not shaded by trees or other buildings.

The costs shown here are annual costs for space heating and space cooling only and thus will be less than total utility bills. Costs for lights, appliances, hot water, cooking, and other uses are not included in these figures. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Electricity costs used in the analysis are $0.12 per kWh in Phoenix. Natural gas costs used in the analysis are $12.84 per MBTU in Phoenix. These figures are based on 25 year projected average costs for electricity during the cooling season and for natural gas during the heating season. All data is provided by the Energy Information Administration (www.eia.doe.gov). RESFEN is a computer program for calculating the annual cooling and heating energy use and costs due to window selection. It is available from Lawrence Berkeley National Laboratory (windows.lbl.gov/software/resfen).

TABLE 50: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: Phoenix, Arizona

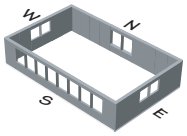
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	7602	–	–	5.4	–	–	$1,012	–	–	5.16	–	–
A	12 month	5951	1650	21.7%	7.3	-1.9	-36.1%	$832	$180	17.8%	4.82	0.33	6.5%
A	summer	6006	1596	21.0%	5.4	0.0	0.6%	$813	$198	19.6%	4.82	0.33	6.5%
B	none	7313	–	–	4.7	–	–	$967	–	–	4.96	–	–
B	12 month	5775	1537	21.0%	6.4	-1.7	-36.2%	$798	$169	17.5%	4.65	0.31	6.2%
B	summer	5824	1489	20.4%	4.6	0.1	1.7%	$781	$186	19.2%	4.65	0.31	6.2%
C	none	5742	–	–	6.4	–	–	$794	–	–	4.33	–	–
C	12 month	4847	895	15.6%	8.0	-1.6	-24.9%	$703	$91	11.4%	4.16	0.17	4.0%
C	summer	4876	866	15.1%	6.4	0.0	-0.5%	$687	$107	13.5%	4.16	0.17	4.0%

TABLE 51: IMPACT OF AWNINGS ON A HOUSE WITH SOUTH ORIENTED WINDOWS
Location: Phoenix, Arizona

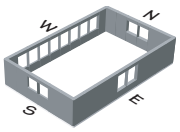
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	7505	–	–	4.6	–	–	$989	–	–	5.11	–	–
A	12 month	5848	1657	22.1%	6.8	-2.3	-49.8%	$813	$176	17.8%	4.84	0.27	5.3%
A	summer	5983	1522	20.3%	4.7	-0.1	-2.0%	$802	$188	19.0%	4.54	0.58	11.2%
B	none	7224	–	–	4.0	–	–	$947	–	–	4.91	–	–
B	12 month	5684	1540	21.3%	6.0	-2.0	-49.1%	$781	$166	17.5%	4.66	0.25	5.1%
B	summer	5802	1422	19.7%	4.0	0.0	-0.8%	$771	$176	18.6%	4.37	0.54	11.1%
C	none	5666	–	–	5.1	–	–	$768	–	–	4.32	–	–
C	12 month	4793	873	15.4%	7.7	-2.6	-51.3%	$693	$75	9.7%	4.18	0.14	3.3%
C	summer	4801	866	15.3%	5.2	-0.1	-2.4%	$662	$106	13.8%	3.92	0.40	9.3%

TABLE 52: IMPACT OF AWNINGS ON A HOUSE WITH WEST ORIENTED WINDOWS
Location: Phoenix, Arizona

Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the west, and 20 sq ft each on the north, east, and south.



WINDOW	AWNING	ANNUAL ENERGY Energy (kWh)	Energy Saved	Energy % Saved	HEATING Energy (MBTU)	Energy Saved	Energy % Saved	HEAT+COOL Cost ($)	Cost Saved	Cost % Saved	COOLING PEAK Peak (kW)	Peak Saved	Peak % Saved
A	none	8122	–	–	6.6	–	–	$1,092	–	–	7.02	–	–
A	12 month	6046	2076	25.6%	7.9	-1.3	-19.4%	$851	$241	22.1%	4.88	2.15	30.6%
A	summer	6149	1973	24.3%	6.5	0.1	2.1%	$845	$246	22.6%	4.88	2.15	30.6%
B	none	7814	–	–	5.8	–	–	$1,044	–	–	6.70	–	–
B	12 month	5868	1947	24.9%	6.9	-1.1	-18.2%	$816	$228	21.8%	4.70	2.00	29.9%
B	summer	5967	1847	23.6%	5.6	0.2	3.4%	$812	$232	22.2%	4.70	2.00	29.9%
C	none	6051	–	–	7.2	–	–	$843	–	–	5.25	–	–
C	12 month	4903	1148	19.0%	8.2	-1.0	-14.1%	$714	$129	15.3%	4.20	1.06	20.1%
C	summer	4945	1106	18.3%	7.1	0.1	2.1%	$704	$139	16.5%	4.20	1.06	20.1%