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

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Introduction

The Benefits of Awnings

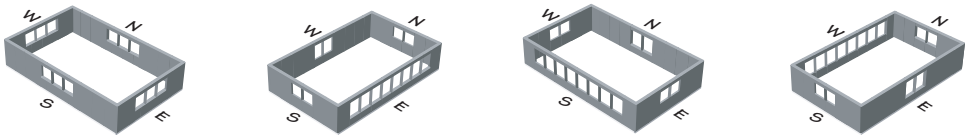
Awnings have advantages that contribute to more sustainable buildings. First, awnings result in cooling energy savings by reducing direct solar gain through windows. This directly reduces the impact of global warming from greenhouse gas emmisions. A second benefit is that peak electricity demand is also 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.

Table 1 shows the cooling and electric peak demand percent savings from using awnings in seven U.S. cities with differing climates. For each city, results are shown for a typical house with windows equally distributed on all four orientations, as well as a house with predominantly east-, south-, and west-facing orientations. The north orientation is not shown since the impacts of external shading devices are small.

In each case, there are significant percent savings in cooling costs as a result of using awnings. Similarly, there are significant percent savings in the peak electricity demand in all cities. While percent savings provides a general indication of the positive benefits of awnings, the magnitude of the actual savings must be examined in more detail.

Tables 2, 3 and 4 show the impact of awnings for three cities: a predominantly cold climate (Boston), a mixed heating and cooling climate (St. Louis), and a predominanty hot climate (Phoenix). There are three window types and three shading conditions. The window types are clear double glazing, high-solar-gain low-E glazing, and low-solar-gain low-E glazing. The three shading conditions include: no shading, awnings deployed 12 months a year, and awnings deployed in the summer only.

TABLE 1: SUMMARY OF AWNING IMPACTS IN SEVEN U.S. CITIES



CITY	EQUAL ORIENTATION		EAST ORIENTATION		SOUTH ORIENTATION		WEST ORIENTATION	
	Cooling Energy % Saved	Cooling Peak % Saved	Cooling Energy % Saved	Cooling Peak % Saved	Cooling Energy % Saved	Cooling Peak % Saved	Cooling Energy % Saved	Cooling Peak % Saved
Minneapolis	25-26%	9-10%	29-31%	22-23%	28-34%	5-22%	26-27%	25-32%
Boston	23-24%	17-22%	30-32%	28-37%	24-33%	22-36%	28-30%	33-40%
Seattle	60-70%	35-39%	51-69%	23%	71-80%	44-53%	69-72%	43-49%
Albuquerque	28-31%	11-17%	34-39%	12-27%	28-33%	9-19%	34-39%	35-43%
Phoenix	14-21%	9-13%	15-22%	4-6%	15-22%	3-11%	18-26%	20-31%
St.Louis	14-17%	11-16%	18-21%	13-23%	8-18%	17-30%	18-23%	20-33%
Sacramento	37-39%	15-21%	36-39%	9-13%	40-45%	10-26%	43-48%	30-39%

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 one side, the distribution is 240 sq ft on that side and 20 sq ft on the others. U-factor and SHGC are for the total window including frame. 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

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Cold Climate Impacts

Table 2 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 orientations, Table 2 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 2, the awnings reduce the cooling energy 23–24 percent compared to a completely unshaded case. However, 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 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 2 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.

Mixed Climate Impacts

Table 3 shows the impact of awnings on a typical house in St. Louis, Missouri, a mixed climate without either heating or cooling being predominant. The same window orientation, window types, and shading conditions used for Boston in Figure 2 are applied here for St. Louis.

The awnings reduce the cooling energy 14–17 percent compared to a completely unshaded case. However, 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 summer, the total cost of heating and cooling is reduced 1–3 percent in St. Louis, 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 11–16 percent in St. Louis. This may contribute to the ability to downsize the mechanical cooling system.

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 and St. Louis are applied in Phoenix.

In Phoenix, the awnings reduce the cooling energy 14–21 percent compared to a completely unshaded case. However, because awnings block passive solar gain in winter, heating energy increases by 28–39 percent 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 will be 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 9–13 percent in Phoenix, potentially contributing to the ability to downsize the mechanical cooling system.

In comparing Tables 2, 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 orientaion. 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 for a greater number of cities and multiple orientation conditions can be found in the rest of the report.

REFERENCES

Carmody, J., S. Selkowitz, D. Arasteh, and L. Heschong, "Residential Windows: A Guide to New Technologies and Energy Performance," W.W. Norton & Company, 2007.

Efficient Windows Collaborative Web Site: www.efficientwindows.org

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TABLE 2: IMPACT OF AWNINGS ON A HOUSE—BOSTON, MASSACHUSETTS

WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	855	–	$100	–	68.1	–	$1,254	–	2.7	–
A	12 month	651	24%	$76	$24	74.4	-9%	$1,319	-5%	2.1	22%
A	summer	651	24%	$76	$24	70.3	-3%	$1,253	0%	2.1	22%
B	none	822	–	$96	–	63.3	–	$1,170	–	2.5	–
B	12 month	631	23%	$74	$22	69.0	-9%	$1,228	-5%	2.0	22%
B	summer	631	23%	$74	$22	65.1	-3%	$1,166	0%	2.0	22%
C	none	449	–	$53	–	70.4	–	$1,220	–	1.9	–
C	12 month	343	24%	$40	$12	74.3	-6%	$1,264	-4%	1.6	17%
C	summer	343	24%	$40	$12	72.1	-2%	$1,228	-1%	1.6	17%

TABLE 3: IMPACT OF AWNINGS ON A HOUSE—ST. LOUIS, MISSOURI

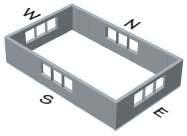
WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	2366	–	$277	–	54.8	–	$927	–	3.9	–
A	12 month	1970	17%	$231	$46	60.0	-9%	$950	-2%	3.3	16%
A	summer	1970	17%	$231	$46	55.9	-2%	$899	3%	3.3	16%
B	none	2283	–	$267	–	50.8	–	$867	–	3.7	–
B	12 month	1918	16%	$224	$43	55.4	-9%	$888	-2%	3.1	15%
B	summer	1918	16%	$224	$43	51.6	-2%	$840	3%	3.1	15%
C	none	1571	–	$184	–	56.3	–	$863	–	3.0	–
C	12 month	1358	14%	$159	$25	59.8	-6%	$885	-3%	2.7	11%
C	summer	1358	14%	$159	$25	57.5	-2%	$856	1%	2.7	11%

TABLE 4: IMPACT OF AWNINGS—PHOENIX, ARIZONA

WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	7438	–	$870	–	5.4	–	$992	–	5.6	–
A	12 month	5905	21%	$691	$179	7.6	-39%	$829	16%	4.9	13%
A	summer	6011	19%	$703	$167	5.5	-1%	$816	18%	4.9	13%
B	none	7171	–	$839	–	4.8	–	$950	–	5.3	–
B	12 month	5739	20%	$671	$167	6.6	-39%	$796	16%	4.7	12%
B	summer	5838	19%	$683	$156	4.8	0%	$785	17%	4.7	12%
C	none	5708	–	$668	–	6.3	–	$789	–	4.6	–
C	12 month	4837	15%	$566	$102	8.1	-28%	$704	11%	4.2	9%
C	summer	4884	14%	$571	$96	6.5	-2%	$689	13%	4.2	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. U-factor and SHGC are for the total window including frame. 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, $0.10 per kWh in St. Louis, $0.12 per kWh per MBTU in Phoenix. Natural gas costs used in the analysis are $16.20 per MBTU in Boston, $12.46 per MBTU in St. Louis, 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.

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Minneapolis, Minnesota

HDD65: 7985 / CDD65: 634

Tables 5–8 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 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 percent savings compared to the unshaded condition.

As shown in Table 5, the awnings reduce the cooling energy 25–26 percent compared to a completely unshaded case. However, because awnings block passive solar gain in winter, heating energy increases by 5–7 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 summer, the lowest energy use is achieved.

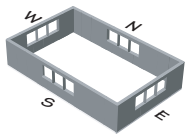
The total cost of heating and cooling is reduced 0–1 percent in Minneapolis when awnings are only used in the summer, but the total cost is increased if they remain in place 12 months a year.

Table 5 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.

Tables 6, 7 and 8 show similar results for a house in Minneapolis with the windows predominantly facing to the east, south, and west, respectively. In all three cases, the cooling energy use and cooling peak demand without awnings is higher than in the equal orientation case. This is particularly true with peak demand in the west orientation with savings up to 32 percent. Generally, this means the beneficial impact of the awnings is greater with predominantly east, south, and west orientations than in the equal orientation case.

TABLE 5: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	1097	–	$128	–	94.0	–	$1,169	–	2.9	–
A	12 month	817	26%	$96	$33	100.5	-7%	$1,208	-3%	2.6	10%
A	summer	817	26%	$96	$33	96.3	-3%	$1,162	1%	2.6	10%
B	none	1063	–	$124	–	87.6	–	$1,094	–	2.8	–
B	12 month	794	25%	$93	$31	93.6	-7%	$1,129	-3%	2.5	10%
B	summer	794	25%	$93	$31	89.7	-2%	$1,085	1%	2.5	10%
C	none	599	–	$70	–	94.5	–	$1,117	–	2.1	–
C	12 month	450	25%	$53	$17	98.8	-5%	$1,146	-3%	2.0	9%
C	summer	450	25%	$53	$17	96.5	-2%	$1,121	0%	2.0	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. U-factor and SHGC are for the total window including frame. 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.

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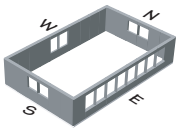
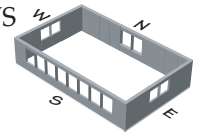
TABLE 6: IMPACT OF AWNINGS ON A HOUSE WITH MAINLY EAST ORIENTED WINDOWS
Location: Minneapolis, Minnesota
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



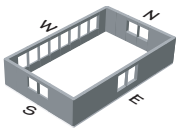
WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	1217	–	$142	–	94.7	–	$1,190	–	3.3	–
A	12 month	845	31%	$99	$43	100.4	-6%	$1,210	-2%	2.6	23%
A	summer	845	31%	$99	$43	97.2	-3%	$1,175	1%	2.6	23%
B	none	1170	–	$137	–	88.3	–	$1,115	–	3.2	–
B	12 month	824	30%	$96	$41	93.5	-6%	$1,131	-1%	2.5	22%
B	summer	823	30%	$96	$41	90.5	-2%	$1,099	1%	2.5	22%
C	none	648	–	$76	–	94.8	–	$1,125	–	1.9	–
C	12 month	459	29%	$54	$22	98.7	-4%	$1,146	-2%	1.9	0%
C	summer	459	29%	$54	$22	97.0	-2%	$1,128	0%	1.9	0%

TABLE 7: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	1123	–	$131	–	85.0	–	$1,072	–	3.2	–
A	12 month	798	29%	$93	$38	98.0	-15%	$1,178	-10%	2.6	18%
A	summer	739	34%	$86	$45	88.9	-5%	$1,071	0%	2.5	22%
B	none	1076	–	$126	–	79.1	–	$1,002	–	3.0	–
B	12 month	775	28%	$91	$35	91.2	-15%	$1,101	-10%	2.5	18%
B	summer	716	33%	$84	$42	82.7	-4%	$999	0%	2.4	21%
C	none	599	–	$70	–	89.1	–	$1,057	–	2.1	–
C	12 month	440	27%	$51	$19	97.6	-10%	$1,132	-7%	2.0	5%
C	summer	406	32%	$47	$23	92.5	-4%	$1,071	-1%	1.9	10%

TABLE 8: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	1172	–	$137	–	95.9	–	$1,199	–	3.9	–
A	12 month	850	27%	$99	$38	100.9	-5%	$1,216	-1%	2.6	32%
A	summer	850	27%	$99	$38	97.8	-2%	$1,182	1%	2.6	32%
B	none	1125	–	$132	–	89.5	–	$1,122	–	3.7	–
B	12 month	827	26%	$97	$35	93.9	-5%	$1,136	-1%	2.5	32%
B	summer	827	26%	$97	$35	91.0	-2%	$1,104	2%	2.5	32%
C	none	629	–	$74	–	95.4	–	$1,130	–	2.6	–
C	12 month	467	26%	$55	$19	98.9	-4%	$1,149	-2%	2.0	25%
C	summer	467	26%	$55	$19	97.2	-2%	$1,131	0%	2.0	25%

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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 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. However, 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 summer, the lowest energy use is achieved.

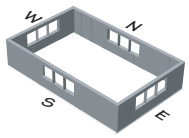
The total cost of heating and cooling is about equal in Boston when awnings are only used in the summer, but the total cost is increased if they remain in place 12 months a year.

Table 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.

Tables 10, 11 and 12 show similar results for a house in Boston with the windows predominantly facing to the east, south, and west, respectively. In all three cases, the cooling energy use and cooling peak demand without awnings is higher than in the equal orientation case. This is particularly true with peak demand in the west orientation with savings up to 40 percent. Generally, this means the beneficial impact of the awnings is greater with predominantly east, south, and west orientations than in the equal orientation case.

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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	855	–	$100	–	68.1	–	$1,254	–	2.7	–
A	12 month	651	24%	$76	$24	74.4	-9%	$1,319	-5%	2.1	22%
A	summer	651	24%	$76	$24	70.3	-3%	$1,253	0%	2.1	22%
B	none	822	–	$96	–	63.3	–	$1,170	–	2.5	–
B	12 month	631	23%	$74	$22	69.0	-9%	$1,228	-5%	2.0	22%
B	summer	631	23%	$74	$22	65.1	-3%	$1,166	0%	2.0	22%
C	none	449	–	$53	–	70.4	–	$1,220	–	1.9	–
C	12 month	343	24%	$40	$12	74.3	-6%	$1,264	-4%	1.6	17%
C	summer	343	24%	$40	$12	72.1	-2%	$1,228	-1%	1.6	17%

	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. U-factor and SHGC are for the total window including frame. 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.

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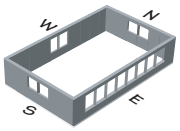
TABLE 10: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: Boston, Massachusetts

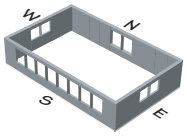
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	981	–	$115	–	68.8	–	$1,286	–	3.3	–
A	12 month	670	32%	$78	$36	74.1	-8%	$1,319	-2%	2.1	37%
A	summer	670	32%	$78	$36	71.0	-3%	$1,268	1%	2.1	37%
B	none	941	–	$110	–	64.0	–	$1,203	–	3.1	–
B	12 month	652	31%	$76	$34	68.8	-7%	$1,229	-2%	2.0	37%
B	summer	652	31%	$76	$34	65.9	-3%	$1,182	2%	2.0	37%
C	none	505	–	$59	–	70.8	–	$1,236	–	2.1	–
C	12 month	351	30%	$41	$18	74.2	-5%	$1,264	-2%	1.5	28%
C	summer	351	30%	$41	$18	72.5	-2%	$1,237	0%	1.5	28%

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

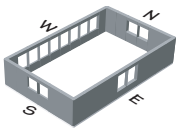
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	868	–	$102	–	60.1	–	$1,127	–	3.1	–
A	12 month	631	27%	$74	$28	72.1	-20%	$1,278	-13%	2.1	33%
A	summer	585	33%	$68	$33	63.5	-6%	$1,132	0%	2.0	37%
B	none	834	–	$98	–	55.8	–	$1,050	–	3.0	–
B	12 month	617	26%	$72	$25	66.9	-20%	$1,192	-13%	2.0	33%
B	summer	572	31%	$67	$31	58.8	-5%	$1,053	0%	1.9	36%
C	none	446	–	$52	–	65.6	–	$1,141	–	2.0	–
C	12 month	337	24%	$39	$13	73.2	-12%	$1,246	-9%	1.6	22%
C	summer	316	29%	$37	$15	68.3	-4%	$1,162	-2%	1.5	26%

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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	965	–	$113	–	70.3	–	$1,308	–	3.7	–
A	12 month	677	30%	$79	$34	74.7	-6%	$1,329	-2%	2.2	40%
A	summer	677	30%	$79	$34	71.7	-2%	$1,281	2%	2.2	40%
B	none	919	–	$107	–	65.3	–	$1,220	–	3.6	–
B	12 month	658	28%	$77	$31	69.2	-6%	$1,237	-1%	2.1	40%
B	summer	658	28%	$77	$31	66.4	-2%	$1,192	2%	2.1	40%
C	none	512	–	$60	–	71.6	–	$1,250	–	2.5	–
C	12 month	363	29%	$42	$17	74.4	-4%	$1,269	-2%	1.7	33%
C	summer	363	29%	$42	$17	72.8	-2%	$1,243	1%	1.7	33%

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Seattle, Washington

HDD65: 4867 / CDD65: 127

Tables 13–16 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 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.

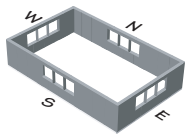
As shown in Table 13, the awnings reduce the cooling energy 61–70 percent compared to a completely unshaded case. However, because awnings block passive solar gain in winter, heating energy increases by 3–4 percent if the awnings remain in place 12 months a year. By removing or retracting the awnings in winter while keeping them in place in the summer, the lowest energy use is achieved.

The total cost of heating and cooling is reduced 1–4 percent in Seattle 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 35–39 percent in Seattle. This may contribute to the ability to downsize the mechanical cooling system.

Tables 14, 15 and 16 show similar results for a house in Seattle with the windows predominantly facing to the east, south, and west, respectively. In all three cases, the cooling energy use and cooling peak demand without awnings is higher than in the equal orientation case. This is particularly true with peak demand in the west orientation with savings up to 49 percent. Generally, this means the beneficial impact of the awnings is greater with predominantly east, south, and west orientations than in the equal orientation case.

TABLE 13: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	252	–	$29	–	49.5	–	$636	–	2.9	–
A	12 month	98	61%	$11	$18	51.5	-4%	$633	1%	1.8	39%
A	summer	98	61%	$11	$18	50.0	-1%	$615	3%	1.8	39%
B	none	240	–	$28	–	45.6	–	$587	–	2.8	–
B	12 month	96	60%	$11	$17	47.2	-4%	$581	1%	1.7	39%
B	summer	96	60%	$11	$17	45.8	0%	$564	4%	1.7	39%
C	none	107	–	$12	–	50.5	–	$623	–	2.0	–
C	12 month	32	70%	$4	$9	52.2	-3%	$630	-1%	1.3	35%
C	summer	32	70%	$4	$9	51.3	-2%	$620	1%	1.3	35%

	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. U-factor and SHGC are for the total window including frame. 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.

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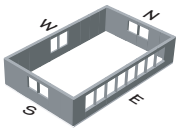
TABLE 14: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: Seattle, Washington

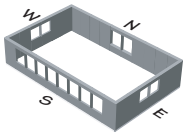
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	214	–	$25	–	49.9	–	$635	–	2.2	–
A	12 month	103	52%	$12	$13	51.3	-3%	$631	1%	1.7	23%
A	summer	103	52%	$12	$13	50.1	0%	$617	3%	1.7	23%
B	none	204	–	$24	–	46.0	–	$586	–	2.1	–
B	12 month	100	51%	$12	$12	47.0	-2%	$580	1%	1.6	23%
B	summer	100	51%	$12	$12	46.0	0%	$567	3%	1.6	23%
C	none	108	–	$13	–	50.8	–	$626	–	1.6	–
C	12 month	34	69%	$4	$9	52.0	-3%	$628	0%	1.3	23%
C	summer	34	69%	$4	$9	51.4	-1%	$621	1%	1.3	23%

TABLE 15: IMPACT OF AWNINGS ON A HOUSE WITH SOUTH ORIENTED WINDOWS
Location: Seattle, Washington

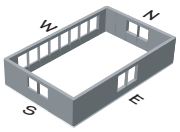
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	336	–	$39	–	46.4	–	$613	–	3.8	–
A	12 month	94	72%	$11	$28	50.6	-9%	$621	-1%	1.8	52%
A	summer	89	73%	$10	$29	47.5	-2%	$584	5%	1.8	53%
B	none	320	–	$37	–	42.6	–	$565	–	3.6	–
B	12 month	92	71%	$11	$27	46.3	-9%	$570	-1%	1.7	51%
B	summer	87	73%	$10	$27	43.5	-2%	$535	5%	1.7	53%
C	none	135	–	$16	–	48.6	–	$604	–	2.3	–
C	12 month	30	78%	$3	$12	51.8	-7%	$625	-3%	1.3	44%
C	summer	28	80%	$3	$13	50.2	-3%	$605	0%	1.3	45%

TABLE 16: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	358	–	$42	–	51.3	–	$675	–	4.0	–
A	12 month	110	69%	$13	$29	51.7	-1%	$637	6%	2.1	49%
A	summer	110	69%	$13	$29	50.7	1%	$625	7%	2.1	49%
B	none	338	–	$40	–	47.2	–	$623	–	3.8	–
B	12 month	103	69%	$12	$28	47.4	0%	$585	6%	2.0	48%
B	summer	103	69%	$12	$28	46.4	2%	$573	8%	2.0	48%
C	none	133	–	$16	–	51.6	–	$640	–	2.5	–
C	12 month	37	72%	$4	$11	52.2	-1%	$631	1%	1.4	43%
C	summer	37	72%	$4	$11	51.7	0%	$624	2%	1.4	43%

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Albuquerque, New Mexico

HDD65: 4361 / CDD65: 1210

Tables 21–24 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 21 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.

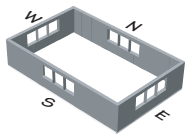
As shown in Table 21, the awnings reduce the cooling energy 28–31 percent compared to a completely unshaded case. However, because awnings block passive solar gain in winter, heating energy increases by 19–33 percent if the awnings remain in place 12 months a year. By removing or retracting the awnings in winter while keeping them in place in the summer, the lowest energy use is achieved.

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

Table 21 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.

Tables 22, 23 and 24 show similar results for a house in Albuquerque with the windows predominantly facing to the east, south, and west, respectively. In all three cases, the cooling energy use and cooling peak demand without awnings is higher than in the equal orientation case. This is particularly true with peak demand in the west orientation with savings up to 43 percent. Generally, this means the beneficial impact of the awnings is greater with predominantly east, south, and west orientations than in the equal orientation case.

TABLE 21: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	1881	–	$220	–	29.7	–	$572	–	2.7	–
A	12 month	1297	31%	$152	$68	39.3	-32%	$610	-7%	2.2	17%
A	summer	1297	31%	$152	$68	32.5	-9%	$531	7%	2.2	17%
B	none	1805	–	$211	–	26.9	–	$531	–	2.6	–
B	12 month	1260	30%	$147	$64	35.7	-33%	$564	-6%	2.2	16%
B	summer	1260	30%	$147	$64	29.2	-9%	$490	8%	2.2	16%
C	none	1144	–	$134	–	34.3	–	$533	–	2.0	–
C	12 month	820	28%	$96	$38	40.7	-19%	$566	-6%	1.7	11%
C	summer	820	28%	$96	$38	36.7	-7%	$520	2%	1.7	11%

	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. U-factor and SHGC are for the total window including frame. 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

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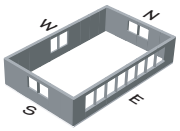
TABLE 22: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: Albuquerque, New Mexico

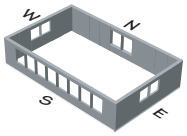
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	2159	–	$253	–	30.4	–	$615	–	3.0	–
A	12 month	1326	39%	$155	$97	38.9	-28%	$609	1%	2.2	27%
A	summer	1326	39%	$155	$97	33.1	-9%	$543	12%	2.2	27%
B	none	2058	–	$241	–	27.6	–	$571	–	2.9	–
B	12 month	1286	38%	$150	$90	35.4	-28%	$563	1%	2.1	26%
B	summer	1286	38%	$150	$90	29.9	-8%	$501	12%	2.1	26%
C	none	1268	–	$148	–	34.7	–	$553	–	2.0	–
C	12 month	837	34%	$98	$50	40.5	-17%	$566	-2%	1.7	12%
C	summer	837	34%	$98	$50	37.1	-7%	$528	5%	1.7	12%

TABLE 23: IMPACT OF AWNINGS ON A HOUSE WITH SOUTH ORIENTED WINDOWS
Location: Albuquerque, New Mexico

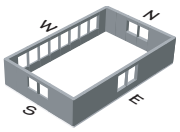
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	1844	–	$216	–	23.9	–	$502	–	2.7	–
A	12 month	1259	32%	$147	$68	37.1	-55%	$579	-15%	2.2	19%
A	summer	1236	33%	$145	$71	26.8	-12%	$460	8%	2.2	19%
B	none	1769	–	$207	–	21.4	–	$464	–	2.6	–
B	12 month	1221	31%	$143	$64	33.6	-57%	$535	-15%	2.1	18%
B	summer	1201	32%	$141	$66	23.9	-12%	$422	9%	2.1	19%
C	none	1106	–	$129	–	28.9	–	$467	–	1.9	–
C	12 month	802	28%	$94	$36	39.7	-37%	$552	-18%	1.7	9%
C	summer	788	29%	$92	$37	31.9	-11%	$462	1%	1.7	11%

TABLE 24: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	2168	–	$254	–	32.2	–	$637	–	3.9	–
A	12 month	1333	39%	$156	$98	39.4	-22%	$615	3%	2.2	43%
A	summer	1333	39%	$156	$98	34.1	-6%	$555	13%	2.2	43%
B	none	2072	–	$242	–	29.3	–	$591	–	3.8	–
B	12 month	1295	38%	$151	$91	35.8	-22%	$569	4%	2.2	43%
B	summer	1295	38%	$151	$91	30.8	-5%	$512	13%	2.2	43%
C	none	1275	–	$149	–	35.7	–	$566	–	2.7	–
C	12 month	839	34%	$98	$51	40.6	-14%	$568	0%	1.7	35%
C	summer	839	34%	$98	$51	37.5	-5%	$532	6%	1.7	35%

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Phoenix, Arizona

HDD65: 1153 / CDD65: 3814

Tables 25–28 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 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 14–21 percent compared to a completely unshaded case. However, because awnings block passive solar gain in winter, heating energy increases by 28–39 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 summer, the lowest energy use is achieved.

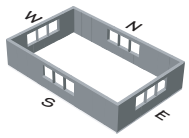
The total cost of heating and cooling is reduced 13–18 percent in Phoenix when awnings are only used in the summer, but the total cost is increased if they remain in place 12 months a year.

Table 25 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.

Tables 26, 27 and 28 show similar results for a house in Phoenix with the windows predominantly facing to the east, south, and west, respectively. In all three cases, the cooling energy use and cooling peak demand without awnings is higher than in the equal orientation case. This is particularly true with peak demand in the west orientation with savings up to 31 percent. Generally, this means the beneficial impact of the awnings is greater with predominantly east, south, and west orientations than in the equal orientation case.

TABLE 25: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	7438	–	$870	–	5.4	–	$992	–	5.6	–
A	12 month	5905	21%	$691	$179	7.6	-39%	$829	16%	4.9	13%
A	summer	6011	19%	$703	$167	5.5	-1%	$816	18%	4.9	13%
B	none	7171	–	$839	–	4.8	–	$950	–	5.3	–
B	12 month	5739	20%	$671	$167	6.6	-39%	$796	16%	4.7	12%
B	summer	5838	19%	$683	$156	4.8	0%	$785	17%	4.7	12%
C	none	5708	–	$668	–	6.3	–	$789	–	4.6	–
C	12 month	4837	15%	$566	$102	8.1	-28%	$704	11%	4.2	9%
C	summer	4884	14%	$571	$96	6.5	-2%	$689	13%	4.2	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. U-factor and SHGC are for the total window including frame. 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.

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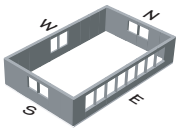
TABLE 26: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: Phoenix, Arizona

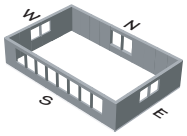
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	7602	–	$889	–	5.4	–	$1,012	–	5.2	–
A	12 month	5951	22%	$696	$193	7.3	-36%	$832	18%	4.8	6%
A	summer	6006	21%	$703	$187	5.4	1%	$813	20%	4.8	6%
B	none	7313	–	$856	–	4.7	–	$967	–	5.0	–
B	12 month	5775	21%	$676	$180	6.4	-36%	$798	17%	4.6	6%
B	summer	5824	20%	$681	$174	4.6	2%	$781	19%	4.6	6%
C	none	5742	–	$672	–	6.4	–	$794	–	4.3	–
C	12 month	4847	16%	$567	$105	8.0	-25%	$703	11%	4.2	4%
C	summer	4876	15%	$571	$101	6.4	0%	$687	13%	4.2	4%

TABLE 27: IMPACT OF AWNINGS ON A HOUSE WITH SOUTH ORIENTED WINDOWS
Location: Phoenix, Arizona

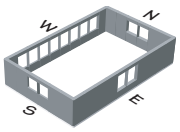
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	7505	–	$878	–	4.6	–	$989	–	5.1	–
A	12 month	5848	22%	$684	$194	6.8	-50%	$813	18%	4.8	5%
A	summer	5983	20%	$700	$178	4.7	-2%	$802	19%	4.5	11%
B	none	7224	–	$845	–	4.0	–	$947	–	4.9	–
B	12 month	5684	21%	$665	$180	6.0	-49%	$781	18%	4.7	5%
B	summer	5802	20%	$679	$166	4.0	-1%	$771	19%	4.4	11%
C	none	5666	–	$663	–	5.1	–	$768	–	4.3	–
C	12 month	4793	15%	$561	$102	7.7	-51%	$693	10%	4.2	3%
C	summer	4801	15%	$562	$101	5.2	-2%	$662	14%	3.9	9%

TABLE 28: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	8122	–	$950	–	6.6	–	$1,092	–	7.0	–
A	12 month	6046	26%	$707	$243	7.9	-19%	$851	22%	4.9	31%
A	summer	6149	24%	$719	$231	6.5	2%	$845	23%	4.9	31%
B	none	7814	–	$914	–	5.8	–	$1,044	–	6.7	–
B	12 month	5868	25%	$686	$228	6.9	-18%	$816	22%	4.7	30%
B	summer	5967	24%	$698	$216	5.6	3%	$812	22%	4.7	30%
C	none	6051	–	$708	–	7.2	–	$843	–	5.3	–
C	12 month	4903	19%	$574	$134	8.2	-14%	$714	15%	4.2	20%
C	summer	4945	18%	$579	$129	7.1	2%	$704	16%	4.2	20%

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St. Louis, Missouri

HDD65: 5021 / CDD65: 1437

Tables 41–44 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 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 14–17 percent compared to a completely unshaded case. However, 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 summer, the lowest energy use is achieved.

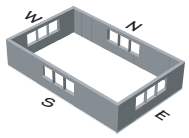
The total cost of heating and cooling is reduced 1–3 percent in St. Louis when awnings are only used in the summer, but the total cost is increased if they remain in place 12 months a year.

Table 41 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.

Tables 42, 43 and 44 show similar results for a house in St. Louis with the windows predominantly facing to the east, south, and west, respectively. In all three cases, the cooling energy use and cooling peak demand without awnings is higher than in the equal orientation case. This is particularly true with peak demand in the west orientation with savings up to 33 percent. Generally, this means the beneficial impact of the awnings is greater with predominantly east, south, and west orientations than in the equal orientation case.

TABLE 41: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	2366	–	$277	–	54.8	–	$927	–	3.9	–
A	12 month	1970	17%	$231	$46	60.0	-9%	$950	-2%	3.3	16%
A	summer	1970	17%	$231	$46	55.9	-2%	$899	3%	3.3	16%
B	none	2283	–	$267	–	50.8	–	$867	–	3.7	–
B	12 month	1918	16%	$224	$43	55.4	-9%	$888	-2%	3.1	15%
B	summer	1918	16%	$224	$43	51.6	-2%	$840	3%	3.1	15%
C	none	1571	–	$184	–	56.3	–	$863	–	3.0	–
C	12 month	1358	14%	$159	$25	59.8	-6%	$885	-3%	2.7	11%
C	summer	1358	14%	$159	$25	57.5	-2%	$856	1%	2.7	11%

	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. U-factor and SHGC are for the total window including frame. 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.

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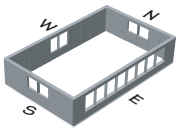
TABLE 42: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: St. Louis, Missouri

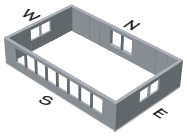
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	2538	–	$297	–	55.4	–	$952	–	4.2	–
A	12 month	2013	21%	$236	$61	59.7	-8%	$951	0%	3.2	23%
A	summer	2013	21%	$236	$61	56.4	-2%	$910	4%	3.2	23%
B	none	2448	–	$286	–	51.4	–	$892	–	4.0	–
B	12 month	1960	20%	$229	$57	55.2	-7%	$890	0%	3.1	23%
B	summer	1960	20%	$229	$57	52.1	-1%	$851	5%	3.1	23%
C	none	1683	–	$197	–	56.6	–	$879	–	3.0	–
C	12 month	1372	18%	$161	$36	59.6	-5%	$884	-1%	2.6	13%
C	summer	1372	18%	$161	$36	57.8	-2%	$861	2%	2.6	13%

TABLE 43: IMPACT OF AWNINGS ON A HOUSE WITH SOUTH ORIENTED WINDOWS
Location: St. Louis, Missouri

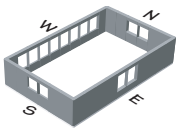
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the south, and 20 sq ft each on the north, east, and west.



WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	2223	–	$260	–	49.2	–	$842	–	4.5	–
A	12 month	1934	13%	$226	$34	58.1	-18%	$923	-10%	3.3	26%
A	summer	1826	18%	$214	$46	50.7	-3%	$820	3%	3.1	30%
B	none	2133	–	$250	–	45.4	–	$786	–	4.3	–
B	12 month	1883	12%	$220	$29	53.7	-18%	$863	-10%	3.2	26%
B	summer	1777	17%	$208	$42	46.8	-3%	$766	3%	3.0	30%
C	none	1453	–	$170	–	52.4	–	$802	–	3.2	–
C	12 month	1335	8%	$156	$14	58.9	-13%	$872	-9%	2.7	17%
C	summer	1260	13%	$147	$23	54.4	-4%	$807	-1%	2.5	22%

TABLE 44: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	2614	–	$306	–	56.7	–	$976	–	4.9	–
A	12 month	2022	23%	$237	$69	60.2	-6%	$958	2%	3.3	33%
A	summer	2022	23%	$237	$69	57.2	-1%	$920	6%	3.3	33%
B	none	2514	–	$294	–	52.6	–	$914	–	4.7	–
B	12 month	1965	22%	$230	$64	55.6	-6%	$895	2%	3.2	32%
B	summer	1965	22%	$230	$64	52.8	0%	$860	6%	3.2	32%
C	none	1681	–	$197	–	57.4	–	$888	–	3.4	–
C	12 month	1383	18%	$162	$35	59.8	-4%	$888	0%	2.7	20%
C	summer	1383	18%	$162	$35	58.1	-1%	$866	2%	2.7	20%

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Sacramento, California

HDD65: 2793 / CDD65: 1144

Tables 45–48 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 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 37–39 percent compared to a completely unshaded case. However, because awnings block passive solar gain in winter, heating energy increases by 11–17 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 summer, the lowest energy use is achieved.

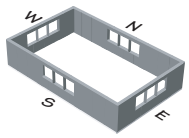
The total cost of heating and cooling is reduced 13–21 percent in Sacramento when awnings are only used in the summer, but the total cost is increased if they remain in place 12 months a year.

Table 45 also shows that awnings reduce peak electricity demand by 15–21 percent in Sacramento. This may contribute to the ability to downsize the mechanical cooling system.

Tables 46, 47 and 48 show similar results for a house in Sacramento with the windows predominantly facing to the east, south, and west, respectively. In all three cases, the cooling energy use and cooling peak demand without awnings is higher than in the equal orientation case. This is particularly true with peak demand in the west orientation with savings up to 39 percent. Generally, this means the beneficial impact of the awnings is greater with predominantly east, south, and west orientations than in the equal orientation case.

TABLE 45: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	1787	–	$209	–	19.0	–	$530	–	3.5	–
A	12 month	1082	39%	$127	$82	22.2	-17%	$454	14%	2.8	21%
A	summer	1082	39%	$127	$82	19.6	-3%	$421	21%	2.8	21%
B	none	1708	–	$200	–	17.2	–	$494	–	3.4	–
B	12 month	1060	38%	$124	$76	20.0	-17%	$422	15%	2.6	21%
B	summer	1060	38%	$124	$76	17.6	-2%	$392	21%	2.6	21%
C	none	1070	–	$125	–	21.4	–	$441	–	2.7	–
C	12 month	671	37%	$78	$47	23.8	-11%	$405	8%	2.3	15%
C	summer	671	37%	$78	$47	22.2	-4%	$385	13%	2.3	15%

	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. U-factor and SHGC are for the total window including frame. 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

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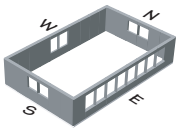
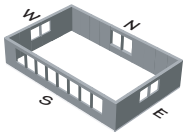
TABLE 46: IMPACT OF AWNINGS ON A HOUSE WITH EAST ORIENTED WINDOWS
Location: Sacramento, California
Note: The 300 sq ft of window area is distributed as follows—240 sq ft on the east, and 20 sq ft each on the north, south, and west.



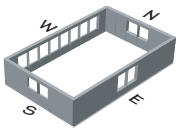
WINDOW	AWNING	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	1814	–	$212	–	19.8	–	$544	–	3.1	–
A	12 month	1100	39%	$129	$84	22.2	-12%	$456	16%	2.7	13%
A	summer	1100	39%	$129	$84	20.2	-2%	$431	21%	2.7	13%
B	none	1727	–	$202	–	17.9	–	$506	–	3.0	–
B	12 month	1072	38%	$125	$77	20.0	-12%	$424	16%	2.6	13%
B	summer	1072	38%	$125	$77	18.1	-1%	$401	21%	2.6	13%
C	none	1059	–	$124	–	21.9	–	$445	–	2.5	–
C	12 month	680	36%	$80	$44	23.7	-9%	$406	9%	2.2	9%
C	summer	680	36%	$80	$44	22.6	-3%	$391	12%	2.2	9%

TABLE 47: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	1907	–	$223	–	16.1	–	$514	–	3.7	–
A	12 month	1054	45%	$123	$100	21.3	-32%	$437	15%	2.8	26%
A	summer	1054	45%	$123	$100	16.9	-5%	$383	25%	2.8	26%
B	none	1822	–	$213	–	14.4	–	$479	–	3.5	–
B	12 month	1027	44%	$120	$93	19.1	-32%	$406	15%	2.6	26%
B	summer	1027	44%	$120	$93	15.0	-4%	$355	26%	2.6	26%
C	none	1095	–	$128	–	19.2	–	$418	–	2.5	–
C	12 month	657	40%	$77	$51	23.4	-22%	$398	5%	2.3	10%
C	summer	657	40%	$77	$51	20.2	-5%	$358	14%	2.3	10%

TABLE 48: 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	COOLING Energy (kWh)	COOLING Energy % Saved	COOLING Cost ($)	COOLING Cost $ Saved	HEATING Energy (MBTU)	HEATING Energy % Saved	HEAT+COOL Cost ($)	HEAT+COOL Cost % Saved	COOLING PEAK (kW)	COOLING PEAK % Saved
A	none	2196	–	$257	–	20.3	–	$614	–	4.6	–
A	12 month	1148	48%	$134	$123	22.3	-10%	$466	24%	2.8	39%
A	summer	1148	48%	$134	$123	20.3	0%	$440	28%	2.8	39%
B	none	2102	–	$246	–	18.4	–	$574	–	4.4	–
B	12 month	1120	47%	$131	$115	20.1	-9%	$434	25%	2.7	38%
B	summer	1120	47%	$131	$115	18.2	1%	$410	29%	2.7	38%
C	none	1240	–	$145	–	22.4	–	$481	–	3.3	–
C	12 month	702	43%	$82	$63	23.8	-7%	$411	15%	2.3	30%
C	summer	702	43%	$82	$63	22.6	-1%	$395	18%	2.3	30%

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