Tucson, Arizona

Awnings

Typical Year (TMY3) HDD65 1596 / CDD65 3019, Hot Year (2007) HDD65 1470 / CDD65 3567

Tables 51-54 show the impact of awnings on a typical house in Tucson with different window orientations over a typical year. Tables 55-58 repeat this analysis for a hot year in Tucson. The impact varies depending on the type of window glazing and whether the awnings are in place all twelve months or only during the cooling season. For a house with windows equally distributed in the four orientations, Table 51 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 for heating and cooling. In all cases, the net and percent savings are in reference to a house with no shading.

Table 51 shows that awnings reduce cooling energy use by 17-26 percent as compared to the unshaded house. The higher savings are for awnings at 165 degrees over windows with clear glazings, while the lower savings are for awnings at 90 degrees over windows with Low-E glazings. Because awnings block useful solar gain in winter, heating energy use increases when the awnings remain in place 12 months a year. Using the awnings only during the cooling season produces the largest net energy savings. The net energy savings are from 9 to 12 percent in Tucson when awnings are used only during the cooling season from February through November, while the savings are from 4 to 6 percent when they are deployed throughout the year.

Table 51 also shows that awnings reduce peak electricity demand by 9-15 percent in Tucson, with larger reductions for the clear glazings and smaller reductions for the Low-E glazing. Tables 52, 53, and 54 show results for houses in Tucson where the windows predominantly face to the east, south, and west, respectively. Both the cooling energy savings and the peak demand reductions are largest on west-facing awnings. Tables 55-58 show the impact of awnings on a particularly hot year (2007) in Tucson. The main effect is to increase the cooling savings by 24 percent due to the hotter or longer summer.

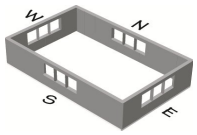


Table 51. Impact of awnings on a house in Tucson, Arizona with equally distributed windows on a typical year

Window Type	Awning	Operation	Heating			Cooling				Heat+Cool			Peak Cooling		
			Energy (MBtu)	Savings (MBtu)	Savings ($)	Cool (kWh)	Savings (kWh)	Savings ($)	Savings (%)	Cost ($)	Savings ($)	Savings (%)	Peak (kW)	Savings (kW)	Savings (%)
Single Clear	None		16.9			6794				925			5.43		
	Black Awning	summer	19.9	-3.1	-49	5319	1475	143	22	831	94	10	4.69	0.74	14
	90°	12 month	22.8	-5.9	-93	5296	1498	145	22	873	52	6	4.69	0.74	14
	Linen Awning	summer	19.4	-2.5	-40	5516	1278	124	19	841	84	9	4.81	0.62	11
	90°	12 month	21.7	-4.9	-77	5495	1299	126	19	876	49	5	4.81	0.62	11
	Black Awning	summer	21.1	-4.3	-67	5046	1748	169	26	823	102	11	4.59	0.84	15
	165°	12 month	25.1	-8.3	-131	5020	1774	172	26	884	41	4	4.59	0.84	15
	Linen Awning	summer	20.1	-3.2	-51	5312	1482	144	22	833	92	10	4.74	0.70	13
	165°	12 month	23.2	-6.4	-101	5289	1505	146	22	880	45	5	4.74	0.70	13
Double Clear	None		12.4			5981				775			4.68		
	Black Awning	summer	14.8	-2.4	-39	4789	1192	116	20	698	77	10	4.14	0.54	12
	90°	12 month	17.2	-4.9	-77	4772	1209	117	20	735	40	5	4.14	0.54	12
	Linen Awning	summer	14.4	-2.0	-32	4950	1031	100	17	707	68	9	4.23	0.45	10
	90°	12 month	16.4	-4.0	-64	4935	1046	101	17	738	38	5	4.23	0.45	10
	Black Awning	summer	15.7	-3.3	-53	4567	1414	137	24	691	84	11	4.04	0.64	14
	165°	12 month	19.1	-6.7	-106	4548	1433	139	24	743	33	4	4.04	0.64	14
	Linen Awning	summer	14.9	-2.6	-40	4784	1197	116	20	700	76	10	4.16	0.52	11
	165°	12 month	17.6	-5.2	-82	4767	1214	118	20	740	35	5	4.16	0.52	11
Double HiSol LowE	None		10.4			5850				731			4.50		
	Black Awning	summer	12.6	-2.2	-35	4672	1178	114	20	652	80	11	3.99	0.52	11
	90°	12 month	14.8	-4.4	-70	4656	1194	116	20	686	45	6	3.99	0.52	11
	Linen Awning	summer	12.2	-1.8	-28	4837	1013	98	17	661	70	10	4.08	0.43	9
	90°	12 month	14.1	-3.7	-59	4822	1028	100	18	690	41	6	4.08	0.43	9
	Black Awning	summer	13.4	-3.0	-47	4451	1399	136	24	643	88	12	3.89	0.62	14
	165°	12 month	16.5	-6.2	-98	4434	1416	137	24	691	40	5	3.89	0.62	14
	Linen Awning	summer	12.7	-2.3	-36	4668	1182	115	20	653	78	11	4.00	0.50	11
	165°	12 month	15.2	-4.8	-76	4651	1199	116	20	691	40	5	4.00	0.50	11

Window Type	Frame	U-factor	SHGC
Single Clear	Aluminum	1.16	0.77
Double Clear	Wood/vinyl	0.49	0.56
Double HiSol LowE	Wood/vinyl	0.37	0.53

The costs shown here are annual costs for heating and cooling only and thus will be less than the total utility bill. Heating is assumed to be provided by a gas furnace and cooling by a central air-conditioner. Electricity costs used in the analysis are 9.7 cents per kWh and natural gas costs are $16.32 per MBTU, which are the average costs in 2009 for the state of Arizona according to the Energy Information Administration (see Appendix E for details).

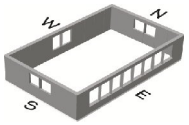


Table 52. Impact of awnings on a house in Tucson, Arizona with east-facing windows on a typical year

Window Type	Awning	Operation	Heating			Cooling				Heat+Cool			Peak Cooling		
			Energy (MBtu)	Savings (MBtu)	Savings ($)	Cool (kWh)	Savings (kWh)	Savings ($)	Savings (%)	Cost ($)	Savings ($)	Savings (%)	Peak (kW)	Savings (kW)	Savings (%)
Single Clear	None		16.3			7193				954			5.26		
	Black Awning	summer	19.5	-3.2	-51	5286	1907	185	27	820	134	14	4.61	0.65	12
	90°	12 month	22.2	-6.0	-95	5275	1918	186	27	863	91	10	4.61	0.65	12
	Linen Awning	summer	18.9	-2.6	-42	5549	1644	159	23	837	118	12	4.70	0.56	11
	90°	12 month	21.3	-5.0	-79	5539	1654	160	23	873	81	9	4.70	0.56	11
	Black Awning	summer	21.4	-5.2	-82	4859	2334	226	32	810	144	15	4.49	0.77	15
	165°	12 month	25.2	-8.9	-142	4847	2346	227	33	869	86	9	4.49	0.77	15
	Linen Awning	summer	20.1	-3.9	-61	5231	1962	190	27	825	129	14	4.61	0.66	12
	165°	12 month	23.2	-6.9	-110	5220	1973	191	27	873	81	9	4.61	0.66	12
Double Clear	None		11.9			6361				805			4.62		
	Black Awning	summer	14.5	-2.6	-41	4785	1576	153	25	694	112	14	4.09	0.53	11
	90°	12 month	16.9	-4.9	-78	4777	1584	153	25	730	75	9	4.09	0.53	11
	Linen Awning	summer	14.1	-2.1	-34	5006	1355	131	21	707	98	12	4.17	0.45	10
	90°	12 month	16.1	-4.1	-66	4998	1363	132	21	739	67	8	4.17	0.45	10
	Black Awning	summer	16.0	-4.1	-65	4433	1928	187	30	683	122	15	3.99	0.63	14
	165°	12 month	19.3	-7.4	-116	4424	1937	188	30	734	71	9	3.99	0.63	14
	Linen Awning	summer	15.0	-3.1	-48	4742	1619	157	25	697	108	13	4.09	0.53	11
	165°	12 month	17.6	-5.7	-90	4733	1628	158	26	738	67	8	4.09	0.53	11
Double HiSol LowE	None		9.8			6155				752			4.42		
	Black Awning	summer	12.1	-2.3	-36	4629	1526	148	25	641	111	15	3.90	0.52	12
	90°	12 month	14.4	-4.6	-72	4621	1534	149	25	676	76	10	3.90	0.52	12
	Linen Awning	summer	11.7	-1.9	-30	4842	1313	127	21	655	97	13	3.97	0.45	10
	90°	12 month	13.7	-3.8	-61	4834	1321	128	21	685	67	9	3.97	0.45	10
	Black Awning	summer	13.5	-3.6	-58	4287	1868	181	30	629	123	16	3.80	0.61	14
	165°	12 month	16.6	-6.8	-107	4277	1878	182	31	677	75	10	3.80	0.61	14
	Linen Awning	summer	12.6	-2.7	-43	4588	1567	152	25	644	108	14	3.89	0.53	12
	165°	12 month	15.1	-5.3	-83	4579	1576	153	26	683	69	9	3.89	0.53	12

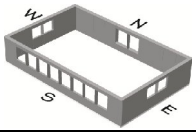


Table 53. Impact of awnings on a house in Tucson, Arizona with south-facing windows on a typical year

Window Type	Awning	Operation	Heating			Cooling				Heat+Cool			Peak Cooling		
			Energy (MBtu)	Savings (MBtu)	Savings ($)	Cool (kWh)	Savings (kWh)	Savings ($)	Savings (%)	Cost ($)	Savings ($)	Savings (%)	Peak (kW)	Savings (kW)	Savings (%)
Single Clear	None		14.7			6663				878			5.07		
	Black Awning	summer	18.5	-3.8	-60	4989	1674	162	25	776	102	12	4.56	0.52	10
	90°	12 month	21.8	-7.1	-113	4989	1674	162	25	829	50	6	4.56	0.52	10
	Linen Awning	summer	17.5	-2.9	-45	5179	1484	144	22	779	99	11	4.63	0.45	9
	90°	12 month	20.0	-5.4	-85	5179	1484	144	22	819	59	7	4.63	0.45	9
	Black Awning	summer	19.7	-5.0	-79	4835	1828	177	27	780	98	11	4.47	0.61	12
	165°	12 month	25.4	-10.7	-169	4835	1828	177	27	870	8	1	4.47	0.61	12
	Linen Awning	summer	18.1	-3.5	-55	5065	1598	155	24	778	100	11	4.56	0.52	10
	165°	12 month	22.0	-7.4	-116	5065	1598	155	24	840	39	4	4.56	0.52	10
Double Clear	None		10.8			5837				736			4.46		
	Black Awning	summer	13.8	-3.0	-48	4524	1313	127	22	657	80	11	4.04	0.42	9
	90°	12 month	16.6	-5.8	-92	4524	1313	127	22	701	35	5	4.04	0.42	9
	Linen Awning	summer	13.1	-2.3	-36	4677	1160	112	20	660	76	10	4.10	0.36	8
	90°	12 month	15.2	-4.4	-70	4677	1160	112	20	694	42	6	4.10	0.36	8
	Black Awning	summer	14.7	-4.0	-63	4387	1450	141	25	658	78	11	3.96	0.49	11
	165°	12 month	19.4	-8.7	-137	4387	1450	141	25	733	3	0	3.96	0.49	11
	Linen Awning	summer	13.5	-2.8	-44	4578	1259	122	22	658	78	11	4.04	0.42	9
	165°	12 month	16.8	-6.0	-95	4578	1259	122	22	709	27	4	4.04	0.42	9
Double HiSol LowE	None		9.0			5552				680			4.24		
	Black Awning	summer	11.7	-2.7	-42	4276	1276	124	23	599	82	12	3.85	0.39	9
	90°	12 month	14.2	-5.2	-82	4276	1276	124	23	639	41	6	3.85	0.39	9
	Linen Awning	summer	11.0	-2.0	-32	4429	1123	109	20	604	77	11	3.91	0.33	8
	90°	12 month	12.9	-3.9	-62	4429	1123	109	20	634	47	7	3.91	0.33	8
	Black Awning	summer	12.5	-3.5	-55	4141	1411	137	25	599	81	12	3.77	0.47	11
	165°	12 month	16.8	-7.8	-123	4141	1411	137	25	667	13	2	3.77	0.47	11
	Linen Awning	summer	11.4	-2.4	-39	4327	1225	119	22	601	80	12	3.85	0.39	9
	165°	12 month	14.4	-5.4	-85	4327	1225	119	22	647	33	5	3.85	0.39	9

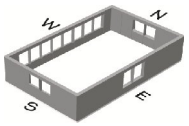


Table 54. Impact of awnings on a house in Tucson, Arizona with west-facing windows on a typical year

Window Type	Awning	Operation	Heating			Cooling				Heat+Cool			Peak Cooling		
			Energy (MBtu)	Savings (MBtu)	Savings ($)	Cool (kWh)	Savings (kWh)	Savings ($)	Savings (%)	Cost ($)	Savings ($)	Savings (%)	Peak (kW)	Savings (kW)	Savings (%)
Single Clear	None		18.9			7422				1019			7.04		
	Black Awning	summer	21.3	-2.4	-38	5431	1991	193	27	864	155	15	5.03	2.01	29
	90°	12 month	23.5	-4.6	-72	5409	2013	195	27	896	123	12	5.03	2.01	29
	Linen Awning	summer	20.9	-2.0	-31	5695	1727	167	23	882	136	13	5.33	1.71	24
	90°	12 month	22.7	-3.8	-60	5673	1749	169	24	909	109	11	5.33	1.71	24
	Black Awning	summer	22.6	-3.7	-58	5011	2411	234	32	843	176	17	4.60	2.44	35
	165°	12 month	25.8	-6.9	-109	4985	2437	236	33	891	127	12	4.60	2.44	35
	Linen Awning	summer	21.6	-2.7	-43	5378	2044	198	28	864	155	15	4.91	2.13	30
	165°	12 month	24.2	-5.3	-83	5354	2068	200	28	901	117	12	4.91	2.13	30
Double Clear	None		13.9			6531				854			6.02		
	Black Awning	summer	15.9	-1.9	-30	4902	1629	158	25	726	127	15	4.40	1.62	27
	90°	12 month	17.8	-3.8	-61	4885	1646	159	25	755	99	12	4.40	1.62	27
	Linen Awning	summer	15.5	-1.6	-25	5120	1411	137	22	742	112	13	4.64	1.37	23
	90°	12 month	17.1	-3.2	-51	5104	1427	138	22	766	88	10	4.64	1.37	23
	Black Awning	summer	16.9	-2.9	-46	4555	1976	191	30	708	145	17	4.06	1.96	33
	165°	12 month	19.7	-5.7	-91	4537	1994	193	31	751	103	12	4.06	1.96	33
	Linen Awning	summer	16.1	-2.2	-34	4859	1672	162	26	726	128	15	4.34	1.67	28
	165°	12 month	18.3	-4.4	-69	4841	1690	164	26	759	94	11	4.34	1.67	28
Double HiSol LowE	None		11.7			6333				799			5.75		
	Black Awning	summer	13.4	-1.7	-27	4742	1591	154	25	672	127	16	4.19	1.56	27
	90°	12 month	15.2	-3.5	-56	4726	1607	156	25	699	100	13	4.19	1.56	27
	Linen Awning	summer	13.1	-1.4	-23	4954	1379	134	22	688	111	14	4.43	1.32	23
	90°	12 month	14.7	-3.0	-47	4938	1395	135	22	711	88	11	4.43	1.32	23
	Black Awning	summer	14.3	-2.6	-41	4402	1931	187	30	653	146	18	3.85	1.90	33
	165°	12 month	16.9	-5.3	-83	4384	1949	189	31	693	106	13	3.85	1.90	33
	Linen Awning	summer	13.6	-1.9	-31	4698	1635	158	26	671	128	16	4.14	1.61	28
	165°	12 month	15.7	-4.0	-64	4682	1651	160	26	703	96	12	4.14	1.61	28

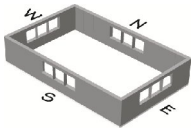


Table 55. Impact of awnings on a house in Tucson, Arizona with equally distributed windows on a hot year

Window Type	Awning	Operation	Heating			Cooling				Heat+Cool			Peak Cooling		
			Energy (MBtu)	Savings (MBtu)	Savings ($)	Cool (kWh)	Savings (kWh)	Savings ($)	Savings (%)	Cost ($)	Savings ($)	Savings (%)	Peak (kW)	Savings (kW)	Savings (%)
Single Clear	None		15.9			8304				1056			5.79		
	Black Awning	summer	17.7	-1.8	-28	6513	1791	174	22	911	145	14	5.04	0.75	13
	90°	12 month	20.9	-5.0	-79	6508	1796	174	22	961	95	9	5.04	0.75	13
	Linen Awning	summer	17.4	-1.5	-23	6759	1545	150	19	930	127	12	5.16	0.63	11
	90°	12 month	20.1	-4.2	-66	6754	1550	150	19	972	84	8	5.16	0.63	11
	Black Awning	summer	18.4	-2.5	-40	6153	2151	208	26	888	169	16	4.95	0.85	15
	165°	12 month	22.8	-6.9	-109	6147	2157	209	26	956	100	9	4.95	0.85	15
	Linen Awning	summer	17.8	-1.9	-31	6487	1817	176	22	911	145	14	5.08	0.72	12
	165°	12 month	21.4	-5.5	-86	6482	1822	177	22	966	90	9	5.08	0.72	12
Double Clear	None		12.1			7347				903			5.00		
	Black Awning	summer	13.5	-1.4	-22	5886	1461	142	20	784	119	13	4.41	0.59	12
	90°	12 month	16.2	-4.1	-65	5882	1465	142	20	826	77	9	4.41	0.59	12
	Linen Awning	summer	13.2	-1.2	-18	6087	1260	122	17	799	104	11	4.50	0.50	10
	90°	12 month	15.6	-3.5	-55	6083	1264	122	17	836	67	7	4.50	0.50	10
	Black Awning	summer	14.0	-2.0	-31	5589	1758	170	24	764	139	15	4.34	0.66	13
	165°	12 month	17.7	-5.6	-89	5584	1763	171	24	821	82	9	4.34	0.66	13
	Linen Awning	summer	13.6	-1.5	-24	5862	1485	144	20	783	120	13	4.45	0.56	11
	165°	12 month	16.6	-4.5	-71	5857	1490	144	20	830	73	8	4.45	0.56	11
Double HiSol LowE	None		10.3			7150				855			4.77		
	Black Awning	summer	11.5	-1.3	-20	5707	1443	140	20	736	120	14	4.19	0.58	12
	90°	12 month	14.1	-3.9	-61	5704	1446	140	20	777	79	9	4.19	0.58	12
	Linen Awning	summer	11.3	-1.0	-16	5904	1246	121	17	751	104	12	4.29	0.49	10
	90°	12 month	13.6	-3.3	-52	5901	1249	121	17	786	69	8	4.29	0.49	10
	Black Awning	summer	12.0	-1.8	-28	5410	1740	169	24	715	141	16	4.12	0.65	14
	165°	12 month	15.6	-5.3	-84	5405	1745	169	24	770	85	10	4.12	0.65	14
	Linen Awning	summer	11.6	-1.4	-22	5681	1469	142	21	735	121	14	4.23	0.54	11
	165°	12 month	14.5	-4.2	-67	5677	1473	143	21	779	76	9	4.23	0.54	11

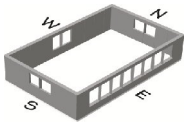


Table 56. Impact of awnings on a house in Tucson, Arizona with east-facing windows on a hot year

Window Type	Awning	Operation	Heating			Cooling				Heat+Cool			Peak Cooling		
			Energy (MBtu)	Savings (MBtu)	Savings ($)	Cool (kWh)	Savings (kWh)	Savings ($)	Savings (%)	Cost ($)	Savings ($)	Savings (%)	Peak (kW)	Savings (kW)	Savings (%)
Single Clear	None		15.6			8681				1089			5.55		
	Black Awning	summer	17.6	-1.9	-31	6530	2151	208	25	911	178	16	4.97	0.57	10
	90°	12 month	20.5	-4.9	-77	6526	2155	209	25	957	132	12	4.97	0.57	10
	Linen Awning	summer	17.2	-1.6	-25	6818	1863	181	21	933	155	14	5.05	0.49	9
	90°	12 month	19.8	-4.1	-66	6816	1865	181	21	974	115	11	5.05	0.49	9
	Black Awning	summer	18.9	-3.2	-51	6001	2680	260	31	880	209	19	4.88	0.67	12
	165°	12 month	22.8	-7.2	-114	5998	2683	260	31	943	146	13	4.88	0.67	12
	Linen Awning	summer	18.1	-2.4	-38	6426	2255	219	26	909	180	17	4.98	0.56	10
	165°	12 month	21.3	-5.7	-90	6423	2258	219	26	960	129	12	4.98	0.56	10
Double Clear	None		11.9			7737				938			4.90		
	Black Awning	summer	13.5	-1.5	-24	5936	1801	175	23	788	150	16	4.40	0.50	10
	90°	12 month	16.0	-4.1	-64	5933	1804	175	23	828	111	12	4.40	0.50	10
	Linen Awning	summer	13.2	-1.3	-20	6180	1557	151	20	807	131	14	4.47	0.43	9
	90°	12 month	15.4	-3.5	-55	6177	1560	151	20	842	96	10	4.47	0.43	9
	Black Awning	summer	14.4	-2.5	-39	5494	2243	217	29	760	178	19	4.32	0.58	12
	165°	12 month	17.8	-5.9	-93	5492	2245	218	29	814	124	13	4.32	0.58	12
	Linen Awning	summer	13.8	-1.9	-30	5852	1885	183	24	786	153	16	4.41	0.49	10
	165°	12 month	16.6	-4.7	-74	5849	1888	183	24	830	109	12	4.41	0.49	10
Double HiSol LowE	None		10.0			7514				886			4.67		
	Black Awning	summer	11.4	-1.4	-22	5743	1771	172	24	736	150	17	4.18	0.50	11
	90°	12 month	13.9	-3.9	-61	5741	1773	172	24	776	111	12	4.18	0.50	11
	Linen Awning	summer	11.1	-1.1	-18	5984	1530	148	20	756	130	15	4.25	0.42	9
	90°	12 month	13.3	-3.3	-52	5982	1532	148	20	790	96	11	4.25	0.42	9
	Black Awning	summer	12.2	-2.2	-35	5312	2202	213	29	708	179	20	4.09	0.58	12
	165°	12 month	15.6	-5.6	-88	5310	2204	214	29	761	126	14	4.09	0.58	12
	Linen Awning	summer	11.7	-1.7	-26	5663	1851	179	25	733	153	17	4.19	0.49	10
	165°	12 month	14.4	-4.4	-70	5661	1853	180	25	777	109	12	4.19	0.49	10

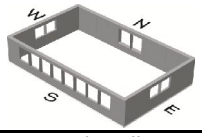
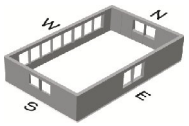


Table 57. Impact of awnings on a house in Tucson, Arizona with south-facing windows on a hot year

Window Type	Awning	Operation	Heating			Cooling				Heat+Cool			Peak Cooling		
			Energy (MBtu)	Savings (MBtu)	Savings ($)	Cool (kWh)	Savings (kWh)	Savings ($)	Savings (%)	Cost ($)	Savings ($)	Savings (%)	Peak (kW)	Savings (kW)	Savings (%)
Single Clear	None		13.0			8246				1005			5.26		
	Black Awning	summer	15.3	-2.3	-36	6206	2040	198	25	844	162	16	4.91	0.35	7
	90°	12 month	19.8	-6.8	-107	6206	2040	198	25	915	91	9	4.91	0.35	7
	Linen Awning	summer	14.8	-1.8	-28	6464	1782	173	22	861	145	14	4.96	0.30	6
	90°	12 month	18.4	-5.4	-85	6464	1782	173	22	918	87	9	4.96	0.30	6
	Black Awning	summer	16.1	-3.0	-48	5997	2249	218	27	835	170	17	4.85	0.41	8
	165°	12 month	22.8	-9.7	-154	5997	2249	218	27	942	64	6	4.85	0.41	8
	Linen Awning	summer	15.2	-2.2	-34	6318	1928	187	23	853	153	15	4.92	0.34	7
	165°	12 month	20.2	-7.2	-114	6318	1928	187	23	933	73	7	4.92	0.34	7
Double Clear	None		9.8			7242				857			4.60		
	Black Awning	summer	11.6	-1.8	-29	5604	1638	159	23	727	130	15	4.34	0.26	6
	90°	12 month	15.6	-5.8	-91	5604	1638	159	23	789	68	8	4.34	0.26	6
	Linen Awning	summer	11.2	-1.4	-22	5817	1425	138	20	741	116	14	4.38	0.23	5
	90°	12 month	14.4	-4.6	-73	5817	1425	138	20	792	65	8	4.38	0.23	5
	Black Awning	summer	12.2	-2.4	-38	5420	1822	177	25	718	139	16	4.29	0.32	7
	165°	12 month	17.9	-8.1	-128	5420	1822	177	25	809	48	6	4.29	0.32	7
	Linen Awning	summer	11.5	-1.7	-27	5687	1555	151	21	734	123	14	4.35	0.26	6
	165°	12 month	15.9	-6.1	-96	5687	1555	151	21	802	55	6	4.35	0.26	6
Double HiSol LowE	None		8.3			7047				813			4.41		
	Black Awning	summer	9.8	-1.6	-25	5426	1621	157	23	681	132	16	4.12	0.29	7
	90°	12 month	13.5	-5.2	-83	5426	1621	157	23	739	74	9	4.12	0.29	7
	Linen Awning	summer	9.5	-1.2	-19	5638	1409	137	20	696	117	14	4.17	0.24	5
	90°	12 month	12.4	-4.2	-66	5638	1409	137	20	743	71	9	4.17	0.24	5
	Black Awning	summer	10.4	-2.1	-34	5236	1811	175	26	672	142	17	4.07	0.34	8
	165°	12 month	15.7	-7.4	-118	5236	1811	175	26	756	58	7	4.07	0.34	8
	Linen Awning	summer	9.8	-1.5	-24	5503	1544	150	22	688	126	15	4.13	0.28	6
	165°	12 month	13.8	-5.6	-88	5503	1544	150	22	752	62	8	4.13	0.28	6

Table 58. Impact of awnings on a house in Tucson, Arizona with west-facing windows on a hot year



Window Type	Awning	Operation	Heating			Cooling				Heat+Cool			Peak Cooling		
			Energy (MBtu)	Savings (MBtu)	Savings ($)	Cool (kWh)	Savings (kWh)	Savings ($)	Savings (%)	Cost ($)	Savings ($)	Savings (%)	Peak (kW)	Savings (kW)	Savings (%)
Single Clear	None		17.3			9102				1156			7.20		
	Black Awning	summer	18.7	-1.4	-22	6725	2377	230	26	948	208	18	5.32	1.88	26
	90°	12 month	21.3	-4.0	-64	6718	2384	231	26	989	167	14	5.32	1.88	26
	Linen Awning	summer	18.5	-1.2	-19	7048	2054	199	23	976	180	16	5.60	1.60	22
	90°	12 month	20.7	-3.4	-54	7040	2062	200	23	1010	146	13	5.60	1.60	22
	Black Awning	summer	19.5	-2.2	-34	6122	2980	289	33	902	254	22	4.96	2.24	31
	165°	12 month	23.2	-5.9	-93	6113	2989	290	33	960	196	17	4.96	2.24	31
	Linen Awning	summer	19.0	-1.7	-26	6588	2514	244	28	939	217	19	5.28	1.92	27
	165°	12 month	22.0	-4.7	-74	6580	2522	244	28	986	170	15	5.28	1.92	27
Double Clear	None		13.1			8055				988			6.14		
	Black Awning	summer	14.3	-1.2	-19	6077	1978	192	25	815	173	18	4.62	1.53	25
	90°	12 month	16.6	-3.4	-54	6073	1982	192	25	850	138	14	4.62	1.53	25
	Linen Awning	summer	14.1	-1.0	-15	6349	1706	165	21	838	150	15	4.84	1.30	21
	90°	12 month	16.0	-2.9	-46	6344	1711	166	21	868	120	12	4.84	1.30	21
	Black Awning	summer	14.9	-1.8	-28	5583	2472	240	31	777	211	21	4.36	1.78	29
	165°	12 month	18.1	-5.0	-79	5579	2476	240	31	827	161	16	4.36	1.78	29
	Linen Awning	summer	14.5	-1.4	-21	5970	2085	202	26	807	181	18	4.61	1.53	25
	165°	12 month	17.1	-4.0	-63	5966	2089	202	26	848	140	14	4.61	1.53	25
Double HiSol LowE	None		11.1			7821				934			5.86		
	Black Awning	summer	12.1	-1.0	-16	5879	1942	188	25	762	172	18	4.38	1.48	25
	90°	12 month	14.3	-3.2	-51	5876	1945	188	25	796	137	15	4.38	1.48	25
	Linen Awning	summer	12.0	-0.9	-14	6142	1679	163	21	784	149	16	4.59	1.27	22
	90°	12 month	13.9	-2.8	-44	6138	1683	163	22	814	120	13	4.59	1.27	22
	Black Awning	summer	12.7	-1.6	-25	5392	2429	235	31	723	211	23	4.13	1.73	29
	165°	12 month	15.8	-4.7	-74	5388	2433	236	31	772	162	17	4.13	1.73	29
	Linen Awning	summer	12.3	-1.2	-19	5771	2050	199	26	754	180	19	4.37	1.49	25
	165°	12 month	14.8	-3.7	-59	5767	2054	199	26	794	140	15	4.37	1.49	25