

# Denver, Colorado

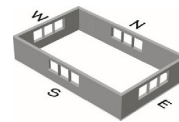
# Roller Shades

Typical Year (TMY3) HDD65 5655 / CDD65 923, Hot Year (2001) HDD65 5841 / CDD65 964

Tables 507-510 show the impact of shade screens on a typical house in Denver with different window orientations over a typical year. Tables 511-514 repeat this analysis for a hot year in Denver. The impact varies depending on the type of window glazing and whether the shade screens are in place all twelve months or only during the cooling season. For a house with windows equally distributed in the four orientations, Table 507 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 507 shows that shade screens reduce cooling energy use by 27-36 percent as compared to the unshaded house. The higher savings are for the more dense shade screens over windows with clear glazings, while the lower savings are for less dense shade screens over windows with Low-E glazings. Because shade screens block useful solar gain in winter, heating energy use increases when the shade screens remain in place 12 months a year. Using the shade screens only during the cooling season produces the largest net energy savings. The net energy savings are 4-5 percent in Denver when shade screens are used only during the cooling season from May through October, while the penalties are from -8 to -5 percent when they are deployed throughout the year.

Table 507 also shows that shade screens reduce peak electricity demand by 16-22 percent in Denver, with larger reductions for the clear glazings and smaller reductions for the Low-E glazing. Tables 508, 509, and 510 show results for houses in Denver where the windows predominantly face to the east, south, and west, respectively. The cooling energy savings are largest on south-facing shade screens, and the peak demand reductions largest on west facing shade screens. Tables 511-514 show the impact of shade screens on a particularly hot year (2001) in Denver. The main effect is to increase the cooling savings by 12 percent due to the hotter or longer summer.



**Table 507. Impact of shade screens on a house in Denver, Colorado with equally distributed windows on a typical year**

Window Type	Shade Screen	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		87.7			1745				1048			4.37		
	Black/Brown 25% Openness Factor	summer	88.0	-0.3	-3	1259	486	44	28	1007	41	4	3.62	0.75	17
		12 month	98.8	-11.1	-113	1127	618	57	35	1104	-56	-5	3.62	0.75	17
	Black/Brown 10% Openness Factor	summer	88.1	-0.4	-4	1178	567	52	32	1001	48	5	3.47	0.90	21
		12 month	101.3	-13.7	-139	1026	719	66	41	1121	-73	-7	3.47	0.90	21
	Black/Brown 10% Openness Factor, full basketweave	summer	88.1	-0.4	-4	1172	573	52	33	1000	48	5	3.45	0.92	21
		12 month	101.7	-14.0	-142	1020	725	66	42	1124	-76	-7	3.45	0.92	21
	Black 5% Openness Factor, full basketweave	summer	88.1	-0.5	-5	1159	586	54	34	999	49	5	3.42	0.95	22
		12 month	102.2	-14.5	-147	1004	741	68	42	1128	-79	-8	3.42	0.95	22
	White 5% Openness Factor, full basketweave	summer	88.2	-0.5	-5	1120	625	57	36	996	52	5	3.37	1.00	23
12 month		102.8	-15.2	-154	956	789	72	45	1130	-82	-8	3.37	1.00	23	
Double Clear	None		72.1			1453				863			3.76		
	Black/Brown 25% Openness Factor	summer	72.3	-0.2	-2	1063	390	36	27	830	34	4	3.15	0.61	16
		12 month	81.2	-9.1	-92	963	490	45	34	911	-47	-5	3.15	0.61	16
	Black/Brown 10% Openness Factor	summer	72.3	-0.3	-3	995	458	42	32	824	39	5	3.02	0.74	20
		12 month	83.3	-11.2	-113	881	572	52	39	925	-61	-7	3.02	0.74	20
	Black/Brown 10% Openness Factor, full basketweave	summer	72.4	-0.3	-3	982	471	43	32	823	40	5	2.99	0.77	20
		12 month	83.7	-11.7	-118	865	588	54	40	928	-64	-7	2.99	0.77	20
	Black 5% Openness Factor, full basketweave	summer	72.4	-0.3	-3	975	478	44	33	823	41	5	2.98	0.78	21
		12 month	84.0	-11.9	-121	857	596	55	41	930	-66	-8	2.98	0.78	21
	White 5% Openness Factor, full basketweave	summer	72.4	-0.3	-3	952	501	46	34	821	43	5	2.95	0.81	21
12 month		84.2	-12.2	-123	827	626	57	43	929	-66	-8	2.95	0.81	22	
Double HiSol LowE	None		65.3			1413				791			3.60		
	Black/Brown 25% Openness Factor	summer	65.5	-0.2	-2	1038	375	34	27	758	32	4	3.00	0.60	17
		12 month	74.0	-8.8	-89	940	473	43	33	836	-46	-6	3.00	0.60	17
	Black/Brown 10% Openness Factor	summer	65.5	-0.2	-2	978	435	40	31	753	37	5	2.90	0.70	19
		12 month	75.8	-10.5	-106	870	543	50	38	847	-56	-7	2.89	0.71	20
	Black/Brown 10% Openness Factor, full basketweave	summer	65.5	-0.3	-3	967	446	41	32	753	38	5	2.87	0.73	20
		12 month	76.1	-10.9	-110	856	557	51	39	850	-59	-7	2.87	0.73	20
	Black 5% Openness Factor, full basketweave	summer	65.5	-0.3	-3	959	454	42	32	752	39	5	2.86	0.74	21
		12 month	76.4	-11.1	-113	848	565	52	40	852	-61	-8	2.85	0.75	21
	White 5% Openness Factor, full basketweave	summer	65.5	-0.3	-3	928	485	44	34	749	42	5	2.82	0.78	22
12 month		76.9	-11.6	-118	808	605	55	43	853	-63	-8	2.81	0.79	22	

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 9.2 cents per kWh and natural gas costs are \$10.45 per MBTU, which are the average costs in 2009 for the state of Colorado according to the Energy Information Administration (see Appendix E for details).

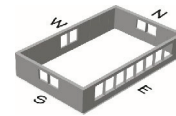


Table 508. Impact of shade screens on a house in Denver, Colorado with east-facing windows on a typical year

Window Type	Shade Screen	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		87.8			2029				1075			3.83		
	Black/Brown 25% Openness Factor	summer	88.1	-0.3	-3	1504	525	48	26	1030	45	4	3.69	0.14	4
		12 month	96.0	-8.2	-83	1362	667	61	33	1097	-22	-2	3.69	0.14	4
	Black/Brown 10% Openness Factor	summer	88.2	-0.4	-4	1400	629	58	31	1022	53	5	3.65	0.18	5
		12 month	97.9	-10.1	-102	1232	797	73	39	1105	-29	-3	3.65	0.18	5
	Black/Brown 10% Openness Factor, full basketweave	summer	88.2	-0.4	-4	1386	643	59	32	1021	54	5	3.65	0.18	5
		12 month	98.1	-10.3	-105	1215	814	74	40	1106	-30	-3	3.65	0.18	5
	Black 5% Openness Factor, full basketweave	summer	88.3	-0.5	-5	1368	661	60	33	1020	56	5	3.64	0.19	5
		12 month	98.5	-10.7	-108	1193	836	76	41	1107	-32	-3	3.64	0.19	5
	White 5% Openness Factor, full basketweave	summer	88.3	-0.5	-5	1341	688	63	34	1017	58	5	3.63	0.20	5
12 month		99.1	-11.3	-114	1159	870	80	43	1110	-35	-3	3.63	0.20	5	
Double Clear	None		72.3			1700				888			3.39		
	Black/Brown 25% Openness Factor	summer	72.5	-0.2	-2	1280	420	38	25	852	36	4	3.27	0.12	4
		12 month	79.0	-6.7	-68	1167	533	49	31	907	-19	-2	3.27	0.12	4
	Black/Brown 10% Openness Factor	summer	72.6	-0.3	-3	1190	510	47	30	845	44	5	3.23	0.15	5
		12 month	80.5	-8.2	-83	1055	645	59	38	913	-24	-3	3.23	0.16	5
	Black/Brown 10% Openness Factor, full basketweave	summer	72.6	-0.3	-3	1170	530	48	31	843	45	5	3.23	0.16	5
		12 month	80.9	-8.6	-87	1031	669	61	39	914	-26	-3	3.22	0.16	5
	Black 5% Openness Factor, full basketweave	summer	72.7	-0.3	-3	1160	540	49	32	843	46	5	3.22	0.17	5
		12 month	81.1	-8.8	-89	1019	681	62	40	915	-27	-3	3.22	0.17	5
	White 5% Openness Factor, full basketweave	summer	72.7	-0.3	-3	1150	550	50	32	842	47	5	3.22	0.17	5
12 month		81.3	-9.0	-92	1007	693	63	41	917	-28	-3	3.22	0.17	5	
Double HiSol LowE	None		65.2			1644				811			3.23		
	Black/Brown 25% Openness Factor	summer	65.3	-0.2	-2	1238	406	37	25	776	35	4	3.11	0.11	3
		12 month	71.6	-6.5	-65	1126	518	47	32	829	-18	-2	3.11	0.11	4
	Black/Brown 10% Openness Factor	summer	65.4	-0.2	-2	1161	483	44	29	769	42	5	3.09	0.14	4
		12 month	72.9	-7.7	-78	1033	611	56	37	833	-22	-3	3.09	0.14	4
	Black/Brown 10% Openness Factor, full basketweave	summer	65.4	-0.3	-3	1144	500	46	30	768	43	5	3.08	0.15	5
		12 month	73.2	-8.0	-81	1012	632	58	38	834	-23	-3	3.08	0.15	5
	Black 5% Openness Factor, full basketweave	summer	65.4	-0.3	-3	1134	510	47	31	767	44	5	3.08	0.15	5
		12 month	73.4	-8.2	-83	999	645	59	39	835	-24	-3	3.07	0.15	5
	White 5% Openness Factor, full basketweave	summer	65.5	-0.3	-3	1113	531	49	32	765	46	6	3.07	0.16	5
12 month		73.8	-8.7	-88	973	671	61	41	837	-26	-3	3.07	0.16	5	

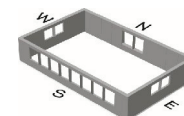


Table 509. Impact of shade screens on a house in Denver, Colorado with south-facing windows on a typical year

Window Type	Shade Screen	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		80.0			1693				966			3.70		
	Black/Brown 25% Openness Factor	summer	80.3	-0.3	-3	1197	496	45	29	924	42	4	3.41	0.29	8
		12 month	94.7	-14.7	-149	1028	665	61	39	1054	-88	-9	3.41	0.29	8
	Black/Brown 10% Openness Factor	summer	80.4	-0.4	-4	1141	552	51	33	919	47	5	3.39	0.31	8
		12 month	98.8	-18.8	-191	960	733	67	43	1090	-124	-13	3.39	0.31	8
	Black/Brown 10% Openness Factor, full basketweave	summer	80.4	-0.4	-4	1148	545	50	32	920	46	5	3.41	0.29	8
		12 month	99.4	-19.4	-197	970	723	66	43	1097	-131	-14	3.41	0.29	8
	Black 5% Openness Factor, full basketweave	summer	80.4	-0.4	-4	1140	553	51	33	919	47	5	3.41	0.29	8
		12 month	100.4	-20.3	-206	962	731	67	43	1105	-139	-14	3.41	0.29	8
	White 5% Openness Factor, full basketweave	summer	80.5	-0.4	-4	1087	606	55	36	915	51	5	3.35	0.35	9
12 month		101.2	-21.2	-215	893	800	73	47	1108	-142	-15	3.35	0.35	9	
Double Clear	None		65.4			1406				792			3.27		
	Black/Brown 25% Openness Factor	summer	65.6	-0.2	-2	1025	381	35	27	759	33	4	3.05	0.21	6
		12 month	78.2	-12.8	-129	911	495	45	35	876	-84	-11	3.05	0.21	6
	Black/Brown 10% Openness Factor	summer	65.7	-0.3	-3	981	425	39	30	755	36	5	3.04	0.22	7
		12 month	81.7	-16.3	-165	859	547	50	39	907	-115	-15	3.04	0.22	7
	Black/Brown 10% Openness Factor, full basketweave	summer	65.7	-0.3	-3	978	428	39	30	755	37	5	3.04	0.22	7
		12 month	82.5	-17.1	-173	854	552	51	39	914	-123	-15	3.04	0.22	7
	Black 5% Openness Factor, full basketweave	summer	65.7	-0.3	-3	975	431	39	31	755	37	5	3.05	0.22	7
		12 month	83.0	-17.6	-178	851	555	51	39	919	-128	-16	3.05	0.22	7
	White 5% Openness Factor, full basketweave	summer	65.7	-0.3	-3	932	474	43	34	751	40	5	2.99	0.27	8
12 month		83.2	-17.8	-180	796	610	56	43	916	-124	-16	2.99	0.27	8	
Double HiSol LowE	None		58.7			1365				719			3.12		
	Black/Brown 25% Openness Factor	summer	58.8	-0.2	-2	1007	358	33	26	688	31	4	2.93	0.18	6
		12 month	71.1	-12.5	-126	903	462	42	34	803	-84	-12	2.93	0.18	6
	Black/Brown 10% Openness Factor	summer	58.9	-0.2	-2	967	398	36	29	685	34	5	2.92	0.20	6
		12 month	74.0	-15.3	-155	855	510	47	37	828	-108	-15	2.92	0.20	6
	Black/Brown 10% Openness Factor, full basketweave	summer	58.9	-0.2	-2	963	402	37	29	685	35	5	2.92	0.20	6
		12 month	74.7	-16.0	-162	851	514	47	38	835	-115	-16	2.92	0.20	6
	Black 5% Openness Factor, full basketweave	summer	58.9	-0.2	-2	961	404	37	30	685	35	5	2.92	0.20	6
		12 month	75.2	-16.5	-167	848	517	47	38	839	-120	-17	2.92	0.20	6
	White 5% Openness Factor, full basketweave	summer	58.9	-0.3	-3	913	452	41	33	681	39	5	2.87	0.24	8
12 month		75.8	-17.2	-174	788	577	53	42	840	-121	-17	2.87	0.24	8	

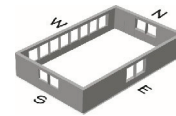


Table 510. Impact of shade screens on a house in Denver, Colorado with west-facing windows on a typical year

Window Type	Shade Screen	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		91.6			1978				1109			6.04		
	Black/Brown 25% Openness Factor	summer	91.7	-0.1	-1	1505	473	43	24	1067	42	4	4.34	1.70	28
		12 month	98.3	-6.8	-69	1343	635	58	32	1120	-11	-1	4.33	1.71	28
	Black/Brown 10% Openness Factor	summer	91.7	-0.2	-2	1411	567	52	29	1059	50	5	4.31	1.72	29
		12 month	99.8	-8.3	-84	1222	756	69	38	1124	-15	-1	3.92	2.12	35
	Black/Brown 10% Openness Factor, full basketweave	summer	91.7	-0.2	-2	1397	581	53	29	1058	51	5	4.31	1.72	29
		12 month	100.0	-8.5	-86	1206	772	71	39	1124	-15	-1	3.84	2.20	36
	Black 5% Openness Factor, full basketweave	summer	91.8	-0.2	-2	1380	598	55	30	1056	53	5	4.31	1.72	29
		12 month	100.3	-8.7	-89	1184	794	73	40	1125	-16	-1	3.75	2.29	38
	White 5% Openness Factor, full basketweave	summer	91.8	-0.2	-2	1353	625	57	32	1054	55	5	4.31	1.72	29
	12 month	100.8	-9.3	-94	1149	829	76	42	1127	-18	-2	3.70	2.34	39	
Double Clear	None		75.0			1648				911			5.11		
	Black/Brown 25% Openness Factor	summer	75.1	-0.1	-1	1269	379	35	23	877	34	4	3.69	1.42	28
		12 month	80.5	-5.5	-56	1154	494	45	30	922	-11	-1	3.69	1.42	28
	Black/Brown 10% Openness Factor	summer	75.1	-0.1	-1	1190	458	42	28	870	41	4	3.65	1.45	28
		12 month	81.7	-6.7	-68	1054	594	54	36	925	-14	-2	3.34	1.77	35
	Black/Brown 10% Openness Factor, full basketweave	summer	75.1	-0.1	-1	1173	475	43	29	869	42	5	3.65	1.46	29
		12 month	82.0	-7.0	-71	1031	617	56	37	925	-15	-2	3.25	1.86	36
	Black 5% Openness Factor, full basketweave	summer	75.1	-0.1	-1	1162	486	44	29	868	43	5	3.65	1.45	28
		12 month	82.2	-7.2	-73	1018	630	58	38	926	-15	-2	3.20	1.90	37
	White 5% Openness Factor, full basketweave	summer	75.1	-0.1	-1	1150	498	46	30	867	44	5	3.65	1.46	29
	12 month	82.4	-7.4	-75	1003	645	59	39	927	-16	-2	3.22	1.89	37	
Double HiSol LowE	None		67.6			1598				831			4.87		
	Black/Brown 25% Openness Factor	summer	67.6	-0.1	-1	1229	369	34	23	798	33	4	3.51	1.36	28
		12 month	72.8	-5.3	-54	1117	481	44	30	840	-10	-1	3.46	1.41	29
	Black/Brown 10% Openness Factor	summer	67.6	-0.1	-1	1163	435	40	27	792	39	5	3.51	1.36	28
		12 month	73.8	-6.3	-63	1033	565	52	35	843	-12	-1	3.17	1.70	35
	Black/Brown 10% Openness Factor, full basketweave	summer	67.7	-0.1	-1	1148	450	41	28	791	40	5	3.51	1.36	28
		12 month	74.0	-6.5	-66	1014	584	53	37	843	-12	-1	3.10	1.77	36
	Black 5% Openness Factor, full basketweave	summer	67.7	-0.1	-1	1137	461	42	29	790	41	5	3.51	1.36	28
		12 month	74.2	-6.6	-67	1000	598	55	37	843	-12	-2	3.05	1.82	37
	White 5% Openness Factor, full basketweave	summer	67.7	-0.1	-1	1115	483	44	30	788	43	5	3.51	1.36	28
	12 month	74.6	-7.1	-72	973	625	57	39	845	-14	-2	3.02	1.85	38	

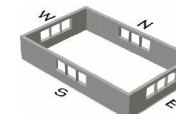


Table 511. Impact of shade screens on a house in Denver, Colorado with equally distributed windows on a hot year

Window Type	Shade Screen	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		87.5			1941				1065			3.51		
	Black/Brown 25% Openness Factor	summer	88.2	-0.7	-7	1404	537	49	28	1023	42	4	3.02	0.49	14
		12 month	99.4	-11.8	-120	1302	639	58	33	1127	-62	-6	3.02	0.49	14
	Black/Brown 10% Openness Factor	summer	88.4	-0.9	-9	1314	627	57	32	1016	49	5	2.93	0.57	16
		12 month	102.1	-14.5	-147	1199	742	68	38	1144	-79	-7	2.93	0.58	16
	Black/Brown 10% Openness Factor, full basketweave	summer	88.4	-0.9	-9	1308	633	58	33	1016	49	5	2.93	0.58	17
		12 month	102.4	-14.9	-151	1192	749	69	39	1147	-82	-8	2.92	0.58	17
	Black 5% Openness Factor, full basketweave	summer	88.5	-0.9	-9	1294	647	59	33	1015	50	5	2.91	0.59	17
		12 month	103.0	-15.4	-156	1177	764	70	39	1151	-86	-8	2.91	0.59	17
	White 5% Openness Factor, full basketweave	summer	88.5	-1.0	-10	1254	687	63	35	1012	53	5	2.88	0.63	18
	12 month	103.7	-16.1	-164	1130	811	74	42	1154	-89	-8	2.87	0.64	18	
Double Clear	None		71.6			1614				873			3.07		
	Black/Brown 25% Openness Factor	summer	72.1	-0.5	-5	1190	424	39	26	840	34	4	2.68	0.39	13
		12 month	81.3	-9.7	-98	1120	494	45	31	927	-53	-6	2.68	0.39	13
	Black/Brown 10% Openness Factor	summer	72.3	-0.7	-7	1118	496	45	31	835	39	4	2.61	0.46	15
		12 month	83.5	-11.9	-121	1039	575	53	36	941	-68	-8	2.61	0.46	15
	Black/Brown 10% Openness Factor, full basketweave	summer	72.3	-0.7	-7	1103	511	47	32	834	40	5	2.60	0.48	16
		12 month	84.0	-12.4	-126	1022	592	54	37	945	-72	-8	2.59	0.48	16
	Black 5% Openness Factor, full basketweave	summer	72.3	-0.7	-7	1097	517	47	32	833	40	5	2.59	0.48	16
		12 month	84.3	-12.7	-129	1014	600	55	37	947	-74	-8	2.59	0.48	16
	White 5% Openness Factor, full basketweave	summer	72.3	-0.7	-7	1069	545	50	34	831	43	5	2.56	0.51	17
	12 month	84.5	-13.0	-131	983	631	58	39	947	-74	-8	2.56	0.52	17	
Double HiSol LowE	None		64.7			1566				799			2.96		
	Black/Brown 25% Openness Factor	summer	65.2	-0.5	-5	1158	408	37	26	767	33	4	2.58	0.38	13
		12 month	74.1	-9.4	-95	1092	474	43	30	851	-52	-6	2.58	0.38	13
	Black/Brown 10% Openness Factor	summer	65.3	-0.6	-6	1094	472	43	30	762	37	5	2.52	0.44	15
		12 month	75.9	-11.2	-113	1020	546	50	35	863	-63	-8	2.52	0.44	15
	Black/Brown 10% Openness Factor, full basketweave	summer	65.3	-0.6	-6	1082	484	44	31	761	38	5	2.51	0.45	15
		12 month	76.3	-11.6	-117	1007	559	51	36	866	-66	-8	2.51	0.45	15
	Black 5% Openness Factor, full basketweave	summer	65.3	-0.6	-6	1074	492	45	31	761	39	5	2.50	0.46	15
		12 month	76.6	-11.9	-120	997	569	52	36	868	-68	-9	2.50	0.46	15
	White 5% Openness Factor, full basketweave	summer	65.4	-0.6	-7	1038	528	48	34	758	42	5	2.46	0.50	17
	12 month	77.1	-12.4	-126	957	609	56	39	869	-70	-9	2.46	0.50	17	

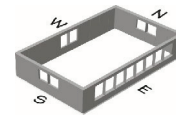


Table 512. Impact of shade screens on a house in Denver, Colorado with east-facing windows on a hot year

Window Type	Shade Screen	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		87.6			2214				1091			3.61		
	Black/Brown 25% Openness Factor	summer	88.2	-0.6	-6	1669	545	50	25	1047	44	4	3.24	0.37	10
		12 month	96.5	-8.9	-90	1553	661	60	30	1121	-30	-3	3.24	0.37	10
	Black/Brown 10% Openness Factor	summer	88.5	-0.8	-8	1555	659	60	30	1039	52	5	3.22	0.39	11
		12 month	98.6	-11.0	-111	1422	792	72	36	1129	-39	-4	3.22	0.39	11
	Black/Brown 10% Openness Factor, full basketweave	summer	88.5	-0.9	-9	1539	675	62	30	1038	53	5	3.22	0.39	11
		12 month	98.9	-11.3	-114	1403	811	74	37	1131	-40	-4	3.22	0.39	11
	Black 5% Openness Factor, full basketweave	summer	88.5	-0.9	-9	1519	695	64	31	1036	54	5	3.22	0.39	11
12 month		99.3	-11.6	-118	1380	834	76	38	1132	-42	-4	3.22	0.39	11	
White 5% Openness Factor, full basketweave	summer	88.6	-0.9	-10	1490	724	66	33	1034	57	5	3.21	0.40	11	
	12 month	99.9	-12.3	-124	1345	869	80	39	1135	-45	-4	3.21	0.40	11	
Double Clear	None		71.8			1862				898			3.04		
	Black/Brown 25% Openness Factor	summer	72.2	-0.5	-5	1425	437	40	23	862	35	4	2.89	0.15	5
		12 month	79.0	-7.3	-74	1339	523	48	28	924	-26	-3	2.89	0.15	5
	Black/Brown 10% Openness Factor	summer	72.4	-0.6	-6	1329	533	49	29	855	42	5	2.88	0.16	5
		12 month	80.8	-9.0	-91	1228	634	58	34	931	-33	-4	2.87	0.16	5
	Black/Brown 10% Openness Factor, full basketweave	summer	72.5	-0.7	-7	1306	556	51	30	854	44	5	2.87	0.17	5
		12 month	81.2	-9.4	-95	1203	659	60	35	933	-35	-4	2.87	0.17	5
	Black 5% Openness Factor, full basketweave	summer	72.5	-0.7	-7	1295	567	52	30	853	45	5	2.87	0.17	5
12 month		81.4	-9.6	-97	1190	672	61	36	934	-36	-4	2.87	0.17	6	
White 5% Openness Factor, full basketweave	summer	72.5	-0.7	-7	1283	579	53	31	852	46	5	2.87	0.17	6	
	12 month	81.6	-9.9	-100	1176	686	63	37	935	-37	-4	2.86	0.17	6	
Double HiSol LowE	None		64.6			1784				818			2.87		
	Black/Brown 25% Openness Factor	summer	65.0	-0.4	-4	1361	423	39	24	783	34	4	2.76	0.11	4
		12 month	71.6	-7.0	-71	1280	504	46	28	842	-25	-3	2.76	0.11	4
	Black/Brown 10% Openness Factor	summer	65.1	-0.6	-6	1280	504	46	28	777	40	5	2.75	0.12	4
		12 month	73.0	-8.4	-85	1187	597	55	33	848	-31	-4	2.75	0.12	4
	Black/Brown 10% Openness Factor, full basketweave	summer	65.2	-0.6	-6	1261	523	48	29	776	42	5	2.74	0.12	4
		12 month	73.3	-8.7	-88	1166	618	57	35	849	-32	-4	2.74	0.12	4
	Black 5% Openness Factor, full basketweave	summer	65.2	-0.6	-6	1250	534	49	30	775	43	5	2.74	0.13	4
12 month		73.5	-8.9	-91	1153	631	58	35	850	-33	-4	2.74	0.13	4	
White 5% Openness Factor, full basketweave	summer	65.2	-0.6	-6	1229	555	51	31	773	44	5	2.74	0.13	5	
	12 month	74.0	-9.4	-95	1127	657	60	37	853	-35	-4	2.73	0.13	5	

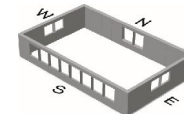


Table 513. Impact of shade screens on a house in Denver, Colorado with south-facing windows on a hot year

Window Type	Shade Screen	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		81.0			1917				996			3.40		
	Black/Brown 25% Openness Factor	summer	81.7	-0.7	-8	1357	560	51	29	953	44	4	3.09	0.31	9
		12 month	97.1	-16.1	-163	1207	710	65	37	1094	-98	-10	2.95	0.45	13
	Black/Brown 10% Openness Factor	summer	81.9	-0.9	-9	1292	625	57	33	948	48	5	3.09	0.31	9
		12 month	101.3	-20.4	-206	1137	780	71	41	1131	-135	-14	2.94	0.47	14
	Black/Brown 10% Openness Factor, full basketweave	summer	81.9	-0.9	-9	1299	618	57	32	949	48	5	3.09	0.31	9
		12 month	101.9	-20.9	-212	1146	771	71	40	1138	-142	-14	2.95	0.45	13
	Black 5% Openness Factor, full basketweave	summer	81.9	-0.9	-9	1292	625	57	33	948	48	5	3.09	0.31	9
12 month		102.9	-21.9	-222	1139	778	71	41	1147	-151	-15	2.95	0.45	13	
White 5% Openness Factor, full basketweave	summer	82.0	-1.0	-10	1233	684	63	36	944	53	5	3.09	0.31	9	
	12 month	103.8	-22.8	-231	1071	846	77	44	1150	-154	-15	2.90	0.51	15	
Double Clear	None		66.1			1582				814			2.89		
	Black/Brown 25% Openness Factor	summer	66.6	-0.6	-6	1154	428	39	27	781	33	4	2.67	0.23	8
		12 month	79.7	-13.6	-138	1075	507	46	32	906	-92	-11	2.67	0.23	8
	Black/Brown 10% Openness Factor	summer	66.7	-0.7	-7	1105	477	44	30	777	37	5	2.65	0.24	8
		12 month	83.3	-17.2	-175	1023	559	51	35	938	-123	-15	2.65	0.24	8
	Black/Brown 10% Openness Factor, full basketweave	summer	66.7	-0.7	-7	1102	480	44	30	777	37	5	2.65	0.24	8
		12 month	84.1	-18.0	-183	1019	563	52	36	946	-131	-16	2.65	0.24	8
	Black 5% Openness Factor, full basketweave	summer	66.8	-0.7	-7	1097	485	44	31	777	37	5	2.66	0.24	8
12 month		84.6	-18.5	-188	1015	567	52	36	950	-136	-17	2.66	0.24	8	
White 5% Openness Factor, full basketweave	summer	66.8	-0.7	-8	1049	533	49	34	773	41	5	2.60	0.29	10	
	12 month	84.8	-18.8	-190	958	624	57	39	947	-133	-16	2.60	0.29	10	
Double HiSol LowE	None		59.2			1530				740			2.78		
	Black/Brown 25% Openness Factor	summer	59.6	-0.5	-5	1132	398	36	26	708	32	4	2.58	0.20	7
		12 month	72.4	-13.2	-134	1061	469	43	31	831	-91	-12	2.58	0.20	7
	Black/Brown 10% Openness Factor	summer	59.7	-0.6	-6	1086	444	41	29	705	35	5	2.57	0.21	8
		12 month	75.3	-16.2	-164	1012	518	47	34	856	-116	-16	2.57	0.21	8
	Black/Brown 10% Openness Factor, full basketweave	summer	59.8	-0.6	-6	1081	449	41	29	705	35	5	2.57	0.21	8
		12 month	76.0	-16.9	-171	1006	524	48	34	863	-123	-17	2.57	0.21	8
	Black 5% Openness Factor, full basketweave	summer	59.8	-0.6	-6	1078	452	41	30	704	35	5	2.57	0.21	7
12 month		76.5	-17.4	-176	1003	527	48	34	867	-128	-17	2.57	0.21	7	
White 5% Openness Factor, full basketweave	summer	59.8	-0.7	-7	1025	505	46	33	700	40	5	2.52	0.26	9	
	12 month	77.3	-18.1	-183	941	589	54	38	869	-129	-17	2.52	0.26	9	

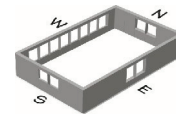


Table 514. Impact of shade screens on a house in Denver, Colorado with west-facing windows on a hot year

Window Type	Shade Screen	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		91.4			2237				1131			5.01		
	Black/Brown 25% Openness Factor	summer	91.8	-0.4	-4	1689	548	50	24	1085	46	4	4.13	0.88	17
		12 month	99.1	-7.7	-78	1540	697	64	31	1146	-14	-1	3.28	1.73	34
	Black/Brown 10% Openness Factor	summer	92.0	-0.5	-5	1582	655	60	29	1077	55	5	4.13	0.88	17
		12 month	100.8	-9.4	-95	1412	825	75	37	1151	-20	-2	3.04	1.97	39
	Black/Brown 10% Openness Factor, full basketweave	summer	92.0	-0.5	-5	1565	672	61	30	1075	56	5	4.13	0.88	17
		12 month	101.1	-9.6	-98	1392	845	77	38	1152	-20	-2	3.00	2.01	40
	Black 5% Openness Factor, full basketweave	summer	92.0	-0.6	-6	1545	692	63	31	1074	58	5	4.13	0.88	17
		12 month	101.4	-9.9	-101	1369	868	79	39	1153	-21	-2	2.95	2.06	41
White 5% Openness Factor, full basketweave	summer	92.0	-0.6	-6	1516	721	66	32	1071	60	5	4.13	0.88	17	
	12 month	101.9	-10.5	-106	1332	905	83	40	1155	-24	-2	2.92	2.09	42	
Double Clear	None		74.5			1865				926			4.23		
	Black/Brown 25% Openness Factor	summer	74.8	-0.3	-3	1431	434	40	23	889	37	4	3.41	0.83	20
		12 month	80.8	-6.2	-63	1326	539	49	29	940	-14	-1	2.88	1.35	32
	Black/Brown 10% Openness Factor	summer	74.9	-0.4	-4	1340	525	48	28	882	44	5	3.41	0.83	20
		12 month	82.2	-7.7	-78	1220	645	59	35	945	-19	-2	2.69	1.54	36
	Black/Brown 10% Openness Factor, full basketweave	summer	74.9	-0.4	-4	1320	545	50	29	880	46	5	3.41	0.83	20
		12 month	82.5	-8.0	-81	1197	668	61	36	946	-20	-2	2.65	1.59	37
	Black 5% Openness Factor, full basketweave	summer	74.9	-0.4	-4	1308	557	51	30	879	47	5	3.41	0.83	20
		12 month	82.7	-8.2	-83	1184	681	62	37	946	-20	-2	2.62	1.61	38
White 5% Openness Factor, full basketweave	summer	74.9	-0.4	-4	1296	569	52	31	878	48	5	3.41	0.83	20	
	12 month	83.0	-8.4	-85	1170	695	64	37	948	-22	-2	2.62	1.61	38	
Double HiSol LowE	None		67.1			1805				845			4.08		
	Black/Brown 25% Openness Factor	summer	67.3	-0.3	-3	1382	423	39	23	809	36	4	3.28	0.80	20
		12 month	73.0	-6.0	-60	1280	525	48	29	857	-12	-1	2.75	1.33	33
	Black/Brown 10% Openness Factor	summer	67.4	-0.3	-3	1307	498	46	28	803	42	5	3.28	0.80	20
		12 month	74.2	-7.1	-72	1192	613	56	34	861	-16	-2	2.59	1.49	37
	Black/Brown 10% Openness Factor, full basketweave	summer	67.4	-0.3	-3	1288	517	47	29	801	44	5	3.28	0.80	20
		12 month	74.5	-7.4	-75	1171	634	58	35	862	-17	-2	2.55	1.53	37
	Black 5% Openness Factor, full basketweave	summer	67.4	-0.4	-4	1275	530	48	29	800	45	5	3.28	0.80	20
		12 month	74.6	-7.6	-77	1156	649	59	36	862	-17	-2	2.53	1.55	38
White 5% Openness Factor, full basketweave	summer	67.4	-0.4	-4	1253	552	51	31	798	47	6	3.28	0.80	20	
	12 month	75.1	-8.0	-81	1130	675	62	37	864	-19	-2	2.50	1.58	39	