

Medford, Oregon

Typical Year (TMY3) HDD65 4529 / CDD65 601, Hot Year (2003) HDD65 4086 / CDD65 1048

Tables 297-300 show the impact of awnings on a typical house in Medford with different window orientations over a typical year. Tables 301-304 repeat this analysis for a hot year in Medford. 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 297 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 297 shows that awnings reduce cooling energy use by 33-47 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 -1 to 0 percent in Medford when awnings are used only during the cooling season from April through October, while the penalties are from -9 to -5 percent when they are deployed throughout the year.

Table 297 also shows that awnings reduce peak electricity demand by 14-22 percent in Medford, with larger reductions for the clear glazings and smaller reductions for the Low-E glazing. Tables 298, 299, and 300 show results for houses in Medford 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 301-304 show the impact of awnings on a particularly hot year (2003) in Medford. The main effect is to increase the cooling savings by 110 percent due to the hotter or longer summer.

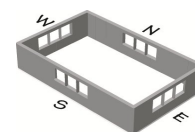


Table 297. Impact of awnings on a house in Medford, Oregon with equally distributed windows on a typical year

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		93.4			1957				1465			5.43		
	Black Awning	summer	98.0	-4.5	-64	1154	803	61	41	1468	-3	0	4.41	1.02	19
	90°	12 month	104.3	-10.9	-153	1154	803	61	41	1558	-93	-6	4.41	1.02	19
	Linen Awning	summer	97.2	-3.7	-52	1254	703	53	36	1464	1	0	4.55	0.87	16
	90°	12 month	102.7	-9.2	-130	1254	703	53	36	1542	-77	-5	4.55	0.87	16
	Black Awning	summer	99.5	-6.1	-86	1038	919	69	47	1481	-16	-1	4.21	1.22	22
	165°	12 month	107.9	-14.5	-204	1038	919	69	47	1600	-135	-9	4.21	1.22	22
	Linen Awning	summer	98.3	-4.8	-68	1167	790	60	40	1473	-8	-1	4.41	1.02	19
	165°	12 month	105.3	-11.8	-167	1167	790	60	40	1572	-107	-7	4.41	1.02	19
Double Clear	None		81.8			1662				1278			4.72		
	Black Awning	summer	85.6	-3.8	-54	1028	634	48	38	1285	-6	0	3.93	0.79	17
	90°	12 month	91.0	-9.2	-130	1028	634	48	38	1360	-82	-6	3.93	0.79	17
	Linen Awning	summer	85.0	-3.2	-45	1108	554	42	33	1282	-3	0	4.05	0.67	14
	90°	12 month	89.7	-7.9	-111	1108	554	42	33	1348	-69	-5	4.05	0.67	14
	Black Awning	summer	86.9	-5.1	-72	934	728	55	44	1295	-17	-1	3.77	0.95	20
	165°	12 month	93.9	-12.1	-171	934	728	55	44	1395	-116	-9	3.77	0.95	20
	Linen Awning	summer	85.9	-4.1	-57	1036	626	47	38	1288	-10	-1	3.93	0.79	17
	165°	12 month	91.8	-10.0	-140	1036	626	47	38	1371	-93	-7	3.93	0.79	17
Double HiSol LowE	None		76.1			1619				1195			4.53		
	Black Awning	summer	79.8	-3.7	-51	1008	611	46	38	1201	-5	0	3.78	0.75	17
	90°	12 month	85.1	-9.0	-127	1008	611	46	38	1276	-80	-7	3.78	0.75	17
	Linen Awning	summer	79.2	-3.0	-43	1085	534	40	33	1198	-2	0	3.89	0.64	14
	90°	12 month	83.8	-7.7	-108	1085	534	40	33	1263	-67	-6	3.89	0.64	14
	Black Awning	summer	81.0	-4.8	-68	913	706	53	44	1210	-15	-1	3.63	0.90	20
	165°	12 month	87.9	-11.8	-166	913	706	53	44	1308	-113	-9	3.63	0.90	20
	Linen Awning	summer	80.0	-3.9	-55	1014	605	46	37	1204	-9	-1	3.78	0.75	17
	165°	12 month	85.8	-9.7	-137	1014	605	46	37	1286	-91	-8	3.78	0.75	17

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 7.6 cents per kWh and natural gas costs are \$14.53 per MBTU, which are the average costs in 2009 for the state of Oregon according to the Energy Information Administration (see Appendix E for details).

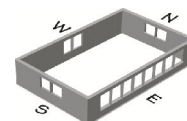


Table 298. Impact of awnings on a house in Medford, Oregon with east-facing windows on a typical year

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		90.4			1803				1411			4.33		
	Black Awning	summer	94.9	-4.5	-63	1051	752	57	42	1417	-6	0	3.90	0.43	10
	90°	12 month	99.1	-8.7	-123	1051	752	57	42	1477	-66	-5	3.90	0.43	10
	Linen Awning	summer	94.1	-3.6	-51	1148	655	50	36	1413	-2	0	3.96	0.37	8
	90°	12 month	97.8	-7.3	-104	1148	655	50	36	1465	-54	-4	3.96	0.37	8
	Black Awning	summer	97.6	-7.2	-101	907	896	68	50	1444	-33	-2	3.78	0.55	13
	165°	12 month	103.0	-12.6	-177	907	896	68	50	1520	-110	-8	3.78	0.55	13
	Linen Awning	summer	95.9	-5.5	-77	1038	765	58	42	1430	-19	-1	3.88	0.45	10
	165°	12 month	100.4	-10.0	-141	1038	765	58	42	1494	-83	-6	3.88	0.45	10
Double Clear	None		81.0			1545				1258			3.89		
	Black Awning	summer	84.8	-3.9	-55	947	598	45	39	1267	-10	-1	3.54	0.36	9
	90°	12 month	88.4	-7.5	-105	947	598	45	39	1318	-60	-5	3.54	0.36	9
	Linen Awning	summer	84.2	-3.2	-45	1030	515	39	33	1264	-6	-1	3.59	0.31	8
	90°	12 month	87.3	-6.3	-89	1030	515	39	33	1308	-50	-4	3.59	0.31	8
	Black Awning	summer	87.0	-6.0	-85	831	714	54	46	1288	-31	-2	3.44	0.45	12
	165°	12 month	91.5	-10.6	-149	831	714	54	46	1352	-95	-8	3.44	0.45	12
	Linen Awning	summer	85.6	-4.7	-66	938	607	46	39	1278	-20	-2	3.52	0.37	10
	165°	12 month	89.5	-8.5	-120	938	607	46	39	1332	-74	-6	3.52	0.37	10
Double HiSol LowE	None		76.4			1499				1190			3.77		
	Black Awning	summer	80.2	-3.7	-53	929	570	43	38	1200	-10	-1	3.42	0.35	9
	90°	12 month	83.7	-7.3	-103	929	570	43	38	1250	-60	-5	3.42	0.35	9
	Linen Awning	summer	79.5	-3.1	-44	1009	490	37	33	1197	-7	-1	3.47	0.30	8
	90°	12 month	82.6	-6.2	-88	1009	490	37	33	1241	-51	-4	3.47	0.30	8
	Black Awning	summer	82.2	-5.7	-81	816	683	52	46	1220	-29	-2	3.33	0.44	12
	165°	12 month	86.7	-10.3	-145	816	683	52	46	1283	-93	-8	3.33	0.44	12
	Linen Awning	summer	80.9	-4.4	-63	919	580	44	39	1209	-19	-2	3.40	0.36	10
	165°	12 month	84.7	-8.3	-116	919	580	44	39	1263	-73	-6	3.40	0.36	10

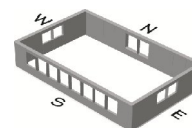


Table 299. Impact of awnings on a house in Medford, Oregon with south-facing windows on a typical year

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		85.7			1763				1341			4.33		
	Black Awning	summer	89.8	-4.1	-58	974	789	60	45	1339	2	0	3.83	0.50	12
	90°	12 month	99.2	-13.6	-191	972	791	60	45	1472	-131	-10	3.83	0.50	12
	Linen Awning	summer	88.9	-3.3	-46	1061	702	53	40	1334	7	1	3.89	0.45	10
	90°	12 month	96.9	-11.2	-158	1060	703	53	40	1446	-105	-8	3.89	0.45	10
	Black Awning	summer	90.4	-4.7	-66	951	812	61	46	1346	-5	0	3.80	0.53	12
	165°	12 month	103.7	-18.0	-254	949	814	62	46	1533	-192	-14	3.80	0.53	12
	Linen Awning	summer	89.2	-3.6	-50	1052	711	54	40	1337	3	0	3.87	0.46	11
	165°	12 month	100.0	-14.3	-202	1051	712	54	40	1489	-148	-11	3.87	0.46	11
Double Clear	None		76.8			1460				1193			3.79		
	Black Awning	summer	80.4	-3.6	-50	882	578	44	40	1199	-6	-1	3.47	0.32	8
	90°	12 month	88.6	-11.8	-167	882	578	44	40	1316	-123	-10	3.47	0.32	8
	Linen Awning	summer	79.7	-2.9	-40	948	512	39	35	1194	-2	0	3.52	0.27	7
	90°	12 month	86.7	-9.9	-140	948	512	39	35	1294	-101	-8	3.52	0.27	7
	Black Awning	summer	80.8	-4.0	-57	862	598	45	41	1205	-12	-1	3.44	0.35	9
	165°	12 month	92.2	-15.4	-216	862	598	45	41	1364	-171	-14	3.44	0.35	9
	Linen Awning	summer	79.9	-3.1	-44	940	520	39	36	1198	-5	0	3.49	0.30	8
	165°	12 month	89.2	-12.4	-175	940	520	39	36	1328	-135	-11	3.49	0.30	8
Double HiSol LowE	None		72.5			1419				1128			3.67		
	Black Awning	summer	75.9	-3.4	-48	868	551	42	39	1135	-7	-1	3.36	0.31	8
	90°	12 month	83.9	-11.5	-161	868	551	42	39	1248	-120	-11	3.36	0.31	8
	Linen Awning	summer	75.2	-2.8	-39	932	487	37	34	1131	-2	0	3.40	0.27	7
	90°	12 month	82.0	-9.6	-135	932	487	37	34	1227	-98	-9	3.40	0.27	7
	Black Awning	summer	76.4	-3.9	-55	846	573	43	40	1140	-12	-1	3.32	0.35	10
	165°	12 month	87.3	-14.9	-210	846	573	43	40	1295	-166	-15	3.32	0.35	10
	Linen Awning	summer	75.5	-3.0	-43	921	498	38	35	1134	-5	0	3.37	0.30	8
	165°	12 month	84.5	-12.0	-169	921	498	38	35	1260	-132	-12	3.37	0.30	8

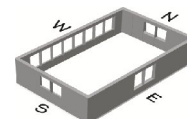


Table 300. Impact of awnings on a house in Medford, Oregon with west-facing windows on a typical year

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		94.2			2175				1491			6.57		
	Black Awning	summer	97.3	-3.2	-45	1141	1034	78	48	1458	34	2	4.35	2.22	34
	90°	12 month	101.5	-7.4	-104	1141	1034	78	48	1517	-26	-2	4.35	2.22	34
	Linen Awning	summer	96.8	-2.6	-37	1270	905	68	42	1460	32	2	4.66	1.90	29
	90°	12 month	100.4	-6.2	-88	1270	905	68	42	1511	-19	-1	4.66	1.90	29
	Black Awning	summer	98.8	-4.7	-66	941	1234	93	57	1464	27	2	3.94	2.63	40
	165°	12 month	104.3	-10.2	-143	941	1234	93	57	1541	-50	-3	3.94	2.63	40
	Linen Awning	summer	97.8	-3.6	-51	1110	1065	81	49	1462	30	2	4.36	2.20	34
	165°	12 month	102.3	-8.2	-115	1110	1065	81	49	1526	-34	-2	4.36	2.20	34
Double Clear	None		83.8			1810				1318			5.66		
	Black Awning	summer	86.6	-2.8	-39	1015	795	60	44	1297	21	2	3.89	1.77	31
	90°	12 month	90.2	-6.4	-89	1015	795	60	44	1348	-29	-2	3.89	1.77	31
	Linen Awning	summer	86.1	-2.3	-33	1116	694	52	38	1298	20	2	4.14	1.52	27
	90°	12 month	89.3	-5.4	-76	1116	694	52	38	1342	-24	-2	4.14	1.52	27
	Black Awning	summer	87.8	-4.0	-56	861	949	72	52	1303	16	1	3.58	2.09	37
	165°	12 month	92.4	-8.6	-121	861	949	72	52	1368	-50	-4	3.58	2.09	37
	Linen Awning	summer	87.0	-3.1	-44	996	814	62	45	1301	18	1	3.91	1.75	31
	165°	12 month	90.8	-7.0	-99	996	814	62	45	1355	-37	-3	3.91	1.75	31
Double HiSol LowE	None		79.1			1760				1248			5.46		
	Black Awning	summer	81.8	-2.7	-38	995	765	58	43	1227	20	2	3.76	1.70	31
	90°	12 month	85.3	-6.2	-88	995	765	58	43	1278	-30	-2	3.76	1.70	31
	Linen Awning	summer	81.3	-2.2	-31	1091	669	51	38	1228	19	2	4.00	1.45	27
	90°	12 month	84.4	-5.3	-75	1091	669	51	38	1272	-24	-2	4.00	1.45	27
	Black Awning	summer	82.9	-3.8	-54	844	916	69	52	1232	15	1	3.45	2.00	37
	165°	12 month	87.5	-8.4	-119	844	916	69	52	1297	-50	-4	3.45	2.00	37
	Linen Awning	summer	82.1	-3.0	-42	973	787	59	45	1230	17	1	3.78	1.68	31
	165°	12 month	85.9	-6.8	-96	973	787	59	45	1284	-37	-3	3.78	1.68	31

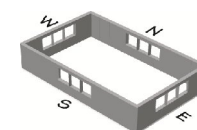
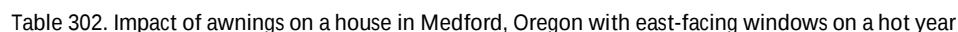


Table 301. Impact of awnings on a house in Medford, Oregon with equally distributed windows on a hot year

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		76.2			3475				1336			6.62		
	Black Awning	summer	78.3	-2.2	-31	2417	1058	80	30	1287	49	4	5.83	0.79	12
	90°	12 month	86.9	-10.7	-151	2409	1066	81	31	1407	-71	-5	5.83	0.79	12
	Linen Awning	summer	78.0	-1.8	-26	2563	912	69	26	1292	43	3	5.96	0.66	10
	90°	12 month	85.3	-9.2	-129	2555	920	70	26	1395	-60	-4	5.96	0.66	10
	Black Awning	summer	79.1	-3.0	-42	2224	1251	95	36	1283	52	4	5.55	1.07	16
	165°	12 month	90.5	-14.3	-202	2215	1260	95	36	1442	-106	-8	5.55	1.07	16
	Linen Awning	summer	78.5	-2.3	-33	2418	1057	80	30	1289	47	4	5.75	0.87	13
	165°	12 month	87.9	-11.8	-166	2410	1065	81	31	1421	-85	-6	5.75	0.87	13
Double Clear	None		66.9			3036				1173			5.82		
	Black Awning	summer	68.7	-1.8	-25	2196	840	64	28	1134	38	3	5.22	0.59	10
	90°	12 month	75.8	-8.9	-126	2191	845	64	28	1235	-62	-5	5.22	0.59	10
	Linen Awning	summer	68.4	-1.5	-21	2312	724	55	24	1139	34	3	5.33	0.48	8
	90°	12 month	74.6	-7.6	-108	2308	728	55	24	1225	-53	-5	5.33	0.48	8
	Black Awning	summer	69.4	-2.4	-34	2043	993	75	33	1132	41	3	5.00	0.81	14
	165°	12 month	78.8	-11.8	-167	2038	998	75	33	1264	-91	-8	5.00	0.81	14
	Linen Awning	summer	68.8	-1.9	-27	2197	839	63	28	1136	37	3	5.16	0.65	11
	165°	12 month	76.7	-9.8	-137	2192	844	64	28	1246	-74	-6	5.16	0.65	11
Double HiSol LowE	None		62.1			2961				1099			5.57		
	Black Awning	summer	63.9	-1.7	-24	2151	810	61	27	1063	37	3	5.02	0.56	10
	90°	12 month	70.8	-8.7	-122	2147	814	62	27	1160	-61	-6	5.02	0.56	10
	Linen Awning	summer	63.6	-1.4	-20	2262	699	53	24	1067	33	3	5.12	0.45	8
	90°	12 month	69.6	-7.4	-105	2258	703	53	24	1151	-52	-5	5.12	0.45	8
	Black Awning	summer	64.4	-2.3	-33	1999	962	73	32	1059	40	4	4.80	0.77	14
	165°	12 month	73.6	-11.5	-162	1994	967	73	33	1188	-89	-8	4.80	0.77	14
	Linen Awning	summer	64.0	-1.8	-26	2148	813	61	27	1064	36	3	4.96	0.61	11
	165°	12 month	71.6	-9.5	-133	2144	817	62	28	1171	-72	-7	4.96	0.61	11



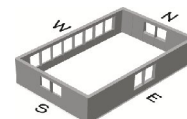


Table 304. Impact of awnings on a house in Medford, Oregon with west-facing windows on a hot year

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		77.4			3700				1370			8.27		
	Black Awning	summer	78.8	-1.4	-20	2375	1325	100	36	1290	80	6	5.90	2.37	29
	90°	12 month	85.1	-7.7	-109	2363	1337	101	36	1378	-8	-1	5.90	2.37	29
	Linen Awning	summer	78.5	-1.2	-16	2550	1150	87	31	1299	71	5	6.26	2.02	24
	90°	12 month	84.0	-6.7	-94	2539	1161	88	31	1376	-6	0	6.26	2.02	24
	Black Awning	summer	79.4	-2.0	-28	2042	1658	125	45	1273	97	7	5.06	3.21	39
	165°	12 month	88.0	-10.6	-149	2028	1672	126	45	1393	-23	-2	5.06	3.21	39
	Linen Awning	summer	78.9	-1.6	-22	2297	1403	106	38	1286	84	6	5.61	2.66	32
	165°	12 month	86.0	-8.6	-122	2285	1415	107	38	1385	-15	-1	5.61	2.66	32
Double Clear	None		69.1			3223				1218			7.14		
	Black Awning	summer	70.3	-1.2	-17	2162	1061	80	33	1154	63	5	5.26	1.88	26
	90°	12 month	75.6	-6.5	-91	2154	1069	81	33	1228	-11	-1	5.26	1.88	26
	Linen Awning	summer	70.1	-1.0	-14	2301	922	70	29	1162	56	5	5.55	1.59	22
	90°	12 month	74.7	-5.6	-78	2293	930	70	29	1226	-8	-1	5.55	1.59	22
	Black Awning	summer	70.8	-1.7	-24	1900	1323	100	41	1142	76	6	4.60	2.54	36
	165°	12 month	77.9	-8.8	-124	1891	1332	101	41	1241	-23	-2	4.60	2.54	36
	Linen Awning	summer	70.5	-1.3	-19	2100	1123	85	35	1152	66	5	5.05	2.09	29
	165°	12 month	76.4	-7.2	-102	2091	1132	86	35	1234	-16	-1	5.05	2.09	29
Double HiSol LowE	None		65.0			3137				1154			6.85		
	Black Awning	summer	66.2	-1.2	-16	2116	1021	77	33	1093	61	5	5.07	1.78	26
	90°	12 month	71.4	-6.4	-90	2109	1028	78	33	1166	-12	-1	5.07	1.78	26
	Linen Awning	summer	66.0	-1.0	-13	2252	885	67	28	1100	54	5	5.34	1.51	22
	90°	12 month	70.5	-5.5	-77	2245	892	67	28	1164	-10	-1	5.34	1.51	22
	Black Awning	summer	66.7	-1.7	-23	1863	1274	96	41	1081	73	6	4.45	2.41	35
	165°	12 month	73.7	-8.6	-122	1855	1282	97	41	1179	-25	-2	4.45	2.41	35
	Linen Awning	summer	66.3	-1.3	-18	2057	1080	82	34	1091	63	5	4.86	2.00	29
	165°	12 month	72.1	-7.1	-100	2050	1087	82	35	1172	-18	-2	4.86	2.00	29