

MEMORANDUM

Date: March 19, 2010
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Subject: TCA Cool Wall coating energy saving calculations for 9 climates

Introduction

This memo documents results and methodology for calculating the energy savings of TCA Cool Wall coating compared to conventional paint when they are applied to the outside surfaces of walls for a retail store in nine climates - Miami, FL; Phoenix, AZ; Las Vegas, NV; Dallas, TX; Bakersfield, CA; Richmond, VA; Knoxville, TN; Sacramento, CA; Los Angeles, CA.

TCA Cool Wall coating has a solar reflectance of 0.462, while conventional paint has a solar reflectance of 0.229. Both coatings have an emissivity of 0.88.

Summary

The analysis is done for a 150' x 300' single story retail store with the long axis along East-West.

- TCA Cool Wall coating shows lower cooling energy use than conventional paint
- TCA Cool Wall coating saves annual electricity ranging from 8,224 kWh in Richmond to 16,895 kWh in Phoenix.
- On the basis of annual cooling and fan electricity usage, the savings range from 3.8% in Miami to 8.3% in Los Angeles.
- On the basis of per square foot of wall area, the savings range from 0.61 kWh/ft² in Richmond to 1.25 kWh/ft² in Phoenix.
- Maximum energy savings occur in summer months when cooling is most required

Results

Table 1 shows annual electrical usage and TCA Cool Wall electricity savings. Table 2 shows monthly building electrical usage.

Table 1: Annual Electrical Usage and TCA Cool Wall kWh Savings

Locations	Cases	Lights kWh	Plug Loads kWh	Cooling kWh	Fans kWh	Cooling + Fans kWh	Total kWh	Savings kWh	Savings % of Cooling + Fans kWh	Savings % of Total kWh	Savings kWh/sf of Wall Area
Miami, FL	Conventional Paint	370,580	70,585	290,005	56,806	346,811	787,976				
	TCA Cool Wall Paint	370,580	70,585	279,562	54,170	333,732	774,897	13,079	3.8%	1.7%	0.97
Phoenix, AZ	Conventional Paint	370,580	70,585	264,817	88,021	352,838	794,003				
	TCA Cool Wall Paint	370,580	70,585	251,470	84,473	335,943	777,108	16,895	4.8%	2.1%	1.25
Las Vegas, NV	Conventional Paint	370,580	70,585	199,612	87,186	286,798	727,963				
	TCA Cool Wall Paint	370,580	70,585	188,687	84,266	272,953	714,118	13,845	4.8%	1.9%	1.03
Dallas, TX	Conventional Paint	370,580	70,585	185,606	64,716	250,322	691,487				
	TCA Cool Wall Paint	370,580	70,585	177,215	62,661	239,876	681,041	10,446	4.2%	1.5%	0.77
Bakersfield, CA	Conventional Paint	370,580	70,585	162,872	69,292	232,164	673,329				
	TCA Cool Wall Paint	370,580	70,585	153,004	66,427	219,431	660,596	12,733	5.5%	1.9%	0.94
Richmond, VA	Conventional Paint	370,580	70,585	113,575	55,729	169,304	610,469				
	TCA Cool Wall Paint	370,580	70,585	107,752	53,328	161,080	602,245	8,224	4.9%	1.3%	0.61
Knoxville, TN	Conventional Paint	370,580	70,585	119,128	53,640	172,768	613,933				
	TCA Cool Wall Paint	370,580	70,585	112,601	51,295	163,896	605,061	8,872	5.1%	1.4%	0.66
Sacramento, CA	Conventional Paint	370,580	70,585	102,597	59,891	162,488	603,653				
	TCA Cool Wall Paint	370,580	70,585	94,821	56,707	151,528	592,693	10,960	6.7%	1.8%	0.81
Los Angeles, CA	Conventional Paint	370,580	70,585	72,871	43,839	116,710	557,875				
	TCA Cool Wall Paint	370,580	70,585	65,578	41,428	107,006	548,171	9,704	8.3%	1.7%	0.72

Table 2: Monthly Building Electrical Usage kWh

Locations	Cases	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Miami, FL	Conventional Paint	56,163	51,747	59,131	63,126	71,343	73,082	78,298	77,637	72,513	68,896	60,213	55,839
	TCA Cool Wall Paint	55,152	50,794	58,098	62,112	70,219	71,921	77,095	76,448	71,368	67,711	59,187	54,805
Phoenix, AZ	Conventional Paint	47,171	43,240	56,120	59,943	70,210	86,690	96,654	91,190	79,163	63,845	52,590	47,200
	TCA Cool Wall Paint	46,406	42,477	55,006	58,762	68,728	84,765	94,552	88,821	77,038	62,522	51,506	46,538
Las Vegas, NV	Conventional Paint	45,229	42,033	47,824	54,431	62,948	78,763	89,957	87,058	71,332	57,273	45,976	45,151
	TCA Cool Wall Paint	44,934	41,363	47,062	53,461	61,776	77,119	87,725	84,918	69,705	56,140	45,153	44,770
Dallas, TX	Conventional Paint	43,791	39,161	47,276	53,707	61,303	72,429	80,704	81,752	66,217	56,601	45,168	43,390
	TCA Cool Wall Paint	43,568	38,959	46,648	52,859	60,342	71,254	79,031	79,980	64,970	55,614	44,679	43,148
Bakersfield, CA	Conventional Paint	43,435	41,470	46,920	49,075	61,027	68,961	79,631	76,550	61,779	55,433	45,603	43,454
	TCA Cool Wall Paint	43,214	40,846	46,115	48,165	59,819	67,469	77,580	74,779	60,505	54,266	44,700	43,149
Richmond, VA	Conventional Paint	42,824	38,760	43,153	45,682	51,739	62,407	70,301	65,438	57,897	48,212	41,762	42,303
	TCA Cool Wall Paint	42,613	38,528	42,877	44,974	50,839	61,268	69,067	64,342	56,765	47,435	41,440	42,106
Knoxville, TN	Conventional Paint	42,637	38,306	43,875	45,774	54,847	61,486	68,505	68,700	58,055	47,687	41,697	42,377
	TCA Cool Wall Paint	42,425	38,139	43,408	44,984	53,810	60,300	67,252	67,476	57,000	46,886	41,262	42,130
Sacramento, CA	Conventional Paint	42,729	39,090	43,813	44,645	53,386	56,910	65,146	64,557	56,907	51,169	42,775	42,535
	TCA Cool Wall Paint	42,462	38,667	43,284	43,845	52,171	55,642	63,694	63,134	55,548	49,933	42,108	42,212
Los Angeles, CA	Conventional Paint	42,752	38,698	43,763	43,704	47,550	47,766	52,417	54,018	50,680	48,798	44,071	43,669
	TCA Cool Wall Paint	42,222	38,226	43,147	42,965	46,646	46,811	51,412	52,994	49,720	47,834	43,236	42,969

Methodology and Model Assumptions

This analysis is done for a typical single story retail store using VisualDOE 4.1. VisualDOE 4.1 is a windows interface to the hourly building energy simulation program DOE-2.1E which was developed by the Lawrence Berkeley National laboratory. DOE-2.1E is a whole building energy analysis tool that uses hourly weather data to calculate energy consumption of a building due to internal and external thermal loads. Details of DOE-2 are available at gundog.lbl.gov. DOE-2.1E version 119 was used for this analysis.

For each climate, two energy models are created with the only difference in absorptance of the outside surfaces of the external walls. The following assumptions are made for the energy models:

Envelope

Size of store:	150' x 300' (45,000 ft ²), long axis along East-West, single story
Space height:	15'
Windows:	No windows
Wall construction:	8" concrete without insulation (U = 0.578)
Roof construction:	Concrete built-up roofing with insulation (U = 0.063)
Floor construction:	Slab-on-grade without insulation
Skylights:	No skylights
Reflectance of walls:	0.462 for TCA Cool Walls, 0.229 for conventional walls
Zoning:	Nine thermal zones with each zone served by a HVAC system

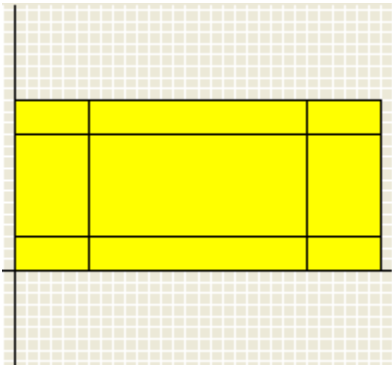


Figure 1 The nine-zone model

Internal loads

Number of people:	100 ft ² per person
Lighting Power Density:	2.1 W/ft ²
Equipment Power Density:	0.4 W/ft ²
Outside air:	15 cfm per person
Infiltration:	Perimeter zone 0.5 ACH when occupied; Core zone 0.05 ACH when occupied. 0 ACH when not occupied.

HVAC system

System type:	Packaged Single Zone system. Total nine systems.
Cooling thermostat set point:	75°F
Heating thermostat set point:	70°F
Operating schedule:	9am to 9pm everyday
Economizer:	No economizer
Supply air volume:	Autosized by DOE-2.1E
Cooling capacity:	Autosized by DOE-2.1E
Cooling system efficiency:	9.5 EER

Weather data

The TMY2 hourly weather data for the nine locations from NREL (http://rredc.nrel.gov/solar/old_data/nsrdb/tmy2/) was used for the energy calculations.