DOE/CE/15611-- T3

EEM Evaluation for EDD Los Angeles Building

Energy Technologies Evaluation for the EDD Los Angeles Building

Summary Report

1. Introduction

This study evaluated the feasibility of potential energy efficiency measures (EEM's) for the proposed EDD office building located at 5401 Crenshaw in Los Angeles, CA. The 26,748 ft² single-story building is currently in the final design phase. Key building energy features include uninsulated exterior concrete block walls, R19 insulated roof, glazing on north and east orientations only, multiple air source rooftop packaged heat pumps, and electric resistance water heaters. For this project, DEG evaluated seven potential EEM's from both performance and 30 year life cycle cost (LCC) perspectives.

2. Objective

The overall project objective was to evaluate seven energy efficiency measures which could be integrated into the EDD Los Angeles Building without major redesign consequences, and to report those technologies which appear to be cost-effective from a current cost perspective, based on LADWP rates applicable to the building.

3. Methodology

3.1. Analysis Assumptions

The EDD building will have typical office occupancy (weekdays 8 AM to 6 PM) with additional walk-in traffic during the daytime hours. Typical peak hour building occupancy is estimated at 160 persons. Assumed thermostat settings during occupied periods were 76°F cooling and 70°F heating. 1.0 Watt/ft² lighting power was assumed based on the specified lighting design; miscellaneous equipment power levels of 1.0 Watt/ft² were also assumed.

The research version of the MICROPAS full-year hourly building simulation program used for performance estimating models all envelope components, building schedule impacts (both thermostat and internal gain), and hourly climate influences on building space conditioning. A Los Angeles hourly weather file (see summary in Appendix A) was used for all simulation runs. Custom models were used as necessary for several specialized EEM's.

Utility rates provided by LADWP (the General Service Schedule A-2 rate options are summarized in Appendix B) were used in the energy evaluations. Three rate options for the EDD building were evaluated for the base case building using DEG's rate comparison model, and a preferred rate option was selected. Projected annual savings were converted to 30 year life cycle value by converting future year savings to present value with an assumed 2% real discount rate. Benefit/cost ratio's (BCR's) were computed as the ratio of discounted value and cost streams over the 30 year term. The cost streams included estimated incremental installed costs plus future replacement or operation/maintenance costs discounted at the assumed 2% (real) rate.

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3.2. EEM Descriptions

This section summarizes the candidate EEM's and their respective input assumptions.

3.2.1. Wall Insulation

1" isocyanurate rigid wall insulation was modelled as an EEM added to the base case exterior walls, which comprise uninsulated masonry with gypsum board applied to furring strips. The R7 insulation with R2 additional reflective airspace between furring members was modelled on all walls and on the west wall only. Improved comfort resulting from higher winter and lower summer wall temperatures was simulated by slight alterations in thermostat settings based on prior research. Wall insulation installed cost was estimated at \$.55/ft².

3.2.2. Added Roof Insulation

MICROPAS was used to project the space conditioning impact of increasing the roof insulation from the R19 base case value to R30. Plastic-wrapped fiberglass batts were assumed for both base and R30 cases. Incremental installed cost was estimated at \$.165/ft².

3.2.3. WhiteCap Night Roof-Spray System

The WhiteCap system sprays water on the roof surface at night and stores the evaporatively and radiatively cooled water for next-day cooling. On sloping roofs, the cooled water is collected at the roof drains, filtered, and delivered to a thermal storage location. Both underfloor and underground tank thermal storage options were evaluated for the EDD building. After detailed reviews influenced by alternate LADWP rate structures, a preferred two-part Whitecap configuration was identified which would store water cooled on the 16,740 ft² east roof section in a buried 15,000 gallon tank north of the building, with tank water delivered on thermostat demand to cooling coils at the four 10 ton heat pumps serving the open plan section of the building; water cooled on the west roof slope would be circulated through underfloor tubing located beneath rooms located along the west and south walls. These rooms, which will typically have lower occupancy levels and cooling loads than the open plan area, will be served by twelve smaller heat pumps. The lower cost "passive" cooling delivery provided by underfloor tubing will most cost-effectively serve these areas.

MICROPAS cooling loads were used in conjunction with external WhiteCap hourly simulation models to project performance for both west and east roof systems. Cost evaluations reflect the WhiteCap potential to reduce auxiliary cooling capacity. System design costs were included in WhiteCap cost estimates. The EDD Whitecap system could, at \$11,000 additional cost, provide fire suppression using optical fire detectors to activate the spray system if fire is detected on the roof. Additional WhiteCap benefits include reduced cooling equipment size and cost, nightly roof cleaning, and extended heat pump life due to reduced operating hours.

3.2.4. Skylight Tubes with Daylighting Controls

Daylighting with dimming controls and ballasts was evaluated as an enhancement to the proposed T8 lighting in the open plan area. An array of 13" skylight tubes on 14' centers was assumed in four daylighting control zones. Cost estimates included four daylighting controls, 150 dimmable ballasts, and 90 skylight tubes. Assumed ballast life was 15 years.

Performance impacts were estimated based on monitoring data for a similar application near Sacramento. 90% of lighting energy savings were assumed also to reduce building cooling loads, with the remainder assumed non-coincident with cooling.

3.2.5. Gas Water Heating

Base case water heating equipment included 50 gallon and tankless electric water heaters with 18 and 6 kW heaters, respectively for the employee and visitor restrooms. Gas water heating was evaluated for both locations. Loads for the employee restroom were based on ASHRAE office building assumption of 1 gallon/day per employee for 70 employees. Estimated water heating load for the visitor restroom was 20 gal./day based on 200 visitors with a 10% use rate.

Gas and electric water heating performance were based on prior DEG work analyzing water heating systems for the California Title-24 Standards under contract to the California Energy Commission. Assumed incremental gas water heating costs included gas line extension (estimated at 100 feet) from a neighboring building, gas piping within the building, and the exhaust flue.

3.2.6. Heat Pump Water Heating

Heat pump water heaters (HPWH's) were also evaluated for both water heating locations. Assumed HPWH average coefficient of performance (COP) was 2.0 based on heat extraction from indoor air. Space cooling accomplished in this configuration was included in HPWH energy savings. Average monthly peak hour demand savings were conservatively estimated at 1.0 kW based on the low HPWH peak demand (0.6 kW) relative to the base case electric water heater.

3.2.7. Water Loop Heat Pump Space Conditioning

Water loop heat pumps (WLHP's) heat or cool by extracting heat from or discharging heat to a circulating water loop which can be heated or cooled (typically with boiler and cooling tower components or a ground heat exchanger) to maintain a reasonable loop water temperature range. WLHP's may be located inside the building because they do not exchange heat with outdoor air. WLHP advantages include reduced exterior equipment exposure, higher operating efficiencies, and partial heat recovery under simultaneous heating and cooling loads. WLHP disadvantages for the EDD building include more difficult service access, loss of thermal access to outdoor air, need for separate ventilation air components, and possible design modifications due to plenum space limitations.

A WLHP system was only considered a viable candidate EEM in conjunction with the WhiteCap system, which could act as a very efficient, low-cost cooling tower. WLHP performance and costs were evaluated incrementally with respect to WhiteCap systems with a chilled water coil at each heat pump return air intake. In cooling season, loop water would cool return air before entering the heat pump condenser. Cooling operation would gradually warm the WhiteCap storage volume during the day, with all heat rejected at night via the roof spray system. Compared to the base case rooftop heat pumps, the WLHP system would increase cooling efficiency and partially shift cooling demand to off-peak hours.

Estimated WLHP costs included the WLHP units with added cooling coils and controls, connecting piping, and an efficient gas auxiliary heater selected based on a comparison of gas and heat pump options.

3.3. Final EEM Package

After each EEM was evaluated as an addition to the base case, all EEM's with BCR greater than 1.25 were combined into a final EEM package. The final package was then analyzed to

compute overall projected energy and cost impacts. The 1.25 BCR threshold was arbitrarily selected in recognition that performance and cost estimates vary in precision, and that EEM's with higher BCR's slightly degrade the economics of marginal EEM's.

4. Results

Projected annual base case energy use and demand are summarized in Table 1. The projected annual cooling load is almost five times the heating load. Under the selected LADWP Rate A, base case space conditioning energy use will cause approximately 38% of the \$28,300 projected annual energy bill.

Table 1: Projected Base Case Use				
Cooling kWh	44,860			
Heating kWh	9,110			
Water Heating kWh	5,490			
Lighting kWh	66,340			
Miscellaneous kWh	66,340			
Supply and Exhaust Fan kWh	31,740			
Total Annual kWh	223,880			

Based on monthly electrical energy and demand projections for the base case building under LADWP Rates A (Primary Service), B (Primary Service Time-of-Use), and D (Rolled-in Demand Service), Rate A was selected as the preferred rate, saving approximately 0.6% over Rate B. Projected Rate D costs were approximately 13% higher compared to Rate B. Rate A includes a \$0.046/kWh energy charge and demand charges ranging from \$14.27/kW-month from June through October to \$13.11/kW-month from November through May.

Table 2 summarizes results of the individual EEM analyses. Wall insulation was found to be most cost-effective on the west wall, with a 7.3 benefit/cost ratio (BCR), but was also projected to have 2.0 BCR when applied to all exteror walls. R30 ceiling insulation was also found to be cost-effective on a life-cycle basis with a 1.5 BCR.

The WhiteCap system was projected to be the largest energy saver of the candidate EEM's, and showed the second highest projected BCR, assuming HVAC unit sizings are reduced by a total of 25 tons in accordance with simulation results. Appendix C provides additional detail on WhiteCap economics. Both gas and heat pump water heating options were found to be cost-effective for the employee restroom, with the heat pump showing a higher BCR. Neither option was found to be viable for the visitor restroom.

Water loop heat pumps, which were evaluated as an incremental EEM added to the WhiteCap system, were not found to be cost-effective because of high first cost and limited demand savings compared to the basic WhiteCap system. Since the WLHP units would reject heat to the WhiteCap water during pre-peak hours, they would reduce WhiteCap cooling capacity during afternoon peak load hours. WLHP demand savings from higher system efficiencies

would be approximately equal to demand savings under the anticipated cooling delivery strategy for the basic WhiteCap system. The skylight tube daylighting system showed the lowest projected BCR of the candidate EEM's, due to high costs for the tubes and the dimming ballasts necessary to reduce fluorescent lighting energy use.

	Energy	Annual	30	Initial	30	
	Savings	Bill	Year	Incremental	Year	
	(kWh)	Savings	Benefit	Cost	LCC	BCR
R7 Wall Insulation (West only)	2960	\$340	\$6,660	\$908	\$908	7.3
WhiteCap	20680	\$3,360	\$65,856	\$10,094	\$10,767	6.1
HPWH (Employee restroom)	4375	\$382	\$7,487	\$900	\$1,569	4.8
Gas WH (Employee restroom)	. 0	\$219	\$4,292	\$1,390	\$1,464	2.9
R7 Wall Insulation	5600	\$291	\$5,704	\$2,897	\$2,897	2.0
Ceiling Insulation	2380	\$322	\$6,310	\$4,350	\$4,350	1.5
Water Loop Heat Pumps	7260	\$1,395	\$27,342	\$22,050	\$38,433	0.7
HPWH (Visitor restroom)	430	\$47	\$921	\$1,000	\$1,743	0.5
Gas WH (Visitor restroom)	490	\$14	\$274	\$300	\$523	0.5
Daylighting Option	25060	\$1,884	\$36,926	\$94,000	\$100,275	0.4

A final EEM package was developed and analyzed based on results of the individual EEM studies. Full R7 wall insulation and R30 ceiling insulation were selected as cost-effective improvements to the building envelope; WhiteCap and the employee restroom heat pump water heater were selected as cost-effective mechanical system EEM's. Table 3 summarizes performance and economics of the recommended EEM package. The four proposed EEM's would save approximately 14% of anticipated base case energy use and, by significantly reducing demand charges, would reduce the projected annual energy bill by more than 19%. For an \$18,240 initial incremental cost, the four EEM's would produce more than \$106,000 life cycle value with an overall benefit/cost ratio of 5.4.

Table 3: Final EEM Package Projections						
Includes: WhiteCap, HPWH (employee rest room)	, R7					
wall insulation, and R30 ceiling insulation)					
Annual Energy Savings (kWh) 30700						
Peak Summer Month Demand Savings (kW)	29					
Annual Cost Savings	\$5,420					
30 Year Cost Savings NPV						
Initial Incremental Cost \$18,240						
30 Year Incremental LCC \$19,583						
Overall Benefit Cost Ratio 5.4						

5.0. Conclusions

After detailed performance and economic evaluations, the following four energy-efficiency measures were projected to be cost-effective for the EDD Los Angeles Building:

- 1) 1" isocyanurate insulation board between exterior wall furring strips
- 2) R30 ceiling insulation instead of the currently-specified R19 insulation
- 3) a WhiteCap roof-spray/storage cooling system as described in Section 3.2.3.
- 4) a heat pump water heater for the employee restroom area.

Other than reducing energy costs, none of these measures is expected to have noticeable impact on building operation. The two insulation measures are completely passive and should continue to save energy throughout the life of the building. While WhiteCap system economics were computed based on reduced cooling system sizing, the life cycle benefit/cost ratio would remain favorable at 1.32 if base case sizing remained unchanged. In this scenario, full cooling performance would be delivered even if the WhiteCap system malfunctioned. Similarly, the heat pump water heater performs incrementally to the base case water heater, which would satisfy loads (at higher energy cost) at any time the heat pump unit failed to operate. However, both "active" EEM's are relatively simple mechanical components with high anticipated reliability.

6.0. Recommendations

Wall insulation, added ceiling insulation, a WhiteCap roof spray natural cooling system, and a heat pump water heater for the employee restroom are recommended for implementation in the EDD Los Angeles building. Building design drawings and specifications should be altered to show these changes and added features.

The recommended changes are projected to generate more than \$100,000 net present value over the 30 year economic analysis period, at a combined benefit/cost ratio of 5.4.

The recommended budget increases for the four EEM's include approximately \$20,000 for minimum incremental costs per results of these studies, plus the following optional amounts:

- 1) \$40,000 additional WhiteCap costs if cooling capacity is not reduced
- 2) \$11,000 for configuring WhiteCap as an automatic fire suppression system
- 3) \$3,000 for soils studies related to WhiteCap underslab tubing.

With all optional costs plus a 10% contingency, the total incremental budget would be approximately \$81,000.

Appendix A:

Average Summer Weather Data

Weather File: CTZ06R.WTF

Location: Long Beach

Average Hourly Conditions for Summer Months

		MAY DB	MAY WB	JUN DB	JUN WB	JUL DB	JUL WB	AUG DB	AUG WB	SEP DB	SEP WB
HR	1	58	54	61	58	65	60	67	63	65	59
HR	2	58	54	61	58	65	60	66	63	64	59
HR	3	57	54	61	58	65	60	66	62	64	59
HR	4	57	53	61	58	64	60	66	62	64	59
HR	5	56	53	61	58	64	60	66	62	63	58
HR	6	57	54	60	57	65	60	66	62	64	59
HR	7	59	54	61	58	66	61	66	63	65	59
HR	8	59	55	63	59	67	61	67	63	65	59
HR	9	61	55	65	60	69	62	69	64	68	61
HR	10	63	56	68	61	71	63	71	65	72	62
HR	11	65	57	70	62	74	64	75	66	75	63
HR	12	66	57	72	64	76	64	76	67	77	63
HR	13	67	57	75	64	78	65	78	68	78	64
HR	14	68	58	75	64	80	65	79	68	80	65
HR	15	68	58	76	65	79	65	80	68	79	64
HR	16	68	58	75	64	79	65	80	68	78	63
HR	17	67	58	75	64	79	65	78	67	76	63
HR	18	65	57	73	63	76	64	75	66	74	62
HR	19	63	56	70	62	73	62	72	65	71	.61
HR	20	61	55	67	60	69	61	69	64	68	60
HR	21	61	55	64	59	68	61	68	63	68	60
HR	22	60	54	63	59	67	60	67	63	67	60
HR	23	60	54	62	58	66	60	67	63	66	59
HR	24	59	54	62	58	66	60	67	63	63	57

Appendix B:

LADWP Rates

SCHEDULE A-2 - GENERAL SERVICE

1. Applicability

D.

Applicable to General Service, including lighting and power, and charging of batteries of commercial electric vehicles, which may be delivered through the same service in compliance with the Department's Rules. Applicable to service at 30 kW demand or greater, but less than 500 kW demand. Not applicable to service which parallels, and connects to, customer's own generating facilities, except as such facilities are intended solely for emergency standby.

2.	Mor	tbly F	lates	High Season June-Oct.	Low Season NovMay
	a.	Rate	A - Primary Service		
		(1)	Service Charge	\$25.00	\$25.00
		(2)	Facilities Charge - per kW	\$ 2.25	\$ 2.25
		(3)	Demand Charge - per kW	\$13.78	\$12.62
		(4)	Energy Charge - per kWh	\$ 0.02181	\$ 0.02181
		(5)	ECA - per kWh	See General	Provisions
		(6)	ESA - per kW	See General	Provisions
	ъ.	Rate	B - Primary Service Time-of-Use		
	•	(1)	Service Charge	\$25.00	\$25.00
		(2)	Facilities Charge - per kW	\$ 2.25	\$ 2.25
		(3)	Demand Charge - per kW High Peak Period Low Peak Period Base Period	\$ 8,63 \$ 4.21 \$ 1.40	\$ 7.90 \$ 3.85 \$ 1.40
••		(4)	Energy Charge - per kWh High Peak Period Low Peak Period Base Period	\$ 0.02949 \$ 0.02907 \$ 0.01658	\$ 0.02907
		(5).	Electric Vehicle Discount - per kWh	\$ {0.02500}	\$ (0.02500)
		(6)	ECA - per kWh	See General	Provisions
		(7)	ESA - per kW	See General	Provisions

10

C.	Rate C - Subtransmission Service									
	(1)	Service Charge	\$50.00	\$50.00						
	(2)	Facilities Charge - per kW	\$ 1.65	\$ 1.65						
	(3)	Demand Charge - per kW High Peak Period Low Peak Period Base Period	\$ 8.52 \$ 4.10 \$ 0.80	\$ 7.80 \$ 3.76 \$ 0.80						
	(4)	Energy Charge - per kWh High Peak Period Low Peak Period Base Period	\$ 0.02800 \$ 0.02772 \$ 0.01585	\$ 0.02772						
	(5)	Electric Vehicle Discount - per kWh	\$ (0.02500)	\$ (0.02500)						
	(6)	ECA - per kWh	See General Provisions							
	(7)	ESA - per kW	See General Provisions							
,	(8)	Reactive Energy Charge	See Rate A-3	3(A)						
d.	Rate I	2 - Rolled-in Demand Service	•							
	(1) .	Service Charge	\$25.00	\$25.00						
	(2)	Facilities Charge - per kW	\$ 2.25	\$ 2.25						
	(3)	Energy Charge - per kWh High Peak Period Low Peak Period Base Period	\$ 0.22790 \$ 0.12730 \$ 0.05090							
	(4)	Electric Vehicle Discount - per kWh	\$(0.02500)	\$ (0.02500)						
	(5)	ECA - per kWh	See General	Provisions						
	(6)	ESA - per kW	See General	Provisions						

3. Billing

The bill under Rate A or D shall be the sum of parts (1) through (6). The bill under Rate B shall be the sum of parts (1) through (7). The bill under Rate C shall be the sum of parts (1) through (8).

AOB SPECIAL BILLING

TEL:818-771-2839

May 23,95

10:42 No.006 P.01

March 31, 1995

GENERAL PROVISION F - ENERGY COST ADJUSTMENT FACTOR

The Energy Cost Adjustment Factor (ECAF) per kWh of energy consumed during the months of April, May, and June 1995 will be \$0.02454. The rate for the previous quarter was \$0.02580.



GENERAL PROVISION G - ELECTRIC SUBSIDY ADJUSTMENT FACTOR

The Electric Subsidy Adjustment Factor (ESAF) per kWh of residential energy consumed during the period January 1, 1995 through December 31, 1995 will be \$0.00207. The rate for the previous year was \$0.00145.

The Electric Subsidy Adjustment Factor per kilowatt demand as derived for the facilities charge during the period January 1, 1995 through December 31, 1995 will be \$0.49. The rate for the previous year was \$0.47.

GENERAL PROVISION F - WATER PROCUREMENT ADJUSTMENT FACTOR

The Water Procurement Adjustment Factor (WPAF) per 100 cubic feet of water consumed during the months of April, May, and June 1995 will be \$0.394. The rate for the previous quarter was \$0.502.

For test bills comparison, the Water Cost Adjustment Factor per 100 cubic feet of water consumed during the months of April and May 1995 will be \$0.462. The previous rate for the previous quarter was \$0.567.

GENERAL PROVISION G - WATER QUALITY IMPROVEMENT ADJUSTMENT FACTOR

The Water Quality Improvement Adjustment Factor (WQIAF) per 100 cubic feet of water consumed during the months of April, May, and June 1995 will be \$0.250. The rate for the previous quarter was \$0.229.

GENERAL PROVISION H - WATER REVENUE ADJUSTMENT FACTOR

The Water Revenue Adjustment Factor (WRAF) per 100 cubic feet of water consumed during the months of April, May, and June 1995 will be \$0.00. The rate for the previous quarter was \$0.00.

OUTSIDE THE CITY OF LOS ANGELES SURCHARGE

The Water Surcharge per 100 cubic feet of water consumed to services outside the City of Los Angeles during the period January 1, 1995 through December 31, 1995 will be \$0.175. The rate for the previous year was \$0.229.

PATRICIA A. MARTIN Commercial Manager

Special Billing

APPROVED:

5-4

F. RENNIE POWELL

DEPARTMENT OF WATER & POWER CITY DF LOS ANGELES

HISTORICAL AND PROJECTED ENERGY COST ADJUSTMENT (ECA) BILLING FACTORS ALL UNITS IN DOLLARS/KHH

·	PERIOD APPLICABLE	1994-95	CALENDAR YEAR 1995	1995-96	CALENDAR YEAR 1996	1996-97	CALENDAR YEAR 1997	
* The state and	JULY AUGUST SEPTEMBER	0.02438 0.02438 0.02438		8.02494 0.82494 0.02494		0.02668 0.02668 0.02668		•
	OCTOBER HOVEMBER DECEMBER	0.02539 0.02539 0.02539		0.02552 0.02552 0.02552		0.02659 0.02659 0.82659		
	JANUARY FEBRUARY HARCH	0.02588 0.02588 0.02588		0.02588 0.02588 0.02588		0.02672 0.02672 0.02672		
(APRIL HAY JUNE	0.02454× 0.02454× 0.02454×		0.02612 0.02612 0.02612		0.02716 0.02716 0.02716		•
8	AVERAGE	0.02501	0.92529	0.02561	0.82632	0.82679	0.02713	Y ER
(PERIÓD APPLICABLE	1997-98	CALENDAR YEAR	1998-99	CALENDAR YEAR	1999-00	CALENDAR YEAR	BELAUDR
	JULY AUGUST SEPTEMBER	0.02758 9.02738 0.02738		0.02768 0.02768 0.02768		8.02725 0.02725 0.02725		RIAN BE 1756
	OCTOBER NOVEMBER DECEMBER	0.82726 0.02726 0.02726		0.02742 0.02742 0.02742		0.02750 0.02750 0.02750		MR. 8 333 S ROOM
	JANUARY FEBRUARY HARCH	0.02692 0.02692 0.02692	•	0.02693 0.02693 0.02693		0.02715 0.02715 0.02715		
	APRIL Hay Juhe	0.02720 0.02720 0.02720		#.02686 #.02686 #.02686		0.02743 0.82743 0.02743		
	AVERAGE	0.02719	0.02730	•.02722	0.02713	0.02733	0.02756	•
	*LATEST ACTL	JAL ENERGY CO	ST ADJUSTHENT		** **********	**********		
	CONSERVATION RATE GROUP 04 83 1995	N AND PLANNIN	G DIVISION		•		•	

Appendix C:

WhiteCap Economic Study



123 C Street Davis, CA 95616

Tel: 916-757-4844 Fax: 916-753-4125

WhiteCap

SAMPLE ECONOMICS

Prepared 5/25/95

Building:

EDD Los Angeles

Floor Area (ft2): 26,748

1. INSTALLED COSTS

(Standard 79	tons, W	hiteCap	54	tons)
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Cost Item	Standard	WhiteCap
WhiteCap System		
Roof Spray System		\$13,374
Floor Tubing & Coil	S	\$13,220
15,000 gal. Storage T	ank	\$16,500
Hardware & Contro	ls	\$6,600
Subtotal		\$49,694
HVAC System: Subtotal	\$142,200	\$102,600
Base @ \$1800/ton		
WC @ \$1900/ton		
Totals	\$142,200	\$152,294
Net WhiteCap2 Cost:		\$10,094

2. ENERGY COST SAVINGS

Energy Charges	\$2,080	\$1,121
Demand Charges	\$6,744	\$4,342
Total Cooling Cost	\$8,824	\$5,463
Annual Net WhiteCap2 Savings		\$3,361
Thirty Year WhiteCap2 Savings	\$65,856	
3. TOTAL WhiteCap Net Present value		\$55,762