

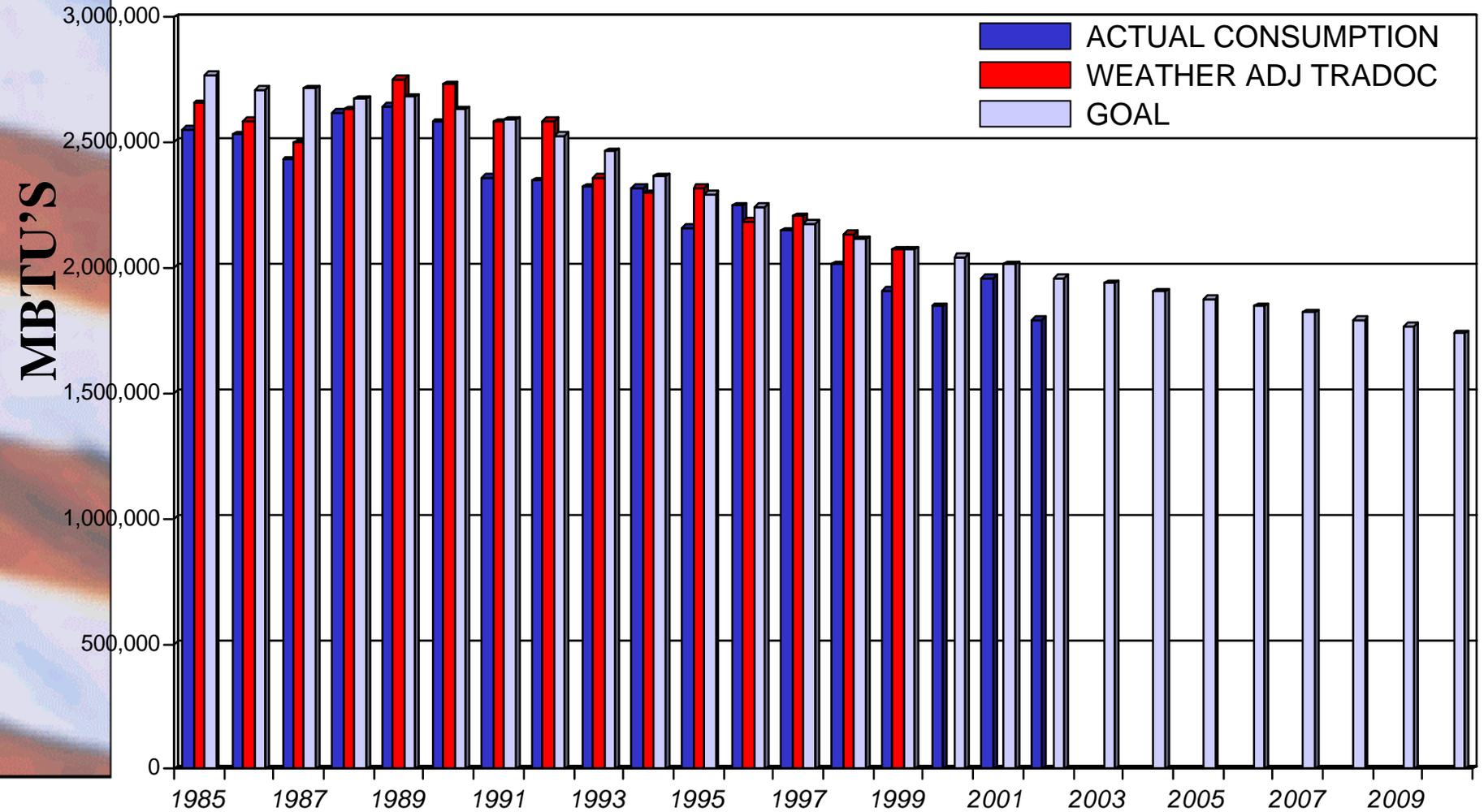
FORT KNOX ENERGY PROGRAM

ARMY BREAKOUT WORKSHOP

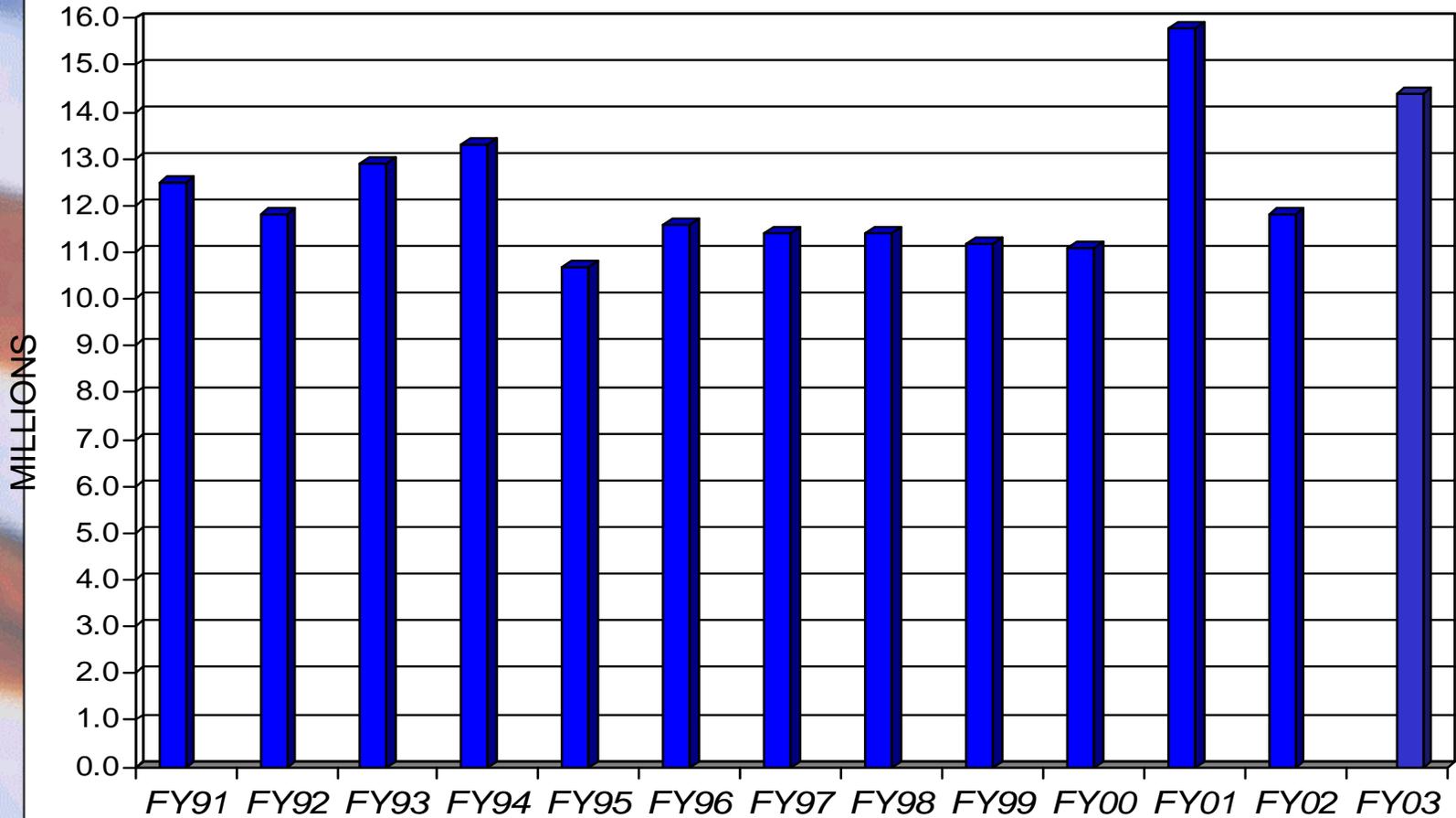
21 August 2003

***GARY MEREDITH P.E. CEM
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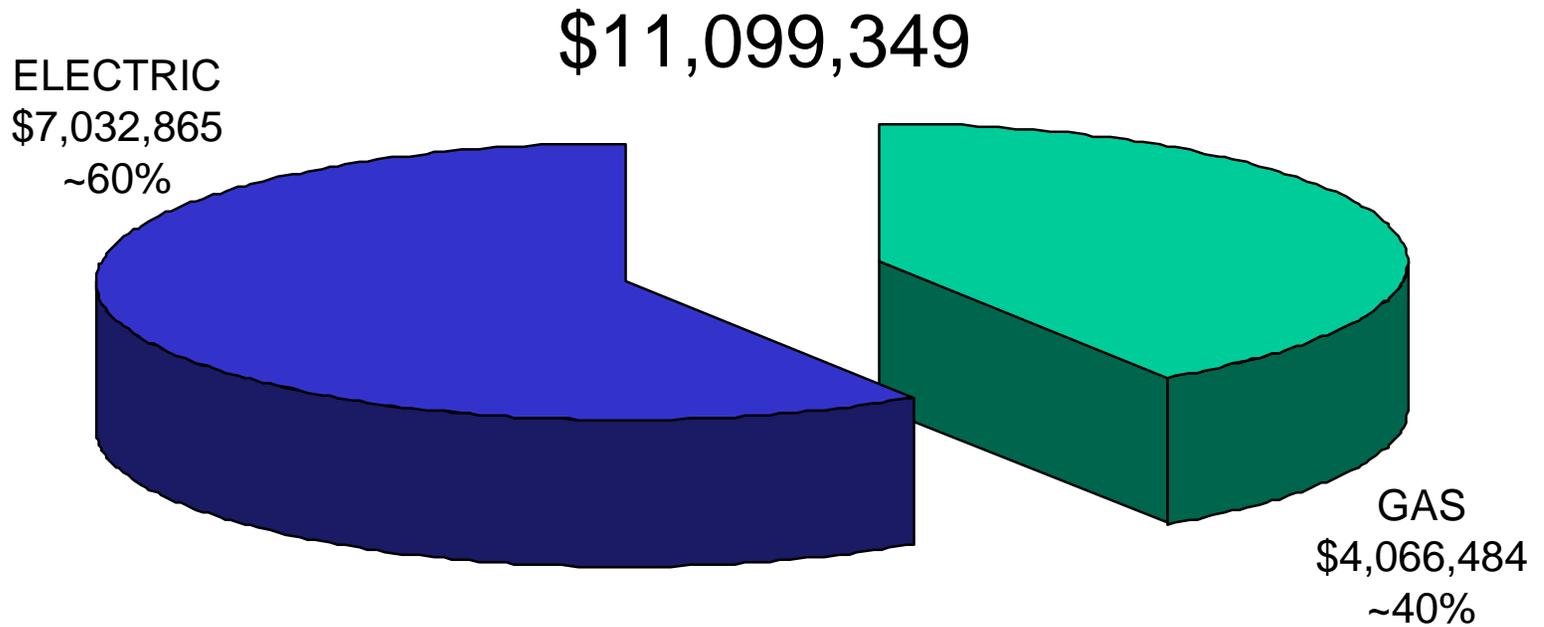
FORT KNOX STATUS COMPARED TO TRADOC GOAL



FORT KNOX UTILITY COST FY DOLLARS SPENT

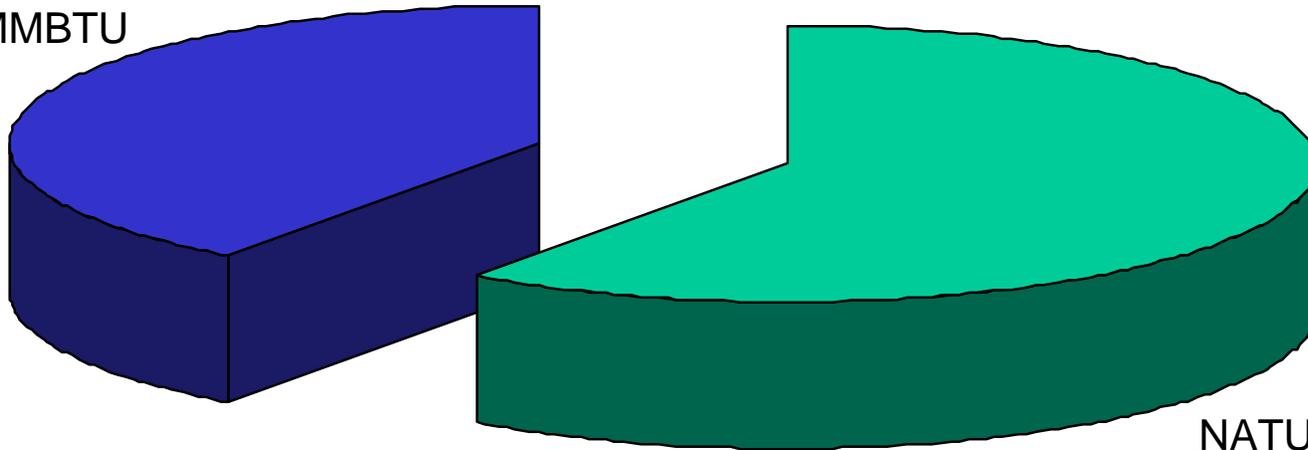


FORT KNOX FY02 GAS AND ELECTRICITY BILL



FY02 MMBTU USAGE COMPARISON

ELECTRIC
about 40%
0.8 MMBTU



NATURAL GAS
about 60%
1.2 MMBTU

WAYS TO REDUCE ENERGY CONSUMPTION

- CONSUMER AWARENESS TURN OFF LIGHTS, COMPUTER, ADJUST TEMPS, ETC
- DESIGN ENERGY EFF INTO CONSTRUCTION AND RENOVATION.
- ECIP – ENERGY CONSERVATION IMPROVEMENT PROGRAM
- FEMP - FEDERAL ENERGY MANAGEMENT PROGRAM
- ESPC - ENERGY SAVINGS PERFORMANCE CONTRACTS
- DSM - DEMAND SIDE MANAGEMENT/UESC CONTRACTS

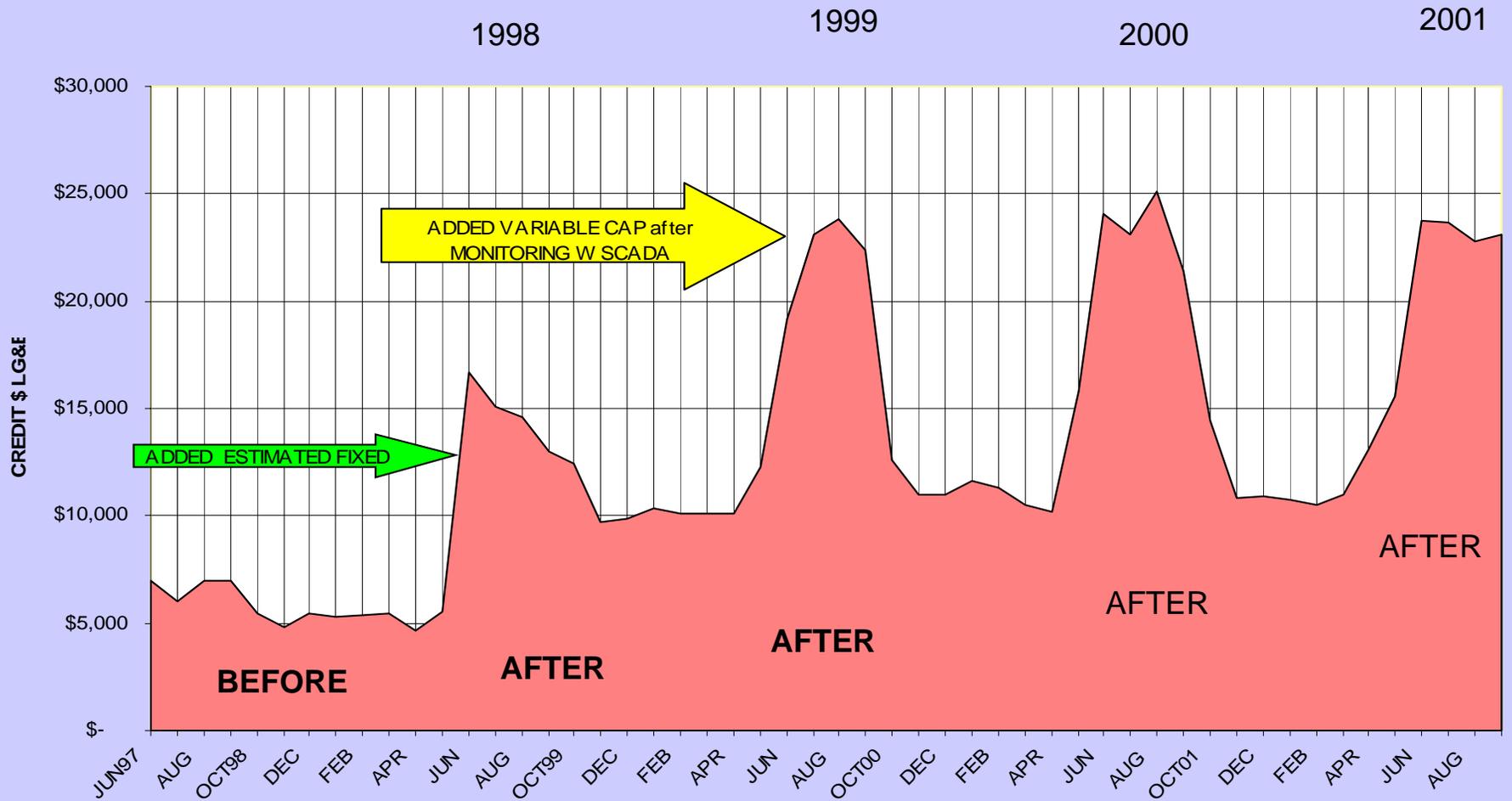
FORT KNOX PROJECT TOTALS

- \$18,069,100 – Project Costs
- 280,023 – Estimated MCF Saved
- 13,732,790 – Estimated Kwh Saved
- \$2,884,579 – Annual Savings
- **CURRENTLY AWARDED~ \$32 MILLION**

PROJECTS INCLUDE:

- LIGHTING IN ALL NON-FAMILY HOUSING (SCHOOLS, HOSPITAL, COMMISSARY)
- INFRARED HEAT IN ALL HIGH BAY BUILDINGS (>110 bldgs, 10%, 1.2 M FT²)
- LIGHTS-OFF T- STATS IN MOST IR SPACE (Dark goes to 55°F)
- LED TRAFFIC SIGNALS (12 YEAR BULBS)
- REDUCED - HIGH BAY GLASS WALLS WITH SPRAY ROOF (~70 EA)
- GROUND COUPLED HP'S, 13 BLDGS, 250,000 FT², 265 WELLS
- BOILER PLANT 860 REPLACED, SAVES \$1 M/YR &~100K, mmbtu/yr
- HVAC REPLACEMENTS & BUILDING AUTOMATION SYSTEM
- SCADA TO MONITOR THE ELECTRIC UTILITY SYSTEM (99 PF)

UTILITY DOLLAR CREDIT FOR GOOD POWER FACTOR



FORT KNOX IRELAND ARMY HOSPITAL

NEW CENTRAL CHILLED WATER AND STEAM PLANT

ENERGY CONSERVATION PROJECT

➤ FINANCIAL DATA

Project Cost	\$4,830,644
Annual Energy Cost Savings	\$1,004,011
Simple Payback	4.8 Years
Annual Energy Savings	131,756 MMBtu

➤ MAJOR EQUIPMENT

<u>QTY</u>	<u>DESCRIPTION</u>
4	215 H.P. Flextube Steam Boilers 9 K MMBTU
3	800 Ton Centrifugal Water Chillers
3	800 Ton Cooling Towers
2	200 H.P. Chilled Water Distribution Pumps
3	50 H.P. Cooling Tower Pumps
3	40 H.P. Chiller Pumps
1	155 KW Diesel Emergency Generator
1	2000 A Utility Synchronous Switchgear
1	12,000 Gal Emergency Fuel Oil Tank

**ENERGY DESIGN STANDARDS FOR FORT KNOX
(for all NEW & RENOVATION projects)**

CMT NO.	REFERENCE	COMMENTS
1	Lighting	Use T-8 lamps only (4100K, CRI 70 (F32TB/TL741) without special permission. Design all to IES stds. Effort to standardize. These lamps shall be driven by instant start electronic ballasts, unless special reason. U-tubes should be avoided as they are fragile and expensive. Use the proper fixture or retrofit for 2 ft straight T-8 tubes. Use Florescent tubes (best choice if applicable), high-pressure Sodium or Metal Halide in high bay areas. Porch/entrance lights, use PL13 w/photo cell.
2	Light Switching	Lighting in large areas (cafeterias, conference areas, maintenance areas) should provide <u>Switching for partial area lighting for small area use, when entire facility is not needed.</u>
3	LED Exit Signs	Use LED Exit signs, all cases.
4	Motors	Use energy efficient motors that meet the "NEMA Premium" efficiency standards.
5	Outside lighting	Install photocells control on all outside lighting and street lighting to Nolin Recc Electric street light standards.
6	Occupancy Sensors	Install occupancy sensors in break areas, conference rooms, bathrooms, offices, and other. Ceiling Mount sensors where applicable.
7	Water heaters	Insulate water heaters and provide thermal breaks or install new high efficient heaters all with electronic ignitions.
8	Metering (All buildings) All Utilities	Gas, electric and water meters should be installed to Public Service Commission (PSC) and Fort Knox standards. All utilities shall be metered and installed to utility company standards. Nolin electric, (LG&E Gas & HC#1 Water) . Knox specs are available on request.
9	Infrared Heating and heating	High bay/K SPAN and maintenance areas should be heated by most efficient means or, with condensing style- inline gas fired type infrared Heating systems capable of exhaust via plastic pipe. Exhaust through walls not roofs is desirable. Employ lightstats to set back at night to 55 degrees F or be tied to the post wide building automation system. Project Manager energy decision on a case by case decision. All heating equip shall have electronic ign. unless special case.
10	Insulated windows	Thermopane insulated windows shall be used with double low E (E squared) glass, and argon filled. Temper glass as applicable.
11	Insulation R-Factor	Proper R value insulation for roof and walls shall be used. Spray Polyurethane foam is often a preferred roof material. Walls shall have a house wrap coating in addition to the normal insulation.
12	General	Designs shall consider all energy saving devices and choose most efficient product in order to conform to the Energy Policy Act of 1992 , & latest exe order on energy, and adhere to LCCA standards.
13	Transformers	Use Amphorous Core transformer for low power consumption should be considered
14	FaucetAerators&shower heads	Use faucet aerators on all faucets
15	Faucets	Use spring loaded or sensor detection faucets except in family housing as applicable.
16	HVAC controls & automation	All building controls shall be compatible w/existing base wide building automation system, Trane Tracer System (spec available). The School System at Knox has a centralized Johnson Controls System.
17	HVAC	Ground coupled heat pumps or hybrid systems shall be considered first for all buildings, where applicable. Seer for air coupled heat pumps minimum shall be 13, higher is desirable if conforms to LCCA..
18	Traffic Signals	Only LED traffic sign bulbs shall be used most cases. Again LCCA (life cycle cost analysis) applies.
19	Sky Lighting/	Day lighting is acceptable in most cases for roofs and walls if applicable to replace artificial lighting.

POC is the Energy office 502-624-8358 Gary Meredith,

Approved by: T. Hutchins

**JOSEPH V. MUSCARELLA
COL, EN
Director of Base Operations Support**

DSM

- FORT KNOX SERVED BY 4 ELECTRIC UTILITIES
- WORKED WITH LARGEST UTILITY FIRST BUT GOT BETTER DEAL WITH SMALLER CO-OP
- CO-OP AND BASE COME UP WITH VIABLE PROJECTS
- COOP'S HAVE AN ADVANTAGE TO US OF LOW INTEREST \$'S
- NON-PROFIT STATUS

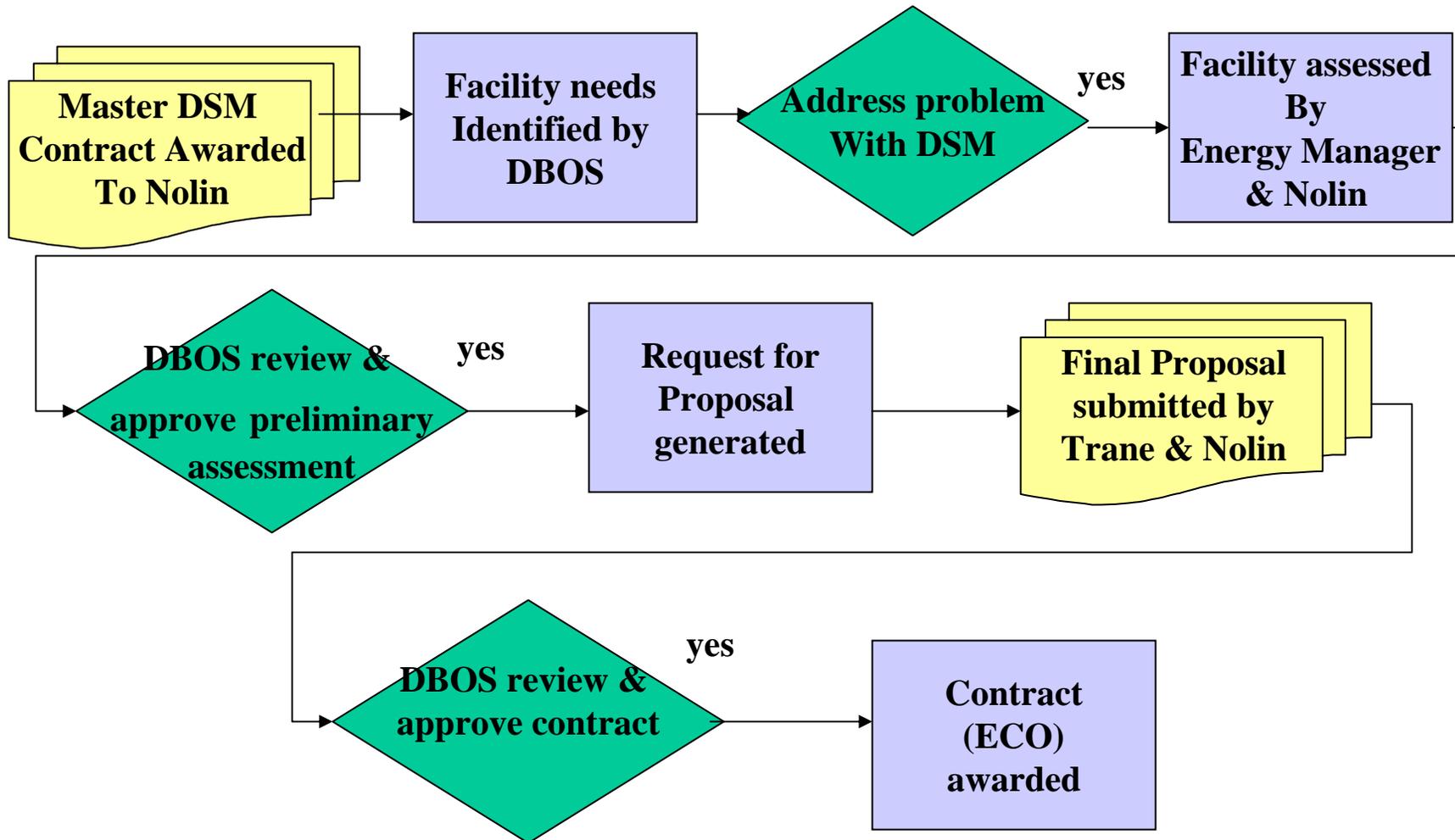
WHAT IS DSM?

- DSM UTILITY HIRES A CONTRACTOR
- DSM UTILITY PAYS CONTRACTOR IN FULL ONCE COMPLETE
- POST PAYS FOR PROJECT OVER 10 YEARS AT THE UTILITIES' INTEREST RATE (6 - 6.5%) NOW.....2.8%
- UTILITY IS PAID A ONE TIME 7% MANAGEMENT FEE
- NO OUTSIDE FEASIBILITY STUDIES TO DATE
- NO DESIGN FEES PAID

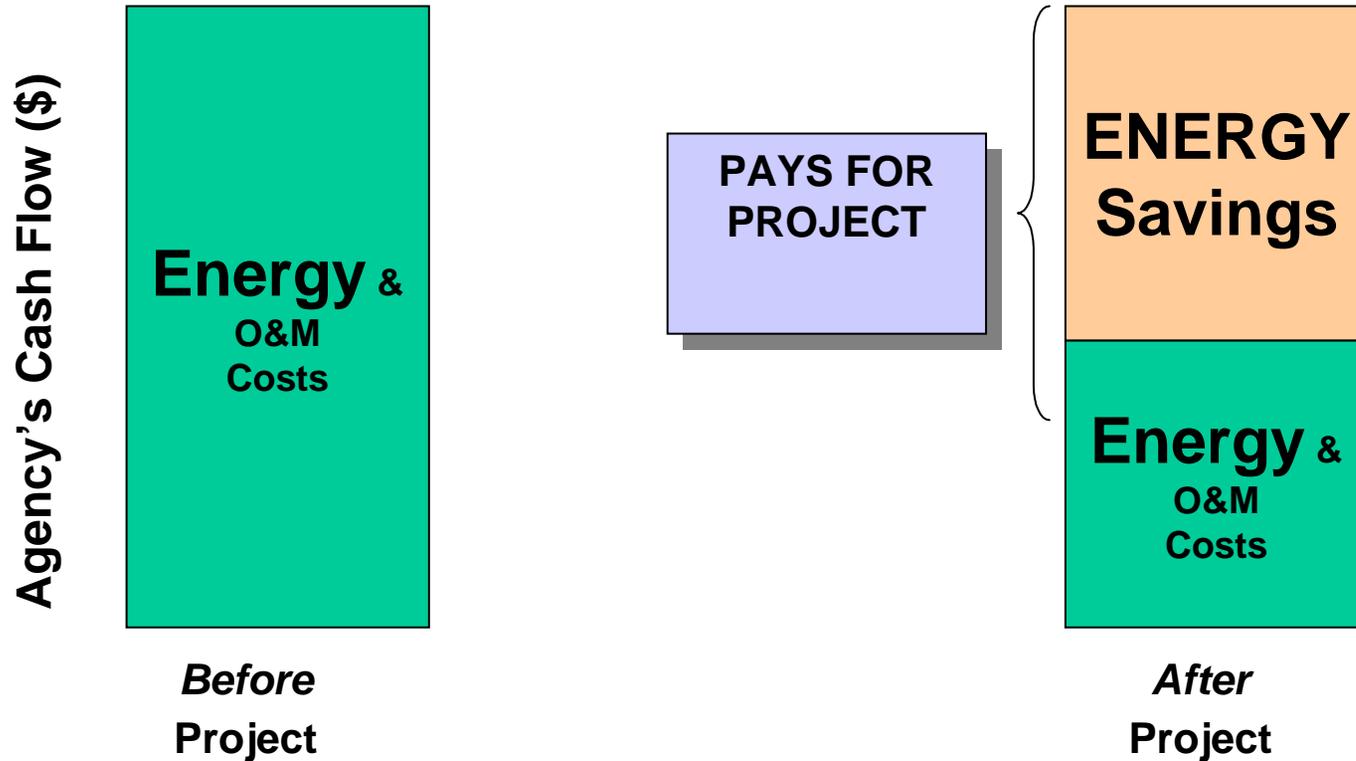
DSM LIMITATIONS

- 10-YEAR PAYBACK OR LESS IS REQUIRED
- GOVT. PAYS FOR PROJECT EVEN IF SAVINGS ARE NOT REALIZED
- PROJECTS CAN BE LIMITED TO SIMPLER DESIGNS (LIGHTING, LOW HANGING FRUIT) – OR CAN USE BUNDLING

DSM Project Award Process



Mechanics of How DSM Works



ENERGY PROGRAM CONCERNS

- ENERGY MANAGERS SERVE TWO MASTERS
- PLEASE TASK ENERGY MANAGERS BOSS...
- HELPS MY BOSS MANAGE WHAT YOU NEED
- GOVERNMENT MUST BUILD IN ENERGY EFFICIENCY IN ALL CONSTRUCTION, MCA, ETC.
- 1391 PROCESS.. WRITE IN ENERGY EFF. EQUIPCAN'T ADD \$'s LATER EVEN IF SMART
- AVOID LOWEST FIRST COST, IF NOT EFFICIENT.
- PAY NOW OR PAY HIGHER UTIL BILL FOR LIFE
- MOLD PROBLEMS ...USUALLY HVAC PROBLEM
- CENTRAL FUNDING OF ENERGY PROJECTS

ECO 51 Revised Facility List

7/25/03

646,456 Ft² Total

1109 / Admin – 127,096 Ft²

1491 / Dining – 17,510 Ft²

1724 / Training – 203,380 Ft²

1726 / Training – 50,816 Ft²

2389 / Admin – 63,268 Ft²

2814 / Barracks – 29,924 Ft²

2815 / Barracks – 35,736 Ft²

2816 / Barracks – 29,924 Ft²

2817 / Barracks – 23,142 Ft²

2818 / Barracks – 29,924 Ft²

2819 / Barracks – 35,736 Ft²

Construction Scope Highlights

ECO 51

- **1109 – Integrate Trane Fan Coils, Chillers & Boilers into Tracer Summit System**
- **1491 – Integration of Existing Equipment to New DDC Control for Monitoring & Scheduling**
- **1724 – Skidgel Hall**
 - **BacNet Siemens System to Base Wide Summit System**
 - **Installation of High Efficiency Hot Water Heating Boilers**
 - **Shutdown of Skidgel / Marshall Old Steam Plant (1725)**
- **1726 – Marshall Hall**
 - **Total New HVAC System with Direct Digital Controls**
 - **Geothermal Heat Pumps**
 - **Dehumidification / Ventilation Routine**
 - **Diffuser Replacement**
 - **20% Ceiling Tile Replacement**
 - **Window Replacement**
- **2389 – BacNet York system into Summit**
- **2817 – New DDC Control of Central HVAC Equipment**

ECO 51 Pro Forma (Revision)
Boiler Plant (1725) Maintenance Savings Only

POSITIVE 1ST YEAR

	Year										
	0	1	2	3	4	5	6	7	8	9	10
Energy Savings	\$42,500	\$262,616	\$265,242	\$267,895	\$270,574	\$273,279	\$276,012	\$278,772	\$281,560	\$284,375	\$287,219
Capital Expenditure Saving	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Existing Maintenance Costs	\$0	\$32,000	\$32,960	\$33,949	\$34,967	\$36,016	\$37,097	\$38,210	\$39,356	\$40,537	\$41,753
Total Annual Savings	\$42,500	\$294,616	\$298,202	\$301,843	\$305,541	\$309,296	\$313,109	\$316,982	\$320,916	\$324,912	\$328,972
Annual Project Principle	\$0	(\$111,026)	(\$111,026)	(\$111,026)	(\$111,026)	(\$111,026)	(\$111,026)	(\$111,026)	(\$111,026)	(\$111,026)	(\$111,026)
Annual Project Interest	\$0	(\$71,278)	(\$66,527)	(\$61,775)	(\$57,023)	(\$52,271)	(\$47,519)	(\$42,767)	(\$38,015)	(\$33,263)	(\$28,511)
Annual Maintenance	\$0	(\$90,320)	(\$93,030)	(\$95,820)	(\$98,695)	(\$101,656)	(\$104,706)	(\$107,847)	(\$111,082)	(\$114,415)	(\$117,847)
Total Annual Costs	\$0	(\$272,624)	(\$270,582)	(\$268,621)	(\$266,743)	(\$264,952)	(\$263,250)	(\$261,639)	(\$260,123)	(\$258,704)	(\$257,384)
Annual Net Cash Flow	\$42,500	\$21,992	\$27,620	\$33,223	\$38,797	\$44,343	\$49,859	\$55,342	\$60,793	\$66,209	\$71,588
Cummulative Cash Flow	\$42,500	\$64,492	\$92,112	\$125,335	\$164,132	\$208,475	\$258,334	\$313,676	\$374,469	\$440,678	\$512,266

Assumptions:	
Trane Project Cost	\$1,526,434
Additional Scope Cost	\$30,000
Total ECO Cost	\$1,556,434
Nolin Project Fee (7%)	\$108,950
Project Term	15
Annual Interest Rate	4.2800%
Annual Project Principle	(\$111,026)
Energy Savings	\$262,616
Energy Escalation Rate	1.00%
Existing Maintenance Costs	\$32,000
Trane Maintenance Cost	\$90,320
O&M Savings	(\$58,320)
Capital Expenditure Savings	\$0
Operations Escalation Rate	3.00%
Annual MMBTU Savings	47,748

FY03

FT KNOX, KY

DBOS YTD UESC-DSM-ESPC PAYMENTS

Project #	DUKE ESPC 3 rd yr	11mil DSM POST Dsm 1-46,50	5 mil w M 16 bldgs DSM #47 GEO-child&e	1.2Mil w M One-Stop&lib Dsm #54 #1384&2368	1.4 mil w M Dsm #57 #1467	not reimb ESTIMATED DSM payments not- reimb	Total year to Date cumulative
Oct-02	5,058	\$ 94,661	\$ 28,341	\$ -	\$ -	128,060	128,060
Nov-02	5,058	\$ 97,587	\$ 39,012	\$ -	\$ -	141,657	269,717
Dec-02	5,058	\$ 102,491	\$ 41,323	\$ -	\$ -	148,872	418,589
Jan 2003	5,058	\$ 104,256	\$ 49,260	\$ -	\$ -	158,574	577,163
Feb 03	5,180	\$ 118,612	\$ 50,766	\$ -	\$ -	174,558	751,721
MAR 03	5,180	\$ 113,348	\$ 56,200	\$ 2,388	\$ -	177,116	928,837
APR 03	5,180	\$ 116,524	\$ 59,722	\$ 2,777	\$ -	184,203	1,113,040
May-03	5,180	\$ 115,932	\$ 57,224	\$ 3,033	\$ -	181,368	1,294,408
Jun 03	5,180	\$ 115,060	\$ 57,163	\$ 6,405	\$ -	183,808	1,478,216
Jul 03	5,180	\$ 113,163	\$ 56,286	\$ 6,743	\$ -	181,372	1,659,588
Aug 03	5,180	\$ 114,000	\$ 57,000	\$ 8,000	\$ 3,000	187,180	1,846,768
Sep 03	5,180	\$ 114,000	\$ 57,000	\$ 9,000	\$ 4,000	189,180	2,035,948
TOTALS	61,672	\$ 1,319,634	\$ 609,296	\$ 38,346	\$ 7,000	\$ 2,035,948 FY 03 est	

Budgeted 1.7 mil fy03

FY03

8/7/03

FT KNOX, KY**"ESTIMATED" UESC-DSM-ESPC PAYMENTS****SHADED ARE ACTUALS PAID TO DATE THIS FY**

	290K	67K	.3 MIL	5 mil	5 mil	600K est
	SCHOOLS	COMMISS	IACH	IACH	IACH	PX HVAC
Project #	DSM-1S	DSM-2C	Dsm #35	DSM#45	DSM #48	Dsm #52
	Light-occ	Lighting	Lighting-retr	Hosp blr plt	HOSP HVAC	

Oct-02	\$ 2,884	\$ 668	\$ 2,863	\$ 74,527	\$ 13,650	
Nov-02	\$ 2,800	\$ 659	\$ 2,816	\$ 74,351	\$ 17,506	
Dec-02	\$ 2,782	\$ 655	\$ 2,794	\$ 73,813	\$ 23,362	
Jan 2003	\$ 2,770	\$ 651	\$ 2,779	\$ 74,640	\$ 28,395	
Feb 03	\$ 2,763	\$ 650	\$ 2,773	\$ 75,322	\$ 35,715	
MAR 03	\$ 2,756	\$ 648	\$ 2,766	\$ 75,192	\$ 39,100	
APR 2003	\$ 2,749	\$ 647	\$ 2,759	\$ 75,063	\$ 45,788	
may-03	\$ 2,741	\$ 645	\$ 2,753	\$ 76,370	\$ 45,796	
Jun 03	\$ 2,708	\$ 635	\$ 2,703	\$ 74,326	\$ 50,158	
Jul 03	\$ 2,680	\$ 627	\$ 2,661	\$ 73,548	\$ 49,420	
Aug 03	\$ 2,708	\$ 635	\$ 2,703	\$ 74,326	\$ 50,158	
Sep 03	\$ 2,708	\$ 635	\$ 2,703	\$ 74,326	\$ 50,158	
TOTALS	33,048.16	7,756.53	33,392.73	895,803.76	449,206.88	~\$1.5 Mil/YR