GENERAL

1.01. Applicable Sections. Division 01 applies.

1.02. Summary. The computer analysis predicts energy consumption and energy system performance. It can optimize electrical and mechanical system operations and architectural alternatives such as building orientation, building length and width, number of building stories, wall and roof construction, thickness of insulation, window size and type, and solar and shading applications. Base optimization on a life cycle cost study. Normally, designers will choose the least life cycle cost alternatives taking into account building aesthetics. Perform analysis at the 30% Design Stage. BLAST 3.0, DOE-2.2, Trane TRACE 700, Carrier HAP-E20, EnergyPlus, or other similar computer programs which perform transient thermal analyses are acceptable.

1.03. Compliance with 10CFR. Compliance with energy targets shown in Table 1 (from 1991 Corps of Engineers Design Criteria) are mandatory and are predicated on Title 10 CFR, Subpart F, Part 434 "Energy Conservation Voluntary Performance Standards for New Commercial and Multifamily High-Rise Residential Buildings, Mandatory for New Federal Buildings," Section 434.601. See attached Figures 1 and 2 for compliance.

1.04. Compliance with current regulations:

A. Regulation

1. Executive Order 13514 – Federal Leadership in Environmental, Energy, and Economic Performance.
2. Executive Order 13423 – Strengthening Federal Environmental, Energy, and Transportation Management, dated January 24, 2007.
3. Energy Policy Act of 2005 (EPACT 2005)
4. Energy Independence & Security Act of 2007 (EISA 2007)

B. Optimize Energy Performance

1. Energy Efficiency. Establish a whole building performance target that takes into account the intended use, occupancy, operations, plug loads, other energy demands, and design to earn the Energy Star targets for new construction and major renovation where applicable. For new construction, reduce the energy cost budget by 30 percent compared to the baseline building performance rating per the American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., (ASHRAE)/Illuminating Engineering Society of North America (IESNA) Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential. For major renovations, reduce the energy cost budget by 20 percent below pre-renovations 2003 baseline. Laboratory spaces may use the Labs21 Laboratory Modeling Guidelines. Use Energy Star and FEMP-designated Energy Efficient Products, where available.
2. The basis for the 2003 baseline shall be taken from:

   National Renewable Energy Laboratory
   Technical Report NREL/TP-550-46101
   September 2009
   “Grocery Store 50% energy Savings Technical Support Document”

   Table 4-21 to 4-23 which establish monthly electrical demand factors and shall be used to predict consumption of electrical energy in the proposed refrigeration system knowing the maximum demand of that system.

Figure 4-4 which gives the energy consumption for the assumed 2003 baseline building knowing the climatic zone.

1.05. Life Cycle Cost Analysis:

A. Base on the National Bureau of Standards (NBS) handbook 135, "Life-cycle Costing Manual for the Federal Energy Management Program," the current edition.

B. Analysis shall result in the least building energy use, consistent with least life cycle cost.

C. The HVAC system to be considered will be packaged rooftop DX cooling, indirect gas fired heating equipment as this equipment has been demonstrated to have the lowest life cycle costs in most instances. Where rooftop equipment is prohibited by Base or post policy, consider split system DX cooling and heat pump heating. Where electric or gas utilities are abnormally high or climatic conditions are extreme, the use of boilers, desiccant dehumidifiers or other strategies may be considered. In these cases, provide a life-cycle cost economic analysis to evaluate alternative fuel sources and other energy reduction strategies. See paragraph this section entitled “Guidelines”.

1.06. Definitions:

A. Energy Use Budget (EUB). The energy KCAL that is consumed within the 5'-0” line of a building per year over a 24 hour/day, 365 days/year period and specified operating hours. This energy consists of space heating, space cooling, ventilation and lighting loads, excluding process loads. See Tables 1 and 1A attached.

B. Process Loads. Non-real property installed equipment or user equipment loads (typewriters, copiers, merchandise display cases, commissary refrigeration systems, computer systems, industrial equipment, training systems, etc.) and their cooling requirements, meat department wash down, and hot water heating requirements for commissaries. Do not include specialized ventilation systems, such as exhaust hoods or those required by OSHA standards, in the calculation of the EUB. People are not considered process loads. Therefore, include their contribution to the EUB in the energy calculations and base such calculations on expected or actual operating times. Combine them with other EUB elements which are calculated at the expected or actual operating times to provide the total EUB.

C. Design Energy Usage (DEU). Sum of energy figures for heating, cooling, ventilation, domestic hot water (DHW), and lighting, which the designer calculates as part of the design. Make DEU computations based on normal operating hours over a period of one year.

D. Total DEU (TDEU). Similar to DEU, except, its basis is expected or actual operating hours over a one-year period. It not only includes the sum of five energy consumption components (heating, cooling, lighting, and ventilation), but also includes process load energy figures.

E. EUB. Target energy figure which represents maximum allowable energy consumption in KCAL/m^2/YR (BTU/SF/YR) over a 24 hour/day, 365 days/year period with the operating hours specified.

F. Heating Energy Figure. Calculated energy figure for heating building environment based on the required operating time.

G. Cooling Energy Figure. Calculated energy figure for cooling the building environment based on the required operating time.

H. Ventilation Energy Figure. Calculated energy figure for ventilating building environment based on required operating time. This figure is the fan energy for circulating air during the economizer cycle, if used, and conditioned air when the heating or cooling system is not on.

I. Lighting Energy Figure. Calculated energy figure for lighting the building based on the required operating time.

J. Domestic Hot Water (DHW) Energy Figure. Calculated energy figure for heating domestic hot water based on the operating hours. This energy figure does not include the process load for meat department wash down operation.

K. Process Load Energy Figure: Calculated energy figure for process loads based on the average load factor from "Grocery Store 50% Energy Savings Technical Support Document".

1.07. Guidelines:

A. DEUs apply only to building loads and to energy consumed within the 5'-0" line of a building except for the following cases:

1. Where a packaged chiller, cooling tower, air-cooled refrigeration condenser, transformer or substation, or heating plant is located outside the 5'-0" line but serves only one building, charge the energy required to operate these facilities to the building.

2. Where equipment in paragraph 1.6.A.1. above serves two to four buildings, pro-rate the energy requirements among the buildings. Where such facilities serve five or more buildings, consider these facilities in the category of central plants.

B. Losses from steam, chilled water, high temperature water or hot water distribution lines beyond the 5'-0" line are not chargeable to the building energy consumption except as provided in paragraph 1.6.A.2. above.

C. Exterior lighting beyond the 5'-0" line is not chargeable to the building energy consumption.

D. For the purposes of calculating energy budget figures, use the fuel conversion factors indicated in Table 2 attached.

E. At specific installations where the energy source KCAL (BTU) content varies significantly from the value presented in Table 2 above, then the local value may be used provided:

1. There is adequate data on permanent file covering a period of at least two years to support the different value, and

2. There is a fully documented basis to expect that different value to remain in effect for the foreseeable future with the documentation to remain in a permanent file.

F. Measure energy in the form of steam, high temperature water, medium temperature water or chilled water which is supplied from a central plant, at the building boundary with proper credit given to the energy in the condensate return or water return. Do not charge distribution line losses beyond the building 5'-0") line against the building consumption.

G. Consider hot water requirements, with the exception of domestic hot water (hand washing, restrooms, etc.) as process load in commissaries.

H. Clearly identify the calculated TDEU in the summary analysis of the energy report. Calculated TDEU should be in the range of 131,000 to 160,000 BTU/SF/YR.

1.08. Energy Budget Analysis Requirements shall include but not be limited to the following information:

A. The space heating, cooling, ventilation, lighting, and DHW energy figures based on the operating hours, plus the DEU based on the actual or expected operating hours per day and days per week, ~~not~~ including process loads.

B. Comments on the ease or difficulty of meeting the EUB, if the DEU varies from the EUB by 10 to 14.9% (+ or -).

C. A detailed summary of the heat gain/loss analysis at the 30% design stage.

D. A computer-generated printout of DEUs that are calculated after all optimized, cost effective and practicable energy efficient applications, or techniques are included in the envelope of the building and building non-process loads. Design the facility to an optimum EUB, and do not

consider the EUB as a convenient stopping point for determining the building energy efficiency. Likely, the calculated DEU will be less, and in some cases much less, than the EUB, depending on the incorporation of other forms of energy efficient applications.

E. Provide certification of mandatory compliance with Section 435.112 of Title 10 CFR, Part 435, Subpart A, "Energy Conservation voluntary Performance Standards for New Commercial and Multifamily High-Rise Residential Buildings, Mandatory for Federal Buildings," published January 30, 1989, for each design. Provide the statement below on the first sheet of the design documents.

"We certify that these design documents comply with the requirements of Section 435.112 of Title 10 CFR, Part 435, Subpart A."

(Provide Signature)	(Provide Signature)	(Provide Signature)
Architect	Mechanical Engineer	Electrical Engineer

F. Provide a listing of the minimum compliance requirements of Section 435.112 in the design analysis at the 30% design stage. Provide the designer's approach to meeting compliance requirements in the design analysis. See Figure 1 attached.

G. EUB values in Table 1 are the highest allowable calculated annual energy consumptions for a commissary or commissary office building design. Target the design below the tabulated EUB values. Use of tabulated EUB values shall serve as maximum criteria for designers and design review personnel.

H. Indicate in the completed energy analysis the final calculated TDEU. Include a written evaluation of the calculated energy figure. Mention in the written evaluation the ease or difficult in meeting the recommended TDEU range. If necessary, itemize recommendations for energy saving initiatives for government action.

END OF SECTION

TABLE 1

Energy Use Budget (EUB) Values in 1000 BTU/ft^2/YR (2713 KCAL/M^2/YR) Weather Regions												HRS PER DAY	DAYS PER WEEK
	1	2	3	4	5	6	7	8	9	10	11		
ADMIN/ OPERATIONS BUILDINGS: OVER 740 SM (8,000 SF)	45	45	40	40	35	40	40	35	35	40	40	10	5
UNDER 740 SM (8,000 SF)	50	50	40	40	40	45	45	35	30	35	35	10	5
COMMISSARY BUILDINGS	90	80	70	60	55	60	70	55	55	55	65	12[2]	6[2]

NOTE 1: If more than one distinct function such as warehousing is being performed in an area which comprises more than 10% of the building's floor area, the EUB will be normalized using the following formula:

EUB=EUB 1 (Area 1/Area Total) + EUB 2 (Area 2/Area Total) + EUBN (Area N/Area Total)

Where: EUB is for the mixed use building, EUBN is for one of the distinct functional areas, Area N is the gross floor area devoted to function N, and Area Total is the total gross floor area of the building.

NOTE 2: Occupancy hours per day and days per week may vary. Tabulated EUB values are based on 12 hours per day and 6 days per week.

TABLE 1A

WEATHER REGION DEFINITION			
WEATHER REGION	COOLING DEG DAYS	HEATING DEGREE DAY RANGE (BASE 65 F)	
1 \2	N/A	> 15000	N/A
2 \2	N/A	> 13000	< = 15000
3 \2	N/A	> 11000	< = 13000
4 \3	< 2000	> 9000	< = 11000
5 \3	< 2000	> 7000	< = 9000
6 \3	< 2000	> 5500	< = 7000
7 \3	< 2000	> 4000	< = 5500
8 \3	< 2000	> 2000	< = 4000
9 \4	< 2000	N/A	< = 2000
10 \4	< 2000	N/A	< = 2000
11 \4	< 2000	> 2000	N/A
\1 The data published in TM 5-785/AFM 88-29/NAFAC P-89 (Engineering Weather Data) will be used to select the appropriate weather regions.			
\2 Weather Regions 1, 2 and 3 are determined by the Heating Degree Day Range independent of the Cooling Degree Day.			
\3 Weather Regions 4, 5, 6, 7, 8 and 9 are determined by the Cooling Degree Days being less than 2000 and then by the appropriate range bracket of Heating Degree Day.			
\4 Weather Regions 10 and 11 are determined by the Cooling Degree Days being greater than 2000 and then by the appropriate range bracket of Heating Degree Day.			

TABLE 2

FUEL CONVERSION FACTORS /1 /2 & /3	
TYPE OF FUELS	CONVERSION FACTORS
Anthracite Coal	7,890,000 cal/Kg 28.4 million BTU/short ton
Bituminous Coal	6,858,000 cal/Kg 24.6 million BTU/short ton
Electricity	860.06 cal/KWH 3,413 BTU/KWH
No. 2 Distillate Fuel Oil	9,271,100 cal/LITER 138,700 BTU/gal
Residual Fuel Oil	10,006,400 cal/LITER 149,700 BTU/gal
Kerosene	9,023,800 cal/LITER 135,000 BTU/gal
LP Gas	6,583,500 cal/LITER 95,5000 BTU/gal
Natural Gas	44,512,400 cal/m^3 1,031 BTU/ft^3
Purchased Steam or Steam from Central Plant	580,800 cal/Kg 1,000 BTU/lb

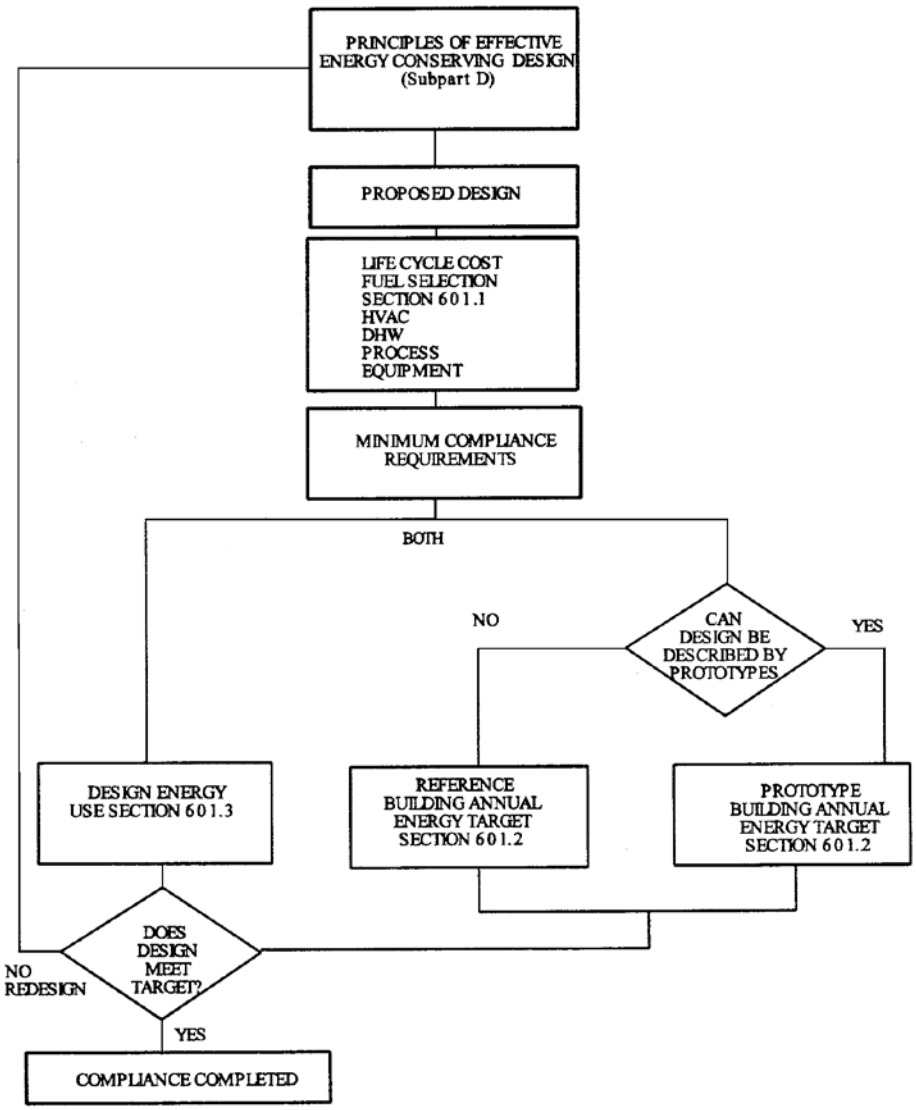
\1 High temperature, Medium temperature, or Chilled Water from a Central Plant will use the heat value of fluid based on the actual temperature and pressure delivered to the 5' line.

\2 The EUB values assume that no electric resistive heating will be used in the building (except auxiliary electric resistive heating used with heat pump systems). When 10% or more of a building's annual heating consumption will be derived from electric resistive heating, the electric resistive portion will be multiplied by 2.2 to reflect additional conversion losses.

****3 At specific installations where the energy source cal/Kg (BTU) content is known to vary consistently by 10% or more from the values given above the local value may be used provided there is adequate data on file for two years or more to justify the revision and that this value is expected to hold true for at least five years following building occupancy.

Figure 1

Building Energy Compliance Alternative



REVISED VERSION
September 14, 2000

Figure 2
A-E SUMMARY OF ENERGY CONSUMPTION FOR EUB VALUE

INSTALLATION: _____ HOST _____
PDC NO.: _____ PROJECT _____
A-E FIRM: _____
DESIGN _____

I. **BUILDING ENVELOPE LOSS PER DEGREE HOUR (DH)**

AREA	ORIENTATION	DATA REQUIRED			
ROOF	------	"U" FACTOR	_____	KW/DH (BTU/DH)	_____
WALL	N OR NE	"U" FACTOR	_____	KW/DH (BTU/DH)	_____
WALL	E OR SE	"U" FACTOR	_____	KW/DH (BTU/DH)	_____
WALL	S OR SW	"U" FACTOR	_____	KW/DH (BTU/DH)	_____
WALL	W OR NW	"U" FACTOR	_____	KW/DH (BTU/DH)	_____
		TOTAL WALL LOSS:	_____	KW/DH (BTU/DH)	_____
GLASS	N OR NE	"U" FACTOR	_____	KW/DH (BTU/DH)	_____
GLASS	E OR SE	"U" FACTOR	_____	KW/DH (BTU/DH)	_____
GLASS	S OR SW	"U" FACTOR	_____	KW/DH (BTU/DH)	_____
GLASS	W OR NW	"U" FACTOR	_____	KW/DH (BTU/DH)	_____
		TOTAL GLASS LOSS:	_____	KW/DH (BTU/DH)	_____
		INFILTRATION LOSS:		KW/DH (BTU/DH)	_____
		ROUND FLOOR LOSS:		KW/DH (BTU/DH)	_____
TOTAL LOSS THROUGH BUILDING ENVELOPE:				KW/DH (BTU/DH)	_____

II. **SOLAR GAIN THROUGH BUILDING ENVELOPE**

ROOF:		TEMP DIFF	_____	KW/H (BTUH)	_____
WALL	N OR NE	TEMP DIFF	_____	KW/H (BTUH)	_____
WALL	E OR SE	TEMP DIFF	_____	KW/H (BTUH)	_____
WALL	S OR SW	TEMP DIFF	_____	KW/H (BTUH)	_____
WALL	W OR NW	TEMP DIFF	_____	KW/H (BTUH)	_____

TOTAL AVERAGE SOLAR GAIN WITH 100% SOLAR ENERGY: KW/H (BTUH) _____

WINTER GAIN: KW/H (BTUH) _____
SUMMER GAIN: KW/H (BTUH) _____

Figure 2
A-E SUMMARY OF ENERGY CONSUMPTION FOR EUB VALUE

III. **INTERNAL HEAT GAINS**

OCCUPANTS:	NUMBER	_____	SENS GAIN/OCCUPANT	_____	KW/H (BTUH) _____
LIGHTING:	TYPE	_____	TOTAL WATTAGE	_____	KW/H (BTUH) _____

TOTAL INTERNAL HEAT GAINS (WINTER): KW/H (BTUH) _____

TOTAL GAIN TO THE INTERIOR (WINTER): KW/H (BTUH) _____
(ENVELOPE + INTERNAL GAINS)

V. **ENERGY USED FOR HEATING**

SALES POINT TEMPERATURE:		_____
OCCUPIED DEGREE HOURS DESIGN BALANCE POINT TEMP:	DH	_____
HEATING LOAD OCCUPIED:	KW (MBTU)	_____
HEATING LOAD UNOCCUPIED:	KW (MBTU)	_____
VENTILATION HEATING LOAD:	KW (MBTU)	_____
TOTAL HEATING LOAD:	KW (MBTU)	_____

VI. **COOLING LOADS AND ENERGY USED FOR COOLING**

OCCUPIED COOLING HOURS:	DH	_____
OCCUPIED COOLING DEGREE HOURS:	DH	_____
CONDUCTION GAIN THROUGH WALLS AND ROOF:	KW (MBTU)	_____
CONDUCTION GAIN FOR GLASS:	KW (MBTU)	_____
SOLAR GAIN:	KW (MBTU)	_____
HEAT GAIN FROM VENTILATION AIR:	KW (MBTU)	_____
HEAT GAIN FROM LIGHTS:	KW (MBTU)	_____
HEAT GAIN FROM OCCUPANTS:	KW (MBTU)	_____
TOTAL COOLING LOAD:	KW (MBTU)	_____

Figure 2
A-E SUMMARY OF ENERGY CONSUMPTION FOR EUB VALUE (CONT.)

VII. **CALCULATION OF NON HEATING AND NON COOLING LOADS**

SERVICE WATER HEATING: LITERS (GALLONS) PER DAY _____ DAYS PER YR _____
ENERGY USE: KW (MBTU) _____
ANNUAL USE WITH SYSTEM DEFICIENCY: KW (MBTU) _____

ANNUAL LIGHTING ENERGY
OCCUPIED KWH _____
WK NITE KWH _____
WKEND KWH _____
TOTAL KWH _____

ANNUAL VENTILATION LOAD
AIR HANDLER MOTORS KWH _____
EXHAUST FANS KWH _____

VIII. **TOTAL ANNUAL ENERGY USE**

HEATING: KW/m^2/YR (BTU/SF/YR) _____
COOLING: KW/m^2/YR (BTU/SF/YR) _____
LIGHTING: KW/m^2/YR (BTU/SF/YR) _____
VENTILATION: KW/m^2/YR (BTU/SF/YR) _____
DHW HEATING: KW/m^2/YR (BTU/SF/YR) _____

DESIGN ENERGY USE BUDGET VALUE: _____ KW/m^2/YR (BTU/SF/YR)
BASED ON OPERATING TIME OF: _____ HRS/DAY
_____ DAYS/WEEK