

**EPACT 05
EISA 07
and
Army
Facilities**



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Drivers

- **Energy Policy Act of 2005 (EPACT 2005)– 14Jul05**
- **Energy Independence and Security Act of 2007 (EISA 2007) – 19Dec07**



Energy Policy Act of 2005

“The Secretary shall establish, by rule, revised Federal building energy efficiency performance standards that require that—if life-cycle cost-effective for new Federal buildings—the buildings be designed to achieve energy consumption levels that are at least 30 percent below the levels established in the version of the ASHRAE Standard or the International Energy Conservation Code, as appropriate, that is in effect as of the date of enactment of this paragraph”



EPACT Impact on Army Facilities

- **UFC 3-400-01 “Energy Conservation” requires all new facilities and all retrofits costing more than 25% to comply with EPACT**
- **Latest MILCON Transformation RFPs require for all new construction:**
 - **30% better requirement from EPACT 2005**
 - **Building envelope tightness requirement (.25 cfm/ft² of envelope area at .3 iwg (75Pa))**
 - **Requirement to perform blower door test and thermography on completed construction**
- **OACSIM-funded EPACT study**



Army EPACT Study

- **Funded by OACSIM**
- **Being performed by partnership of HQ USACE, Corps District COSs, ERDC/CERL, NREL, and ASHRAE**
- **Goals:**
 - **To develop specific Army RFP guidance for EPACT compliance (Design Energy Targets and “Design Guides to achieve a min of 30% savings) for selected Tier 1 Army facilities for CONUS locations**
 - **To ensure effective/easy compliance with EPACT2005 in all Army MILCON projects**

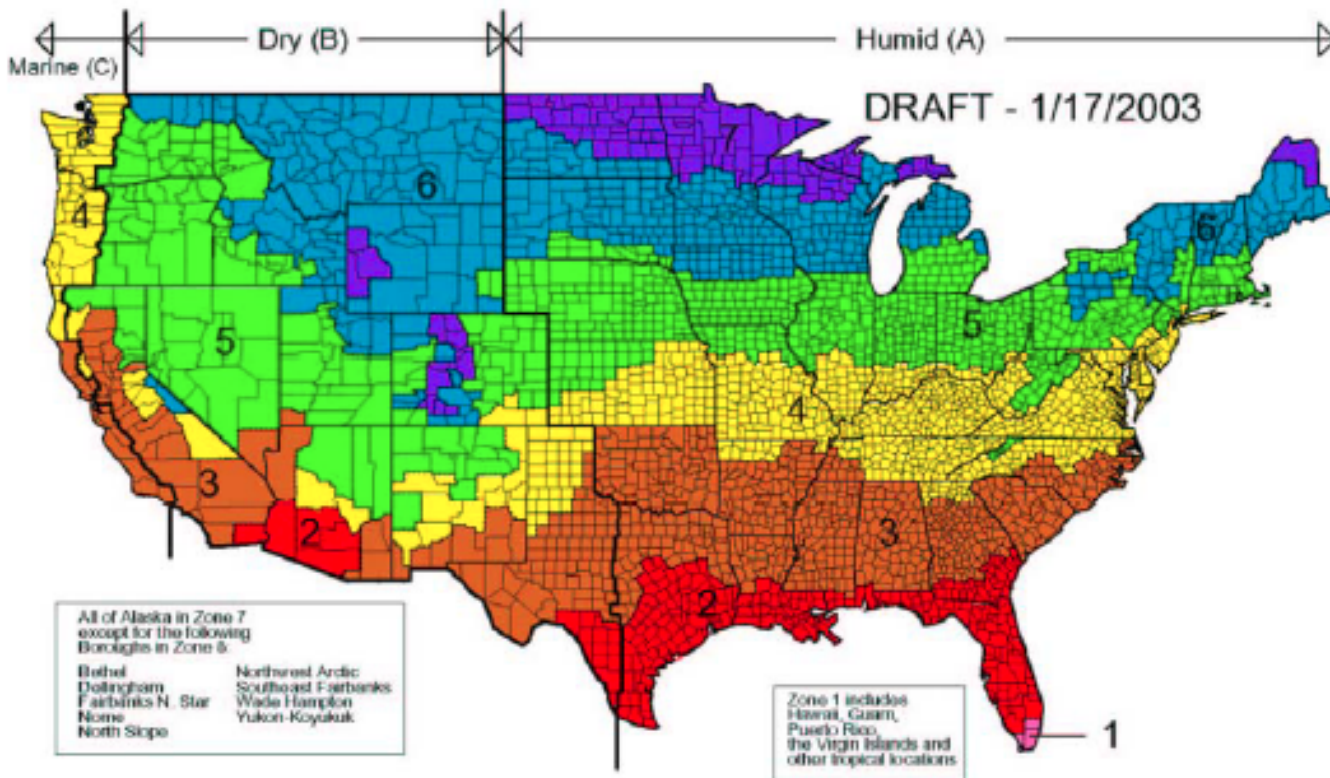


Army EPACT Study

- **Building types studied: UEPH, training barracks, TEMF, BHQ, DFAC, CDC, COF, Reserve Centers**
- **15 DOE CONUS Climate Zones**
- **Based on energy consumption NOT energy cost**
- **Status:**
 - **UEPH and TEMF studies done and implemented in MILCON Transformation RFP**
 - **Training Barracks, BHQ, DFAC, CDC, and COF studies done but not yet in MT RFP**
 - **Army Reserve Centers study done soon**

DOE U.S. Climate Zones

Figure 3-1: Climate Zone Map



Locations

Climate Zone	City	HDD (Base65°F)	CDD (base 50°F)
1A	Miami, FL	200	9474
2A	Houston, TX	1599	6876
2B	Phoenix, AZ	1350	8425
3A	Memphis, TN	3082	5467
3B	El Paso, TX	2708	5488
3C	San Francisco, CA	3016	2883
4A	Baltimore, MD	4707	3709
4B	Albuquerque, NM	4425	3908
4C	Seattle, WA	4908	1823
5A	Chicago, IL	6536	2941
5B	Colorado Springs, CO	6415	2312
6A	Burlington, VT	7771	2228
6B	Helena, MT	7699	1841
7A	Duluth, MN	9818	1536
8A	Fairbanks, AK	13940	1040



Army EPACT Study Results

- **Table of Design Energy Targets that specify the maximum energy consumption (in BTU/Ft²-yr) to achieve 30% reduction compared to a 90.1-2004 design for each facility type and location**
- **A table (design guide) showing one prescriptive path for achieving at least a 30% energy savings in an LCC effective manner for each facility type and location**
- **MT RFP language to implement above**



Original EPACT 2005 Compliance Path for all Army MILCON projects

- 1. Develop baseline building design iaw ASHRAE 90.1-2004**
- 2. Perform detailed energy analysis of the baseline design to determine the 30% better target energy consumption**
- 3. Develop a custom design for the project to improve energy performance and still meet minimums req of ASHRAE 90.1-2004**
- 4. Perform detailed energy analysis of the custom design to determine if 30% better and LCC effective**
- 5. Repeat steps 3 and 4 until 30% LCC solution found**



Two New Compliance Paths for Specific MILCON Projects from Study

- **Perform energy and LCC analysis for specific custom design and show that the specified design energy target is achieved in LCC effective manner**

Or

- **Follow prescriptive table solution for the building type/location and no further analyses required for EPACK 2005 compliance**

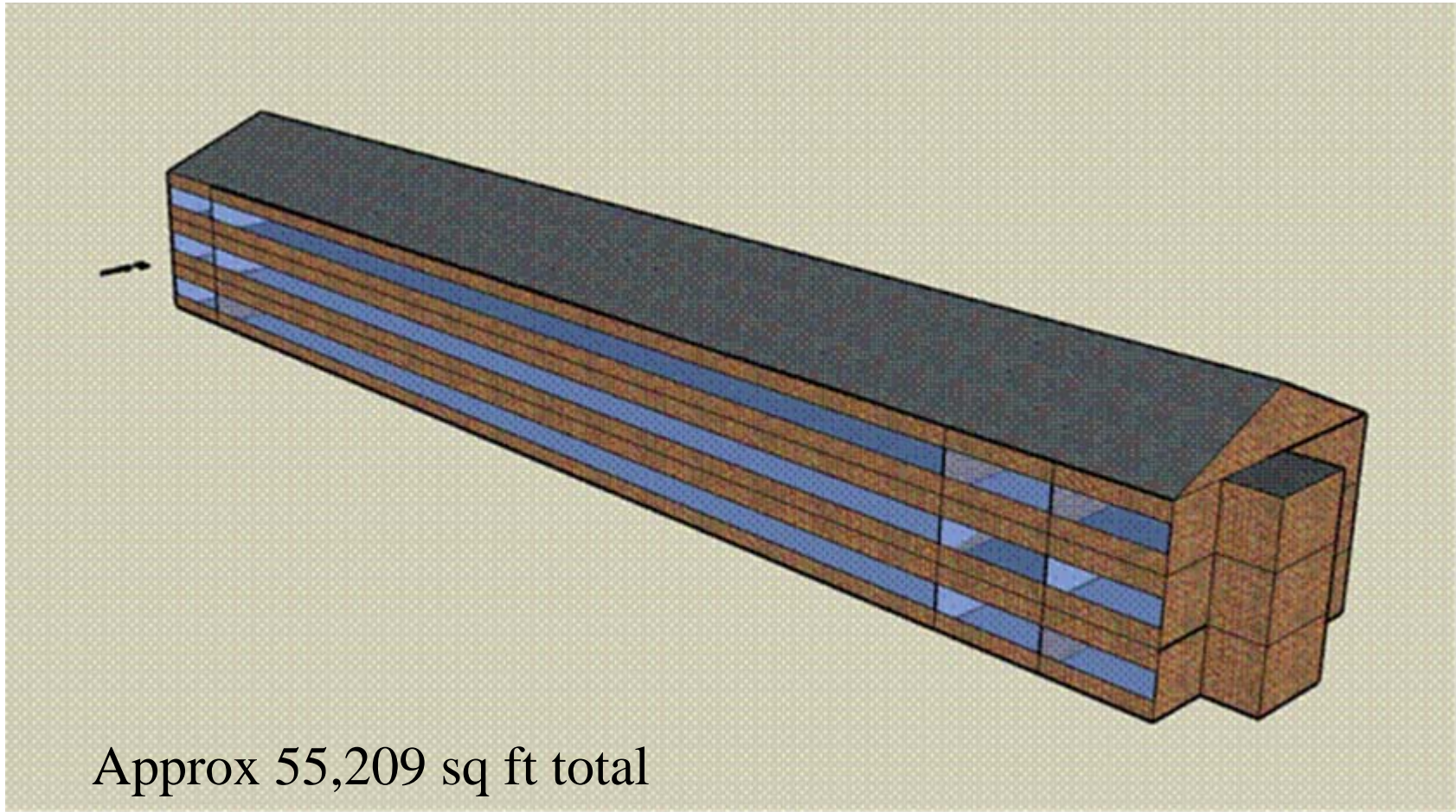


UEPH Barracks Analysis

- **Analyses performed by NREL using EnergyPlus**
- **Standard Barracks Design provided by COS**
- **Baseline (90.1-2004) assumptions provided by ASHRAE advisory committee**
- **Schedule assumptions and new technology suggestions provided by ERDC-CERL**



UEPH EnergyPlus Rendering



Approx 55,209 sq ft total

UEPH Barracks Design Energy Targets

Climate Zone	City	Energy Budget w/o plug loads (kBtu/ft ²)	
		ASHRAE 90.1-2004 Building	EPACT 2005 Target
1A	Miami, FL	82	57
2A	Houston, TX	82	57
2B	Phoenix, AZ	45	32
3A	Memphis, TN	71	50
3B	El Paso, TX	42	30
3C	San Francisco, CA	47	33
4A	Baltimore, MD	75	52
4B	Albuquerque, NM	48	34
4C	Seattle, WA	60	42
5A	Chicago, IL	77	54
5B	Colorado Springs, CO	54	38
6A	Burlington, VT	83	58
6B	Helena, MT	68	47
7A	Duluth, MN	91	64
8A	Fairbanks, AK	123	86

UEPH Energy Conservation Measures

	Baseline Models	Efficient Models
Wall Insulation	Standard 90.1-2004	Higher R-Values
Roof Insulation	Standard 90.1-2004	Higher R-Values
Roof Solar Reflectance	0.08	0.27
Window-to-Wall Ratio	20%	20%
Window Construction	Standard 90.1-2004	ASHRAE AEDG 30% Small Offices
Infiltration	0.4 cfm/ft² @ 75 Pa	0.25 cfm/ft² @ 75 Pa
Ventilation	Exhaust plus make-up air for infiltration at 5 Pa	Same as baseline but reduced make-up air for the tighter building

UEPH Energy Conservation Measures

	Baseline Models	Efficient Models
Lighting	1.1 W/ft ² in rooms, 0.5 in corridors, 0.6 in stairwells	0.9 W/ft ² in rooms, 0.45 in corridors, 0.54 in stairwells
SWH Boiler Efficiency	80%	95%
Grey water heat recovery	None	Assumed 30% savings on shower hot water
HVAC Systems	Packaged Single Zone with DX coil (3.05 COP) for cooling and natural gas coil (80% efficient) for heating	DOAS with DX coil (3.5 COP) and ERV (75%-70% sensible effectiveness) and hot water coil, 4-pipe fan coil with central chiller and boiler

UEPH Energy Efficient Solution Results

Zone	City	ASHRAE 90.1-2004 Building Energy Budget (kBtu/ft ²)	EPACT 2005 Building Energy Budget (kBtu/ft ²)	Government Furnished Example Technology Solution <u>SET</u> to meet EPACT 2005	
				Energy Budget (kBtu/ft ²)	Energy Savings versus ASHRAE Bldg
1A	Miami, FL	82	57	40	51%
2A	Houston, TX	82	57	37	55%
2B	Phoenix, AZ	45	32	32	30%
3A	Memphis, TN	71	50	35	51%
3B	El Paso, TX	42	30	30	30%
3C	San Francisco, CA	47	33	26	45%
4A	Baltimore, MD	75	52	32	57%
4B	Albuquerque, NM	48	34	29	40%
4C	Seattle, WA	60	42	27	55%

UEPH Energy Efficient Solution Results

Zone	City	ASHRAE 90.1- 2004 Building Energy Budget (kBtu/ft ²)	EPACT 2005 Buildi ng Ener gy Budge t (kBtu/ft ²)	Government Furnished Example Technology Solution <u>SET</u> to meet EPACT 2005	
				Energy Budget (kBtu/ft ²)	Energy Savings versus ASHRA E Bldg
5A	Chicago, IL	77	54	32	58%
5B	Colorado Springs, CO	54	38	28	48%
6A	Burlington, VT	83	58	32	61%
6B	Helena, MT	68	47	29	57%
7A	Duluth, MN	91	64	33	64%
8A	Fairbanks, AK	123	86	42	66%

UEPH BARRACKS Climate Zone 3A

Government Furnished Example Technology Set

Item	Component	ASHRAE 90.1-2004 Bldg ₁	Gov Furnished Example Bldg
Roof	Attic	R-30	R-40
	Surface reflectance	0.08	0.27
Walls	Light Weight Construction	R-13	R-20
Floors	Mass	R-6.3 c.i.	R-10 c.i.
Slabs	Unheated	NR ₂	NR ₂
Doors	Swinging	U-0.70	U-0.70
	Non-Swinging	U-1.45	U-1.45
Infiltration		0.4 cfm/ft ² @ 75 Pa	0.25 cfm/ft ² @ 75 Pa ₃
Vertical Glazing	Window to Wall Ratio (WWR)	10% - 20%	10% - 20%
	Thermal transmittance	U-0.57	U-0.45
	Solar heat gain coefficient (SHGC)	0.37	0.31

UEPH BARRACKS Climate Zone 3A

Government Furnished Example Technology Set (cont)

Item	Component	ASHRAE 90.1-2004 Bldg ₁	Gov Furnished Example Bldg
Interior Lighting	Lighting Power Density (LPD)	1.1 W/ft ²	0.9 W/ft ²
	Ballast		Electronic ballast
HVAC	Air Conditioner	PSZ-AC 12.0 SEER (3.05 COP)	4-Pipe Fan Coil with central chiller and boiler plus DOAS ₄ with 14.0 SEER DX coil (3.52 COP) and HHW coil on central boiler SAT control 55°F – 62°F with OAT 75° – 54°F
	Gas Furnace	80% E _t	none
	ERV	None	70% - 75% sensible effectiveness

UEPH BARRACKS Climate Zone 3A

Government Furnished Example Technology Set (cont)

Item	Component	ASHRAE 90.1-2004 Bldg ₁	Gov Furnished Example Bldg
Economizer Ventilation		NR	NR
	Outdoor Air Damper	Motorized control	Motorized control
	Demand Control	NR	NR
Ducts	Laundry Room		Decoupled ₅
	Sealing		Seal class B
	Location		Interior only
Service Water Heating	Insulation level		R-6 ₆
	Gas storage	80% E_t	90% E_t
	Drain Water Heat Recovery	None	Showers only - 30% effic ₇

EPACT 2005 for Army facilities in Japan and Korea

- **IMCOM has funded ERDC/CERL to utilize previous study results to develop similar design energy targets and prescriptive solutions for Japan and Korea climates**
- **Results for 7 tier-one facilities will be complete in Feb 09**
- **Army must work with Japan and Korea govts to effectively implement in all projects**



EISA 2007

- **New federal buildings shall be designed so that the fossil fuel-generated consumption is reduced, as compared with such energy consumption by a similar building in 2003 (CBECS data) as follows:**

Year	Percent Reduction
2010	55
2015	65
2020	80
2025	90
2030	100



Analysis of Army Situation

- **New Army buildings with low plug/process loads will nearly meet the 2010 goal by already known energy conservation measures from EPACK study (See BHQ example)**
- **New Army buildings with large plug/process loads cannot meet 2010 goal via energy conservation from EPACK study (See DFAC example) – more study required**
- **Complying with goal beyond 2010 will require SERIOUS new energy conservation and renewable usage efforts**



BHQ example

- CBECS 2003 Average U.S. Site Energy for office is 73 KBTU/ft²-yr
- EISA 2007 55% fossil fuel reduction goal for 2010 is 33 KBTU/ft²-yr (site energy)
- EPACT 2005 compliant BHQ results (KBTU/ft²-yr):

Zone	Total Energy	Bld Energy	Process Energy
1A, Miami	28	18	10
2B, Phoenix	25	15	10
5A, Chicago	26	16	10
7A, Duluth	28	18	10
8A, Fairbanks	36	26	10



DFAC example

- CBECS 2003 Average U.S. Site Energy for cafeteria is 302 KBTU/ft²-yr
- EISA 2007 55% fossil fuel reduction goal for 2010 is 136 KBTU/ft²-yr (site energy)
- EPACT 2005 compliant DFAC results (KBTU/ft²-yr):

Zone	Total Energy	Bld Energy	Process Energy
1A, Miami	295	92	203
2B, Phoenix	287	83	204
5A, Chicago	326	106	220
7A, Duluth	366	137	229
8A, Fairbanks	432	198	234



**THE
END**

