

MEETING EPACT 2005



Green in the Military II - 2009



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- **Design, Construction & Energy Reduction Requirements**

- **Details about the new updated Energy Conservation UFC and the new “Prescriptive” path for compliance with Section 109 of the Energy Policy Act of 2005. (30% Better than ASHRAE)**

Design, Construction and Energy Reduction Requirements For New Buildings

Energy Policy Act of 2005



Previously Discussed by Matt Gray (DoE)

● Highlights (New facilities):

- **Section 103** - Utility Meters
- **Section 104** - Energy Star or FEMP Recommended Products
- **Section 109** - Achieve Energy Savings 30% below ASHRAE Standard 90.1-2004

“Federal Leadership” MOU & EO 13423



Discussed in Detail in Session 2

Required Sustainability & Energy Features:

- **Building Commissioning**
 - Fundamental
- **Energy Reduction**
 - Design to Earn Energy Star Targets
 - 30% for New Construction (EPACT05)
 - 20% for Major Renovations
- **Measurement & Verification, Metering, Benchmarking**
- **20% Water Use Reduction**
- **Efficient Landscaping – 50 % Reduced Irrigation**
- **Thermal Comfort – Meet ASHRAE 55**
- **Moisture Control Strategy**
- **Daylighting & Lighting Control**

“Federal Leadership” MOU & EO 13423



Required Sustainability & Energy Features (Con't):

- **Low Emitting / Low VOC Materials**
- **IAQ During and After Construction**
 - **Protect Site, Materials, Ductwork**
 - **Flush Building after Construction**
- **10% Recycled Content**
- **Environmentally Preferable Products (EPP)**
 - **Bio-based**
 - **Rapidly Renewable**
 - **EPA EPP Certified**
 - **Forest Stewardship Council (FSC) Certified Wood**
- **Construction Waste Management**
- **Eliminate Ozone Depleting Compounds**



ECB 2008-01

“Energy Policy Act of 2005 Implementation and USGBC LEED® Certification”

- **Posted on the Whole Building Design Guide**
 - www.wbdg.org
- **Provides guidance & [funding](#) for Navy & USMC Projects**
- **EPACT 05**
- **EO 13423 / MOU**
- **LEED Silver**
 - **FY09 & beyond projects**
 - **\$750,000 ECC limitation**
 - **US Green Building Council Certified**

Navy EFACT05 Study



- **Navy commissioned a study completed in 2007 to determine ECMs & costs to reach 30% savings. (Steven Winter Associates)**
- **5 building types in 5 weather regions**
- **Study showed a 1-3% cost increase depending on building type & location**
- **19% - 38% LCC effective energy savings**
- **Results available on WBDG**

Recommended ECMs

- **Premium Efficiency Motors**
- Improved Lighting Design
- Occupancy Sensors
- Ultra High Efficiency Chillers
- Outdoor Air Total Heat Recovery
- High Performance Windows
- High Efficiency Condensing Boiler
- Economizers
- Static Pressure Reduction
- **Daylight Dimming**



Most provisions not yet implemented into contract documents

Section 433 - (1 yr. for “rule” development)

- Reduce Fossil Fuel Use in New Facility Designs...
 - 55% reduction by 2010
 - 100% reduction by 2030

Section 441

- Increases LCC Analysis from 25 to 40 yrs

Section 523 -

- Min. 30% of Building Domestic Hot Water by Solar
(unless not LCC effective)

Unified Facility Criteria

UFC 3-400-01

Energy Conservation

UFC 3-400-01 Energy Conservation



- **Posted on the Whole Building Design Guide**
 - www.wbdg.org

- **Guiding document for energy conservation in DoD Contracts for new construction & major renovation**

- **Recently updated to include EPEAT05 Compliance**
 - **Describes analysis & submittal requirements**
 - **Provides limited guidance on ECMs**

- **Under major update development (Expected – early 2009)**
 - **Update will include new “Army” Target Energy Budget (TEB) & Prescriptive Compliance methods**
 - **Some new EISA requirements**
 - **Significant additional guidance on ECMs**

UFC EPACT Compliance Method – 3 Paths



Standard EPAct05 Path	Demonstration Path (UFC)	Prescriptive Path (UFC)
ASHRAE Standard 90.1 Mandatory Requirements	ASHRAE Standard 90.1 Mandatory Requirements	ASHRAE Standard 90.1 Mandatory Requirements
Apply desired & req'd Energy Conservation Measures	Apply desired & req'd Energy Conservation Measures	Apply Prescriptive Energy Conservation Measures
Model Base Building with ASHRAE Prescriptive Requirements & Model Proposed Design per ASHRAE Standard 90.1 <u>Appendix G</u>	UFC Target Energy Budget (TEB) Targets & Model Proposed Design per ASHRAE Standard 90.1 <u>Appendix G</u>	No calcs required
Achieve 30% Better Performance Submit all calculations	Meet TEB Provide Calcs For Proposed Model Only	

TRAINING BARRACKS Climate Zone 3A

Government Furnished Prescriptive Technology Set



Item	Component	ASHRAE 90.1-2004 Bldg ₁	Gov Furnished Prescriptive 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
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

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TRAINING BARRACKS Climate Zone 3A

Government Furnished Prescriptive Technology Set (cont)



Item	Component	ASHRAE 90.1-2004 Bldg	Gov Furnished Prescriptive 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 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
	Exhaust Energy Recovery	None	70% - 75% sensible effectiveness

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TRAINING BARRACKS Climate Zone 3A

Government Furnished Prescriptive Technology Set (cont)



Item	Component	ASHRAE 90.1-2004 Bldg ₁	Gov Furnished Prescriptive 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

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UFC Prescriptive Measures – Infiltration Reduction



- **Requires Air Barrier around entire conditioned envelope**
 - **Specific sealing materials & requirements**
 - **Detailed requirements to seal:**
 - **Envelope Penetrations**
 - **Where walls meet roof & floor**
 - **Around Doors & Windows**

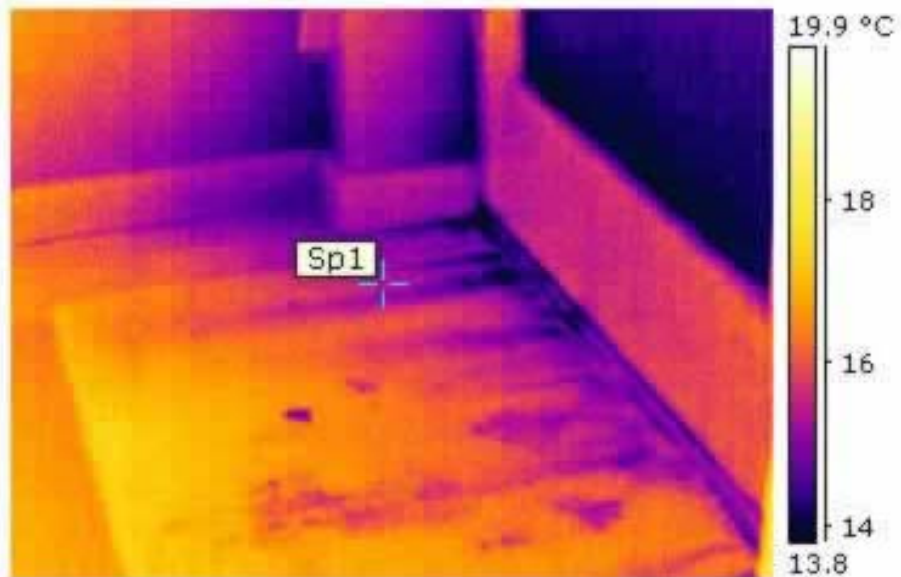
- **Meets the Moisture Strategy Requirement for EO 13423**

- **Addresses Mold issues for many buildings**

UFC Prescriptive Measures – Air Barrier Infiltration Reduction



- Requires Blower Door Testing to prove compliance
- Requires IR Thermography to locate leaks



Energy Efficient Solution Results – Barracks / BEQ



Zone	City	ASHRAE 90.1-2004 Building Energy Budget (kBtu/ft ²)	EPACT 2005 Building Energy Budget (kBtu/ft ²)	Government Furnished Prescriptive Technology Solution <u>SET</u> to meet EPACT 2005	
				Energy Budget (kBtu/ft ²)	Energy Savings vs. ASHRAE
1A	Miami, FL	82	58	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%
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%

Energy Savings (w/o plug loads) Using Prescriptive ECMs – Maintenance Facility



CZ	City	Baseline (kBtu/ft ²)	Final Energy Efficient Solution (kBtu/ft ²)	Energy Savings
1A	Miami, FL	36	15	59%
2A	Houston, TX	45	19	58%
2B	Phoenix, AZ	42	17	59%
3A	Memphis, TN	56	25	56%
3B	El Paso, TX	47	20	58%
3C	San Francisco, CA	43	17	59%
4A	Baltimore, MD	75	35	53%
4B	Albuquerque, NM	61	27	56%
4C	Seattle, WA	64	29	54%
5A	Chicago, IL	93	45	52%
5B	Colorado Springs, CO	80	36	55%
6A	Burlington, VT	108	54	50%
6B	Helena, MT	99	49	50%
7A	Duluth, MN	134	65	51%
8A	Fairbanks, AK	207	105	49%

Tools to Help



Energy Conservation Measure (ECM) Selection Toolkit

- Helps identify LCC effective EMCs & costs for project development
- Posted on the NAVFAC Sustainable page on WBDG (Draft)
- Full version due Spring 09

Navy Solar Domestic Hot Water Decision Tool

- Solar DHW Required by EISA 07
- Cost Effective in many locations
- Evaluates SDHW for a project based on local Solar Resource
- Compares Life Cycle Cost of Solar vs Electricity or Gas
- Provides Y/N decision on whether Solar DHW is cost effective
- Provides solar system size & cost estimate for Programming
- Currently Navy Only but will be posted on WBDG in future

Navy Solar Domestic Hot Water Decision Tool



EISA SOLAR DOMESTIC HOT WATER DECISION TOOL v.4 for FY10-11 Projects

PURPOSE: This tool can assist in the determination of whether Solar Domestic Hot Water is Life Cycle Cost Effective for a specific project. The 2007 Energy Independence and Security Act (EISA) requires that 30% of a building's hot water must come from solar if life cycle cost effective.

INPUTS:	
Building Type	Fitness Center, Bowling, Rec
Size (square feet)	30,000
Solar Region	Hawaii
UIC - Activity	N62013 - NAVSTA PEARL HARBOR HI
Nat Gas Available?	NO

CALCULATE

DIRECTIONS:

Make selections & fill in the 5 yellow cells above.

Inputs:

- 1) Select from one of the Building Types in the drop-down list.
- 2) Enter the building (primary facility) square footage.
Note: 1 sq meter = 10.76 sq feet
- 3) Select the facility location "Solar Region" from the drop-down list.
Note: Look in other Solar Regions if your Activity is not listed where expected.
- 4) Select the facility location "UIC - Activity" from the drop-down list.
- 5) Select whether natural gas is available at the building site from the drop-down list.
- 6) Calculations should be automatic. If not, press "CALCULATE" button.

Outputs:

Solar DHW Life Cycle Cost Effective: This determines if Solar Domestic Hot Water (DHW) is life cycle cost effective when compared to electricity or natural gas. If "YES", solar is cost effective. For solar to be cost effective, both the Electric Rate and the Natural Gas Rate must be greater than or equal to their respective Break-Even's. If Natural Gas is not available, Natural Gas is not considered; therefore, the Electric Rate must be greater than or equal to the Electric Rate Break-Even.

Electric Utility Rate: This is the Electric Rate for the specific Activity. It is the cost to the Activity for the energy purchased from the utility escalated to 2011. This is not the Public Works cost.

Electric Rate Break-Even: This is a calculation of the break-even cost of solar over a 25 year economic life compared to electric water heaters.

Natural Gas Utility Rate: This is the Natural Gas Rate for the specific Activity. This is the cost to the Activity for the energy purchased from the utility escalated to 2011. This is not the Public Works cost.

Natural Gas Rate Break-Even: This is a calculation of the break-even cost of solar over a 25 year economic life compared to gas water heaters.

Bldg Hot Water Demand: Estimated hot water demand based on building type and square footage.

30% Solar Cost: This is the added "First Cost" of providing 30% of the daily domestic hot water consumption using solar thermal energy. Costs are escalated to 2011. **This is the minimum EISA requirement if Solar LCC Effectiveness is YES.**

30% Solar Collector Size: This is the square footage of FLAT PLATE panels required to meet 30% of the solar energy requirements to supply domestic hot water.

30% Energy Savings/yr (KWh): This is the annual energy saved by the solar DHW system.

30% Cost Savings/yr: This is the annual energy cost saved by the solar DHW system.

100% Solar Cost: This is the added "First Cost" of providing 100% of domestic hot water using solar energy. Cost is escalated to 2011. If the Utility Rate is significantly higher than the Break Even Rate, consider providing 100% of the DHW with solar for greater energy savings.

100% Solar Collector Size: This is the square footage of FLAT PLATE panels required to meet 100% of the solar energy requirements to supply domestic hot water.

100% Energy Savings/yr (KWh): This is the annual energy saved by the solar DHW system.

100% Cost Savings/yr: This is the annual energy cost saved by the solar DHW system.

Note: If the electric rate and/or the gas rate shown is not correct for the Activity, this tool can still be used.

Compare the break even rate to the actual utility rate (escalated to 2011). If the Utility Rate is higher than the Break Even Rate, then Solar DHW is cost effective.

OUTPUTS:	
Is Solar DHW Life Cycle Cost Effective?	YES
Electric Utility Rate (\$/ KWh)	0.137
Electric Rate Break-Even (\$/ KWh)	0.055
Natural Gas Utility Rate (\$/ KWh)	0.000
Natural Gas Rate Break-Even (\$/ KWh)	0.000
Bldg HW Demand (gal./day)	1,600
First Cost - 30% Solar DHW (\$)	\$26,920
30% Solar Collector Size (square feet)	375
30% Annual Energy Savings (KWh/yr)	25,816
30% Annual Cost Savings (\$/yr)	\$3,517
First Cost - 100% Solar DHW (\$)	\$86,399
100% Solar Collector Size (square feet)	1,251
100% Annual Energy Savings (KWh/yr)	85,386
100% Annual Cost Savings (\$/yr)	\$11,725

New Energy Policy Implemented

- **EPACT05**
- **EO 13423**
- **Navy LEED Policy**
- **EISA 07– soon to be fully Implemented**

Limited Guidance Available

- **Navy Study (Steven Winter Associates)**
- **Army Study**
- **UFC 3-400-01**
- **Whole Building Design Guide**

Future Guidance & New Compliance Methods

- **New UFC 3-400-01**

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Questions ?



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