2017
Spangdahlem Air Base
Installation Energy Plan

United States Air Forces in Europe

Prepared by
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52d Civil Engineer Squadron
52 CES/CENPE

Commander's Foreword

I am pleased to present the 52d Fighter Wing's Installation Energy Plan. This document outlines my strategic framework for managing infrastructure energy consumption at Spangdahlem Air Base. We will manage our utilities costs, implement the most sustainable infrastructure technologies, expand renewable energy, and engage the SAB community, taking concrete steps toward achieving the 52d FW Saber goals:

Strengthen and sustain our culture of responsibility

Bolster bonds of allied friendship and cooperation

Be USAFE's most environmentally-friendly wing

By controlling energy demand and purchasing only the resources we need, the 52 FW continues its commitment to good stewardship of Germany's natural and economic resources in conjunction with our community neighbors.

With our total installation energy management approach functioning, we can fulfill the USAF energy goals of reducing demand, increasing supply, and changing our culture: practicing sound stewardship while maintaining global air superiority into the 21st century.

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JOSEPH D. MCFALL, Colonel, USAF
Commander, 52d Fighter Wing
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Plan Executive Summary

The overall purpose of this Installation Energy Plan is to outline a strategic infrastructure and community engagement framework to manage energy consumption at Spangdahlem Air Base.

Spangdahlem Air Base and its GSUs have symbolized a strong U.S. – German partnership for over 60 years. The 52d Fighter Wing continues to provide sound management of the natural environment and respect for the surrounding communities. In managing our energy inputs, we can better manage our outputs, for example, greenhouse gas emissions. By controlling energy demand and purchasing only the resources we need, the 52 FW is a conscientious partner committed to good stewardship of Germany's natural and economic resources in conjunction with our community neighbors.

Reducing energy consumption while diversifying supply is a critical component of US national security strategy. USAF energy goals are:

- Reduce installation energy consumption
- Increase energy supply to enhance energy security
- Culture change to consider energy in use in every airman's day-to-day activities

This Plan outlines the steps necessary to meet USAF energy goals, fulfill policy mandates, and implement MAJCOM guidance. The 52d Civil Engineer Squadron will pursue the following operational goals:

- Improve current infrastructure
- Construct sustainable future infrastructure
- Expand renewable energy
- Manage energy conservation goals

Statistical Summary

In FY16, total energy consumption for all fuel types at Spangdahlem Air Base and GSUs totaled 112,010 MWh, costing approximately $10M. The aggregate real property footprint totaled 7,504,822 SF.

FY2016 Energy Intensity was 50.9 Million British Thermal Units per thousand square feet (50.9 MBTU/kSF), or 160 kilowatt hours per square meter (160 kWh/SM).

The latest Executive Order 13693 goal requires the reduction of our energy intensity of 50.6 MBTU/kSF (baseline year 2015) to 38 MBTU/kSF by 2025.

Detailed graphical information on historical and current SAB utilities consumption and expenditures is contained in Appendix B – Base Performance Charts.

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Introduction, Context, and Scope

The purpose of this plan is to outline a strategic infrastructure and community engagement framework to manage energy consumption at Spangdahlem Air Base in compliance with the installation component of USAF goals to reduce installation energy consumption.

Energy enables Air Force operations, and reducing energy consumption, while diversifying supply, is a critical component of US national security strategy. The Air Force alone consumes almost half of the total energy utilized by all US Government agencies. Therefore, smart management of USAF energy consumption can have a significant effect on the "bottom line."

Spangdahlem Air Base: USAF and Host Nation Cooperation

Spangdahlem Air Base (SAB), Bitburg Annex, and other GSUs have symbolized a strong U.S. – German partnership for over 60 years. The 52d Fighter Wing continues to provide sound management of the natural environment and respect for the surrounding communities. In managing our energy inputs, we can better manage our outputs, for example, greenhouse gas emissions. Additionally, any large purchaser of commodities such as fuel oil and electricity can have an effect on market prices. By controlling energy demand and purchasing only the resources we need, the 52 FW is a conscientious partner committed to good stewardship of Germany's natural and economic resources in conjunction with our community neighbors.

Spangdahlem Air Base Energy and Utilities Overview

FY2016 Consumption

In FY16, total infrastructure energy consumption for all fuel types at Spangdahlem Air Base and GSUs totaled 112,010 MWh, costing approximately $10M.

Total area	: 7,504 kSF	(= 697,221 SM)
Total energy consumed	: 381,899 MBTU	(= 112,010,000 kWh)
Baseline 2015	: 50.6 MBTU/kSF	(= 160 kWh/SM)
Total water consumed	: 117,321 kGal	(= 444,107 M^3)

Detailed information on current SAB utilities consumption and expenditures is available in the 52 CES Portfolio Optimization Element's *FY16 Annual Energy Management Report*.

Price Escalations

Since utilities are sold on the open market in Germany, SAB is exposed to normal price escalations present in Host Nation and world commodities markets. Additionally, energy commodities in Germany are purchased in Euros, so SAB is also exposed to currency market fluctuations. Therefore, although total SAB energy consumption has gone down relative to historic highs, because of periodic Euro strengthening against the dollar, the dollar-denominated price we pay for energy has increased accordingly.

Energy Intensity

Because of variables in pricing and types of fuels, comparing costs alone does not accurately portray comparative energy consumption. *Energy intensity* is a standard comparative metric unaffected by differences in building size, building function, and passage of time. Energy intensity comparisons are expressed as a simple ratio:

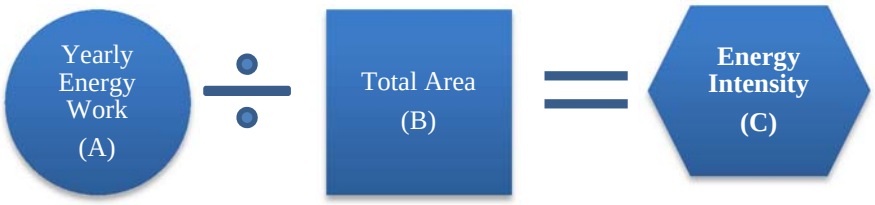

Figure 1 - Calculation of Energy Intensity

SAB FY2016 Energy Intensity is 50.9 Million British Thermal Units per thousand square foot (50.9 MBTUs/kSF), or 160 kilowatt hours per square meter (160 kWh/SM).

Reduction Efforts and Requirements

Since 1985, Spangdahlem Air Base has reduced energy consumption by 57% and is on a linear track to meet all current federal energy reduction mandates.

Executive Order 13423 required a facility energy intensity reduction of 30% by 2015 (baseline year of 2003). Using a linear model after FY05, average annual energy consumption had to be reduced by 3% to achieve 30% by 2015. The 52FW achieved a total of 24% reduction by FY15. Now, Executive Order 13693, requires a facility energy intensity reduction of 2.5% per year through FY25 established on the baseline year of FY15. Final reduction required on the FY15 baseline is 25%.

Detailed graphical information on historical and current SAB utilities consumption and expenditures is contained in Appendix B – Base Performance Charts.

Specific FY2016 Energy Costs

Energy Source	Energy Cost	Consumption	Cost / unit
Fuel oil	$3,780,538	68,251,143 kWh	0.055 $/kWh
Purchased heat	$518,787	3,466,882 kWh	0.150 $/kWh
Electricity	$5,923,958	40,052,836 kWh	0.148 $/kWh
Total	$10,223,283	111,770,861 kWh	0.091 $/kWh
Total area (SF-SM)	7,504,822 SF	697,221 SM	
Average Energy / Area	15 kWh/SF	160 kWh/SM	
Energy Cost / Area	1.36 $/SF	14.66 $/SM	

Table 1 - FY16 Energy Costs for SAB and significant energy-using GSUs

Total average for all above-listed energy sources during FY2016 is $0.091 per kWh. This equals a specific energy rate of $1.36/SF (=$14.66/SM).

FY2016 52 FW Utilities Purchases

District heat was purchased for Bitburg Annex Housing but was terminated in June 2016. The district heat contract at Kalkar still exists.

Electricity is purchased for the following sites: Bitburg Annex, Großlittgen, Kalkar, Niederkail, Spangdahlem AB, Sülm-Esslingen, Geilenkirchen and Zemmer.

Fuel Oil is purchased for Spangdahlem, Bitburg, Großlittgen, Sülm-Esslingen and Zemmer.

Potable water is produced in house for Spangdahlem AB (Industrial and MFH).

Potable water is purchased for Bitburg, Kalkar, Sülm-Esslingen and Zemmer.

	FY2016 Utilities Purchases					
Location	**District heat**	**Electric-ity**	**Fuel Oil**	**Natural gas**	**Potable water (produced)**	**Potable water (purchased)**
Bitburg MFH	X	X	X			X
Großlittgen		X	X			
Kalkar	X	X				X
Niederkail		X				
Spangdahlem		X	X		X	
Sülm-Esslingen		X	X			X
Geilenkirchen		X		X		
Zemmer		X	X			X

Table 2 - 52 FW FY16 Utilities Purchases

Air Force Energy Consumption and Strategy

Total Air Force energy consumption, distribution statistics, and expenditures are reported in the *2017 Air Force Energy Flight Plan.*

USAF Vision: Make Energy a Consideration in All We Do

The *2017 Air Force Energy Flight Plan* outlines governing goals, guidelines and strategy for installation energy planning according to the following energy vision intended to *Make Energy a Consideration in All We Do*:

- **Improve Resiliency:** The Air Force is committed to improving responsiveness to disruptions to energy and water supplies and increasing the ability to quickly resume normal operations and mitigate impact to the mission
- **Optimize Demand:** With energy costs continuing to increase and budgets becoming more fiscally constrained, the Air Force is looking to optimize demand through operational and logistical efficiencies and new technologies as a way to improve its energy resiliency and enhance its mission effectiveness
- **Assure Supply:** The Air Force is committed to diversifying the types of energy and securing the quantities necessary to perform its mission as a way to assure supply, both for near-term benefits and long-term energy security. The Air Force is focusing on developing onsite sources of clean energy, particulary those sources that can protect the Air Force from grid failure or other supply dis-ruptions. Increased use of on-site clean energy can provide the Air Force with con-sistency in energy pricing, as well as promote positive environmental benefits by avoid-ing greenhouse gas emissions

USAF Energy Goals

- Reduce facility energy intensity by 2.5% per annum through 2025 (25% total from baseline year of FY15)
- Reduce base water consumption intensity by 2% per annum through 2025 (36% total from baseline year of FY07)
- Increase use of renewable and alternative electrical and thermal energy at annual targets (10%, 13%, 16%, 20%) to attain 25% by FY25
- Increase use of renewable electrical energy at annual targets (10%, 15%, 20%, 25%) to attain 30% by FY25
- Reduce ground vehicle greenhouse gas emissions 30% by FY25 with a baseline year of FY14 (Federal fleet vehicles are exempt at OCONUS locations)
- Reduce petroleum consumption by all ground vehicles by 2% annually through FY20 with a baseline year of FY08 (Federal fleet vehicles are exempt at OCONUS locations)

Energy and the 52d Fighter Wing Saber Goals

52FW Leadership outlined a series of "Saber Goals" in 2010. Reducing energy demand, increasing efficiency, and promoting conservation fall under the following 52 FW Saber Goals:

- Strengthen and sustain our culture of responsibility
- Bolster bonds of allied friendship and cooperation
- Kill the crap that wastes time and resources
- Become USAFE's most environmentally-friendly wing

Asset Optimization

The 52 CES Portfolio Optimization Element Energy (52 CES/CENPE) administers SAB Energy and Utilities Management. In FY16 the Energy and Utilities Management Section processed a total of over 800 utilities invoices totaling approximately $10M for all fuel types purchased (excluding aviation and ground fuels).

Within the Portfolio Optimization Element, the Energy and Utilities Management Section functions synergistically with the Real Property Section, leading space utilization and optimization, and the Community and Master Planning Section, which maintains a base master plan and champions sustainable area development initiatives. Functions scattered throughout SAB should be colocated to reduce footprint, promote efficiencies gained by consolidation, and reduce second-order inefficiencies (for example, unnecessary vehicle trips consuming both time and fuel). In short, the Real Property Element ensures that SAB tenants and functions utilize the right amount of space, use an appropriate amount of resources (Energy and Utilities), and are located properly on the installation (Community Planning).

Figure 2 - Optimization Model

Heating and Cooling Behaviour - Key Parameters for Culture Change

Culture change means changing behavior on a large scale, and this begins with each individual airman. To support the AF strategic goal of culture change, we must begin with energy awareness to make energy a consideration in all we do, strengthening and sustaining our culture of responsibility. Participation of every squadron, element, and shop across Spangdahlem Air Base is necessary to affect culture change with the goal of using no more than we need. We can no longer ignore "minor" energy waste—all waste must be acknowledged and eliminated through a culture of continuous optimization and improvement; otherwise, the conservation actions of a few will be outweighed by the waste of many. Energy must become a responsibility of every airman, civilian, and contractor.

Examples of cultural change are reflected in how we utilize energy and adapt to climate specific working conditions. As per USAFEI 32-7040, Air Conditioning (AC) Utilization Procedures and Guidance, USAFE installations in Germany do not meet the temperatures required to allow comfort cooling. Equipment cooling is allowed to reduce the temperature and/or humidity levels for the purpose of cooling specialized equipment or electronics (IAW manufacturer's specifications, Technical Order (TO), or other appropriate published document). This cooling is limited to the the authorized area only to prohibit inadvertent cooling of other areas. A supporting document for equipment cooling that references a requirement for AC cannot be used to justify cooling for an entire building. Sizing of the AC units will be specified for the approved equipment areas.

As mentioned earlier, Spangdahlem Air Base is following the requirements from USAFEI 32-7040. However the base determines the final decision on existing and new AC installations. In cooperation with the 52 CEO HVAC Shop, the energy management team identifies the most economic and energy efficient solution, if a need for cooling exists. Temperature measurements taken by the energy manager play a vital role in identifying internal loads that might make the installation of cooling reasonable. Also, control of the installed AC equipment is managed by the 52 CEO HVAC Shop to ensure that the internal room temperatures comply with standards. Additionally, guidelines for setpoint temperatures are issued to facility managers during the monthly training sessions to include responsible use of AC equipment in their dedicated facilities. The temperature settings according to the Air Force Guidance Memorandum 2016-01 are displayed in Table 3.

Occupancy	**Heating Max Temp (deg F)**		**Cooling Min Temp (deg F)**		
	Occupied	**Unoccupied**	**Occupied**	**Unoccupied**	**Max Humidity ****
Administrative Areas *	70	55	73	80	50%
NAF Retail Space	70	55	73	80	50%
Community Areas (theater, youth facilities, etc.)	70	55	73	80	50%
Warehouses***	60	55	80	80	50%
Shop Spaces***	65	55	76	80	50%

Table 3 - AFGM2016-01 Setpoint Guidance

*Administrative areas include administrative spaces in all facilities. Any administrative space co-located with mission equipment, defaults to the temperature and humidity requirements of the equipment.
**Represents a design humidity for the space. The goal is to avoid mold problems in the facility (typically 40 – 60% relative humidity). Actual humidity levels will vary depending on local climate.
***Where eligible for air conditioning.

Due to inefficiency and safety reasons, all non-oil filled electrical space heaters are prohibited from use by personnel. The use of oil filled electrical radiators, in areas where no water based heating exists or no other economical heat generation solution exists, requires the approval of the 52 CES Fire Department prior to installation. Adherance to the above (Table 3) by not heating above 70°F or cooling below 73°F is paramount in Spangdahlem attaining its reduction goals.

Energy Conservation versus Energy Efficiency

Energy *efficiency* refers to infrastructure, while energy *conservation* refers to human behavior. For example, upgrading a heating system to extract more energy from fuel is an act of energy efficiency, while turning down the heat in a building at night and on weekends is an act of energy conservation. Since infrastructure efficiency gains can be negated by human negligence, infrastructure changes alone will not be sufficient as we strive to meet energy reduction goals: thus the AF goal of culture change. Both energy efficiency and energy conservation actions are necessary to reduce energy waste. By combining efficient infrastructure (energy efficiency) with conscientious behavior (energy conservation), we unlock powerful potential to reduce our overall energy consumption make energy a consideration in all we do.

Water Use and Energy Consumption

The relationship between water use and energy consumption is not immediately apparent; however, pumping both water and sewage consumes most of the energy associated with operating a drinking water supply system. Operating water treatment facilities requires additional energy consumption. Therefore, water reduction efforts have a direct effect on energy consumption—wasting water wastes both water *and* energy. Harvesting rainwater, collecting gray water, and installing low-flow water fixtures are examples of infrastructure options to reduce overall consumption of potable water and reduce demand on our drinking water supply system.

Policies

Air Force Policy Directive (AFPD) 90-17, Energy Management, is the overall SAB Energy Program policy document. Initial energy reduction goals were established by the National Energy Conservation Policy Act (NECPA), 1988, which set a reduction goal of 10% by 1995, the Energy Policy Act, 1992 (EPACT92), which required a reduction goal of 20% by 2000, and Presidential Executive Order (E.O.) 13123, which mandated a reduction goal of 35% by the year 2010, against a 1985 baseline.

The EPAct of 2005 added further reductions, setting an energy reduction goal of 20% by FY15 on 2003 baseline (2% reduction per year). E.O. 13423 (dated Jan 2007) established energy conservation goals reducing consumption by 3% per year or by 30% total at the end of FY15, starting at FY05 (baseline is FY03).

Our current energy conservation goals are derived from E.O. 13693 (dated Mar 2015). The overall energy goal is to reduce building energy intensity by 2.5% per year or by 25% total at the end of FY25, starting at FY15 (baseline is FY15). A table of specific policy drivers is provided in Appendix E – Statutory and Policy Drivers.

Conclusion

Successful energy management will require ongoing effort. As we work to implement the most efficient infrastructure technologies, expand renewable energy, and engage the SAB community, we will reduce installation energy consumption. With infrastructure energy management functioning in concert with aviation fuels and ground fuels management, we can fulfill the USAF energy goals of reducing demand, increase supply, and changing our culture: practicing sound stewardship while maintaining global air superiority into the 21st century.

Appendices

Appendix A – Key Energy Management Personnel

Appendix B – Base Performance Charts

Appendix C – 3-Year Energy Project Plan

Appendix D – Top Energy and Water Users

Appendix E – Statutory and Policy Drivers

Appendix A – Key Energy Management Personnel

52 CES/CENP Energy and Utilities Management Team

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Energy Management Working Group Members

Name	Title / Position	Office Symbol
Harenz, Werner	Civ, Chief, Portfolio Optimization Element	52 CES/CENP
Thiel, Daniel	Civ, Base Energy Manager	52 CES/CENPE
Reeves, Eric	Civ, Resource Efficiency Manager	52 CES/CENPE
Lorenz, Norbert	Civ, Operations Electrical Engineer	52 CES/CEOERP
Weber, Lothar	Civ, Lead Electrical Engineer	52 CES/CENM

Table 4 - Energy Management Working Group Members

Energy Management Steering Group Members	
52 FW/CC	52 CES/CC
52 MDG/CC	52 CES/CD
52 MXG/CC	52 CES/CEN
52 MSG/CC	52 CES/CENP
52 OG/CC	52 CES/CENPE

Table 5 - Energy Management Steering Group Members

Appendix B – Base Performance Charts

52 FW FY16 Utility Expenditures by Fuel Type

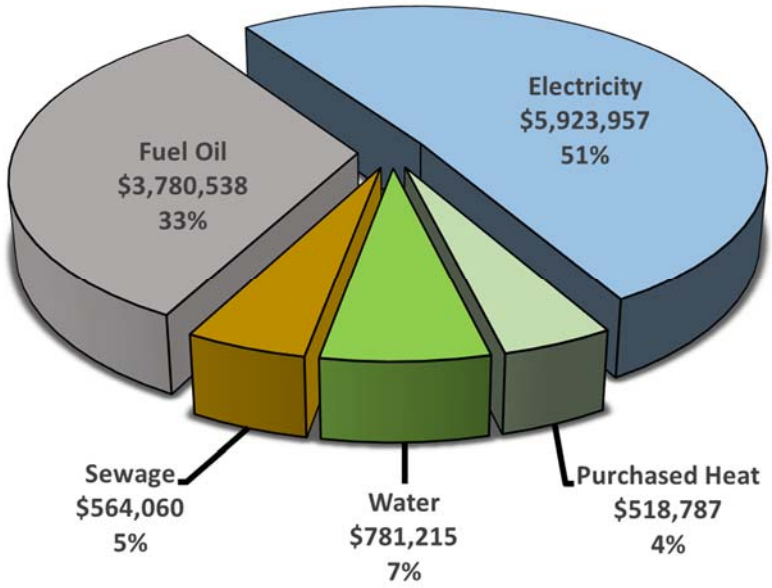

Figure 3 - FY16 Utility Expenditures by Utility Typs

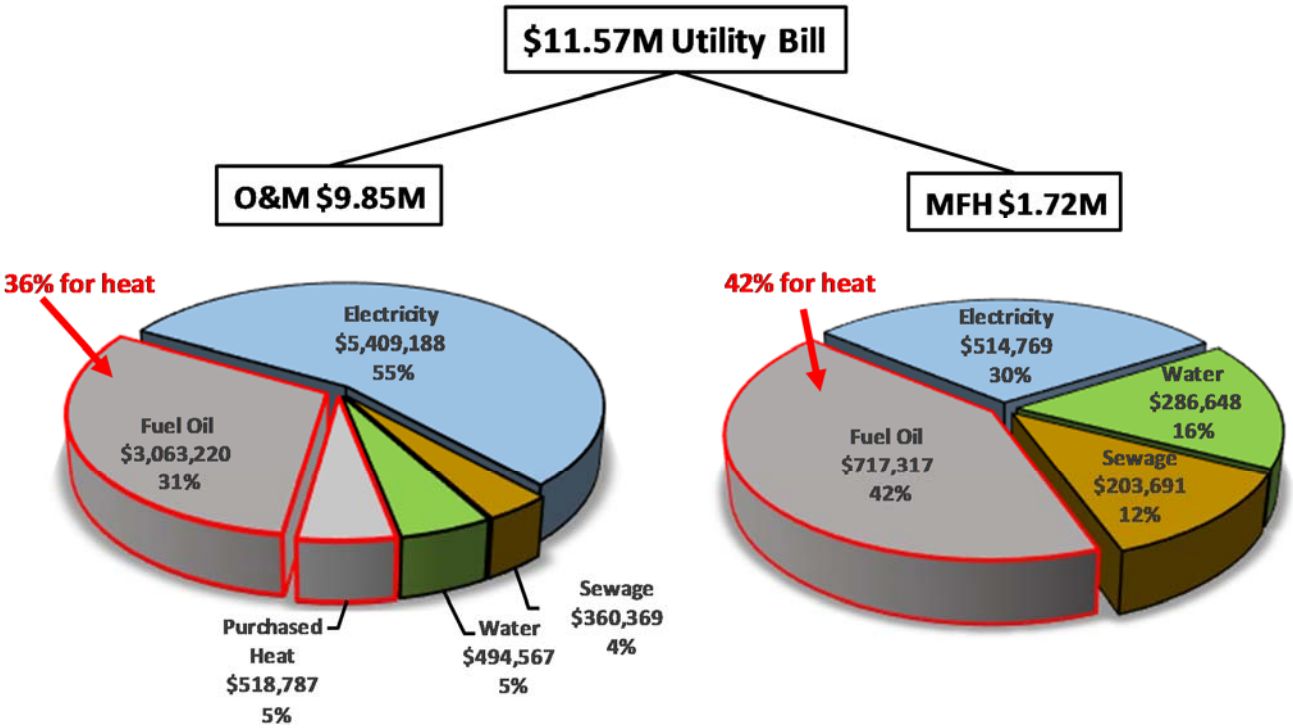

Figure 4 - Utility Cost Breakdown

52 FW FY16 Energy Consumption by Area (Main Base & GSUs vs. MFH)

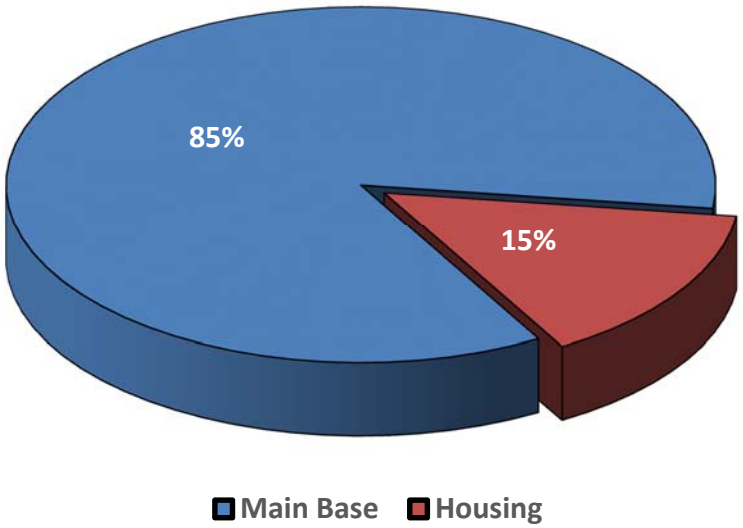

Figure 5 - FY16 Base Energy Distribution, Main Base vs. MFH

52 FW FY16 Energy Consumption by Commodity

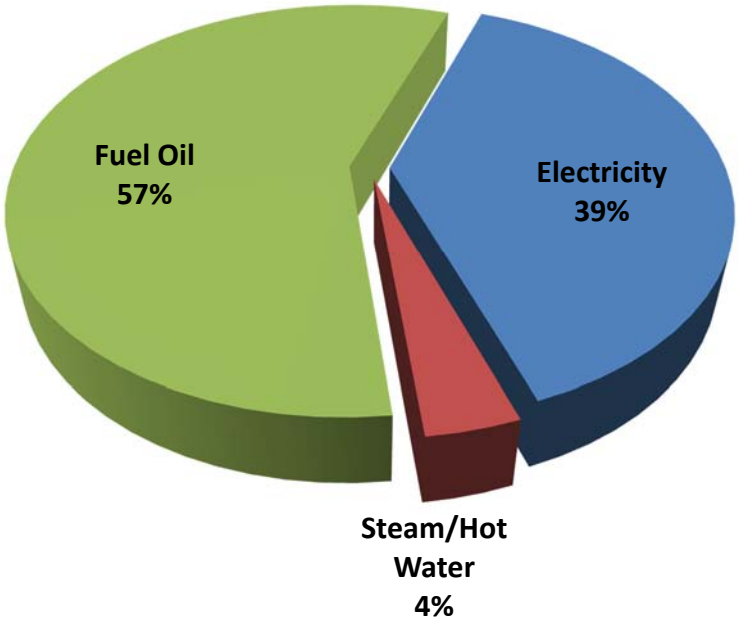

Figure 6 - FY16 Energy Consumption by Commodity

52 FW Energy Reductions FY05 – FY15

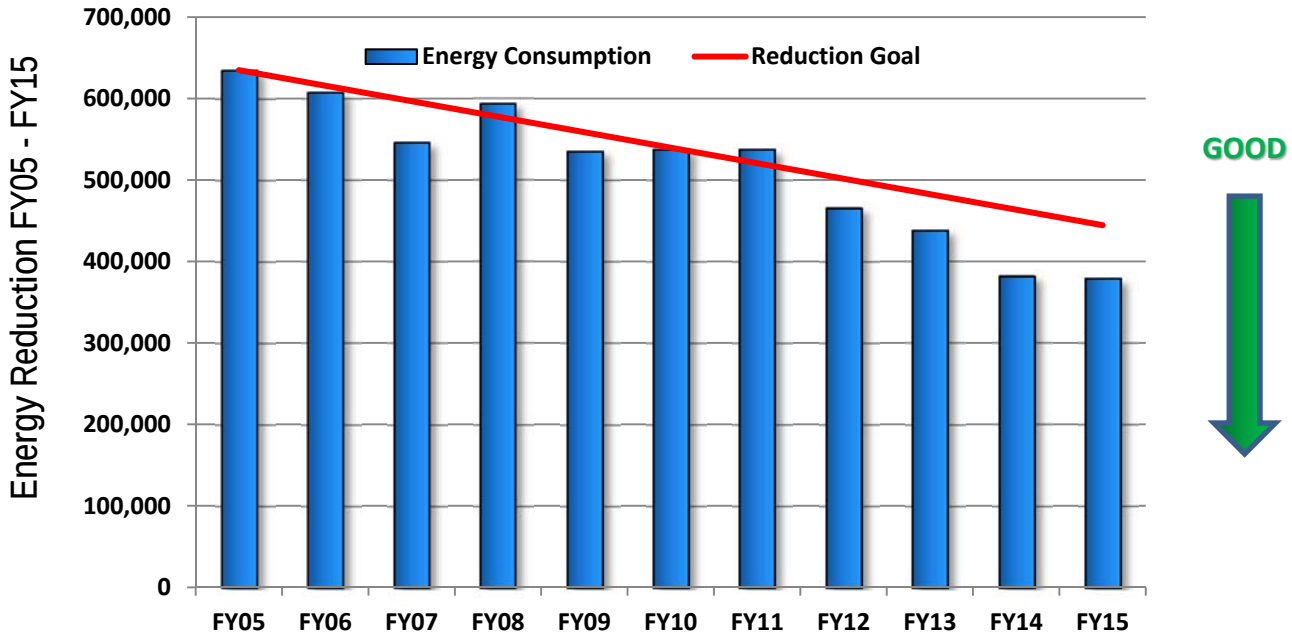

Figure 7 - Energy Reductions FY05 - FY15

52 FW Energy Intensity Reductions FY05 – FY15

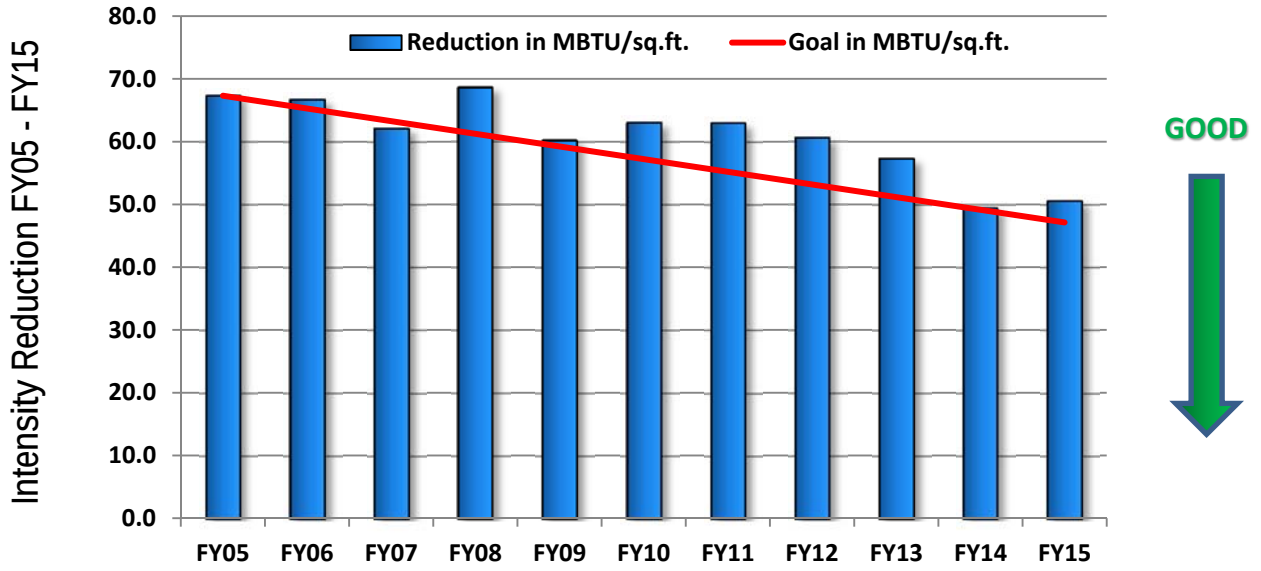

Figure 8 - Energy Intensity Reductions (last decade) From FY05 - FY15

52FW Total Historical Footprint Size FY05 – FY16

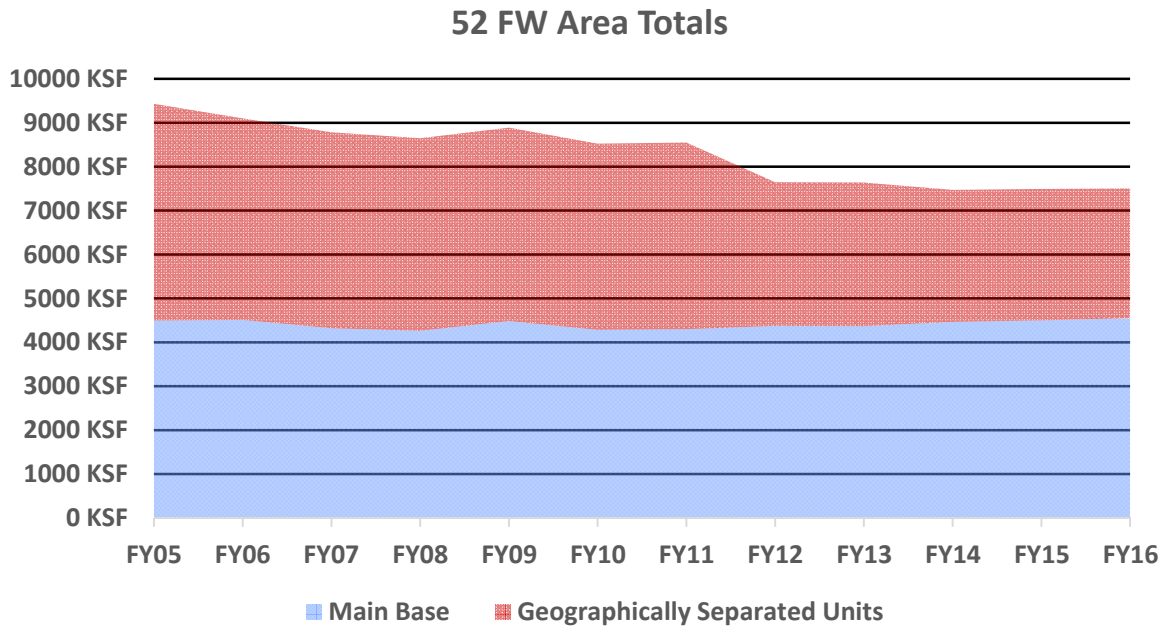

Figure 9 - 52 FW Area Development

52 FW Water Reduction FY07 – FY16

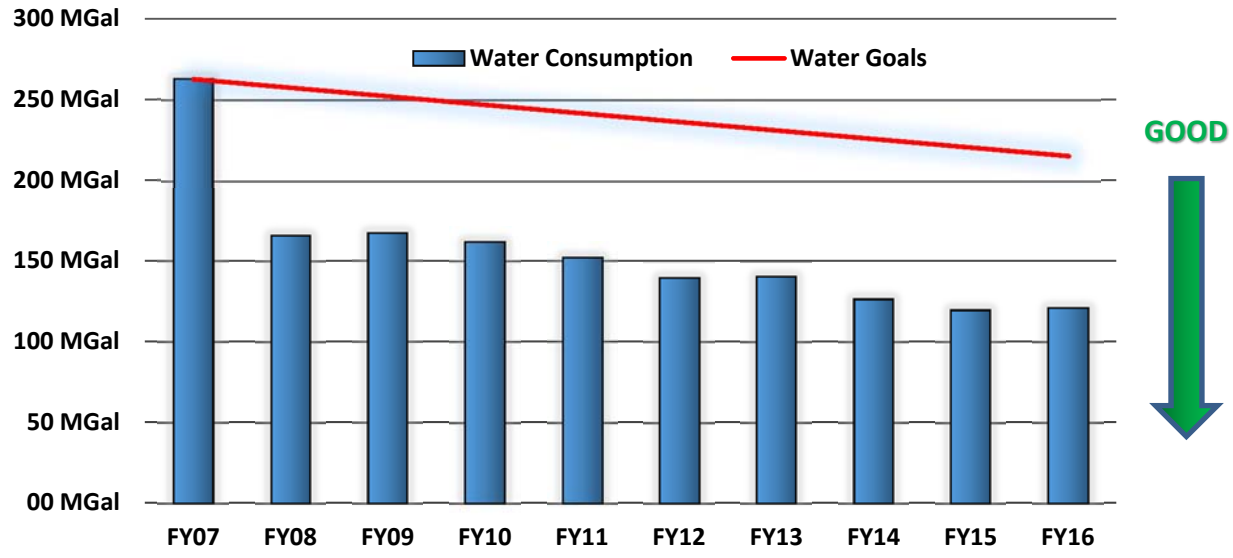

Figure 10 - 52 FW Water Consumption since FY07 baseline year ref: EO 13693

52 FW Water Intensity FY07 – FY16

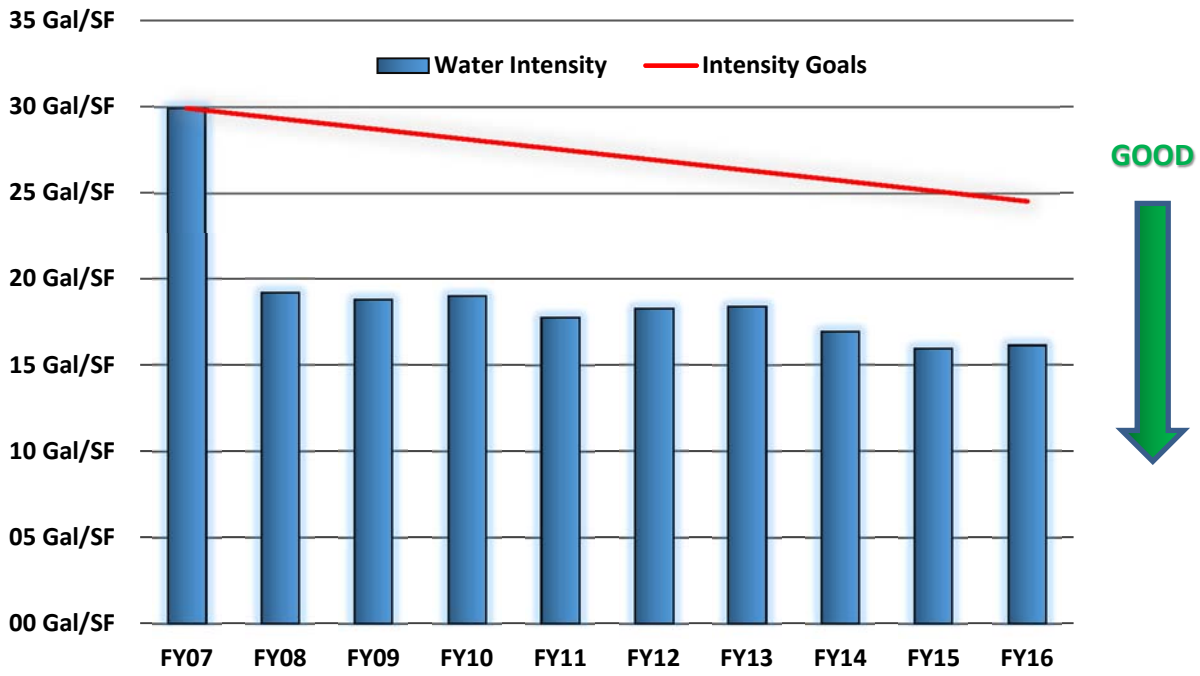

Figure 11 - 52 FW Water Intensity

Appendix C – 3-Year Energy Project Plan

Project Number	Project Title	Cost Estimate	Target Execution	Status
VYHK122412	Replace Hot Water Pumps	$72,000	FY17	Awaiting Project Funds
VYHK142403	Install Revolving Door and De-Stratification Fans	$116,000	FY18	Currently in Design
VYHK142402	Replace Heating System P&E	$322,000	FY17	Awaiting Project Funds
VYHK181364	Boiler Replacement Multi Facilities	$215,000	FY18	Awaiting Design Funds
VYHK191501	Replace Airfield Ramp Lights	$3,025,000	FY19	Awainting Design Funds
VYHK132400 ECM.01.01	ESPC Improve Resiliency by Installing Natural Gas Infrastructure	$26,500,000	FY19	Currently in design Submittals by Summer 2017
VYHK132400 ECM.05.02	ESPC Exterior Lighting Retro-fits	$2,500,000	FY18	Currently in design Submittals by Summer 2017
VYHK132400 ECM.10.01	ESPC Distributed Generation	$17,500,000	FY19	Currently in design Submittals by Summer 2017
VYHK132400 ECM.12.01	ESPC Energy/Utility Distribu-tion	$600,000	FY18	Currently in design Submittals by Summer 2017
VYHK153005	ECIP Install Energy Management Control System	$4,800,000	FY20/21	Currently in design

Table 6 - 24-month Project Development Plan

Appendix D – Top Energy and Water Users

Top Energy Consuming Organizations (Ranked)

Organization	Annual Consumption % of Total	High Consumers
52 FSS	67,090 MBTU/Yr 24%	38 (VOQ), 500 (Club), 580 (Gym), 520 (VOQ), 408 (TLF), 409 (TLF), 410 (TLF), 124 (Rec Center), 42 (Restaurant), 443 (CDC), 427 (Youth Center), 129 (NCO Prof Ed), 130 (NCO Prof Ed), 147(Dining), 146 (MWR Supp), 189 (Hobby Shop), 149 (Library), 300 (Bowling Center)
MFH (CES)	45,150MBTU/Yr 16%	225 (Dorm), 515 (Dorm), 401 (Dorm), 402 (Dorm), 423 (Dorm), 424 (Dorm), 425 (Dorm), 226 (Dorm) , 332 (Dorm), 333 (Dorm), 335 (Dorm), 227 (Dorm), 454(MFH Support), 166(MFW Support)
52 LRS	25,076 MBTU/Yr 9%	103 (Warehouse & Supply), 250 (Warehouse), 101 (Corrosion Ctl), 110 (Vehicle Maint Shop), 219 (Vehicle Maint Shop), 660 (Vehicle Maint Shop), 218 (Traffic Management) 61 (Warehouse)
EMS	21,071 MBTU/Yr 8%	36 (Maintenance), 41 (Aircraft Shop), 157 (Maintenance), 204 (Storage Facility), 99 (Corrosion Ctl), 257 (Shop), 839 (Shop)
52 CES	14,314 MBTU/Yr 5%	120 (Offices/Shops), 47 (Fire Dept), 123 (Old Exchange), 119 (Offices), 763Snow Barn), 771 (Warehouse), 690 (Fire Dept)
52 MED GP	11,462 MBTU/Yr 5%	550 (Health Clinic), 137 (AF Clinic), 175Flt Surg Clinic), 161 (Patient Welfare)
AAFES	10,123 MBTU/Yr 5%	570 (BX), 560 (Shoppette), 153 (Theater)
DoDDS	10,054 MBTU/Yr 5%	441 (M School), 439 (Elem School)
52 SFS	4,314 MBTU/Yr 3%	127 (HQ WG), 605 (Small Arms Range), 985
52 FW	4,398 MBTU/Yr 3%	136 (Dorm), 139 (Offices), 135 (Chapel)
52 OSS	4,235 MBTU/Yr 3%	21 (HQ Group), 32 (Shop), 15 (SQ Ops), 389 (HQ Group)
726 AMS	3,803 MBTU/Yr 2%	670 (SQ Ops)
DeCA	2,904 MBTU/Yr 2%	173/575 (Commissary)
52 COMM	2,581 MBTU/Yr 2%	132 (Offices), 107 (Offices)
52 CONS	1,798 MBTU/Yr 1%	128 (Offices)

Table 7 - Top Consumers

Facilities in RED consume over 5,000 MBTU per year
Facilities in GREEN consume 3,000 to 5,000 MBTU per year
Facilities in BLUE consume less than 3,000 MBTU per year

Appendix E – Statutory and Policy Drivers Table

Drivers	EPACT 2005 (P.L. 109-58) [except as noted]	Executive Order 13693	EISA 2007	Implementing Instructions	Air Force Policy
Facility Energy Efficiency	Beginning in FY06, reduce facility energy intensity (MBTU/sf) 2% per year based on 2003 baseline (Title I, Subtitle A, Section 102)	Beginning in FY15, reduce facility energy intensity (MBTU/SF) 2.5% per year based on 2015 baseline (25% by 2025). (Section 3)	Repeat E.O. 13423 goal of 3% per year based on 2003 baseline (30% by 2015) (Title IV, Subtitle C, Section 431)	Implementing Instructions for Executive Order 13693 *Planning for Federal Sustainability in the Next Decade* (June 10, 2015)	AFEPPM 04-1 (Nov 2004) AFEPPM 07-01 (draft) AFPD 90-17 (16 Jul 09) AFI 90-1701 (16 Jul 09)
Renewable Energy	Set annual goals for electricity generated with renewables: 3% in FY07–FY09 5% in FY10–FY12 7.5% in FY13 25% by FY25 (10 USC 2911) (Title II, Subtitle A, Section 203)	Total percentage of building electric and thermal energy shall be clean energy: Not less than- 10% in FY16 and 17 13% in FY18 and 19 16% in FY20 and 21 20% in FY22 and 23 25% by FY25 (Section 3)	N/A	2007 Federal Renewable Energy Requirement Guidance for EPAct 2005 and E.O. 13423	AFPD 90-17 (16 Jul 09) AFI 90-1701 (16 Jul 09)
Building Performance/ Sustainability	Establishes building Performance standards--30% below ASHRAE 90.1 if life cycle cost effective (Title I, Subtitle A, Section 109)	All MILCON and major renovations comply with MOU on sustainability. Must incorporate into 15% of existing buildings by end of FY15 (Section 2)	Section 436. Federal High-Performance Green Building	DOE published final rule effective 22 Jan 08 for 10 CFR 433, 434, and 435 to meet the EPAct 2005 performance standards. http://www1.eere.energy.gov/femp/pdfs/fr_notice_cfr433_434_435.pdf The guiding principles of the signed MOU are located at this website: http://www.wbdg.org/eferences/mou.php	Air Force Sustainable Design and Development (SDD) Policy (31 Jul 07). Leadership in Energy and Environmental Design (LEED) is AF standard. Beginning with the FY09 Military Construction (MILCON) program: • 100% capable of achieving LEED Silver • Program SDD costs at 2% of primary facility cost • 5% per FY for formal LEED certification

Drivers	EPACT 2005 (P.L. 109-58) [except as noted]	Executive Order 13693	EISA 2007	Implementing Instructions	Air Force Policy
					• 10% LEED certified in FY10 and after • All S/R&M projects consider using LEED principles where feasible
Advanced Utility Meters	Meter all facilities for electrical where economically feasible by 2012. (Title I, Subtitle A, Section 103)	N/A	Adds requirement for steam and natural gas meters by 2016. (Title IV, Subtitle C, Section 434)	DoE Electric Metering Guidance (Feb 2006) DoE/FEMP Metering Best Practices (Oct 2007)	Defines "cost effectiveness" • Meter steam at plant • Electric, gas, and water meters on renovations over $200K • Meter all buildings over 35KSF for electric and over 50KSF for natural gas. (A7C Memo, 27 Apr 06)
Utility Meter Reporting	Electric meter reports (annually) (Title I, Subtitle A, Section 103)		DoE to field Web-based tool for certification of reports (FY09 2Qtr) Benchmarking metered facilities (Title IV, Subtitle C Section 432) OMB/DoE Annual Renewable reports (Title V, Subtitle C, Section 528)	DoE to provide Web-based certification and benchmarking system within 1 year after enactment of law (ECD Dec 08) OMB will issue Energy scorecards semiannually	
EnergyStar Products	Must purchase EnergyStar-rated or FEMP-designated products Specific products: electric motors (1 to 500 HP) and air conditioning/refrigeration equipment.		Refers to residential boiler efficiencies. (Title III, Subtitle A, Section 303)	The FEMP product web site contains guidance on all associated products including a link to EnergyStar: http://www1.eere.energy.gov/femp/procurement/index.Html	Can be waived if the agency head determines in writing that no ENERGY STAR® or FEMP-designated product (a) meets functional requirement of agency; (b) is not cost-effective over life of the product taking energy cost savings into account; or (c) the

Drivers	EPACT 2005 (P.L. 109-58) [except as noted]	Executive Order 13693	EISA 2007	Implementing Instructions	Air Force Policy
					product requirement is combat-related.
Solar Hot Water			New/renovated facility with a hot water requirement must be 30% solar generated. (Title V, Subtitle C, Section 523)	FEMP Web site on solar hot water design and specifications: http://www1.eere.energy.gov/solar/sh_basics_water.html	
Reduce Fossil Fuel Usage in New Facilities			New Federal buildings and major renovations of existing buildings are to reduce fossil fuel-generated energy consumption by: • 55% by 2010 • 65% by 2015 • 80% by 2020 • 90% by 2025 • 100% by 2030	DoE will publish rule within 1 year from date of EISA for new Federal buildings and Federal buildings undergoing major renovations or of buildings of at least $2.5M in cost.	
Commission, Decommission, and Retro-Commission			Verification and documentation, during the period beginning on the initial day of the design phase of the facility and ending not earlier than 1 year after the date of completion of construction. (Title IV, Subtitle C, section 432)		
Energy Audits			25% of audits per year in "covered" facilities will be "comprehensive" audits for energy and water. (Title IV, Subtitle C, Section 432)	DoD Energy Management Handbook 2005 DoE to define "covered" facilities and what "comprehensive" Entails	

Drivers	EPACT 2005 (P.L. 109-58) [except as noted]	Executive Order 13693	EISA 2007	Implementing Instructions	Air Force Policy
Storm Water Runoff			Provides guidelines for facilities over 5000SF. (Title IV, Subtitle C, Section 438)		
Water Conservation		Beginning in FY15: • 2% reduction per year based on FY07 baseline • 36% by 2025		Establishing Baseline and Meeting Water Conservation Goals of E.O.13423, Jan 08	Water use defined as all water used at federal facilities that is obtained from public water systems or from natural freshwater sources such as lakes, streams, and aquifers, where the water is classified or permitted for human consumption. The 2007 Water Intensity baseline has been established for the Air Force as 55.8 gal per SF per year. (Air Force Guidance 28 March 08)
Greenhouse Gases		Reduce greenhouse gas emissions through reduction of energy intensity. (Section 2)			
Ground Vehicles	75% AFV Acquisitions at agency level, (WR-ALC)	Increase purchase of alternative fuel, hybrid, and plug-in hybrid vehicles when commercially available.	Section 141, Agencies must procure LDV or MDVs that are low in greenhouse gases.	DoD 4500.36-R (16 Mar 07)	A4R Policy Letter, 100% acquisition/lease where available. (AFI 23-302, Oct 2007)
Petroleum Conservation	100% utilization of alternative fuels in AFVs (Section 701)	Reduce petroleum consumption in vehicle fleet by: • 4% by FY17 • 15% by FY21 • 30% by FY25	Petroleum Reduction and Alternative Fuel Use (Section 142)		AFI 23-302, Oct 2007

Drivers	EPACT 2005 (P.L. 109-58) [except as noted]	Executive Order 13693	EISA 2007	Implementing Instructions	Air Force Policy
Alternative Fuel Use	100% utilization of alternative fuels in AFVs (Section 701)	Increase alternative fuel consumption at least 10% annually.	Petroleum Reduction and Alternative Fuel Use. (Section 142)	OSD Policy Directive Memorandum (27 Dec 07)	AFI 23-302, Oct 2007

Table 8 - Drivers

References

52 CES Portfolio Optimization Element Energy, *FY16 Annual Energy Management Report*

USAF, *2017 Air Force Energy Flight Plan*

Air Force Policy Directive (AFPD) 90-17, *Energy Management*, 16 Jul 2009

USAF, *Air Force Infrastructure Energy Plan 2010*

Air Force Instruction (AFI) 90-1701, *Energy Management*

Energy Independence and Security Act (EISA) of 2007

Energy Policy Act (EPAct) of 2005

Executive Order 13221, "Energy Efficient Standby Power Devices" (2 Aug 01)

Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management" (24 Jan 07)

Executive Order 13693, "Planning for Federal Sustainability in the Next Decade" (19 Mar 15)

Federal Energy Management Program, *The Business Case for Sustainable Design in Federal Facilities* (2003)

National Defense Authorization Acts (NDAA) of 2007 and 2008

National Institute of Standards and Technology Handbook 135, *Life-Cycle Costing Manual for the Federal Energy Management Program*

Abbreviations and Acronyms

52 CES	52 Civil Engineer Squadron
52 CES/CENP	52 CES Portfolio Optimization
52 CES/CEO	52 CES Operations Flight
52 FW	52 Fighter Wing
700 CONS	700 Contracting Squadron
AF	Air Force
AFI	Air Force Instruction
AFPD	Air Force Policy Directive
BLCC	Building Life Cycle Cost
BTU	British Thermal Unit
CE	Civil Engineering
CHP	Combined Heat and Power
DOE	Department of Energy
E.O.	Executive Order
EISA	Energy Independence and Security Act
EMSG	Energy Management Steering Group
EMWG	Energy Management Working Group
EPAct	Energy Policy Act
FEMP	Federal Energy Management Program
SF	Square Feet
FY	Fiscal Year
GSU	Geographically Separated Unit
HN	Host Nation
HQ	Headquarters
KSF	Thousand Square Feet
LCCA	Life-Cycle Cost Analysis
kWh	kilowatt hour
LEED	Leadership in Energy & Environmental Design
SM	Square Meter
MAJCOM	Major Command
MBTU	Million BTUs
MFH	Military Family Housing
MILCON	Military Construction
MWh	Megawatt hour
NDAA	National Defense Authorization Act
NECPA	National Energy Conservation Policy Act
O&M	Operations and Maintenance
OSD	Office of the Secretary of Defense
PPB	Planning, Programming, and Budgeting
SAB	Spangdahlem Air Base
USAF	United States Air Force
USAFE	United States Air Forces Europe