AIR COMBAT COMMAND

INSTALLATION SUSTAINABILITY ASSESSMENT REPORT

Global Hawk

Revised/Updated
Final
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Beale Air Force Base
California

Sustainability assessment summary of Beale Air Force Base to establish baseline metrics, to identify actionable opportunities and investment strategies, and to facilitate year-over-year comparisons.

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"So we have a choice to make. We can remain one of the world's leading importers of foreign oil, or we can make the investments that would allow us to become the world's leading exporter of renewable energy. We can let climate change continue to go unchecked, or we can help stop it. We can let the jobs of tomorrow be created abroad, or we can create those jobs right here in America and lay the foundation for lasting prosperity." - President Obama, March 19, 2009

EXECUTIVE SUMMARY

Due to expanding requirements and diminishing resources, and lacking holistic/integrated design approaches, HQ ACC/A7PS has formulated a process for measuring sustainability at Air Combat Command (ACC) installations. This process will establish baseline metrics to identify actionable opportunities and investment strategies, and facilitate year-to-year comparisons. There are many individual efforts already in place at HQ ACC/A7PS and at the installation level. It is within this context that the ACC Installation Sustainability Assessment (ISA) process and report were developed. This report summarizes the current and recommended sustainability efforts at Beale Air Force Base (AFB) and provides a basis for comparison and benchmarking.

Numbers have been calculated for the five sustainability indicators at Beale AFB for their mission support functions. Additionally, flying mission numbers have been established for the total carbon footprint and energy usage to show their additional effect on the installation's overall impact on sustainability. The bullet indicators, as shown in the chart below, represent how Beale AFB compares to industry recognized benchmarks[1]. Green indicates a metric is on target or better than target. Yellow indicates a metric is slightly off target. Red indicates a metric is off target.

MISSION SUPPORT			
Carbon Footprint:	19,047	mTons	
Energy Usage:	579,196	MMBTU	
Water Conservation:	499	Mg	
Waste Production:	4,648	tons	
Land Utilization:	3,905	SF/acre	

FLYING MISSION			
Carbon Footprint:	23,554	mTons	
Energy Usage:	331,838	MMBTU	

SF = square feet, mTons = metric tons, Mg = million gallons, and MMBTU = million British thermal units

Fiscal Year (FY) 09 was the inaugural year for Beale AFB's ISA report and will serve as the base year for each sustainability indicator; therefore, this report does not provide year-to-year comparisons but does establish a baseline for all future measurements. This report demonstrates that the Base is performing well on Mission Support Carbon Footprint, Mission Support Energy Usage, Flying Mission Carbon Footprint, and Flying Mission Energy Usage relative to energy benchmarks; however, it is underperforming on Water Conservation, Waste Reduction, and Land Utilization.

Beale AFB has already implemented a number of sustainability initiatives, including utilizing an energy source with zero greenhouse gas emissions for a significant portion of the installation's electricity, using treated effluent for irrigation and implementing Sustainable Design and High Performance Green Building (SD&HPGB) strategies through design and construction. There are a number of practices Beale AFB should consider implementing to improve each of the sustainability indicators. Some examples include identifying an electricity supplier who can provide renewable energy in accordance with Federal guidelines, capturing storm water for irrigation uses, and limiting future development to infill areas on the installation.

ACC has a solid history of successes with sustainability initiatives; however, progressive action must continue. This report outlines a concise, measurable, and repeatable process that can be utilized year-to-year. Upon this installation's yearly assessment and data analysis, recommendations and actionable items will be established and monitored. ACC HQ/A7PS's role includes identifying synergies between installations to implement new and bridge existing sustainability initiatives. The ACC HQ/A7PS ISA will deliver a positive return on investment and promote leadership in sustainable initiatives.

[1]Industry recognized benchmarks are noted where referenced within the report.

I. INTRODUCTION

A. Installation Sustainability Assessment (ISA) Definition

The Installation Sustainability Assessment (ISA) is a process by which an installation's relative level of sustainability can be measured. It is expressed in five key indicators: (1) Carbon Footprint, (2) Energy Usage, (3) Water Conservation, (4) Waste Reduction, and (5) Land Utilization, and identifies and recommends installation-specific improvement strategies. Identified improvement strategies will allow for the bridging of diverse sustainable initiatives (i.e. energy, heat island effect, water conservation, habitat/watershed protection and restoration, new construction practices) and a more efficient implementation of these initiatives as it will account for installation-wide conditions. Additionally, overall review of completed ISAs will provide valuable trend analysis across installations. Direct comparison of installations is not the focus due to differing missions, climate variations and unique installation attributes.

Sustainable Design is a design philosophy that seeks to maximize the quality of the community and the built environment while minimizing or eliminating the negative impact to the natural environment. The word, installation, is defined as the grounds and buildings that belong to a given institution, and specifically refers to Air Force installations in this document. Sustainability initiatives include conscious efforts to protect habitats, optimize land use, produce zero waste, reduce heat islands, improve air quality, reduce light pollution, use energy efficiently, and maintain the health and well-being of a community.

Initiatives to improve on a particular established indicator typically will also have an effect on other indicators. In determining and prioritizing actionable items, it is important to take into account this interaction to determine which initiatives will result in the most positive outcome and highest return on investment.

B. ISA and the DoD Strategic Sustainability Performance Plan

The *Installation Sustainability Assessment* (ISA) process, metrics, and indicators were initially developed in 2009 by HQ ACC as a means for measuring the overall "green posture" of the installation. In late 2010, the Department of Defense (DoD) published the Strategic Sustainability Performance Plan (SSPP) that identified department wide goals.

HQ ACC reevaluated the ISA process, metrics, and indicators in light of policy established in the SSPP in order to determine if there were conflicts or if changes were needed in the ISA.

The following table provides a summary of the evaluation. The ISA anticipated and aligned favorably with the broad goals and policy in the SSPP. Few modifications in the ISA data collection were needed and those have been fully incorporated into this updated ISA. The SSPP identified some goals that are completely outside the ability of the ISA to collect and report as, to the best of our knowledge; this information is not currently being collected (recall that the ISA relies on collecting data from existing sources).

Bottom Line: The ISA will remain ACC's tool for evaluating the progress of an installation towards the goals and performance expectations of the SSPP.

The following headers are provided in the table below.

- *SSPP Goals* are the goals and sub-goals taken directly from DoD's SSPP.
- *Changes to Align ISAs with SSPP Goals* shows three categories addressing how the ISA aligned with the SSPP.
  - *Few/No ISA Changes* indicates that the original data collect and the data input format of the ISA aligned very closely with the SSPP. *Modifications* that were needed have been incorporated into the ISA.
  - *ISA Additions (data available)* means that the ISA did not originally collect or have a data input format for these goals that were eventually identified in the SSPP. For the most part the data is available *for* collection. However, some of the data may not be easily accessible. Modifications to the ISA spreadsheet have been made for inputting the new data.
  - *Goals outside the ability of the ISA to collect and report* refer to goals that are not applicable to ACC *installations*. It also includes goals for which installations do not have the ability to collect the data for measuring progress against the goal.
- *Data Status and Location* addresses the location within the electronic ISA worksheet where data can be found and inputted in order to calculate progress towards meeting the SSPP goals. It also identifies what data has been collected for each goal.

COMPARISON AND ALIGNMENT OF ISA AND SSPP

SSPP Goals		Changes to Align ISAs with SSPP Goals: Few/No ISA Changes	ISA Additions (Data Available)	Goals Outside the Ability of the ISA to Collect and Report	Data Status and Location
Goal 1	**Use of Fossil Fuels Reduced**				
Sub-Goal 1.1	Energy intensity of facilities reduced by 30% of FY03 levels by FY15 and 37.5% by FY20	●			• Data collected in the ISA is acceptable. • Data input under the Energy Tab Spreadsheets.
Sub-Goal 1.2	18.3% of energy consumed by facilities is produced or procured from renewable sources by FY20	●			• Data collected in the ISA is acceptable. • Data input under the Energy Tab Spreadsheets. • Sustainable Measures Tab worksheet shows a separate table for facilities with the energy intensity bar chart showing the renewable component.
Sub-Goal 1.3	Use of petroleum products by vehicle fleets reduced by 30% by FY20 relative to FY05	●			• Data collected in the ISA acceptable. • Data input under the Energy Tab Spreadsheets. • Sustainable Measures tab shows reduction in transportation energy use and separates petroleum and renewable sources.
Goal 2	**Water Resources Management Improved**				
Sub-Goal 2.1	Potable water consumption intensity by facilities reduced by 26% of FY07 levels by FY20 Assessment of ISA	●			• Data collected in the ISA is acceptable. • Data input under the Water Tab Spreadsheets. • Sustainable Measures Tab shows the percent improvement from baseline in the per built SF table.
Sub-Goal 2.2	Reduce industrial and irrigation water consumption 20% by FY20 from FY10 baseline			●	• Water Tab spreadsheet updated to provide data entry points for when data becomes available. • Data not currently available for input in the ISA for this metric. No separate metering for industrial uses.
Sub-Goal 2.3	All development and redevelopment projects of 5,000 square feet or greater maintaining pre-development hydrology to the maximum extent technically feasible		●		• Water Tab spreadsheet modified to add a yes/no box with a percent compliance. • Data not originally collected for sub-goal.
Goal 3	**Greenhouse Gas Emission from Scope 1 and 2 Sources Reduced 34% by FY20, Relative to FY08**	●			• Data collected in the ISA is acceptable. • Data input under the Energy Tab Spreadsheets.
Goal 4	**Greenhouse Gas Emission from Scope 3 Sources Reduced 13.5% by FY20, Relative to FY08**				
Sub-Goal 4.1	Greenhouse gas emission from employee air travel reduced 15% FY20 relative to FY11		●		• Operations Tab spreadsheet modified to a yes/no box with a percent compliance. • Data not originally collected for sub-goal.
Sub-Goal 4.2	30% of eligible employees teleworking at least once a week, on a regular, recurring basis, by FY20		●		• Operations Tab spreadsheet modified to a yes/no box with a percent compliance. • Data not originally collected for sub-goal.
Sub-Goal 4.3	50% of non-hazardous waste diverted from disposal in landfills not owned by DoD by FY15, and thereafter through FY20	●			• Data collected in the ISA is acceptable. • Waste Management Tab has a check box for verification of the waste is going to non-DoD landfill.

COMPARISON AND ALIGNMENT OF ISA AND SSPP

SSPP Goals		Changes to Align ISAs with SSPP Goals: Few/No ISA Changes	ISA Additions (Data Available)	Goals Outside the Ability of the ISA to Collect and Report	Data Status and Location
Goal 5	**Solid Waste Minimized and Optimally Managed**				
Sub-Goal 5.1	All DoD organizations implementing policies by FY14 to reduce the use of printing paper		●		• Operations Tab spreadsheet modified to a yes/no box with a percent compliance. • Data not originally collected for sub-goal.
Sub-Goal 5.2	50% of non-hazardous solid waste diverted from the waste stream by FY15, and thereafter through FY20—not including construction and demolition debris	●			• Data collected in the ISA is acceptable. • Data input under the Waste Management Tab Spreadsheets.
Sub-Goal 5.3	60% of construction and demolition debris diverted from the waste stream by FY15, and thereafter through FY20		●		• Waste Management Tab spreadsheet modified to add a header for C&D debris. • Data not originally collected for sub-goal.
Sub-Goal 5.4	Ten landfills recovering landfill gas for use by DoD by FY20			●	• Not applicable to ACC installations.
Goal 6	**The Use and Release of Chemicals of Environmental Concern Minimized**				
Sub-Goal 6.1	On-site releases and off-site transfers of toxic chemicals reduced 15% by FY20, relative to FY07		●		• Waste Management Tab spreadsheet modified for listing reportable quantities. • Data not originally collected for sub-goal.
Sub-Goal 6.2	100% of excess or surplus electronic products disposed of in environmentally sound manner		●		• Operations Tab spreadsheet modified to a yes/no box with a percent compliance. • Data not originally collected for sub-goal.
Sub-Goal 6.3	100% of DoD personnel and contractors who apply pesticides are properly certified through FY20		●		• Operations Tab spreadsheet modified to a yes/no box with a percent compliance. • Data not originally collected for sub-goal.
Goal 7	**Sustainability Practices Become the Norm**				
Sub-Goal 7.1	95% of procurement conducted sustainably				• Operations Tab spreadsheet modified to a yes/no box with a percent compliance.
Sub-Goal 7.2	15% of existing buildings conform to the guiding principles on high performance and sustainable buildings by FY15, holding through FY20			●	• ACC/A7PS is evaluating how to implement this goal.
Goal 8	**Sustainability Built into DoD Management Systems**				
Sub-Goal 8.1	All environmental management systems effectively implemented and maintained		●		• Operations Tab spreadsheet modified to a yes/no box with a percent compliance. • Data not originally collected for sub-goal. Data is available.
Sub-Goal 8.2	Sustainability of transportation and energy choices in surrounding areas optimized by coordinating with related regional and local planning		●		• Operations Tab spreadsheet modified to a yes/no box with a percent compliance. • Data not originally collected for sub-goal. Data is available.
Sub-Goal 8.3	All DoD installations have Integrated Pest Management Plans prepared, reviewed, and updated annually by pest management professionals		●		• Operations Tab spreadsheet modified to include a year and review date. • Data not originally collected for sub-goal. Data is available.

C. Goals and Objectives

The ISA has been established to formulate a process for measuring sustainability at the Installation level. ISAs take a comprehensive look at ACC Installations and will address, at a minimum, current use of renewable energy, green-procurement practices, infrastructure systems, existing facility operations, conservation plans, environmental compliance, biological resources, habitat protection, watershed restoration, land use, and environmental stewardship.

The ISA will be used to:

- Report the findings.
- Establish a baseline for year-to-year comparisons.
- Define sustainable initiatives.
- Identify synergistic opportunities between diverse initiatives.
- Support the Mission, improve the quality of life, and conserve resources over time.
- Create an awareness of impacts and a catalyst for cultural change.

D. Setting the Context

Flying Mission:

Flying Mission includes anything that directly affects or has direct participation in flight or deployment operations. The flying mission calculations currently take into account energy usage (i.e. transportation and aviation fuels), mission-specific building, and land use areas to calculate the installation's Flying Mission carbon footprint and energy usage. In the future, once sub-metering is in place, additional measures for Flying Mission may be established for water consumption and waste production.

Mission Support:

Mission Support includes all other activities on the installation that do not directly affect flight and deployment operations.

E. Process

1. Data Collection Categories

The ISA categories are a way of grouping data that was collected and used to calculate a set of sustainability criteria. In summary the ISA data collection categories are:

1. **Development—**Includes land use, building utilization, transportation, noise and light emissions.
2. **Energy—**Includes electrical, gas, oil, and liquid propane gas consumption, power purchased from utility or generated on site, and transportation and mission fuels for government vehicles and support equipment.
3. **Water—**Includes domestic, irrigation and storm water consumption, its source and its usage.
4. **Waste—**Includes solid and liquid waste production and its usage.
5. **Operations—**Includes best management practices such as procurement, training, maintenance, and purchasing program for energy efficient equipment.

The following defines the five data collection categories in more detail.

Development:

Expanding human requirements and economic activities are placing ever increasing pressures on land resources, creating competition and conflicts and resulting in suboptimal use of resources. By examining all uses of land in an integrated manner, it is possible to minimize conflicts, to make the most efficient trade-offs and to link social and economic development with environmental protection and enhancement, thus helping to achieve the objectives of sustainable development.

Land use refers to the activities practiced by humans on land. Land supports uses such as residential, industrial, and commercial facilities, recreational areas, natural infrastructure areas, and transportation functions. Integrating a green infrastructure with community connectivity in land use planning is essential to achieving sustainable developments as they incorporate multiple environmental benefits including:

- Reducing storm water runoff volumes and reducing peak flows by utilizing the natural retention and absorption capabilities of vegetation and soils.

  The capacity of the land can be generally categorized as either pervious or impervious. Pervious includes areas that allow rainwater to pass through them and soak into the ground instead of flowing into storm drains. Impervious includes areas that are mainly constructed surfaces covered by impenetrable materials such as asphalt, concrete, brick, and stone. These materials seal surfaces, repel water, and prevent precipitation and melt water from infiltrating soils. Impervious surface areas include rooftops, sidewalks, roads, and parking lots. The impacts of increased impervious surfaces to storm water runoff should be controlled to mimic natural conditions and to protect water quality. Increasing the amount of pervious ground cover increases storm water infiltration rates, thereby reducing the volume of runoff entering our combined or separate sewer systems, and ultimately our lakes, rivers, and streams.

- Improving the rate at which groundwater aquifers are recharged or replenished.

  Groundwater provides about 40 percent of the water needed to maintain normal base flow rates in our rivers and streams. Enhanced groundwater recharge can also boost the supply of drinking water for private and public uses.

- Preventing pollutants from being transported to nearby surface waters.

  Once runoff is infiltrated into soils, plants and microbes can naturally filter and break down many common pollutants found in storm water.

- Limiting the frequency of sewer overflow events by utilizing the natural retention and infiltration capabilities of plants and soils that will reduce runoff volumes and delay storm water discharges.

- Capturing and removing carbon dioxide (CO_2) from the atmosphere via photosynthesis and other natural processes of plants and soils that serve as sources of carbon sequestration.

- Mitigating the effects of urban heat islands and reducing energy demands by providing increased amounts of urban green space and vegetation.

Urban heat islands form as communities replace natural land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat. Heat from the sun is absorbed by impervious surface areas and is radiated back into the atmosphere, increasing temperatures in the surrounding area. Additionally, buildings and streets trap and concentrate waste heat from vehicles, factories, and air conditioners. The displacement of trees and vegetation minimizes their natural cooling effects. Trees, green roofs, and other green infrastructure lower the demand for air conditioning energy, thereby decreasing emissions from power plants.

- Improving air quality by incorporating trees and vegetation in urban landscapes.

  Trees and vegetation absorb certain pollutants from the air through leaf uptake and contact removal. If widely planted throughout a community, trees and plants can even cool the air and slow the temperature-dependent reaction that forms ground-level ozone pollution.

- Providing increased access to recreational spaces and wildlife habitats including greenways, parks, urban forests, wetlands, and vegetated swales.

- Impacting overall human health by providing vegetation and green space.

  Research has linked the presence of trees, plants, and green space to provide a stronger sense of community, improved performance, and even reductions in physical and mental illnesses.

- Improving accessibility by reducing travel distances and improving transportation options by creating nodes such as rideshare and bus stops.

  Community connectivity, or clustering, refers to land use patterns in which related activities are located in proximity to one another. Clustering makes it easier to do such things as run several errands at the same time or to interact with others.

- Protecting greenfields and preserving habitat and natural resources by clustering buildings.

- Reducing greenhouse gas emissions contributing to the carbon footprint as a result of decreased vehicle use traveling to and from sites.

  Transportation fuel consumption and emissions contribute to climate change, smog, and particulate pollution, all of which have negative impacts on human health.

- Controlling noise levels below 65 decibels that is considered an acceptable level in suitable living environments.

  The Noise Control Act of 1972 (Public Law 92-574) directs federal agencies to comply with applicable federal, state, interstate, and local noise control regulations. Sound quality criteria disseminated by the U.S. Environmental Protection Agency (EPA), the U.S. Department of Housing and Urban Development (HUD), and the Department of Defense (DOD) have identified noise levels to protect public health and welfare with an adequate margin of safety. Responses to noise vary, depending on the type and characteristics of the noise, the expected level of noise, the distance between noise source and the receptor, the receptor's

sensitivity, and the time of day. These levels are considered acceptable guidelines for assessing noise conditions in an environmental setting.

- Reducing light pollution through fixture types, direction of light, lighting control and improved airfield lighting.

Energy:

Energy is constantly consumed for the operations of every installation. Data is already being collected by installation personnel to capture all energy sources used at the installation including transportation fuels and mission fuels. Energy sources may include petroleum, natural gas, electricity, coal, and carbon neutral and/or renewable resources such as hydropower, solar, wind, geothermal, biomass, and ethanol. Utilizing existing data, the amount and type of energy consumed is further analyzed to establish a baseline measure for year-to-year comparisons and to monitor the reduction of energy consumption.

Energy usage results in undesired emissions into the environment. Installations typically do not monitor all emissions. Collecting the installation energy data allows the opportunity to calculate a carbon footprint measure (flying mission and mission support) for the installation that can be monitored year-to-year.

Water:

The current water distribution systems at most installations and communities are designed to meet multiple supply needs:

- Potable requirements (e.g., drinking, cooking, cleaning, etc.)
- Firefighting
- Municipal, commercial, and industrial needs
- Non-potable applications (e.g., toilet flushing, landscape irrigation, heating, cooling, etc.)

In some areas of the United States, dual distribution systems have been implemented that provide a primary system for delivering high quality drinking water and a secondary system for non-potable water applications. By using alternative sources for water supplies either to meet non-potable needs or to replenish existing water sources, higher quality sources of drinking water can be preserved. Capacity and functionality of alternative infrastructure systems need to be considered in cases where separate systems are provided for potable and non-potable applications (e.g., water reuse and recovering grey water, rain water, or storm water).

Per the Energy Independence and Security Act of 2007, any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to temperature, rate, volume, and duration of flow. As mentioned under the Development category, storm water is critical to sustainable development. The combination of reducing water consumption, re-using storm, grey, and waste water as water sources, and treating runoff are sustainability goals related to water/storm water.

Waste:

Solid and liquid waste on an installation consists of paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, and hazardous wastes each of which take their own time to

degenerate. The size of the annual waste stream is determined from monthly waste-hauling reports detailing the total tons and cost of the waste that has been hauled. Waste streams include landfill, recycling, hazardous, compost, and any others that are being used on the installation.

Responsible waste management of hazardous and nonhazardous waste is essential to protecting human health and the environment. This includes conserving resources by reducing waste, preventing future waste disposal problems by enforcing regulations and cleaning up areas where waste may have been improperly disposed.

Wastewater is any water that has been adversely affected in quality by human influence. In the most common usage, it refers to the municipal wastewater that contains a broad spectrum of contaminants resulting from the mixing of wastewaters from different sources. Grey water comprises 50-80% of the wastewater produced from such activities as dish washing, laundry, and bathing. The amount of the annual wastewater produced on an installation is calculated as a percentage of the reported total monthly gallons and cost of the municipal domestic water consumption.

Treated wastewater can be used for irrigation, fire protection, toilet flushing, artificial wetlands, processing and cooling towers. Reusing wastewater contributes to conserving water and protecting waterways.

Operations:

Operational best management practices that have been found to be an effective and practical means in protecting or enhancing the environment include such activities as green procurement of goods and services, training, maintenance and purchasing programs for energy efficient equipment.

Green procurement is the purchase of environmentally preferable products and services for such things as recycled paper, green cleaning supplies, office products and printing services. In addition to being cost effective, green procurement reduces the amount of solid and hazardous waste generated and reduces consumption of energy and natural resources.

Proper training of operations and maintenance staff on the use of building systems results in energy savings with minimal upfront investment. The environment benefits from less energy being consumed and less emissions being put into the atmosphere and the building owner benefits from the cost savings associated with less energy being used.

In commercial buildings, use of equipment is the fastest growing consumer of electricity. Purchasing and using energy efficient equipment and appliances saves on the total energy being used and the costs associated with their use.

2. Preliminary Research and Data Collection

HQ ACC/A7PS obtained applicable data and reports for the installation from available resources. Examples of reports used as data sources include the Natural Resources Plan, Integrated Cultural Resources Management Plan, Storm Water Pollution Prevention Plan, Water Management Plan, Drinking Water Management Plan, Pollution Prevention Management Plan, Hazardous Waste Management Plan, Solid and Hazardous Waste Compliance, Economic Impact Analysis, Environmental Restoration Program, Transportation Master Plan, Department of Energy Report, Transportation Fuel Reports, Real Property Reports, and GIS database. Information gathered is

from resources that already exist. Creation of new reports/data by installation personnel is not required.

3. On-site Evaluation and Data Collection

A seven-person A/E team consisting of a Project Manager, Architect, Landscape Architect, Civil Engineer, Mechanical Engineer, Planner, and GIS Specialist met with personnel at Beale AFB on 1-5 February 2010. While at the installation, the A/E team interviewed available civil engineering staff, such as, but not limited to, contracting, engineering, maintenance, and real property personnel to supplement the data collected previously from HQ ACC/A7PS as well as to collect data not previously obtained. The A/E team observed and measured existing conditions such as night time light levels along the flightline and sound levels throughout the installation.

4. Data Analysis

The data collected was entered in the pre-established spreadsheet form. Pre-established sustainability indicators were calculated that are quantifiable, repeatable, simple, and represent installation wide sustainability conditions. The metrics establish a baseline for year-to-year comparison, and document compliance or non-compliance with Federal guidance and other applicable Agency governances (e.g., Executive Orders, Energy Policy Act 2005, Energy Independence and Security Act 2007, MAJCOM directives, etc.).

5. Findings Summary

This report and supporting documentation is a compilation and summary of the information collected and the sustainability indicators calculated for Beale AFB. The data was evaluated using criteria and protocol that is standard to this initiative and provides a consistent reporting structure. HQ ACC/A7PS will review these results and conclusions to identify potential projects, policy changes, incentives, and year-to-year comparisons.

The following defines the sustainability indicators and methodologies in more detail.

Carbon Footprint:

Carbon footprint is the measure of the impact human activities have on the environment in terms of greenhouse gas emissions produced, measured in tons of CO_2.

Gases that trap heat in the atmosphere are referred to as greenhouse gases. Some greenhouse gases, such as CO_2, occur naturally and are emitted to the atmosphere through natural processes and human activities. Other greenhouse gases are created and emitted solely through human activities. Human activities typically produce the following greenhouse gases:

- **CO_2—**CO_2 is produced through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and as a result of other chemical reactions.
- **Methane (CH_4)—**Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.
- **Nitrous Oxide (N_2O)—**Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- **Fluorinated Gases—**Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes.

In the USA, our energy-related activities account for three-quarters of our human-generated greenhouse gas emissions, mostly in the form of CO_2 emissions from burning fossil fuels. More than half the energy-related emissions come from large stationary sources such as power plants, while about a third comes from transportation. Industrial processes (such as the production of cement, steel, and aluminum), agriculture, forestry, other land use, and waste management are also important sources of greenhouse gas emissions in the United States. (U.S. EPA)

For reporting carbon footprint, the General Reporting Protocol v1.1 May 2008 from The Climate Registry was used. This protocol was used to calculate the carbon footprint, as it is one of the most widely accepted systems in the United States and offers a relatively simple approach that can be adapted to installation wide systems. Where data was available, Scopes I and II emissions and some of Scope III emissions have been included. Scope I emissions are all direct greenhouse gases from combustion sources to refrigerant leaks. Scope II includes indirect greenhouse gas emissions from offsite power generation. For this report, Scope III includes an estimate of employee commuting greenhouse gas emissions. Where possible, direct calculations of materials consumed or released to calculate the equivalent greenhouse gas emissions have been used. In some cases, the use of generalized look-up figures and/or averages to generate quantities of emissions has been allowed. It is important to track the greenhouse gas emissions relative to mission fuels and transportation fuels to allow comparisons to other public and corporate entities.

Energy Usage:

Energy usage is integral to every facet of our daily lives and is a critical component of a sustainable installation. The long-term reliance on non-renewable resources can be decreased and renewable resources can be developed in an environmentally and economically responsible manner. This potential for improved energy usage is important as carbon based energy sources are the most significant contributor to greenhouse gas emissions.

For reporting energy use, actual usage data from the Base was captured from reporting practices in the government. For purposes of this project, the energy usage data was separated into building/site energy and transportation categories. Transportation data was further broken down into flying mission and mission support categories along with quantifying which energy sources are from green, bio-, and/or renewable sources. These numbers are used to provide energy consumption relative to full-time equivalent (FTE) and installation building square footages along with allowing analysis of green/renewable sources and flying mission versus mission support consumption. It was important to separate mission energy consumption from standard transportation due to the large amount of fuels required for aircraft, and to provide a fair comparison to other public campuses or corporate entities.

Water Conservation:

As demand for fresh, clean water for irrigation and industry increases, underground aquifers are being drained faster than they can be refilled. Pollution and changing climatic conditions are adding to the burden on fresh water supplies. Poor land development creates more impervious surfaces generating higher levels of runoff, while more natural areas decrease the amount of runoff. There is the potential to become water-self-sufficient by harvesting rainwater and reducing use of domestic water.

For reporting water conservation, the domestic water use is captured and compared to the installation population and building square footages for comparison year-to-year.

Storm water conservation is based on comparing the 2-year post development calculation to a 2-year predevelopment (greenfield) calculation utilizing the USDA, NRCS (SCS) Method as outlined in Urban Hydrology for Small Watersheds Technical Release 55 (TR-55). Any increase in runoff has the potential for contaminated or polluted waters from parking lots, streets, and the airfield to reach water systems off-site, resulting in a need for improved containment and/or treatment.

Waste Reduction:

Every economic activity produces waste. The average human uses 45-85 tons of materials each year. Due to diminishing resources and recent legislation, bases need to reduce the amount of waste produced and increase the amount of waste recovered. Composting has the potential to significantly alter the amount of waste we throw into our local landfills.

For reporting waste reduction, data is captured regarding total waste, landfill, recycling, compost, hazardous materials, and the costs associate with each. The data is compared to installation population and USEPA recommended guidelines, and is tracked year-to-year.

Land Utilization:

Community sustainability requires a transition from poorly-managed sprawl to land use planning practices that create and maintain efficient infrastructure, ensure sense of community, and preserve natural systems. Many current land use practices have converged to generate haphazard, inefficient, and unsustainable sprawl. Stratified land use policies and inadequate funding for demolition of obsolete facilities isolate employment locations, shopping and services, and housing locations from each other creating excessive transportation and creating excessive hard surfaced areas.

For reporting land utilization, source data was gathered on the installation that provides a baseline site area along with area breakdowns for buildable, non-buildable, and habitat areas. Combining this information with building footprints and building areas by category/use codes allows the breakdown of land use and utilization of the installation. Some of the starting basic calculations include total building area relative to the buildable land along with the total non-built or green area relative to the entire site. An attempt was made to provide a reference of built area relative to the site occupancy. Currently, two times the code recommended square footage per FTE is being used to provide a comparison of building area against the installation's population and to depict the utilization of the building space.

6. Recommendations

The recommendations described in this report are derived from the specific information obtained at the installation and are intended for further definition and development for projects that would have a direct and viable impact for the sustainability of the installation. The recommendations are categorized within the pre-established sustainability indicators. Ultimately, this list will be used to develop a prioritized group of projects.

II. INSTALLATION INFORMATION

A. Background

Beale AFB is a U.S. Air Force installation located in Yuba County, northern California, approximately 40 miles north of Sacramento and 10 miles east of the towns of Marysville and Yuba City. Beale AFB is the home of the 9th Reconnaissance Wing. It is named in honor of Navy Lieutenant, Brigadier General in the California Militia and pioneer, Edward Fitzgerald "Ned" Beale. Ned Beale fought in the Mexican-American War and achieved national fame when he carried the first gold samples east from California. He surveyed and built a wagon road used by settlers to move west, which later became part of Route 66 and the Transcontinental Railroad.

B. History

Camp Beale opened in October 1942 as a training site for the 13th Armored and the 81st and 96th Infantry Divisions. During World War II, Camp Beale's 86,000 acres were home for more than 60,000 soldiers, a prisoner-of-war encampment, and a 1,000-bed hospital. As a complete training environment, Camp Beale had tank maneuvers, mortar and rifle ranges, bombardier-navigator training, and chemical warfare classes. In 1948, the camp transferred from the Army to the Air Force. The Air Force conducted bombardier and navigator training at Beale and in 1951 reactivated the Beale Bombing and Gunnery Range for aviation engineer training. The base has been under several commands, including Air Training Command, Continental Air Command, Aviation Engineer Force, the Strategic Air Command and, since 1992, Air Combat Command.

After several organizational and command changes, Beale AFB moved to the Strategic Air Command in 1956. The base's new 12,000-foot runway received its first KC-135 "Stratotanker" in July 1959. The B-52 "Stratofortress" joined the recently activated 4126th Strategic Wing at Beale in January 1960. From January 1962 until April 1965, the base also supported Titan I intercontinental ballistic missile sites at Lincoln, Chico, and the Sutter Buttes. The Air Force reduced Beale to its present size by selling excess acreage in the late 1950s.

In January 1965, the Strategic Air Command activated the 4200th Strategic Reconnaissance Wing at Beale AFB to conduct high-altitude reconnaissance using the new supersonic SR-71 "Blackbird." The wing's first Blackbird arrived in January 1966. Later that year, the historic 9th Strategic Reconnaissance Wing replaced the 4200th. The U-2 "Dragon Lady" joined the wing in July 1976, making Beale home of two of the world's most unique aircraft. That same year the B-52s departed the base.

The 7th Missile (later Space) Warning Squadron brought Beale another unusual mission in July 1979. The squadron operates the Perimeter Acquisition of Vehicle Entry/Phased Array Warning System (PAVE PAWS) radar site located in the base's eastern foothills. This 10-story structure, an early warning and detection system component, stands guard against sea-launched ballistic missile attack. PAVE PAWS is also part of a global satellite tracking system.

The 1990s brought several changes to Beale AFB. First, budget restrictions forced the Air Force to retire the SR-71 in 1990. Although the Blackbird made a two-year comeback in 1995 at Edwards AFB, California, the SR-71's tenure at Beale had ended. In 1992, the Strategic Air, Tactical Air, and Military Airlift Commands consolidated into the Air Combat and Air Mobility Commands. With the reorganization, the base lost its tanker mission and the KC-135s departed for McConnell AFB, Kansas,

in 1994. The Air Force Reserves' 940th Air Refueling Wing moved to Beale from McClellan AFB, bringing the Stratotankers back in 1997.

Another subtle shift began in January 1993 when Detachment 1, 548th Air Intelligence Group (today's 13th Intelligence Squadron) arrived and Detachment 10, 67th Air Intelligence Group (today's 48th Intelligence Squadron) followed in October. These two units would become Distributed Ground Station-2 (DGS-2), one of the Air Force's premier centers for receiving, analyzing, and distributing high-altitude airborne intelligence, surveillance, and reconnaissance (ISR) information. At first confined to U-2 inputs, DGS-2's capability soon expanded to include the "Predator" and "Global Hawk" ISR data as well. In 2003, the 548th Intelligence Group activated at Beale as the parent organization not only for DGS-2, but also for DGS-1 at Langley AFB, Virginia, and several intelligence squadrons across the country.

The shift continued in the new century when the 12th Reconnaissance Squadron activated at Beale in November 2001, as the parent squadron for the RQ-4 "Global Hawk," the Air Force's high-altitude, unmanned, reconnaissance aircraft. Once again, Beale AFB is home for two of the world's most unique aircraft, plus the enduring KC-135 and the T-38 "Talon." The 2005 Base Closure and Realignment Commission (BRAC) actions included moving the KC-135 Tankers to Selfridge ANGB and McGhee-Tyson ANGB.

C. Mission and Vision

The 9th Reconnaissance Wing's mission statement is "Conduct global high altitude surveillance and reconnaissance operations and provide the President, Secretary of Defense, Joint Chiefs of Staff, theatre commanders, and warfighters detailed awareness of enemy force location, operations, capabilities, and intent."

To accomplish this mission, the wing is equipped with the nation's fleet of U-2 and RQ-4 reconnaissance aircraft and associated support equipment. The wing also maintains a high state of readiness in its expeditionary combat support forces for potential deployment in response to theater contingencies. The 9th Reconnaissance Wing is composed of more than 3,000 personnel in four groups at Beale and multiple overseas operating locations.

D. Geography

According to the United States Census Bureau, the Base has a total area of 36.15 square miles, of which 35.07 square miles is land and 1.08 square miles is water.

Coordinates: 39°08'20"N 121°26'11"W

State: California

County: Yuba

Elevation: 113 feet

Terrain: Flat, rolling hills

Soils: Predominantly loam

E. Climate

Temperature: Average July maximum and minimum temperatures are 96°F (36°C) and 61°F (16°C) respectively.

Average January maximum and minimum temperatures are 55°F (13°C) and 38°F (3°C) respectively.

Precipitation: Average yearly precipitation is 22.07 inches (56.06 cm), of which an average yearly snowfall is around 0 inches (0 cm).

Humidity: Humid continental climate

Humidity is variable with the average relative humidity being 61%.

Wind: Wind Power Classification between 1 and 2 (from US DOE National Renewable Energy Laboratory)

WIND POWER CLASSIFICATION	WIND POWER DENSITY	WIND SPEED[1]
1	0-200 w/m^2 @ 50m	0-12.5 mph
2	200-300 w/m^2 @ 50m	12.5-14.3 mph

[1]The Wind Speed does not constitute an average but rather a range of potential wind speeds for Beale AFB.
w/m^2 = watt per square meter, m = meter, and mph = miles per hour

F. Demographics

As of the census of 2000, there were 5,115 people, 1,463 households, and 1,357 families residing on the Base. The population density was 507.5 people per square mile. There were 1,662 housing units at an average density of 164.9/square mile.

III. FINDINGS

A. Description

A set of five sustainability indicators have been established to summarize the installation's level of sustainability. The five indicators are 1) Carbon Footprint, 2) Energy Usage, 3) Water Conservation, 4) Waste Reduction, and 5) Land Utilization. These indicators have been established to consolidate the large amount of data analyzed into a few comprehensive outputs.

B. Current Sustainability Indicators

Refer to the following pages for a summary of findings for the five sustainability indicators for Beale AFB.

BEALE AFB INSTALLATION SUMMARY

Demographics

Total Population	9,603	FTE
Military Personnel	4,050	FTE
Civilian Personnel	1,217	FTE
Dependents	4,336	FTE
Note: Population Data based on the 2007 Economic Impact Statement		

Land Characteristics

Acreage	23,138.88	Acres
Useable Building SF	9,256,032	SF
People per Acre of Developable Area	4.59	People
People Supported by Building Area	9,757	People
Note: Based on 2007 population, and excludes dependents and non-developable acreage.		

2009 Energy Use		
Electricity[1]	94,216,000	kWh
Natural Gas[2]	79,115,000	cf
Oil[2]	51,618	Gal
Potable Water[2]	499,000,000	Gal
Note: Energy Use Data based on 2009 DUERS Report [1]Includes housing [2]Does not include housing		

Waste Management		
Solid Waste	2,333	Tons
Solid Waste Recycled	407	Tons
Waste Water	117,771,000	Gal
Note: Waste Data based on the 2009 Refuse Diversion Report and Water Pollution Control Plan Operating Log Supplementary AF Form 1462		

Fuel Consumption

Mission Fuels		
Aviation Fuels	2,462,077	Gal
Diesel Fuel	232,444	Gal
Gasoline	104,345	Gal
Non-Mission Fuels		
Diesel Fuel	656,563	Gal
Gasoline	262,156	Gal
Note: Fuel Consumption Data based on ACC provided data		

1. Beale Carbon Footprint

In the context of the ISA, carbon footprint is a measure of the Carbon Dioxide (CO2) and other Greenhouse Gas (GHG) generated to produce energy that is used by the installation. Each energy source has an associated CO2/GHG value based on the source (e.g., gas, coal, solar, etc.) and the process used to convert fuels (e.g. gasoline engine, jet engine, oil furnace, etc.) to a usable form.

Total Carbon Footprint Beale AFB is 42,601 mTons (includes Flying and Support Missions)

ACC and Beale AFB jointly need to establish a goal for the installation's carbon footprint. Currently, based on industry benchmarks, Beale AFB produces a smaller carbon footprint for mission support transportation and facilities and a larger one for flying mission shown on the following page.

Annual Total Mission Support Carbon Footprint for Beale AFB is 19,047 mTons

MISSION SUPPORT—Transportation[5] (No Commuting[3])

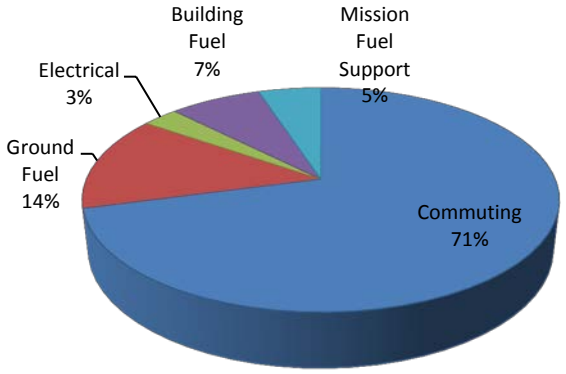
Annual Total Carbon Footprint:	12,308	mTons
Baseline (2005):	(A)	mTons/FTE/year
Previous Year (2008):	(A)	mTons/FTE/year
Current Year (2009):	2.34	mTons/FTE/year
Benchmark[1]:	7.54	mTons/FTE/year
% Reduction from Baseline:	-	
% Reduction from Previous Year:	-	

Baseline (2005):	(A)	mTons/1,000 SF/year
Previous Year (2008):	(A)	mTons/1,000 SF/year
Current Year (2009):	4.15	mTons/1,000 SF/year
Benchmark[2]:	20.44	mTons/1,000 SF/year
% Reduction from Baseline:	-	
% Reduction from Previous Year:	-	

MISSION SUPPORT—Facilities[6]

Annual Total Carbon Footprint:	6,739	mTons
Baseline (2003):	1.34	mTons/FTE/year
Previous Year (2008):	1.35	mTons/FTE/year
Current Year (2009):	1.28	mTons/FTE/year
Benchmark[1]:	7.54	mTons/FTE/year
% Reduction from Baseline:	5%	
% Reduction from Previous Year:	6%	

Baseline (2003):	2.33	mTons/1,000 SF/year
Previous Year (2008):	2.42	mTons/1,000 SF/year
Current Year (2009):	2.27	mTons/1,000 SF/year
Benchmark[2]:	20.44	mTons/1,000 SF/year
% Reduction from Baseline:	2%	
% Reduction from Previous Year:	6%	



MISSION SUPPORT CARBON FOOTPRINT[4] (INCLUDES COMMUTING[3])

[1]Per the American College and University Presidents' Climate Commitment (ACUPCC), the weighted average for college campus' carbon footprint based on 2008 reportings is 7.54 mTons/FTE.
[2]Per the American College and University Presidents' Climate Commitment (ACUPCC), the weighted average for college campus' carbon footprint based on 2008 reportings is 20.44 mTons/1,000 SF.
[3]Greenhouse gases from personal commuting (i.e., back and forth to work) is not included in the Mission Support Transportation calculation table because personal commuting is not part of the SSPP goals. However, in order to gain an understanding of the base's energy/carbon footprint from commuting it is included in the pie chart as a percentage of the Mission Support footprint.
[4]Definitions for pie chart categories can be found in IV. Glossary of Terms and Abbreviations.
[5]Mission Support—Transportation includes ground fuel and mission support fuel quantities shown in the pie chart.
[6]Mission Support—Facilities includes electrical and building fuels shown in the pie chart.
(A) = Data is incomplete.

1a. Beale Carbon Footprint - Flying Mission

Annual Total Flying Mission Carbon Footprint for Beale AFB is 23,554 mTons

FLYING MISSION[1]

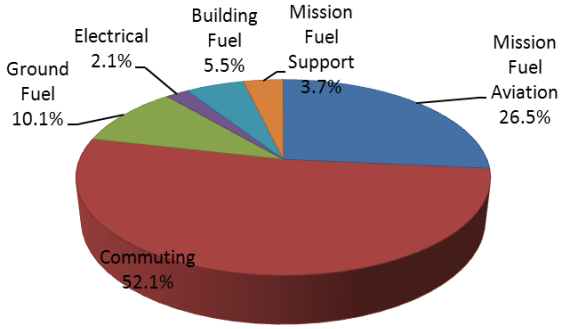
Annual Total Carbon Footprint:	23,554	mTons
Baseline (2003):	(A)	mTons/FTE/year
Previous Year (2008):	6.58	mTons/FTE/year
Current Year (2009):	4.47	mTons/FTE/year
Benchmark[1]:	7.54	mTons/FTE/year
% Reduction from Baseline:	-	
% Reduction from Previous Year:	32%	

Per FTE

Baseline (2003):	(A)	mTons/1,000 SF/year
Previous Year (2008):	11.77	mTons/1,000 SF/year
Current Year (2009):	7.95	mTons/1,000 SF/year
Benchmark[2]:	20.44	mTons/1,000 SF/year
% Reduction from Baseline:	-	
% Reduction from Previous Year:	32%	

Per Built SF

Flying Mission, Support, and Commuting Carbon Footprint Percentages



TOTAL CARBON FOOTPRINT[3]
FLYING, SUPPORT, AND COMMUTING

- The total grassland needed to offset the total carbon footprint
  for Mission Support is 87,574acres = 3.78 times the installation area
  for Flying Mission is 118,980 acres = 5.14 times the installation area
- The Flying Mission carbon footprint is equivalent to 22.7 Pentagons
  1 Pentagon = 77,015,000 cu. ft.

[1]Per the American College and University Presidents' Climate Commitment (ACUPCC), the weighted average for college campus' carbon footprint based on 2008 reportings is 7.54 mTons/FTE.
[2]Per the American College and University Presidents' Climate Commitment (ACUPCC), the weighted average for college campus' carbon footprint based on 2008 reportings is 20.44 mTons/1,000 SF.
[3]Definitions for pie chart categories can be found in IV. Glossary of Terms and Abbreviations.
(A) = Data is incomplete.

2. Beale Energy Usage

Total Energy Usage Beale AFB is 911,034 MMBTU (includes Flying and Support Missions)

ACC and Beale AFB jointly need to establish a goal for the installation's energy intensity. Currently, based on industry benchmarks, Beale AFB has relatively low energy usage. Aviation fuel is the biggest contributor to energy usage for the installation with electrical being the second largest contributor.

Executive Order 13423 requires a 3% annual reduction in energy use; however, based on the findings Beale AFB is doing better than DOE Energy Star benchmarks.

Annual Total Mission Support Energy Usage for Beale AFB is 579,196 MMBTU

MISSION SUPPORT—Transportation[5] (No Commuting[3])

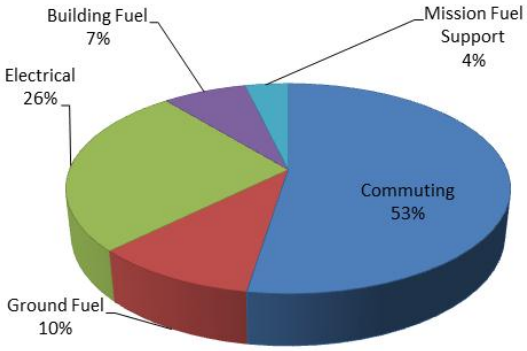
Annual Total Energy Usage:	169,232	MMBTU
Baseline (2005):	(A)	MMBTU/FTE/year
Previous Year (2008):	(A)	MMBTU/FTE/year
Current Year (2009):	32.13	MMBTU/FTE/year
Benchmark[1]:	327.00	MMBTU/FTE/year
% Reduction from Baseline:	-	
% Reduction from Previous Year:	-	

Baseline (2005):	(A)	MMBTU/SF/year
Previous Year (2008):	(A)	MMBTU/SF/year
Current Year (2009):	0.06	MMBTU/SF/year
Benchmark[2]:	0.13	MMBTU/SF/year
% of Energy from Renewable Source:	0%	
% Reduction from Baseline:	-	
% Reduction from Previous Year:	-	

MISSION SUPPORT—Facilities[6]

Annual Total Energy Usage:	409,964	MMBTU
Baseline (2003):	85.50	MMBTU/FTE/year
Previous Year (2008):	79.80	MMBTU/FTE/year
Current Year (2009):	77.84	MMBTU/FTE/year
Benchmark[1]:	327.00	MMBTU/FTE/year
% Reduction from Baseline:	9%	
% Reduction from Previous Year:	2%	

Baseline (2003):	0.15	MMBTU/SF/year
Previous Year (2008):	0.14	MMBTU/SF/year
Current Year (2009):	0.14	MMBTU/SF/year
Benchmark[2]:	0.13	MMBTU/SF/year
% of Energy from Renewable Source:	36%	
% Reduction from Baseline:	7%	
% Reduction from Previous Year:	3%	



MISSION SUPPORT ENERGY USAGE[4] (INCLUDES COMMUTING[3])

[1]Per the American College and University Presidents' Climate Commitment (ACUPCC), the weighted average for college campus' carbon footprint based on 2008 reportings is 7.54 mTons/FTE.
[2]Per the American College and University Presidents' Climate Commitment (ACUPCC), the weighted average for college campus' carbon footprint based on 2008 reportings is 20.44 mTons/1,000 SF.
[3]Greenhouse gases from personal commuting (i.e., back and forth to work) is not included in the Mission Support Transportation calculation table because personal commuting is not part of the SSPP goals. However, in order to gain an understanding of the base's energy/carbon footprint from commuting it is included in the pie chart as a percentage of the Mission Support footprint.
[4]Definitions for pie chart categories can be found in IV. Glossary of Terms and Abbreviations.
[5]Mission Support—Transportation includes ground fuel and mission support fuel quantities shown in the pie chart.
[6]Mission Support—Facilities includes electrical and building fuels shown in the pie chart.
(A) = Data is incomplete.

2a. Beale Energy Usage - Flying Mission

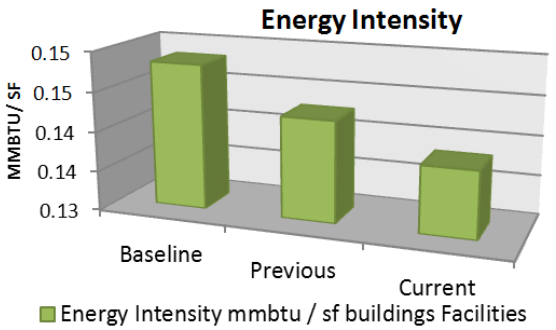
Annual Total Flying Mission Energy Usage for Beale AFB is 331,838 MMBTU

FLYING MISSION

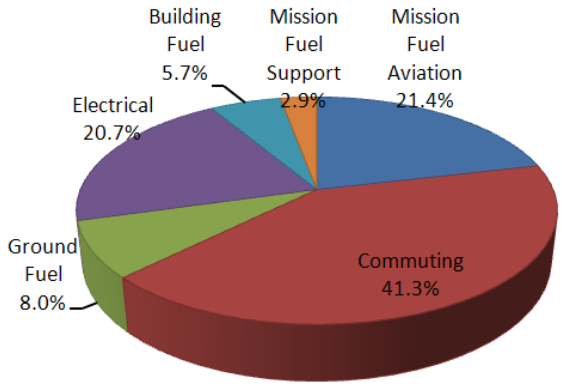
Annual Total Energy Usage:	331,838	MMBTU	
Baseline (2003):	(A)	MMBTU/FTE/year	**Per FTE**
Previous Year (2008):	92.72	MMBTU/FTE/year	
Current Year (2009):	63.00	MMBTU/FTE/year	
Benchmark[1]:	327.00	MMBTU/FTE/year	
% Reduction from Baseline:	-		
% Reduction from Previous Year:	32%		

Baseline (2003):	(A)	MMBTU/SF/year	**Per Built SF**
Previous Year (2008):	0.17	MMBTU/SF/year	
Current Year (2009):	0.11	MMBTU/SF/year	
Benchmark[2]:	0.40	MMBTU/SF/year	
% Reduction from Baseline:	-		
% Reduction from Previous Year:	32%		

Energy Intensity per Square Foot of Total Building Space



Flying Mission, Support, and Commuting Energy Usage Percentages



TOTAL ENERGY USAGE[3]
FLYING, SUPPORT, AND COMMUTING

- % of total energy from a renewable source
  for Mission Support is 21%
  for Flying Mission is 13%

[1]Per the American College and University Presidents' Climate Commitment (ACUPCC), the weighted average for college campus' carbon footprint based on 2008 reportings is 7.54 mTons/FTE.
[2]Per the American College and University Presidents' Climate Commitment (ACUPCC), the weighted average for college campus' carbon footprint based on 2008 reportings is 20.44 mTons/1,000 SF.
[3]Definitions for pie chart categories can be found in IV. Glossary of Terms and Abbreviations.
(A) = Data is incomplete.

3. Beale Water Conservation

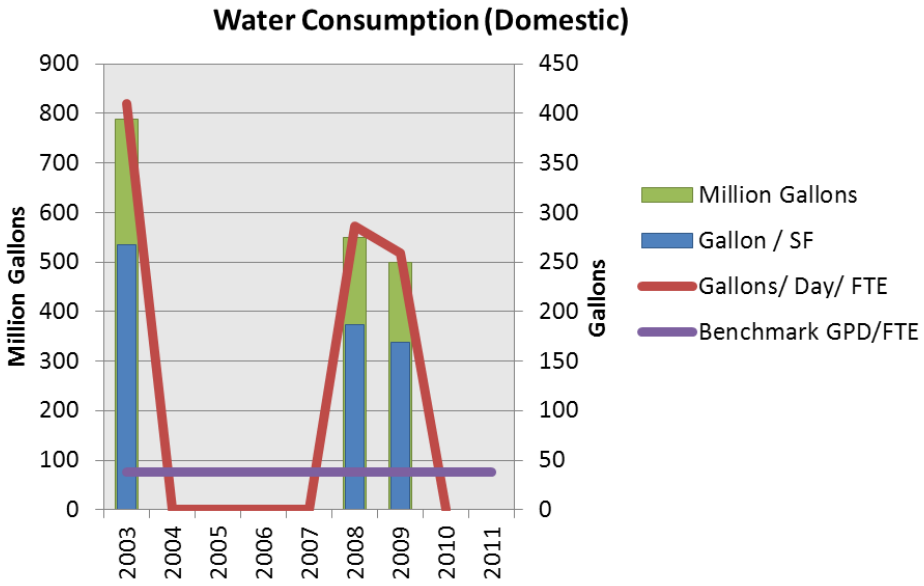
ACC and Beale AFB jointly need to establish a goal for the installation's water conservation. Currently, based on industry benchmarks, Beale AFB has high water consumption.

Beale AFB currently does not implement storm water quality and quantity practices on new development and does not return storm water flows to pre-development levels on individual sites.

MISSION SUPPORT

Annual Total Water Consumption:	499.00	Million Gallons	
Baseline (2007):	(A)	Gallon/FTE/day	Per FTE
Previous Year (2008):	286.09	Gallon/FTE/day	
Current Year (2009):	259.56	Gallon/FTE/day	
Benchmark[1]:	28-38	Gallon/FTE/day	
% Reduction from Baseline:	-		
% Reduction from Previous Year:	9%		

Baseline (2007):	(A)	Gallon/SF/year	Per Built SF
Previous Year (2008):	186.75	Gallon/SF/year	
Current Year (2009):	169.43	Gallon/SF/year	
Benchmark[2]:	-	Gallon/SF/year	
% Reduction from Baseline:	-		
% Reduction from Previous Year:	9%		



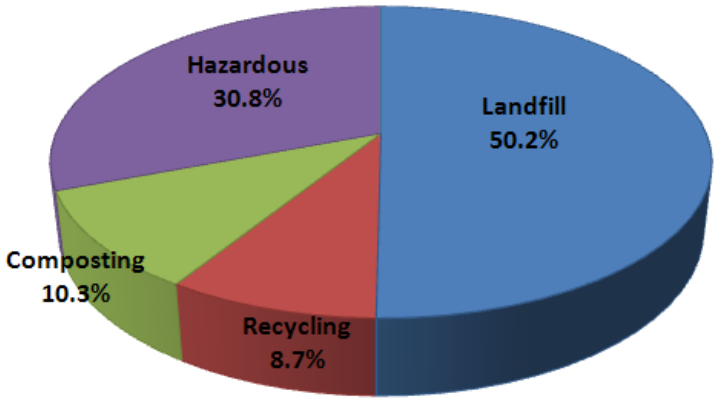
[1]Per Yudelson Associates, Benchmarking Campus Sustainability, 2010.
[2]Benchmark has yet to be established relative to an AFB. This could be established either through the initial ISA investigation or through an additional research project.
(A) = Data is incomplete.

4. Beale Waste Reduction

ACC and Beale AFB jointly need to establish a goal for the installation's waste reduction. Currently, based on industry benchmarks, Beale AFB produces an average amount of waste. Landfill waste is the largest contributor to the waste production and hazardous waste is the second largest contributor.

MISSION SUPPORT

Annual Total Waste Production:	4,648	Tons	
Current Year (2009):	4.84	LBS/FTE/day	Per FTE
Benchmark[1]:	4.62	LBS/FTE/day	
Current Year (2009):	3.14	LBS/SF/day	Per Built SF
Benchmark[2]:	-	LBS/SF/day	
% Non-Hazardous Waste Diverted from Landfill	27%		



- Total % of composted waste material
  Currently is 10.3%

[1]Per the USEPA Municipal Solid Waste in The United States: 2007 Facts and Figures, the annual municipal solid waste (MSW) generation rate in 1960 was just 2.68 pounds (lbs.) per person per day; it grew to 3.66 lbs. per person per day in 1980, reached 4.50 lbs. per person per day in 1990, and increased to 4.65 lbs. per person per day in 2000. Since 2000, MSW generation has remained fairly steady. The generation rate was 4.62 lbs. per person per day in 2007.
[2]Benchmark has yet to be established relative to an AFB. This could be established either through the initial ISA investigation or through an additional research project.

5. Beale Land Utilization

ACC and Beale AFB jointly need to establish a goal for the installation's land utilization. Currently, based on industry benchmarks, Beale AFB building density and building utilization are under the benchmark by approximately a factor of six.

Additional studies and comparisons among ACC installations need to be completed to provide a weighted opinion on land utilization.

MISSION SUPPORT

Total Building Density[1]:

Current Year (2009):	3,905	SF/Acre
Benchmark[2]:	60,000	SF/Acre
Previous Year (2008):	3,882	SF/Acre
% Change from Previous Year:	1%	

Total Building Utilization[5]:

Current Year (2008):	563	SF/FTE
Benchmark[3]:	160	SF/FTE
Previous Year (2008):	559	SF/FTE
% Change from Previous Year:	1%	

MISSION SUPPORT

Total % Green Space[6]:

Current Year (2009):	97%	
Benchmark[4]:	-	
Previous Year (2008):	97%	

Total % Building/Impervious[7]:

Current Year (2009):	7%	
Benchmark[4]:	-	
Previous Year (2008):	7%	

Total % Building/Footprint[8]:

Current Year (2009):	57%	
Benchmark[4]:	-	
Previous Year (2008):	57%	

- 9,912 average daily traffic at the gates = 1.88 trips per FTE
- 4.59 people per acre of Mission Support developable area

[1]Building density = ACSES real property records, building square footage/property acreage.
[2]Per the U.S. Green Building Council (USGBC) LEED-NC guidelines, development density must be equal to or greater than 60,000 SF/acre.
[3]Per building code guidelines, the average gross square foot per FTE figured at 2 times code standard is 160.
[4]Benchmark has yet to be established relative to an AFB. This could be established either through the initial ISA investigation or through an additional research project.
[5]Building Utilization = ACSES real property records, building square footage/population
[6]% Green Space = Non-Built Green area/Total Installation area.
[7]% Building-to-Impervious = ACSES real property records and Geobase, usable building square footage/impervious area.
[8]% Building-to-Footprint = ACSES real property records and Geobase, usable building square footage/building footprint area.

C. Year-to-Year Sustainability Indicators

This is the initial report for Beale AFB; therefore, year-to-year comparisons do not exist at this time. For reports in future years, comparisons will be provided for the established sustainability indicators:

1. **Carbon Footprint**
2. **Energy Usage**
3. **Water Conservation**
4. **Waste Reduction**
5. **Land Utilization**

D. Current Sustainability Initiatives

The ISA process at Beale AFB and the data compiled and analyzed establish baseline sustainability metrics for the installation. The A/E team learned from the data gathering process and interviews that the following sustainable initiatives are currently in place at Beale AFB.

1. A hydro source (a zero greenhouse gas emission energy source) is used for an average of 36% of electrical power at Beale AFB in FY08 and FY09. Although this hydro source is not considered renewable, its use as a power source reduces the installation's carbon footprint. The current Federal guideline requires a renewable energy source for a minimum of 5% by FY10, 7.5% by FY13 and 25% by FY25 of total electric use; other renewable energy sources should be explored to meet this guideline.
2. Beale AFB is in the process of completing the conceptual design for a LEED® Silver Deployment Center (3,000 SM) and has begun planning efforts for LEED® Silver Fitness Center and Child Development Center.
3. An individual metering program is being implemented by installing sub-metering for both electric and gas consumption on all new buildings and existing buildings greater than 30,000 SF. Beale AFB is currently 100% complete with all buildings greater than 30,000 SF.
4. A recycling program is in place in an effort to reduce waste. Recycling efforts at Beale AFB include office and housing waste, as well as industrial waste produced on base.
5. Irrigation of the golf course is provided by treated effluent and Site 13 treated water.
6. Although automatic controls are in place on the flightline, flightline and security lighting is currently manually controlled to decrease energy usage and light pollution.
7. Procurement initiatives using paper with 30% recycled fiber content are in place. Green cleaning products are used in facility maintenance contracts.
8. Operations and Maintenance Manuals are current for all new and remodeled equipment.

E. Guidance Compliance Summary and Matrix

Refer to Appendix C to review Beale AFB compliance with current Federal guidance.

IV. RECOMMENDATIONS

The recommendations described below are derived from the specific information obtained at Beale AFB. They are intended for further definition and development of projects that would have a direct and viable impact on the sustainability of the installation. Ultimately, this list will be used to develop a prioritized group of projects. Some of the other currently established expanding requirements that are in various stages of implementation will have an impact on sustainability; however, these efforts are independent from the goal of this report.

A. Carbon Footprint

- The electrical energy provider for Beale AFB provides on average 36% of the power from a hydroelectric source. This reduces the carbon footprint for Beale AFB significantly. Based on the information gathered and through observations during the site visit, commuting is the single largest contributor to Beale AFB's carbon footprint, followed by mission fuel and ground fuel.
  - Develop strategies to decrease the commuting carbon footprint by exploring alternative work schedules, telecommuting, or methods of encouraging carpooling to reduce consumption of both commuting and building fuels.
    - Coordinated alternative work schedules such as working 9-hour days with a day off every other week for mission support staff will reduce commuting by 10% and reduce building systems use by 10%.
    - If the number of vehicles entering/leaving the installation decreased by 10%, there would be a 4.2% net decrease of the total carbon footprint for the Mission and a 6.8% net decrease of the total carbon footprint for Mission Support.
  - Evaluate the potential to reduce impact of fleet vehicle usage on the installation's carbon footprint. Beale AFB currently utilizes 473 fleet vehicles.
    - Fleet vehicle usage should be logged and analyzed to evaluate the potential for reducing the number of fleet vehicles maintained.
    - As fleet vehicles are recapitalized, existing vehicles should be replaced with carbon neutral vehicles (i.e. alternative-fueled, electric, hybrid).
  - Evaluate the use of the shuttle for commuting from Family Housing to the Main Campus and Flightline. The shuttle is currently only used for official business and ridership is low.
    - Internal traffic counts have not been established but the contribution to the carbon footprint from the 10 mile commute from the Flightline to Family Housing could be reduced by allowing shuttle use for commuting purposes.
  - Use building meters to track and identify building energy usage. For buildings with inefficient systems, improve on energy efficiency by using cleaner carbon based fuels such as natural gas to reduce total carbon fuel consumed.
    - Typical energy efficiency is 80%. If Beale's energy efficiency increased to 95%, there would be a 1% net decrease of the total carbon footprint for the Mission and a 1.7% net decrease of the total carbon footprint for Mission Support.
  - Evaluate the potential for increasing mission simulation capacity in lieu of actual flights.
    - Mission fuel constitutes 34% of the carbon footprint at Beale AFB. A 10% reduction in mission training flights would produce a 3.3% net decrease of the total carbon footprint for the mission.

- Identify an electricity supplier who can provide renewable energy to meet Federal guidelines that require a renewable energy source for a minimum of 5% by FY10, 7.5% by FY13 and 25% by FY25 of total electric use.
- To support the absorption of CO_2, plant young, line native oaks in an informal pattern along Gavin Mandery Drive and Warren Shingle Road.

B. Energy Usage

- Beale AFB is currently well under industry benchmarks for MMBTU/FTE. Beale's energy consumption for Mission Support functions is 101.36 MMBTU/FTE as compared to the benchmark of 327 MMBTU/FTE. For Mission functions, Beale consumes 172.97 MMBTU/FTE. Aviation fuel and electricity are the largest contributors to this consumption.
  - Include sub-metering on all new construction and add sub-metering to all facilities being renovated, including those under 30,000 SF, in order to capture and analyze the data to improve energy efficiency with future facility projects.
  - Implement equipment efficiency programs for appliances, computer equipment, and motors.
    - Energy efficient appliances and computer equipment can reduce energy consumption by at least 20% by purchasing Energy Star products.
    - Energy efficient motors can decrease energy consumption by up to 20%.
  - Where practical, utilize skylights to increase natural light levels and upgrade fluorescent lighting.
    - Skylights deliver light to interior building areas and reduce the need for electric lighting.
    - High efficiency fluorescent lights can reduce power consumption by as much as 40%.
  - Maintain site lighting and flightline lighting to minimum requirements, maintain manual control of flightline lights, and consider the use of LED fixtures where applicable.
    - Based on data gathered while on site, the exterior lighting is at or slightly above the minimum requirements for the flightline and parking areas. In accordance with Engineering Technical Letters 9-12 and 10-2 and as technology improves, replacing existing exterior lighting with LED fixtures should be considered to reduce energy consumption.
    - The flightline lights are currently manually operated. Automatic controls are in place but maintaining manual control will allow operators to extinguish lights when they are not needed.
  - Install roofs with high Solar Reflective Index (SRI) materials on all new facilities.
    - Roofs with high SRI materials minimize heat island effects and maximize energy savings by reducing the amount of heat absorbed by the roof of the building. High SRI material roofs can reduce the cooling load on a building and lower its carbon footprint.
  - Evaluate the potential for on-site renewable energy.
    - Solar, geothermal, wind and bio-fuel are all potentially viable sources of on-site renewable energy. These sources should be evaluated to determine their cost and effectiveness for Beale AFB.

C. Water Conservation

- Water use at Beale AFB is nearly three times the American average of 80-100 gallons per day. Potable water at Beale AFB is used for irrigation as well as commercial and industrial uses. Beale AFB irrigates its golf course with a combination of treated effluent and potable water. In addition,

approximately 240 acres of other landscaped areas are irrigated with potable water at Beale AFB.

- Continue to implement the required 2% reduction per year of water consumption based on Executive Order13423.
  - Implement the next generation of low flow flush toilets and urinals, and automatic faucets on hand wash sinks.
  - Install building water meters in order to capture and analyze the data to improve water conservation with future facility projects.
  - Recover grey water for non-potable uses (irrigation).
- Replace existing landscaping with native plantings and xeriscape.
  - Replacing the 120 acres of turf and additional 120 acres of landscaping with native plantings and xeriscape has the potential to reduce consumption of potable water by 160,000 kgal per year once the plantings have been established. This reduction in consumption will result in a 33% reduction in water use per FTE.
- Capture storm water for irrigation purposes.
  - Over 240,000 kgal of potable water is used each year for golf course and other landscape irrigation. Storm runoff from 330 acres of impervious surfaces would need to be captured to collect 240,000 kgal of water. This reduction in consumption will result in a 48% reduction in water use per FTE.
- Incorporate pervious concrete pavements in parking areas and sidewalks. Collecting rainfall and allowing it to infiltrate reduces storm water runoff, and allows aquifer and groundwater recharge.
  - Converting Beale's parking areas to pervious paving will bring storm water discharge reported in the findings back to pre-development levels.
- Implement storm water requirements under Section 438 of the Energy Independence and Security Act.
  - Projects over 5,000 SF must maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to temperature, rate, volume and duration of flow.

D. Waste Reduction

- Waste production per FTE at Beale AFB is slightly higher than the U.S. daily average. The production of 4.84 lbs. per FTE includes all landfill, hazardous materials, recycling and compost waste streams. Of the waste produced at Beale AFB, 19% is either composted or recycled.
  - Begin tracking industrial recycling.
    - Beale AFB currently manages and tracks the curbside recycling program, but efforts to monitor industrial recycling efforts are not comprehensive. Monitoring industrial recycling can help identify new recycling opportunities and can serve as a revenue stream for the installation.
  - Maximize recycling efforts through end user education and improved recycling facilities.
    - Provide an easily accessible area in each building dedicated to collection and storage of materials for recycling, including paper, corrugated cardboard, glass, plastics and metals.
  - Maximize composting efforts through end user education and garbage hauler contracts.
    - Typical U.S. Municipal Solid Waste has 5.7% wood, 11.9% food and 13.1% yard trimmings, or 30.7% compostable waste. If Beale's paper is blended in and a 24%

composting rate is achieved, this would eliminate 867.6 metric tons of CO_{2e} from going into the atmosphere each year.
    - Municipal Solid Waste is not currently included in the Carbon Footprint calculation. If it was factored in, there would be a 3.8% reduction in Beale's total Carbon Footprint.
- Implement operational procedures to reduce the production of waste and hazardous chemicals used.
    - Institute paperless office practices or standards for double-sided printing and copying.
    - Implement additional Sustainable Procurement Programs.

E. Land Utilization

- Since there are no established benchmarks for development density on an Air Force Base, the USGBC LEED-NC Guidelines were used. These guidelines indicate that development density should be 60,000 SF/acre or greater. Beale AFB currently has a development density of 9,074 SF/acre, more than six times lower than the guidelines.
    - Future development of the installation should focus on infill on Main Base. This will increase development density and concentrate development where there are existing utilities.
        - Infill development will protect natural resources and preserve open space by preventing development of greenfields.
        - Vehicle travel will be reduced by locating facilities near services, therefore reducing energy usage and Beale's carbon footprint.
    - Conduct a study to determine existing internal traffic counts and internal commuting to examine the impact of the proximity of services to family housing and the flightline.
    - Future development sites should limit site disturbance to reduce damage to site ecology.
    - Building footprints should be reduced to accommodate current population needs.
        - Aligning current footprints with the current population will reduce the amount of impervious surface on the installation and reduce the carbon footprint by eliminating energy and building fuel requirements.

V. GLOSSARY OF TERMS AND ABBREVIATIONS

Term	Definition
Alternative work schedule	Work schedules that do not follow the traditional format of an 8-hour day Monday through Friday; alternatively compress the 40 hour work week into fewer days or allow staff to work remotely.
Aviation fuel	All special grades of gasoline for use in aviation reciprocating engines, as given in the American Society for Testing and Materials (ASTM) specification D 910. Includes all refinery products within the gasoline range that are to be marketed straight or in blends as aviation gasoline without further processing (any refinery operation except mechanical blending). Also included are finished components in the gasoline range, which will be used for blending or compounding into aviation gasoline.
Baseline	A standard reference case or condition used as a basis for comparison. Establishing a clearly defined baseline is important and defining a repeatable baseline is essential if the work is to be compared to results of other work.
Baseline year	The year in which the baseline was established.
Benchmark	A standardized problem or test case that serves as a basis for evaluation or comparison. The terms benchmark and baseline are often used interchangeably. Consistent and repeatable benchmarking requires clearly defined performance metrics and protocols for developing the reference case to serve as the baseline.
Buildable area	Land use classification areas including administration, aircraft operations and maintenance, community commercial, community service, manufacturing and production, and medical/dental.
Building Fuel	Includes gas, oil, and liquid propane gas used for buildings.
CO_2 equivalent	A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). CO_2 equivalents are commonly expressed as "million metric tons of CO_2 equivalents (MMTCDE)." The CO_2 equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. (MMTCDE = (million metric tons of a gas) * (GWP of the gas))
CO_2 equivalent (CO_2e)	A measure for describing how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of CO_2 as the reference. For a given mixture and amount of greenhouse gas, the amount of CO_2 that would have the same GWP, when measured over a specified timescale (generally, 100 years).
Carbon equivalent	A metric measure used to compare the emissions of different greenhouse gases based upon their GWP. Greenhouse gas emissions in the U.S. are most commonly expressed as "million metric tons of carbon equivalents" (MMTCE). GWPs are used to convert greenhouse gases to CO_2e–they can be converted to carbon equivalents by multiplying by 12/44 (the ratio of the molecular weight of carbon to CO_2). The formula for carbon equivalents is: MMTCE = (million metric tons of a gas) * (GWP of the gas) * (12/44)
Carbon footprint	The total set of GHG emissions caused directly and indirectly by an individual, organization, event or product.
Climate Registry	A nonprofit collaboration between North American states, provinces, territories, and Native Sovereign Nations to record and track the greenhouse gas emissions of businesses, municipalities and other organizations. Data submitted to the Climate Registry is inputted into the Climate Registry Information System (CRIS), which was developed on EPA's CRAVe-EATS platform.
Commuting	Calculated based on average commuting distance of base FTE using a mix of passenger car and light trucks used for commuting. A typical fuel MPG is calculated for each and summed to calculate the total gallons of fuel used for commuting.
Current year	The FY in progress.
Design guideline	A set of rules and strategies to help building designers meet certain performance criteria such as energy efficiency or sustainability.

Term	Definition
Electrical	Electricity usage entered is for the KWH used by the base annually. Note that the relationship between energy intensity and carbon footprint varies based on the mix of coal, natural gas, diesel, fuel oil, nuclear, wind, solar, and hydro electric energy production within the eGRID region.
Energy	The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful for work. Most of the world's convertible energy comes from fossil fuels that are burned to produce heat that is then used as a transfer medium to mechanical or other means in order to accomplish tasks. In the United States, electrical energy is often measured in kWh, while heat energy is often measured in BTUs.
Energy efficiency	Using less energy to provide the same level of energy service. Also referred to as efficient energy use and is achieved primarily by means of a more efficient technology or process rather than by changes in individual behavior.
Energy intensity	Ratio between the consumption of energy to a given quantity of output; usually refers to the amount of primary or final energy consumed per unit of gross domestic product.
Energy recovery	Includes any technique or method of minimizing the input of energy to an overall system by the exchange of energy from one sub-system of the overall system with another. The energy can be in any form in either subsystem, but most energy recovery systems exchange thermal energy in either sensible or latent form.
Energy Star	An international standard for energy efficient consumer products. Devices carrying the Energy Star logo, such as computer products and peripherals, kitchen appliances, buildings and other products, save 20%-30% on average.
Fiscal Year (FY)	The period used for calculating the annual ("yearly") sustainability indicators. The U.S. government's FY begins on October 1 of the previous calendar year and ends on September 30 of the year with which it is numbered. For example, FY for 2008 is written as "FY08" or as "FY07–08."
Fleet	Two or more vehicles.
Flying Mission	Includes anything that directly effects or has direct participation in flight or deployment operations.
Footprint	The outline of the total area of a lot or site that is surrounded by the exterior walls of a building or portion of a building, exclusive of courtyards. In the absence of surrounding exterior walls, the building footprint shall be the area under the horizontal projection of the roof.
Full-time Equivalent (FTE)	In the U.S. Federal government, FTE is defined by the Government Accountability Office (GAO) as the number of total hours worked divided by the maximum number of compensable hours in a work year as defined by law. For example, if the work year is defined as 2,080 hours, then one worker occupying a paid full time job all year would consume one FTE. Two employees working for 1,040 hours each would consume one FTE between the two of them.
General aviation	That portion of civil aviation, which encompasses all facets of aviation except air carriers. It includes any air taxis, commuter air carriers, and air travel clubs, which do not hold Certificates of Public Convenience and Necessity.
Geographical Information System	An information system that integrates, stores, edits, analyzes, manages, shares, and displays geographic information that is linked to a specific location.
Grassland	Terrestrial ecosystem (biome) found in regions where moderate annual average precipitation (25 to 76 centimeters or 10 to 30 inches) is enough to support the growth of grass and small plants but not enough to support large stands of trees.
Green space	A land use planning and conservation term used to describe protected areas of undeveloped landscape. Also known as open space.

Term	Definition
Greenhouse effect	The effect produced as greenhouse gases allow incoming solar radiation to pass through the Earth's atmosphere, but prevent part of the outgoing infrared radiation from the Earth's surface and lower atmosphere from escaping into outer space. This process occurs naturally and has kept the Earth's temperature about 59°F warmer than it would otherwise be. Current life on Earth could not be sustained without the natural greenhouse effect.
Ground Fuel	Ground Fuel is considered the total of all government vehicle fuel used outside flightline fuel use.
Incentive program	A formal scheme used to promote or encourage specific actions or behavior by a specific group of people during a defined period of time.
Indicator	A parameter, or a value derived from a set of parameters, that points to, provides information about, or describes the state of a phenomenon. It has significance beyond that directly associated with the parameter value. Indicators are one of many tools for simplifying, quantifying, and communicating vast amounts of information in ways that are more easily understood. They are also useful for alerting us to what areas that need more attention, as well as areas that see improvement.
Industrial sector	Construction, manufacturing, agricultural and mining establishments.
Installation	A facility directly owned and operated by or one of its branches that shelters military equipment and personnel and facilitates training and operations.
Land classification	The analysis of land according to its use. Land classifications include agricultural, industrial, recreational, and residential.
Land use	The human modification of natural environment or wilderness into built environment such as fields, pastures, and settlements.
Land use planning	The term used for a branch of public policy which encompasses various disciplines which seek to order and regulate the use of land in an efficient and ethical way.
Leadership in Energy and Environmental Design (LEED)	Green Building Rating System, developed by the USGBC, provides a suite of standards for environmentally sustainable construction.
Lumen	A measure of the perceived power of light.
Meter	Metering devices used on utility mains for electricity, water and gas.
Metric	Any measurable quantity. A performance metric is a metric of some performance characteristic; however, not all metrics are performance metrics. For example, area is a metric, but it is not a performance metric.
Metric ton	Common international measurement for the quantity of greenhouse gas emissions. A metric ton is equal to 2205 lbs. or 1.1 short tons. See short ton.
Military	Any property or aspect of a military.
Mission Fuel	This includes aviation fuel only. That is, the fuel needed for the aircraft to fly.
Mission Support	Includes all other activities on the installation that do not directly affect flight and deployment operations.
Mission Support Fuel	This fuel is used for vehicles working on the flightline. It does not include fuel used for aircraft.
Offset	An agent, element, or thing that balances, counteracts, or compensates for something else.
Performance goal	A specific statement of a desired level of achievement. Performance goals must be measurable and definite such that progress can be evaluated. Performance metrics should be carefully chosen to measure progress toward performance goals.
Performance indicator	A high-level performance metric that is used to simplify complex information and point to the general state or trends of a phenomenon. Performance indicators are used to communicate general trends and are often used on a program planning level to show progress toward goals. See the definition of indicator for more discussion.

Term	Definition
Performance metric	A measurable quantity that indicates some aspect of performance. Performance metrics should measure and communicate progress toward achieving performance goals. There are different levels of performance metrics.
Performance objective	A general statement of a desired achievement.
Population density	A measurement of population per unit area or unit volume.
Potential energy	Energy stored within a physical system that has the potential to be converted into other forms of energy, such as kinetic energy, and to do work in the process. The standard unit of measure for potential energy is the joule, the same as for work or energy in general.
Power generation	The process of creating electricity from other forms of energy. Also known as electricity generation.
Previous year	12-month period prior to the current year.
Procedure	A standard method or set of methods for determining one or more performance metrics.
Procurement	The acquisition of goods and/or services at the best possible total cost of ownership, in the right quality and quantity, at the right time, in the right place and from the right source for the direct benefit or use of corporations, individuals, or even governments, generally via a contract. Simple procurement may involve nothing more than repeat purchasing. Complex procurement could involve finding long term partners or even 'co-destiny' suppliers that might fundamentally commit one organization to another.
Renewable energy	Energy obtained from sources that are essentially inexhaustible, unlike, for example, the fossil fuels, of which there is a finite supply. Renewable sources of energy include wood, waste, geothermal, wind, PV, and solar thermal energy. See hydropower, PV.
Residential sector	An area or portion consisting only of housing units.
Transportation sector	Consists of private and public passenger and freight transportation, as well as government transportation, including military operations.
Abbreviations	
Acre	A unit of area equal to 43,560 square feet.
Btu	British thermal unit: The quantity of heat required to raise the temperature of 1 pound of water 1°F at or near 39.2°F.
CFC	chlorofluorocarbon
CH_3OH	methanol
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent based on the GWP
cu ft or ft^3	cubic foot: A unit of volume of a cube with sides of one foot in length.
DADT	Daily Average Daily Traffic
dB	decibel: A logarithmic unit of measurement that expresses the magnitude of a physical quantity (usually power or intensity) relative to a specified or implied reference level.
eCO_2	CO_2 Equivalents
FC	fluorocarbon
FTE	full-time equivalent
FY	fiscal year
GWP	global warming potential
HCFC	hydrochlorofluorocarbon
HFC	hydrofluorocarbon
J	Joule
kW	Kilowatt

Term	Definition
kWh	kilowatt hour
lb.	Pound
LEV	low emission vehicle
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MMBtu	One Million Btus. A Btu is the quantity of heat required to raise the temperature of 1 pound of water 1°F at or near 39.2°F.
N_2O	nitrous oxide
NGL	natural gas liquid
NMVOC	non-methane volatile organic compound
NO	nitrogen oxide
NO_x	nitrogen oxides
O_3	Ozone
ODS	ozone depleting substance
PFC	perfluorocarbon
PM	particulate matter
ppb	parts per billion
ppm	parts per million
PV	photovoltaic
RCx	retro-commissioning
SF	square feet
SF6	sulfur hexafluoride
SNG	synthetic natural gas
SO_2	sulfur dioxide
SO_x	sulfur oxides
SRI	solar reflectance index
TSS	total suspended solids
VMT	vehicle miles traveled
VOC	volatile organic compounds
Acronyms	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BMP	Best Management Practice
DOE	U.S. Department of Energy
GIS	Geographic Information System
LEED	Leadership in Energy and Environmental Design
MSW	Municipal Solid Waste
SSPP	Strategic Sustainability Performance Plan
EPA or USEPA	U.S. Environmental Protection Agency

VI. APPENDICES (NOT INCLUDED)

A. Data Collection Forms and Supporting Documentation

1. **Development**
2. **Energy**
3. **Water**
4. **Waste**
5. **Operations**

A.1 Development: The following pages include the development data collection forms, data sources, and supporting documentation that supports the information reported in the Installation Sustainability Assessment for Beale AFB.

A.2 Energy: The following pages include the energy data collection forms, data sources, and supporting documentation that supports the information reported in the Installation Sustainability Assessment for Beale AFB.

A.3 Water: The following pages include the water data collection forms, data sources, and supporting documentation that supports the information reported in the Installation Sustainability Assessment for Beale AFB.

A.4 Waste: The following pages include the waste data collection forms, data sources, and supporting documentation that supports the information reported in the Installation Sustainability Assessment for Beale AFB.

A.5 Operations: The following pages include the operations data collection forms, data sources, and supporting documentation that supports the information reported in the Installation Sustainability Assessment for Beale AFB.

B. Data Sources

The following are data sources received from HQ ACC/A7PS and Beale AFB:

1. Beale AFB, California, Final Integrated Natural Resources Management Plan, March 2005
2. Beale AFB, California, Integrated Cultural Resource Management Plan, March 2008
3. Beale AFB, California, Storm Water Pollution Prevention Plan (SWPPP), December 2009
4. Beale AFB, California, Economic Impact Analysis – Description of Real Estate Assets 2007 and Personnel Assigned 2007, October 2007
5. Beale AFB, California, Environmental Restoration Program Site Summaries, December 2007
6. Beale AFB, California, Entry Control Facility Transportation Engineering Assessment, Draft January 2010
7. The Office of The Air Force Civil Engineer, United States Air Force Infrastructure Energy Strategic Plan, 2008
8. U. S. Air Force, U. S. Air Force Energy, Environment, Safety and Occupational Health: Managing for Operational Sustainability, 2007 Inaugural Report
9. Beale AFB, California, FY 2009 Defense Utility Energy Reporting System (DUERS), February 9, 2010
10. Beale AFB, California, FY 2008 Defense Utility Energy Reporting System (DUERS), February 9, 2010
11. Beale AFB, California, FY 2003 Defense Utility Energy Reporting System (DUERS), February 9, 2010
12. Real Property Reports
13. U.S. Green Building Council (USGBC), LEED Certified Projects List
14. U.S. Green Building Council (USGBC), LEED Registered Projects List
15. Zip Code Distribution of Air Force Active Duty Personnel and Payroll Report, 2010
16. Beale AFB, California, GIS Maps
    a. 20100113_Beale. Mdb
    b. FGB_WGS84_UTMz10_PlanningMDS_15Oct09.gdb
    c. Utilities_Golf_Course_WGS84_World_18Dec09.gdb

C. Expanding Requirements

There are expanding requirements for military facilities constantly being developed and issued. The expanding requirements include new Executive Orders, Statutes, Directives, Rulemaking, and Guidance.

1. Executive Order 13423
2. Energy Policy Act 2005
3. Energy Independence and Security Act of 2007
4. Higher Level DoD and HAF directives
5. MAJCOM directives
6. Key Air Force Environmental Goals
7. Other Federal Agency rulemaking and guidance

D. References

The following are publications and websites used as resources:

1. http://epa.gov/
2. http://www.eere.energy.gov
3. http://www.un.org/esa/dsd/susdevtopics/sdt_land.shtml
4. http://www.nps.gov/sustain/spop/jtree.htm
5. http://www.eia.doe.gov
6. ISAUK Research Report 07-01, A Definition of Carbon Footprint, June 2007.
7. http://acupcc.aashe.org/ghg-scope-statistics.php
8. http://www1.eere.energy.gov/femp/program/printable_versions/waterefficiency.html
9. http://oaspub.epa.gov/enviro/pcs_det_reports.pcs_tst?npdesid=CA0110299&npvalue=1&npvalue=2&npvalue=3&npvalue=4&npvalue=5&npvalue=6&rvalue=13&npvalue=7&npvalue=8&npvalue=10&npvalue=11&npvalue=12