

CHAPTER 6.

SUSTAINABILITY AND SMART GROWTH

Sustainability and smart growth work to meet the needs of the present without compromising the ability of future generations to meet their own needs. In this case, it is an approach that ensures that the military maintains its mission, readiness, national defense, training and international defense commitments as well as the quality of life of its service members. The concepts of sustainability and smart growth include the ability to adjust to changing geo-political realities while encouraging local economic growth, preserving the environment, and working to improve the quality of life for Guam residents and visitors.

This chapter summarizes the Sustainability Program of the Guam Joint Military Master Plan (GJMMP). The chapter is organized into three sections: overview (goals, laws, regulations and guidance, and the Navy's energy policy), strategies for implementation of sustainability, and the anticipated results of sustainability measures (e.g., reductions in water use, energy use, greenhouse gas emissions, and vehicle miles traveled, as well as use of renewable energy).

The Navy prepared a Sustainability Summary Report as part of the master planning process (NAVFAC Pacific 2010). This report is included in Appendix N. In summary, the Sustainability Program would meet federal mandates and achieve the following improvements: 30% energy use reduction, 26% water use reduction, 30% reduction of petroleum use in fleet vehicles, 7.5% of total energy from renewable sources, a 7.6% reduction of vehicle miles traveled, and a target of 34% reduction in greenhouse gas emissions. These reductions are applied to the analysis presented in Volume 6 of the EIS.

6.1 OVERVIEW

6.1.1 Goals

In order to reduce environmental impacts and address limited resources, the Department of Defense (DoD), including the Navy and Marine Corps, has adopted guidance and policies that promote sustainable planning, design, development, and operations. The guidelines work to decrease energy use, minimize reliance on traditional fossil fuels, protect and conserve water, enhance indoor air quality, and reduce the environmental impact of materials use and disposal. DoD's over-arching goal is that proposed development be sized, planned, and developed in a manner that is sustainable and works to preserve and protect limited resources.

By choosing sustainability and smart growth, the DoD can create development that is attractive, safe, and healthy for soldiers and their dependents; foster development and operations that meet mission requirements while encouraging social, civic, and physical activity; and work to protect the environment while stimulating economic growth throughout Guam. Sustainability and smart growth policies not only diminish impacts to the limited resources found on Guam, but also help to reduce up front and operating/maintenance costs for the military over the life of its facilities.

6.1.2 Laws, Requirements, and Guidance

The DoD's sustainability and smart growth approach is based on federal, Navy, and Marine Corps policies and guidance. Such guidance requires that the proposed actions on Guam and the Commonwealth of the Northern Mariana Islands (CNMI) be carried out in such a manner as to achieve energy efficiency, pollution reduction, transportation improvements, reduction in water demand, and an appropriately sized footprint (i.e., no larger than needed for the facility function efficiently and effectively). The policies and

guidance also require that new development be designed to meet U.S. Green Building Council's (USGBC's) Leadership in Energy and Environmental Design (LEED) New Construction (NC) Silver certification. The greenhouse gas (GHG) emission target is an important DoD target used to guide the development of an integrated Sustainability Program for Guam. In accordance with Executive Order (EO) 13514, in January 2010, the DoD established an agency-wide goal for GHG reduction of 34%.

The Sustainability Program's core principles reflect the DoD's understanding of and commitment to the global benefits of building a highly energy efficient and environmentally sustainable base. The following federal mandates and regulations, DoD and the Navy targets are the foundation of this Sustainability Program:

- The Energy Independence and Security Act of 2007
- The Energy Policy Act of 2005
- EO 13514, "Federal Leadership in Environmental, Energy, and Economic Performance"
- EO 13423, "Strengthening Federal Environmental, Energy, and Transportation Management"
- The Federal Leadership in High Performance and Sustainable Building Memorandum of Understanding (MOU) 2006
- Greenhouse Gas Targets Announcement for DoD, January 29, 2010
- Energy Awareness Message from Secretary of the Navy Ray Mabus, October 30, 2009
- Energy Independence and Security Act of 2007
- National Defense Authorization Act 2007

Navy, Marine Corps, and Joint Region Marianas policies and guidance consist of:

- Engineering & Construction Bulletin 2008-01 Energy Policy Act of 2005 Implementation and USGBC LEED certification
- Unified Facilities Criteria (UFC) 1-900-01 Selection of Methods for the Reduction, Reuse, and Recycling of Demolition Waste
- UFC 3-210-10 Low Impact Development (LID)
- UFC 4-030-01 Sustainable Development
- Naval Base Guam Instruction 4100.1 Energy Management Program
- Naval Base Guam Instruction 11330.1 Water Conservation Program
- Office of the Chief of Naval Operations Instruction (OPNAVINST) 5090.1B, Chapter 14, Solid Waste Management and Resource Recovery Ashore.

Table 6.1-1 also provides a more detailed summary of relevant federal policies and guidance.

Table 6.1-1. Summary of Federal Policies and Guidance

<i>Component</i>	<i>Energy Policy Act of 2005</i>	<i>EO 13423</i>	<i>EO 13514</i>	<i>Federal Sustainable Performance MOU</i>	<i>Department of Energy 10 CFR</i>
Water Efficiency	<ul style="list-style-type: none"> Apply water conservation technologies 	16% water use reduction by 2015 on existing Navy basis, making conserved water available for future uses as “excess” water supply	Improve water use efficiency and management: <ul style="list-style-type: none"> 26% reduction in personal water consumption 20% reduction in industrial/ agricultural water consumption 	<ul style="list-style-type: none"> 20% less potable water than U.S. Environmental Protection Agency (USEPA)-1992 Water efficient landscape and irrigation strategies 	NA
Renewable Energy	<ul style="list-style-type: none"> 7.5% renewable by 2013 	<ul style="list-style-type: none"> 50% renewable energy is from new renewable sources Install renewable energy sources on agency 	<ul style="list-style-type: none"> 30% reduction of petroleum in fleet vehicles (non-combat vehicles) 	NA	NA
Energy Efficiency	<ul style="list-style-type: none"> Energy Star/Federal Energy Management Program-recommended products required 30% less energy consumption than American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 90.1-2004 baseline Sustainability applied to site, design, and under construction 	<ul style="list-style-type: none"> 30% by the end of 2015 compared to ASHRAE 90.1-2004 baseline Earn Energy Star 7 targets 	<ul style="list-style-type: none"> Reducing energy intensity in buildings Increasing use of renewable energy Reducing use of fossil fuels 	NA	<ul style="list-style-type: none"> Meet Energy Star 7 targets Reduce energy by 30% compared to ASHRAE 90.1-2004 baseline building

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Hydrochloro-fluorocarbons	NA	NA	See Air Quality.	NA	NA
Air Quality	NA	NA	<ul style="list-style-type: none"> • A 34% reduction of greenhouse gas emissions • GHG reduction of 34% 	<ul style="list-style-type: none"> • ASHRAE standards 55-2004 and 62-2004 • Moisture control preventing buildings damage and mold • Use low-emitting materials • Protect indoor air quality during construction 	NA
Solid Waste	NA	<ul style="list-style-type: none"> • Program project site design to recycle or salvage at least 50% of construction and demolition and land clearing waste, where local opportunities exist 	<ul style="list-style-type: none"> • Established goal of diverting at least 50% percent of construction and demolition materials and debris by the end of fiscal year 2015 	<ul style="list-style-type: none"> • Program project site design to recycle or salvage at least 50% of construction and demolition and land clearing waste, where local opportunities exist 	NA

6.1.3 Navy Energy Policy

The Navy has already developed a five-year energy plan that can be used by Naval Facilities Engineering Command Marianas to attain compliance with the Navy's energy and sustainability goals. These goals are designed to ensure that new facilities (such as those associated with the proposed actions) comply with legal mandates including:

- *Energy Intensity*. Reduce energy usage by 3% annually or 30% by 2015 relative to 2003.
- *Renewable Energy*. Increase renewable electricity use to 7.5% of total energy by 2013.
- *Water*. Reduce water consumption 2% per year (16% by 2015) relative to 2007.
- *New Facility Design*. Design and construct all new facilities 30% more efficient than ASHRAE standard 90.1-2004.
- *New Facility Construction*. Construct new facilities to meet LEED Silver certification, as applicable.
- *Metering*. Install advanced electrical metering on all new construction.
- *Energy Efficient Products*. Purchase energy efficient (U.S. Environmental Protection Agency [USEPA] Energy Star, and Federal Energy Management Program) products.
- *Leases and Services Contracts*. Include energy and water program requirements in leases and services contracts.

6.2 IMPLEMENTATION STRATEGIES AND OBJECTIVES

6.2.1 Master Planning and Design

A significant consideration and component of the GJMMP is the integration of sustainability and smart growth guidance, policies, practices, designs, systems, and operations and maintenance. Project Planners have used the Sustainable Systems Integration Model™ (SSIM™), a proprietary, whole systems planning, environmental, and economic evaluation tool, to assess and quantify the results of various potential sustainability and smart growth strategies. SSIM™ outputs are helping to guide master planning and design and would work to support LEED and LID efforts with quantifiable information.

The Sustainability Program builds on the master planning effort already underway and includes five primary tasks: 1) identify UFC that adversely impact sustainable efforts and propose alternative criteria; 2) implement SSIM™; 3) integrate the USGBC's LEED – New Construction (NC); 4) integrate sustainability into the Guam Joint Military Master Plan (GJMMP); and 5) provide initial direction with regard to implementation and monitoring. The foundations of the Sustainability Program are the federal mandates and targets related to energy, water, transportation, green building/LEED and GHG emissions. Based on these foundations, the goal of the Sustainability Program is to define a program that delivers the highest level of environmental improvement to meet the federal mandates in the most cost-effective manner. All applicable credits in the five major categories (sustainable sites, water efficiency, energy and atmosphere, materials and resources and indoor environmental quality) that are not covered by federal mandates were carefully weighted and analyzed in the SSIM™ Pilot Study. This was done for each building type accordingly to ensure overall adherence to required LEED sustainability principles. The results and recommendations (which will be provided to all designers and appropriate Navy business lines) were described in the Sustainability Program E of the SSIM™ Pilot Study selected for the proposed action. This is based on several federal mandates including Executive Order 13423, which directs federal agencies to use USEPA's Comprehensive Procurement Guidelines.

In order to populate and assess outputs of the SSIM™, master planning smart growth and sustainability workshops were conducted on Guam and Hawaii in 2009 and 2010. Stakeholders participating to date have included federal representatives from the Government of Guam, Guam Environmental Protection Agency (GEPA), USEPA, Navy, Marine Corps, and U.S. Fish and Wildlife Service. Government of Guam agencies represented included GEPA, Department of Land Management, and Bureau of Statistics and Planning. In addition, several consultants and the Guam Contractors Association provided additional expertise and local knowledge. Representatives from USEPA helped organize and facilitate the first two planning sessions and stakeholder meetings in Guam.

Participants identified specific elements to be included in the concept sustainability effort for the proposed actions with a primary focus on the proposed Main Cantonment area. Sustainability strategies for each primary system – water, energy (building, district, renewable and public realm), green building/LEED, transportation, and ecosystem services – were adjusted to achieve the maximum environmental benefit in the most cost-effective manner.

6.2.2 Application of LEED Tools

The USGBC's LEED program is a tool to measure performance on various sustainability outcomes and to assist with meeting legal mandates outlined above. The Marine Corps is required to pursue a LEED Silver rating for all applicable new facilities on Guam. Silver certification is gained by achieving a certain number of credits under the LEED rating system. Although the minimum goal is to achieve Silver certification for all qualified buildings, designers will be encouraged to elevate it to Gold and/or even to Platinum certification if reasonably and financially feasible. For the Main Cantonment, the Marine Corps and master planners are reviewing increased density of structures, mixed use building designs and service areas, facilities to increase walking, bicycle use, mass transit, and a reduction of accommodations for vehicles. Such actions work toward developing LEED – NC Campuses. Whereas LEED – NC is submitted to the USGBC on a single building by building basis, a LEED – NC Campus allows for the grouping of several facilities into a “campus” for submittal. LEED Silver credits are awarded if more than 50% of non-hazardous construction and demolition debris is recycled or salvaged, and additional credit is given if 75% recycling rates are achieved. The master planners are working with the various DoD entities to apply LEED standards to their respective facilities and operations.

LEED – NC would be applied to individual buildings of the Guam development. LEED credits would be sought for energy efficiency, water use reduction, smart design of the facility and its location, improved indoor air quality, commissioning of the mechanical systems and efficiencies in operation and maintenance.

6.3 RESULTS

6.3.1 Summary

By applying the Sustainability Program that meets the federal mandates, the baseline program achieves the following improvements:

- A target of 34% reduction in GHG emissions or 61,350 tons (55, 660 metric tons) of carbon dioxide equivalent/year (equivalent of approximately 10,000 cars driven for a year).
- A reduction in power consumption by 30% or nearly 58 gigawatt hours/year (equivalent of powering 1,400 homes on Guam for a year).
- A reduction in water use by 26% or 170 million gallons (640 million liters)/day (equivalent of 286 Olympic swimming pools/year).

- A reduction of petroleum use by 30% in fleet vehicles or approximately 1.9 million gallons (7.2 million liters) of gasoline/year.
- A reduction of nearly 7.6% of vehicle miles traveled (VMT), or approximately 6 million miles (9.7 million kilometers) of driving per year.

6.3.2 Sustainable Systems

6.3.2.1 Water

The goal of the SSIM™ water model for the GJMMP is to optimize the water demand estimate and conservation strategies to produce the highest performance in the most cost-effective manner. By modeling various water conservation strategies, overall potable and non-potable water usage can be determined in order to meet the federal mandates. LID has been incorporated into the water modeling process. Refer to Appendix N for more information related to the Comprehensive Drainage and LID Implementation Study.

By building a “bottom up” whole systems water balance model, water conservation measures have been incorporated into the GJMMP Sustainability Program. This includes measures such as use of low flow fixtures, interior reuse of harvested rainwater and air conditioning condensate, LID, and no irrigation. Combined in an integrated manner on the site, the water program achieves a 26% reduction from the standard to meet the federal mandate.

Example water use reduction measures include:

- *Water Conservation.* Identify and specify appropriate conservation fixtures and devices.
- *Irrigation.* Eliminate use of irrigation systems and water use for landscaping. Meet water use reduction requirements as codified in the Energy Policy Act of 2005 or the Energy Independence and Security Act of 2007.
- *Grey Water Use.* Evaluate options for use of grey water toilet flushing. Incorporate rainwater harvesting, storage and distribution.
- *Stormwater Quality, Quantity, Infiltration and Groundwater Recharge.* Design the base storm drainage system in compliance with LID UFC criteria and other modern storm water management features. Prepare a LID manual for the program to reduce water use by 26%.

6.3.2.2 Energy

Energy analysis and dynamic thermal modeling of representative building types has been conducted to assess the energy performance of the buildings to be constructed as part of the GJMMP Sustainability Program. A total of 2 typical residential building types and 12 typical non-residential building types were analyzed as part of the study. For each building type, an assessment was made of the different combinations of passive and active energy conservation measures that could be applied to the buildings in order to determine which could best help conserve energy. The Sustainability Program and SSIMe (or SSIM™ Energy) building energy studies provide compliance guidance.

The federal targets related to energy, including a 30% reduction of energy use and the requirement that 7.5% of energy used be from renewable sources, are achievable in a cost-effective manner for the GJMMP. Each of the 14 modeled building types has been optimized to meet and or exceed the energy goals put forth in the mandates as defined by the EO. The combination of street, parking lot, and pedestrian trail lighting measures identify significant opportunities for energy savings. This, along with other energy-saving techniques provides for an overall energy reduction of approximately 40% basewide.

Example energy use reduction measures include:

- *Minimizing Energy Demand.* As codified under recent laws, reduce demand for energy by 30% by 2015, eliminate use of fossil fuels by 2050, and generate 5% of hot water needs from solar sources.
- Identify and evaluate systems and elements that would minimize energy demand, meter all new buildings to monitor energy use, and use Energy Star fixtures.
- *Onsite Energy Generation.* Evaluate options such as photovoltaic, solar water systems, renewable sources and district heating and cooling.
- Reduce the heat island effect through the use of shading and light colors.

6.3.3 Green Building / LEED (ND)

The USGBC's LEED program has a number of components applicable to the proposed actions, including: LEED Building Design and Construction Version 3.0 (2009), which is designed for new non-residential construction; LEED Silver, which is currently a federal mandate; and LEED Home, which is a program designed for new residential construction. LEED Neighborhood Development (ND), which is a program that is not required but voluntary and designed for neighborhoods or communities, was also considered.

The Guam smart growth planning sessions that were held on Guam in 2009 identified the opportunity to consider LEED ND for the family housing and bachelor enlisted quarters areas of the Main Cantonment. After review and analysis, neither area meets the pre-requisites of LEED ND. Therefore neither qualifies for the voluntary program. However, there are still a number of good planning and design principles that can be considered for the GJMMP. These strategies include: enhanced trail system, base-wide shuttle system, enhanced green/open space, strategic connectivity, and onsite tree preservation.

All scenarios proposed as part of the LEED analysis are designed to meet the overarching federal requirements (of a 30% improvement over ASHRAE) while achieving the LEED Silver certification.

6.3.4 Transportation

Federal Leadership in Environmental, Energy, and Economic Performance (EO 13514) requires a 30% reduction of petroleum in fleet vehicles (non-combat vehicles) and a reduction of greenhouse gas emissions. Following EO 13514, guidance was provided by the DoD to target a 34% reduction of GHG emissions. Because vehicle associated travel, or VMT, is a significant contributor of GHG emissions, the GJMMP Sustainability Program addresses reduction of VMT and incorporates a sustainable mobility program.

Based on the goals and strategies identified in EO 13514, the following transportation goals were developed for the GJMMP Sustainability Program:

- Meet or exceed the mandates described in EO 13514.
- Reduce VMT.
- Develop a transportation system that complements the land use plan.
- Develop intuitive, user-friendly programs that fit well with the travel patterns, needs, and the environment on Guam.

The GJMMP sustainability transportation program provides feasible and implementable solutions to reduce VMT, number of vehicle trips and gallons of gasoline associated with fleet vehicles. Overall the program results meet the federal mandates, saving approximately 1.9 million gallons of gasoline a year and reducing VMT by approximately 7.6%. Example transportation efficiency measures include:

- *Bicycle and Pedestrian Oriented Site Planning.* Design the site to facilitate and encourage non-motorized vehicle traffic.
- *Reduction of Petroleum in Fleet Vehicles (Non-Combat).* Use of 30% electric and 30% hybrid non-combat vehicles (or 60% hybrid/electric vehicles).
- *Internal Shuttle.* Include a clean fuel shuttle system for the site, addressing location and time based transportation requirements.
- *Integrate On-Site Transportation with Off-Site Transportation.* Design on site transportation to conveniently connect with offsite high-capacity (non-individual motor vehicle) systems such as an off-site shuttle. Create denser neighborhoods within walking distance to service and work facilities.
- *Car Share Program.* Establish a private car share program to reduce car ownership.

6.3.5 Waste Management

Example waste management measures include:

- Establish an Integrated Waste Management Program to include all sites.
- Recycle 50% of construction waste and reuse building materials.
- Expand the existing Navy and Air Force Recycling Programs to include the new sites, to be coordinated with Government of Guam.
- Purchase materials with various percentages of recycled content.

6.3.6 Ecosystem Services

Ecosystem services are the benefits people obtain from the natural environment (or ecosystems) around them. This includes benefits from natural assets (soil, air, water, flora and fauna) and the economic and social values inherent in these services, as well as the opportunities that can arise from considering these services more fully in master planning contexts.

6.3.6.1 Habitat-Friendly Design Strategies

Following are a number of recommended strategies related to habitat-friendly design for incorporation into the GJMMP:

- Enhance greenways for watershed protection, wildfire control, and restoration of habitat.
- Integrate community fruit gardens with reforestation areas or “plots” to improve habitat.
- Provide links with ecological corridors between open space areas. In addition, provide recreation opportunities, pedestrian and bicycle corridors and improved connectivity of the open space network. Green links help to reduce urban heat island effects (temperature rise from paved areas), improve microclimate, and provide opportunities for carbon sequestration (the storage of carbon dioxide in a solid material through biological or physical processes).
- Integrate stormwater drainage networks to create a natural system for the conveyance, storage and infiltration of stormwater, reducing the need for hard infrastructure (impervious paving).
- Provide a comprehensive sustainable trails system throughout the base.
- Use native or adapted plants in landscaping designs.
- In coordination with the development of a base biosecurity plan, ensure an existing high-quality habitat.
- Where feasible, transplant existing vegetation that may be disturbed due to construction activities.
- Provide habitat-friendly guidelines to homeowners to create backyard habitat for birds.

- Coordinate with University of Guam Agriculture Cooperative Extension Service to provide educational opportunities to homeowners on habitat-friendly planting guidelines and biosecurity.

Because of the impact on existing habitat, the Sustainability Program recommends the GJMMP incorporate habitat-friendly design strategies as noted above to minimize impacts on existing resources.

6.3.6.2 Carbon Sequestration

Carbon sequestration (the storage of carbon dioxide in a solid material through biological or physical processes) is an increasingly important consideration in GHG inventories. A project wide landscape strategy with maximized carbon sequestration effect is often one of the most cost-effective ways in helping to offset greenhouse gas emissions. EO 13514 specified the need to pursue "...opportunities with vendors and contractors to address and incorporate incentives to reduce greenhouse gas emissions..." Therefore, it is important to incorporate a carbon sequestration strategy into development of the Installation Appearance Plan and other planning documentation. Approximately 816 tons (740 metric tons) of carbon dioxide equivalent per year would be sequestered within the Main Cantonment. Example strategies include the following:

- Ensure that on-base landscape planting (existing and proposed) assists with reducing the total carbon footprint of the GJMMP through carbon sequestration calculations.
- Understand the impact of super typhoons on the survival of trees by incorporating a viable clustered tree concept. Such urban forest cover in the developed environment provides additional environmental benefits by reducing ozone and other air quality problems, reducing the "urban heat island effect", reducing building energy use through shading, and providing habitat for wildlife.
- The following planting types are noted below with relative strategy:
 - *Park Landscape*. Utilize native/adapted trees planted in clusters (for typhoon protection); provide shade and amenity to the surrounding communities.
 - *Streetscape*. Trees planted along streets, in the median, and parkway areas should include species that have higher carbon sequestration values while meeting the base appearance objectives.
 - *Residential Landscape*. The front yards and back yards of the family housing area present opportunities to reduce building energy use through shading as well as capture the carbon sequestration benefit.
 - *Open Space*. The open space areas on base should focus on improving disturbed site conditions, selecting more native species with high carbon sequestration rates, minimizing the amount of maintenance related emissions, and designing the reforestation plan to maximize long-term survival of trees.
 - *Preserved Area*. Most of the 800 acres (320 hectares) of preserved limestone forest should remain intact and proper long-term forestry management practices should continue as the primary measure to help to increase the potential for carbon sequestration.

6.3.6.3 Community Agriculture/Local Food Production

The Sustainability Program for the GJMMP has identified a practical and expandable local food production program for the proposed base to:

- Foster a "good neighbor" policy with local farmers.
- Provide opportunities for the on-base military community to interact with the University of Guam and the local community.

- Grow local fruit on site in neighborhood fruit gardens (on a small scale) for use, education, carbon sequestration (reduction of overall GHG emissions), and to enhance habitat areas.
- Earn additional LEED NC points through innovation credits.

6.3.7 Integration of Sustainability into Master Planning and Facilities Design

As part of the GJMMP planning process, the Sustainability Program has focused on effective and implementable systems that can be strategic and tactical in order to meet all applicable federal mandates in the most cost-effective manner. Integration into master planning allows the Sustainability Program measures eventually to be incorporated into facilities design.

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