



Twentynine Palms Marine Corps Air Ground Combat Center (MCAGCC)



Sustainability — Non-Industrial Installation

Introduction

MCAGCC Twentynine Palms, CA, is located in the southern Mojave Desert. It is the U.S. Marine Corps' largest installation, occupying approximately 935 square miles. MCAGCC is home to the Marine Corps Air Ground Task Force Training Command (MAGTFTC), representing a consolidated command at the installation. MAGTFTC's primary mission, Enhanced Mojave Viper (EMV), was developed to enable Marines to practice live-fire and maneuver exercises, urban operations, and integration training over a vast and challenging terrain under harsh desert conditions.

To accomplish the mission at MCAGCC, which annually trains over one-third of the Marine Corps' forces, significant infrastructure resources are required. This includes operating and maintaining over 1,000 buildings/structures, 11 production wells and 150 miles of water mains, and a 1.5 million gallon per day wastewater treatment facility. MCAGCC consumes 132 million kWh of energy, produces over 15,000 tons of solid waste, and utilizes 1,200 million gallons of potable water each year.

MCAGCC's infrastructure has evolved to meet its current mission statement,

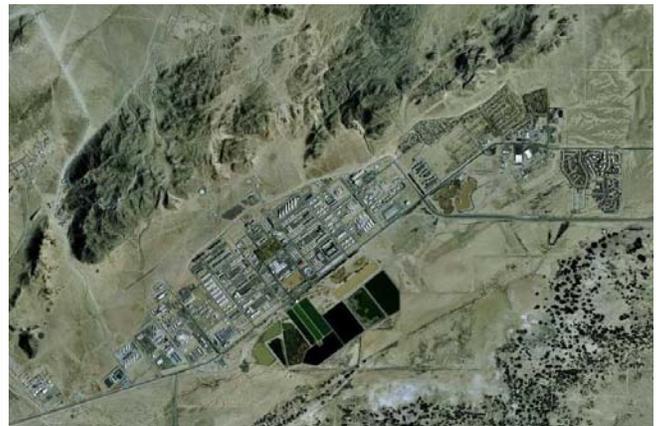
“to conduct relevant live-fire combined arms training, urban operations, and Joint/Coalition level integration training that promotes forces readiness as well as provides the facilities, services, and responsive support to the needs of resident organizations, Marines, Sailors, and families today and tomorrow.”

Background

In 1941, the U.S. Army began using land north of Twentynine Palms, California, as a glider pilot training facility, designated as Camp Condor. Powered-flight training followed and by October 1951 the installation was renamed Twentynine Palms Air Force Base. Training expanded to include bombing ranges and ground operations, but facilities remained relatively remote and primitive with few permanent structures and nothing more than campsites for the trainees. From 1952 to 1955 the need for a formal installation was addressed with development of what is known today as Mainside. Through the 1960s and 1970s the mission for MCAGCC expanded to include live-fire maneuvers and exercises, bringing it to where it is today. The photographs below show the expansion of infrastructure over the past 50 years.



MCAGCC Mainside (Circa 1952)



MCAGCC Mainside (Circa 2010)

Program Summary

In its 70 years, the desert-training mission has progressed from a niche to a national priority. To meet current pre-deployment demands, MCAGCC's population now approaches 30,000 military and civilian personnel. Past facility expansions and current Grow-the-Force initiatives have resulted in a premier desert-training installation. During this growth, the desert environment mandated that sustainable approaches be implemented in order for the installation to survive. The use of non-potable/recycled water resources, development of energy-independence capabilities, on-site remediation operations, and cutting-edge recycling/reutilization programs were ongoing at MCAGCC long before sustainability was elevated to its current level of importance. *These initiatives have been recognized with various awards, including the Department of Energy Federal Energy and Water Management Award (2010), SECNAV Environmental Awards (2008, 2009, SECNAV Energy Award (2010), and Mojave Green Award (2008, 2009, and 2010).*

MCAGCC's leadership in sustainability was quantified during development of its Installation Sustainability Action Plan (ISAP), addressing Executive Orders and DoD's Strategic Sustainability Performance Plan (SSPP). Of 19 sustainability metrics applicable to MCAGCC, eight are already being met or are on track to being met (green), nine have been deemed achievable with action (yellow), and only two are considered difficult to meet (red). The table to the right summarizes the status of each metric.

The remainder of this narrative summarizes key accomplishments at MCAGCC in achieving Base sustainability. Accomplishments are organized consistent with the judging criteria: program management, technical merit, orientation to mission, transferability, and stakeholder interaction.

MCAGCC's approach to growth, while meeting its mission, continues to demonstrate its leadership in sustainability, environmental stewardship, and cooperation with the surrounding civilian population.

Summary of MCAGCC Progress In Achieving SSPP Metrics.

DoD SSPP Sub-Goal Description	MCAGCC Status
Reducing Use of Fossil Fuels (Goal #1)	
Energy intensity of facilities is reduced by 30% of FY 2003 levels by FY 2015 and 37.5% by FY 2020	
18.3% of energy consumed by facilities is produced or procured from renewable sources by FY 2020	
Use of petroleum products by vehicle fleets reduced 30% by FY 2020 relative to FY 2005	
Improving Water Resource Management (Goal #2)	
Potable water consumption intensity by facilities reduced by 26% of FY 2007 levels by FY 2020	
Industrial and irrigation water consumption reduced by 20% of FY 2010 levels by FY 2020	
All development projects >5,000 ft ² maintain pre-development hydrology	
Reducing Greenhouse Gas (GHG) Emissions (Goals #3 and #4)	
GHG emissions from Scope 1 and 2 sources reduced 34% by FY 2020, relative to FY 2008	
GHG emissions from Scope 3 sources reduced 13.5% by FY 2020, relative to FY 2008	
Solid Waste and Chemical Management (Goals #5 and #6)	
All 31 DoD organizations implement policies by FY 2014 to reduce the use of printing paper	
50% of non-hazardous solid waste diverted from the waste stream by FY 2015	
60% of construction and demolition debris diverted from waste stream by FY 2015	
On-site releases and off-site transfers of toxic chemicals reduced 15% by FY 2020, relative to FY 2007	
100% of excess or surplus electronic products disposed in environmentally sound manner	
100% of DoD personnel and contractors who apply pesticides are properly certified through FY 2020	
Sustainability Practices (Goals #7 and #8)	
95% of procurement conducted sustainably	
15% of existing buildings (>5,000 ft ²) conform to Guiding Principles on high performance and sustainable buildings by FY 2015, holding through FY 2020	
Environmental management system (EMS) effectively implemented and maintained	
The sustainability of transportation and energy choices in surrounding areas optimized by coordinating with related regional and local planning	
All DoD installations have Integrated Pest Management Plans prepared, reviewed, and updated annually by pest management professionals	

Program Management

Natural Resources and Environmental Affairs (NREA) managed the development of MCAGCC ISAP and the Base environmental management system (EMS), as well as supporting Facility Master Planning.

Installation Sustainability Action Plan

In 2010, NREA proactively took on the responsibility of developing and overseeing a first-of-its-kind ISAP for MCAGCC. This plan was a collaborative effort between numerous public works, logistics, and environmental staff. After gathering and organizing information on the status of sustainability efforts at MCAGCC, a multi-day working meeting was held in August with Base stakeholders. During the meetings, potential projects and standard operating procedures (SOPs) were discussed that would support achievement of mandated sustainability metrics. The effort was documented in an action-oriented strategy developed to be consistent with sustainability metrics provided in the DoD SSPP.



MCAGCC is currently pursuing LEED certification on 16 projects, all of which will achieve Silver or Gold rating from the USGBC.



The Master Plan includes a green MRF to further reduce waste going to the landfill.

The ISAP is a comprehensive plan addressing energy efficiency, renewable energy, vehicle fleet management, potable and non-potable water conservation, solid waste and chemical waste management, GHG emissions, high-performance and sustainable buildings, sustainable acquisition, EMS, and more. For each sustainability metric, background information, current status in achieving the metric, and recommendations are provided. This management tool provides the map to MCAGCC's future sustainability.

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Facility Master Planning

Effective facility master planning has helped ensure the sustainability of MCAGCC during the Grow-the-Force initiative. MCAGCC has 16 projects registered with U.S. Green Building Council (USGBC), including three projects to achieve LEED Gold and 13 LEED Silver. Planning also includes a new green Materials Recycling Facility (MRF), which will further reduce solid waste entering the Base landfill.

Environmental Management System

NREA has management responsibility for the Base EMS, which is in full compliance (i.e., "green"). In addition, NREA initiated development of a mobile, Web-based application for the environmental compliance inspectors, which improves accuracy, reduces time, and eliminates paper. This tool, called

MCAGCC's ISAP identified/evaluated 13 new projects and 21 SOPs for achievement of DoD sustainability metrics.

ISAP Focus Area	No. of Projects	No. of SOPs
Reducing Use of Fossil Fuels	3	3
Water Resource Management	5	5
Reducing GHG Emissions	2	2
Waste and Chemical Management	3	3
Sustainability Practices	-	8

the EMS Compliance Tool, will be used to track sustainability practices at MCAGCC starting in 2011.

Technical Merit

The technical merit of MCAGCC's sustainability program is evident in the achieved results. This section summarizes the key program results related to fossil fuel use, renewable energy, water conservation, and solid and chemical waste management.

Fossil Fuel Use

During 2010, MCAGCC continued its progressive efforts to improve energy efficiency and is tracking ahead of the mandated goals in SSPP with a 22.8% reduction compared to the FY 2003 baseline. Key accomplishments include:

- A high-efficiency 7.2 MW natural-gas cogeneration facility providing over 60% of the Base power needs, and exhaust heat used for central hot and chilled water for many of the buildings at MCAGCC.
- Comprehensive metering program and a centralized energy management and control system (ECMS). In addition, the Base is conducting a smart-grid demonstration project.
- Initiating an audit program to target improved energy efficiency of MCAGCC's buildings.

The non-tactical vehicle fleet at MCAGCC is a mixed fleet of 740 vehicles. This fleet consists of approximately 37% alternative fuel vehicles (AFVs), including compressed natural gas (CNG), E-85 powered vehicles, hybrid electric vehicles (HEVs) and electric powered global electric motorcars (GEMs), such as electric powered golf carts. In addition to the AFVs, the majority of the 350 diesel-powered vehicles are operating on biodiesel (B-20), which consists of 80% petroleum-derived diesel fuel with the remainder being plant- or vegetable-based oils. Currently, alternative fuels comprised approximately 25% of the total fuel used to operate MCAGCC's fleet.



MCAGCC's non-tactical vehicle fleet consists of 37% AFVs. Alternative fuels comprise 25% of the fuel use.

Renewable Energy

In 2010, approximately 6.2% of electricity was supplied by renewable energy. Aggressive efforts are currently under way to increase on-site renewable energy generation. Key accomplishments include:

- Installation of 1.5 MW of photovoltaic (PV) arrays on the rooftops of parking structures. This is in addition to the 1.1 MW PV farm, one of the largest Federally-owned PV arrays. Current PV arrays provide savings of over \$400,000/yr.
- Over 150 individual solar lights used for physical training areas.
- 15 solar thermal hot water unit applications.
- Implementing contracts to install an additional 4 MW of PV in 2011.
- Installation and testing of geothermal wells.

With the arrays in place and the efforts underway, MCAGCC will soon provide over 10% of its energy consumption with renewable sources, being well on its way to meeting the 18.3% renewable energy power consumption goal.



MCAGCC installed 1.5 MW of rooftop PV arrays to complement the existing 1.1 MW PV farm. An additional 4 MW of PV is under contract.

Technical Merit (Continued)

Water Conservation and Efficiency

High quality drinking water is obtained from a single aquifer on Base. Water conservation and efficiency is paramount to the sustainability of MCAGCC. Alternative sources of water are expensive and energy intensive to access. Understanding the importance of potable water, MCAGCC has reduced its water intensity by 25% (compared to the 2007 baseline), nearly achieving the 26% reduction goal by 2020 identified in the SSPP. Key accomplishments include:

- Over 800 MCAGCC residential units have had green lawns replaced with water saving desert landscaping (i.e., xeriscaping).
- Installed synthetic turf and sunshades at numerous common areas and family parks.
- Recycled water from the wastewater treatment facility combined with water from a non-potable well to irrigate the Base golf course.
- Installed pipelines and obtained permit to utilize recycled water from the wastewater treatment facility on 46.5 acres of landscape and turf requiring irrigation, which reduced potable water use by up to 330,000 gallons per day.
- Installed a new non-potable water well to support the Grow-the-Force construction efforts, reducing potable water demand by over 1M gallons per day.



Xeriscaping and synthetic turf have reduced the use of water for irrigation, conserving this valuable resource.



In 2010, the range residue processing center processed and sold 450 tons of scrap metal (aluminum, brass, and steel).

Solid Waste and Chemical Waste

In 2010, MCAGCC achieved 48% solid waste diversion (not including construction and demolition debris), well ahead of the SSPP target. In addition, the Base is already exceeding the SSPP 15% reduction goal for on-site releases and off-site transfers of toxic chemicals. Key accomplishments include:

- The Recycling Program recycled 8,149 tons of solid waste (metal, glass, paper, wood, etc.), generating over \$1.9M in revenue.
- Piloted thermal heating convection equipment for processing 155 mm steel projectiles. This process rapidly heats the projectile to facilitate crushing by hydraulic compression.
- The bioremediation facility, unique to the Marine Corps, completed its 11th operational cycle in 2010. Each treatment cycle diverts 2,500 yd³ of hydrocarbon-contaminated soil from off-site disposal, saving over \$168,000. The treated soils are used as daily cover at the Base landfill.
- The antifreeze recycling program processed approximately 10.6 tons of antifreeze. The recycled antifreeze was re-issued at no cost.
- Recycled 80 tons of lead-acid batteries and 31 tons of motor oil, resulting in \$25,000 of revenue and cost avoidance on disposal fees.

Orientation to Mission

The sustainability program at MCAGCC is vital to the mission of the Base. Ensuring that reliable, cost-effective energy and water resources are available for training is a top priority of the Command.

Supporting Military Readiness

Energy and water security are key components of the sustainability program that support military readiness. MCAGCC uses a combination of on-site power generation and solar arrays to supply the majority of its power needs, enhancing energy security. The 7.2 MW cogeneration facility, the largest in the Marine Corps, and on-site renewable energy supply 60% of the Base energy requirements annually (95% of the energy requirements in the winter months). Leading the Marine Corps in energy management, MCAGCC saves as much as \$7M annually in energy costs. In addition, construction of a second 7 MW cogeneration facility is currently underway, further enhancing the Base's security and military readiness.

Water is a scarce resource in Southern California, but vital to the sustainability of MCAGCC. The Base supplies all of its own potable water via an aquifer called Surprise Spring. MCAGCC is working with the United States Geological Survey (USGS) to monitor and evaluate groundwater levels and water quality in the aquifer. In addition, the Command has taken steps, including the development of a water conservation plan in 2010, to protect and maximize the life of this valuable, high-quality resource. The outcome of these steps are summarized on page 5 of this narrative, and more efforts are underway for 2011 and beyond.

Integration into Mission Activities

As part of the sustainability program, MCAGCC worked proactively with a Private Party Venture in achieving a higher level of sustainable design for its current Marine Corps Family Housing development project. In doing so, all phases of project development, including design, construction, and property management are helping to increase energy efficiency, reduce resource consumption, and minimize waste. Marine Palms housing will be "Energy Star Qualified," integrating sustainability into the training Mission, reducing the demand on energy and water resources, and improving cost-effectiveness.



MCAGCC's cogeneration facility supports energy security of the Base, supplying nearly 60% of the electrical demand.

Another initiative at MCAGCC that integrates sustainability into the Mission activities is the \$3.5M Experimental Forward Operating Base (ExFOB). The ExFOB includes foldable solar array panels, solar energy converters to charge batteries and run communications equipment, enhanced water

cooling systems, and more. Technology gleaned from ExFOB will not only save money, it will save lives by reducing the number of supply convoys needed to support combat operations.

Enhancing Long-Term Mission

Sustainability at MCAGCC is not just an enhancement to the long-term mission, it is a requirement. Without reliable supplies of energy and water, the Base would not exist. NREA is leading the sustainability efforts to improve energy efficiency, increase use of renewable energy, reduce GHG emissions, improve recycling and waste management, and enhance procurement. These efforts help ensure that the Base will continue training Marines in live-fire maneuvers and urban operations for years to come.

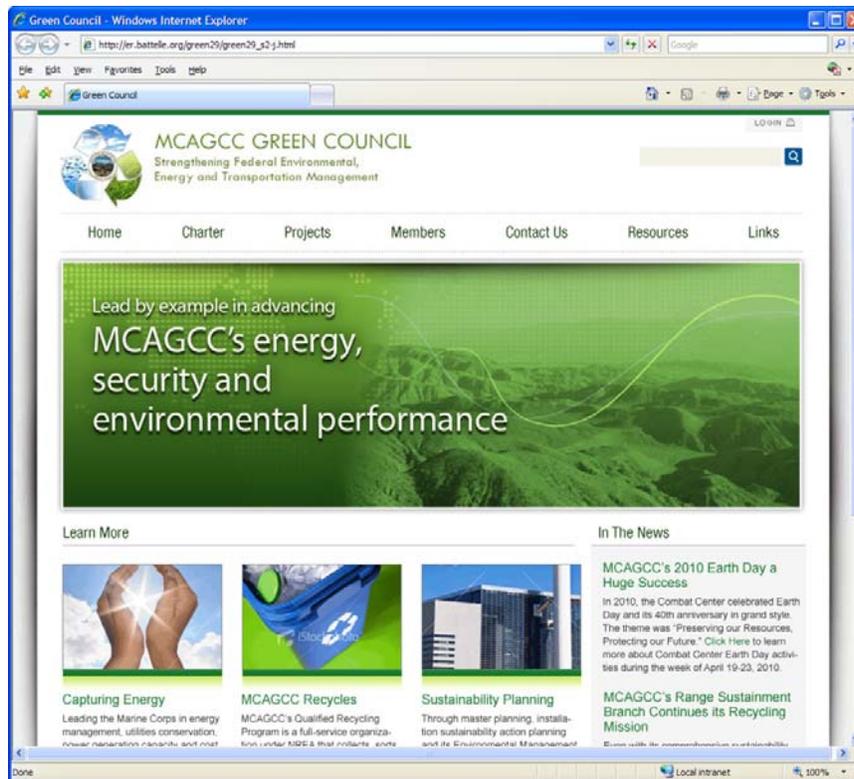
Transferability and Stakeholder Interaction

With MCAGCC's efforts in developing an ISAP in 2010, in advance of planned Marine Corps requirements being finalized, the installation has provided the Marine Corps with an effective template for all other installations to follow. In addition, MCAGCC is launching a new Web site focused on disseminating information and involving stakeholders in the sustainability initiatives at the Base. 2010 Earth Day initiatives also proved successful in involving local stakeholders.

Disseminating Lessons Learned

MCAGCC developed a "Green Council" to assist the Command with promoting environmental awareness by incorporating, adopting, and promoting progressive sustainability standards and practices that demonstrate a commitment to leadership installation sustainability. MCAGCC has taken the "Green Council" concept to other Marine Corps installations to adopt similar cross-functional initiatives to encourage lessons learned.

A Web site is being developed collaboratively among nine divisions at MCAGCC with NREA leading the effort. The goal of the Web site is to provide security-enabled collaboration for council members, as well as a publicly-available area where the installation can communicate progress on sustainability initiatives to Base residents, the surrounding community, and general public.



MCAGCC's Green Council Web site is used to disseminate information and engage stakeholders in our sustainability initiatives.

Success in Involving Stakeholders

MCAGCC celebrated the 40th anniversary of Earth Day in 2010 with the theme "Preserving our Resources, Protecting our Future," organizing 10 formal events including:

- Base-wide beautification clean-up for all unit personnel and installation residents.
- Earth Day poster contests at the Child Development Center.
- Conservation Fair for all Base and community residents.
- Environmental presentations at the Child Development Center and Armed Services YMCA.
- Facility tours of sustainability practices and initiatives for all participants.
- A 5K Fun Run and a 10K Mountain Bike Fun Ride.

Hundreds of Marines, sailors, family members, and civilian personnel participated in these events. In collaboration with four local organizations, volun-

teers distributed thousands of items including: tote bags, biodegradable sports bottles, eco-green pencils, 10-step energy awareness magnets, natural soap products, compact fluorescent light bulbs, energy efficient temperature magnets, coloring books, t-shirts, Energy Star appliance coupons and other general awareness literature.