



Twentynine Palms Marine Corps Air Ground Combat Center (MCAGCC)

Sustainability—Non-Industrial Installation

Introduction

MCAGCC Twentynine Palms, is located in the Southern California Mojave Desert. It is the U.S. Marine Corps' largest installation, occupying approximately 1,101 square miles. MCAGCC is home to the Marine Air Ground Task Force Training Command (MAGTFTC). MAGTFTC's primary mission is to enable Marines to execute live-fire and maneuver training.

To accomplish the mission at MCAGCC, which annually trains over 45,000 Marines with approximate civilian and military populations of 28,760, significant infrastructure resources are required. This includes operating and maintaining over 1,000 buildings/structures, 11 production wells, and a 1.0 million gallons per day (MGD) wastewater treatment facility. Annually, MCAGCC consumes over 450,000 MMBtu of energy, produces almost 15,000 tons of solid wastes, and utilizes approximately 670 million gallons of potable water.

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 operational forces readiness as well as to provide the facilities, services, and support responsive to the needs of resident organizations, Marines, Sailors, and their families today and tomorrow."*

Background

In its 63 years, the combined arms-training mission has progressed from niche to national priority. Past facility expansions and recent initiatives have resulted in the Combat Center being the premier desert-training installation. During this growth, it was key that sustainable approaches be implemented for the installation to continue to meet its mission. The use of non-potable/recycled water resources, development of resilient and independent energy capabilities, on-site remediation operations, and cutting edge recycling/reutilization programs were underway at MCAGCC long before sustainability was elevated to its current level of importance.

Today, MCAGCC's sustainability program is a collaborative effort between the Natural Resources and Environmental Affairs (NREA) Division, the Public Works Division (PWD), the Center Logistics Division (CLD), the local Southwest Regional Fleet Transportation (SWRFT) office, outside stakeholders, and the community. The program has been very successful in



MCAGCC 2014 Earth Day events (including a 5K run), promoted sustainability efforts and initiatives.

improving energy efficiency, reducing fuel use, enhancing water conservation, recycling hazardous and non-hazardous materials, and reducing solid waste entering the Base landfill. Coordination with and outreach to the Marines and the local community is vital to achieving the goals of the sustainability program and mission of MCAGCC.

Summary of Accomplishments

Program Management

The sustainability program at MCAGCC is managed by the Natural Resources and Environmental Affairs (NREA) Division. Program management efforts in FY 2013 and FY 2014 included the development of the MCAGCC Installation Sustainability Action Plan (ISAP), maintenance and improvements to the Base Environmental Management System (EMS), and support for Facility Master Planning.

Installation Sustainability Action Plan

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.

To manage MCAGCC resources effectively and support achievement of the mandated Strategic Sustainability Performance Plan (SSPP) sustainability goals/metrics, MCAGCC has established a Sustainability Management Program. NREA has been assigned responsibility in developing and overseeing the program, coordinating efforts among stakeholders at MCAGCC and regionally.

Central to MCAGCC’s sustainability program are routine reviews and biennial revisions to the

ISAP, now on its third iteration, which documents status in achieving SSPP metrics and identifies action items to continue improvements.

Sustainability efforts were reflected in Headquarters Marine Corps Triennial Environmental Compliance Evaluation Positive Finding for extensive sustainability and pollution prevention efforts, and going above and beyond statutory and regulatory requirements.

The 2014 ISAP was a collaborative effort between numerous public works, logistics, and environmental staff. After gathering and organizing information on the status of sustainability efforts, multi-day working meetings were held in April 2014 with MCAGCC stakeholders. During the meetings, potential projects were identified and 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 SSPP.

Environmental Management System

NREA has management responsibility for the Base EMS, which is in full compliance (i.e., “green” ISAP rating). In addition, NREA deployed a mobile, Web-based application for the environmental compliance inspectors, which improves accuracy, reduces time, and eliminates paper. This tool, called the EMS Compliance Tool, is used to track sustainability practices at MCAGCC. NREA has also populated MCAGCC’s sustainability accomplishments in the Marine Corps Installation West Sustainability Dashboard to share lessons-learned regionally and across the Marine Corps.

Facility Master Planning

Effective facility master planning has helped ensure the sustainability of MCAGCC during recent expansion. MCAGCC has 16 projects registered with U.S. Green Building Council (USGBC), including three projects to achieve LEED Gold. Planning also includes a new green Materials Recycling Facility (MRF) to minimize recyclables going to the landfill, enhancements to the wastewater treatment facilities to maximize use of recycled wastewater, and new potable water options to ensure availability of clean potable water at MCAGCC.



MCAGCC wastewater treatment facilities recycle water for irrigation of the Base golf course.

Summary of Accomplishments

Technical Merit

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

Fossil Fuel Use

During FY 2013 and FY 2014, MCAGCC continued its progressive efforts to reduce fossil fuel use through improved energy efficiency and vehicle fleet management. Key accomplishments included:

- MCAGCC has exceeded the FY 2015 SSPP energy intensity goal of 30% reduction and is on track to exceed the FY 2020 goal of 37.5% reduction.
- MCAGCC completed installation of a new twin turbine high-efficiency cogeneration facility with two 4.6 megawatts (MW) gas-fired turbines and a heat recovery system to supply heating and cooling for Mainside.
- MCAGCC connected the Energy Management and Control System (EMCS) on 25 additional buildings (250 facilities are now controlled through the Base EMCS).
- Added smart grid infrastructure and completed installation of a 564 kW battery storage facility.
- Building audits were performed each year to determine the need for potential lighting replacements, window replacements, insulation improvements, air balancing, and air handler upgrades.
- Energy intensity has improved by 32% compared to the FY 2003 baseline and facility infrastructure improvements provided cost savings of over \$600,000 per year.
- The non-tactical vehicle fleet at MCAGCC consists of approximately 59% alternative fuel vehicles (AFVs), and alternative fuels comprise approximately 22% of the fuel used to operate MCAGCC’s fleet.
- Onboard data recorders have been installed on 161 fleet vehicles to



The new twin-turbine high-efficiency cogeneration facility, provides improved energy efficiency, energy security, and installation resilience.

monitor operating times, speeds, and vehicle performance.

Renewable Energy

Renewable energy is an important source of safe and reliable power at MCAGCC. In FY 2013 and 2014, MCAGCC continued to install and operate solar energy facilities. Key accomplishments include:

- Installed 0.75 MW of photovoltaic (PV) power, bringing the total installed solar PV capacity to 5.2 MW and achieving annual electric cost savings of more than \$550,000. .
- Implementing a Power Purchase Agreement (PPA) to install an additional 3.6 MW of PV.



New construction of Bachelor Enlisted Quarters and Dining Facilities on Mainside achieved LEED Gold.

Summary of Accomplishments

Water Conservation and Efficiency

The need for water conservation and efficiency has never been greater due to the current drought conditions not only in California, but in the entire southwestern United States. Record low amounts of snow and rain in Southern California will have a direct impact upon future water supplies at MCAGCC, since local groundwater resources are recharged by these sources.

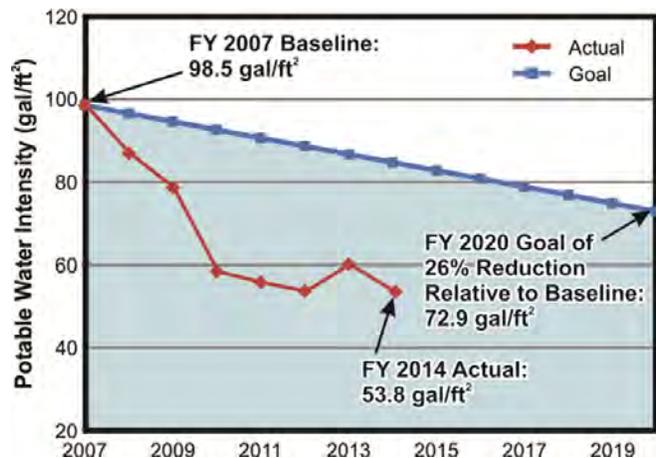
Currently, high quality drinking water is obtained from a single aquifer on Base. Water conservation and efficiency is paramount to the sustainability of MCAGCC. Alternative sources of water are expensive and energy intensive to access. Understanding the importance of potable water, MCAGCC has reduced its water intensity by 45% (compared to the 2007 baseline), which is significantly more than the 26% reduction goal by 2020 identified in the SSPP. Key accomplishments include:

- Conversion of green space to water saving desert landscaping (i.e., xeriscaping) and installation of synthetic turf has reduced the potable water demand for irrigation by approximately 0.12 million gallons per day.
- Continued use of xeriscaping for all new construction on Base.
- Installed synthetic turf and sunshades at numerous common areas and family parks.
- Optimized use of recycled water from the wastewater treatment plant for irrigation at the MCAGCC golf course.
- Reduced non-potable water intensity by 71%, exceeding the 20% reduction goal by FY 2020 identified in the SSPP.
- Conducted a study to investigate the capture and reuse of stormwater to augment the non-potable water used for irrigation. The study showed that stormwater capture and reuse was a viable strategy and could increase the availability of recycled water.
- Established a Water Conservation Task Force to focus on enhancing water conservation.



Desert landscaping and synthetic turf like those shown here at the new MCAGCC sports complex have greatly reduced water use.

Although the potable water consumption intensity has been significantly reduced through current actions, additional reductions are appropriate to ensure water conservation and the mission of the Marine Corps. The MCAGCC's goals are to eliminate the use of potable water for any non-potable demand (e.g., irrigation, vehicle washing, and construction) and to develop alternative sources of potable water. Projects are underway to install new potable and non-potable groundwater wells, to improve water reuse (including wastewater and stormwater), and to better understand potable water use through improved metering.



MCAGCC has already reduced its water intensity by 45% since 2007, significantly exceeding the 2020 goal and extending the useful life of the drinking water aquifer.

Summary of Accomplishments

Solid Waste and Chemical Waste

In FY 2014, MCAGCC achieved 40% solid waste diversion (not including construction and demolition debris). Key accomplishments include:

- Procured 72 System One parts cleaners equipped with solvent recycling technology and coupled with the use of an aqueous base solvent. These units reduced hydrocarbon solvent use by approximately 19.5 metric tons annually and saved the installation approximately \$52,650 annually.
- Proactive efforts in recycling, sorting, and segregation of hazardous waste streams resulted in a 192 ton reduction in RCRA and Non-RCRA hazardous waste shipped off-site for disposal in FY 2014, compared to FY 2013.
- MCAGCC's Hazardous Waste Minimization Program returned approximately \$638,000 in new and unused hazardous material to tenant commands and visiting units aboard the installation. This included avoidance of disposal fees for over 78 metric tons of hazardous waste, providing a cost savings of approximately \$85,715.
- Continued the Lead Acid Battery Reconditioning Program, created in 2008, which recycles used lead acid batteries. Since inception, the program has saved MCAGCC approximately \$4.4 million.
- MCAGCC's Antifreeze Recycling Program has recycled 35,800 gallons of used antifreeze since 2007. The recycled product is returned to activities aboard the installation at no cost. These savings have allowed commands to extend their maintenance dollars while virtually eliminating new antifreeze procurement. To date, this program has saved the installation approximately \$511,700.
- Collected, inspected, and demilitarized over 5.6 million pounds of range residue and training related ordnance debris in FY

2014. This program provides units conducting live fire maneuver training aboard the installation a means to safely turn in ordnance related debris. In FY 2014, 5.5 million pounds of recyclable materials were processed, generating \$1,264,791 in revenue.

- Processed and sold 1,486,020 pounds of cardboard, 186,340 pounds of mixed paper and 37,920 pounds of California Redemption Valued products, generating \$110,889 in revenue.
- Collected, processed, diverted from landfill disposal and sold 1,710,260 pounds of industrial recyclable and scrap materials, generating \$357,098 in revenue.



Processed brass material.

Range residue is collected, demilitarized, and recycled at MCAGCC's processing facility (shown here), providing over \$1M of revenue annually.

While MCAGCC's Qualified Recycling Program has many significant achievements, additional efforts are underway to increase solid waste diversion. Perhaps most significantly, MCAGCC is evaluating the addition of a Material Recycling Facility (MRF) to more efficiently segregate, recycle, and reutilize components of the solid waste stream. A detailed waste characterization study was conducted in FY 2014 that showed at least 10% of the waste stream going to MCAGCC's landfill consists of recyclable materials. The MRF would ensure this material is recycled and does not end up in the Base landfill.

Summary of Accomplishments

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.

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 and resilience. The 16.2 MW of cogeneration facilities, the largest in the Marine Corps, and 5.2 MW of on-site renewable energy, can supply over 95% of the Base energy requirements annually. Leading the Marine Corps in energy management, MCAGCC saves as much as \$7M annually in energy costs, and hopes to increase these savings with efforts to export power when demand allows.

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 works closely with the United States Geological Survey (USGS) to monitor and evaluate groundwater levels and water quality in the aquifer. In addition, the Command is working hard to protect and maximize the life of this valuable, high-quality resource. Efforts are underway to identify and install new water wells and to maximize use of recycled wastewater



Desert landscaping and shade structures such as this enhance water conservation and improve the quality of life for Marines and their families at this desert facility.



MCAGCC's Green Council website promotes sustainability.

and stormwater to ensure sustainable access to water.

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 installation could not sustain mission readiness.

Transferability

MCAGCC's sustainability initiatives are promoted at the Green Council website (<http://www.green29.org>). The vision for the website is to raise environmental awareness by incorporating, adopting, and promoting progressive environmental standards and practices that demonstrate MCAGCC's commitment to leadership in sustainable energy and environmental excellence. The website provides 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 the general public.

MCAGCC also populates sustainability accomplishments in the Marine Corps Installations West Sustainability Dashboard to share lessons-learned regionally and across the Marine Corps. This process can be easily replicated and provides a valuable tool for obtaining project funds and prioritizing sustainability needs.

Summary of Accomplishments

Stakeholder Interaction

ISAP stakeholders include NREA, PWD, CLD and SWRFT. NREA is also leading the Water Conservation Task Force to focus on enhancing water conservation efforts in this desert environment.

MCAGCC also coordinated with other Department of Defense agencies in California, the National Park Service, Bureau of Land Management, California Department of Fish and Wildlife, local government agencies, and community groups on sustainability issues. Of particular note, NREA spearheaded the effort to exempt MCAGCC and other Department of Defense installations from California's greenhouse gas cap-and-trade program. Considering MCAGCC's cogeneration facilities, this was a significant challenge that was overcome through effective communication and coordination with the State legislature.

A major component of the community outreach program for sustainability at the MCAGCC is annual Earth Day events at the installation and with local communities. The Marine Corps theme for Earth Day 2014 was "Global Reach - Local Action." This message was meant to succinctly characterize our world-wide expeditionary focus, while simultaneously protecting the environmental quality of our home bases and stations and the health and welfare of our Marines, families, and civilians. Earth Day related activities included:

- 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, including a interactive booth (see below).
- 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.

Impact/Outcomes

Leadership and funding has been programmed to continue execution and enhancement of the sustainability efforts at MCAGCC. This includes 3.6 MW of new solar renewable energy, new potable water facilities, enhanced wastewater facilities, EMCS expansion, bi-annual updates to the ISAP, a MRF, and more.

The importance of MCAGCC's sustainability initiatives has been highlighted by recent drought conditions in California. The State of California is aggressively pursuing water conservation legislation/measures State-wide. The sustainability program at MCAGCC has put the Base in an excellent position, already exceeding the SSPP goals for water conservation and providing a template for others to follow. MCAGCC's Water Conservation Task Force, established in 2014, will ensure reductions in potable water use continue.



Community outreach is an important part of the sustainability program at MCAGCC. NREA hosted an interactive booth at the 2014 Earth Day event to engage the community on sustainability initiatives.