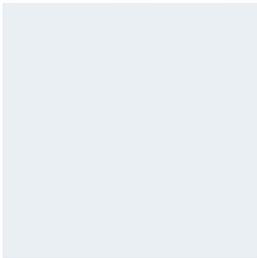
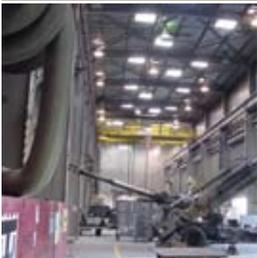


ENERGY WISE PROJECTS

► Toward Energy Security: A Mini-Grid with Cogeneration, Chillers, Photovoltaics and Direct Digital Control Marine Corps Air Ground Combat Center — Twentynine Palms



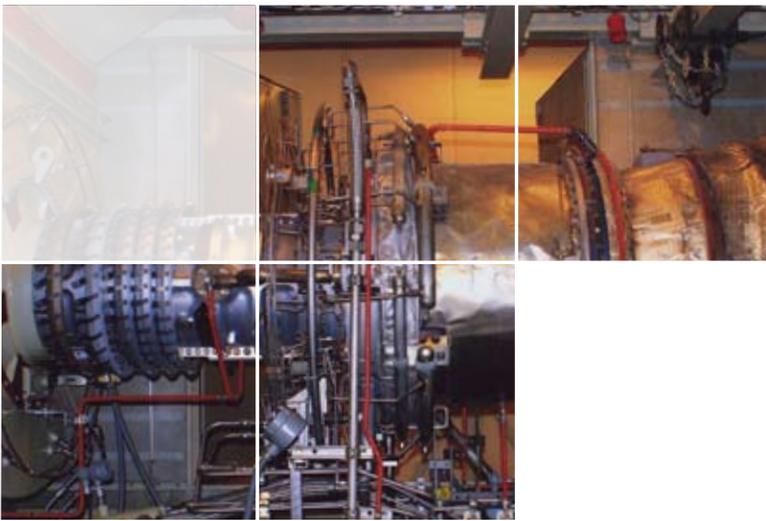
The Challenge

Sprawling over 596,000 acres of southern California's sun-baked Mojave Desert, the Marine Corps Air Ground Combat Center (MCAGCC) at Twentynine Palms faces a perfect storm of energy challenges:

- **Extreme Temperatures:** Reaching up to 120 degrees in the summer and falling as low as nine degrees in the winter.
- **Energy Needs:** Prior to implementing these projects, the annual energy cost was \$14.5 million as the training center served a population of almost 20,000 people.
- **End of the Line:** At the end of Southern California Edison's (SCE) electrical grid, far from generating and pumping stations, service was less reliable and secure. Backup generators wouldn't be adequate sources of power in the event of an earthquake or some other major interruption.

The challenge to base managers was to find a self-sustaining energy source that would reduce their reliance on SCE. To address the issues of a severely taxed, aging HVAC system, constantly rising energy prices and concern over reliability of the existing grid, the energy management team decided to implement a series of projects.





The Solution

Beginning in 2003, Twentynine Palms created a 4-in-1 solution combining cogeneration, chillers, a photovoltaic array and direct digital controls (DDCs) to form their own mini-grid.

1. The **cogeneration system** is a seven megawatt (MW) combined heating and power (CHP) plant producing electricity and heat and is run by a gas and electric powered turbine. The turbine's exhaust provides all of the base's piped hot water for domestic use, some steam applications, and building heating. In the winter, the turbine's exhaust is captured in a heat-recovery generator to supply heat for roughly a third of the base's central heating plant.
2. The three new **chilled water plants** have a total capacity of 6,100 tons, of which 1,300 tons are absorption chillers (one absorption chiller in each plant). The absorption chillers use the waste heat of the cogeneration system to produce chilled water for space cooling and some process applications.
3. The **photovoltaic** array has 8,706 solar panels contributing 1.1 MW to help power the mini-grid. The panels cover 6.5 acres of land.
4. **DDCs** manage the entire system to control and reduce power consumption. The project installed a communications fiber network so that all the buildings and plants could be seen and controlled remotely.

The Funding

The combined cost of this 4-in-1 solution was \$70 million and funded through an Energy Savings Performance Contract (ESPC). The project also installed daylighting to 14 buildings, and EMCS upgrades to about 40 buildings. The cost avoidance generated by the project will be used to pay the contractor over the contract term. There was no initial financial outlay by the command due to the ESPC financing.

The Bottom Line

- ▶ Twentynine Palms ranks as one of the largest and most efficient examples of CHP cogeneration and thermally activated systems anywhere, particularly in the public sector.

Energy Reduction

- Upon completion, the cogeneration system reduced the wattage formerly purchased from SCE by two-thirds.
- Guaranteed the production of about 55 million kilowatt hours per year (kWh/yr) of cogeneration power.
- During the first year of operation, the mini-grid's efficiency was sometimes as high as 75 percent, making it about two and a half times more efficient than conventional power company generation.

Cost Avoidance

- Electricity bill reduced by \$5.8 million/year.
- Contract term of 19 years.
- \$4.5 million utility incentive for renewable resources.
- Chillers are avoiding \$133,496 in annual operation and maintenance costs.

Collateral Benefits

- Uninterrupted power supply for the critical base loads.
- Chilled-water lines were laid out to service future base structures, eliminating the need for complex mechanical AC systems and saving more on up-front and operational costs.
- Use of non-CFC refrigerants protects the environment.
- New chiller plants provide improved quality of life for Marines in barracks.
- The energy management team leveraged the savings of the cogeneration plant (less than four year payback) to invest in longer payback solar photovoltaics, further reducing their dependence on the electric utility company and increasing energy security.
- Due to the proven success of the ESPC cogeneration project, a military construction project is planned that will more than double the cogeneration capacity at Twentynine Palms.

Feedback

"This is a 'win-win' for the Marines and a critical resource for our mission,"
Col. James D. Nichols, former chief of staff MAGTFTC 29 Palms.

"Strategic energy planning is a key component of our Master Plan,"
LCDR. Rob Tye, former head, Facilities Maintenance Division MAGTFTC 29 Palms.

