USMC's Twentynine Palms Central Heating Plant Becomes "Most efficient in the Marine Corps"

Integration of latest operation and maintenance technologies realizes significant savings at U.S. Marine base

Technical Assistance

Success Story

Losses associated with improper operation and maintenance (O&M) cost industry and government billions of dollars each year. Improved O&M offers an opportunity to lower costs and increase energy savings by using existing systems and equipment more effectively. In the military sector, increased consolidation of military bases and activities, coupled with manpower reductions and reduced operating budgets, has provided a significant challenge to U.S. Department of Defense (DoD) energy managers to maintain plant performance in the face of ever increasing load demands on central energy plants.

The Energy Policy Act of 1992 and subsequent Executive Orders requires that energy consumption in the Federal sector be reduced by 35%, from 1985 levels, by 2010. The United States Marine Corps (USMC) is working with the U.S. Department of Energy's (DOE's) Federal Energy Management Program (FEMP) to utilize national laboratory capabilities to meet these energy-efficiency goals. The Pacific Northwest National Laboratory, a recognized leader in the development of advanced O&M technologies, worked with the USMC to provide the Twentynine Palms central heating plant with newly developed technological and infrastructure improvements.

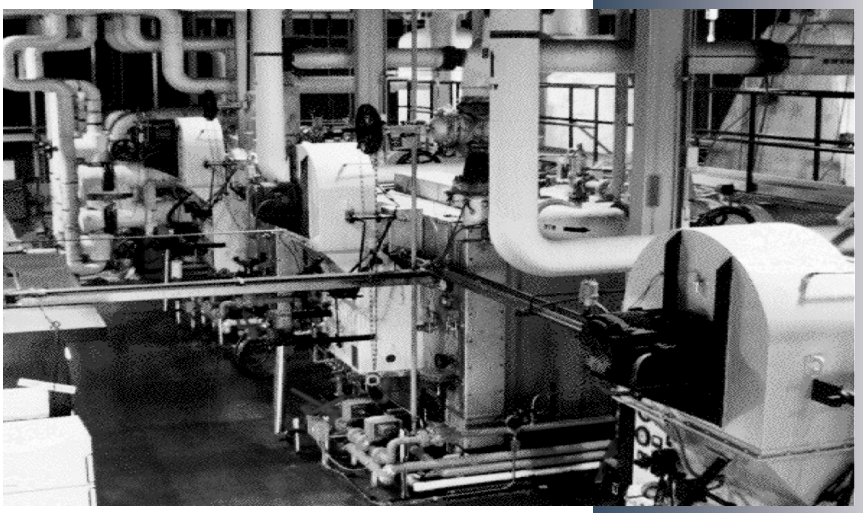
What was the project?

The central heating plant at the Marine Corps Air Ground Combat Center at Twentynine Palms, California, is a gas-fired 120 million Btu/hr pressurized hot water plant providing heat and hot water to support over 15,000 personnel and related buildings and services. The then 12-year-old central heating plant was the site of the first implementation for the Decision Support for Operations and Maintenance (DSOM) system developed by Pacific Northwest National Laboratory staff.

Working with supervisors and operators, Pacific Northwest National Laboratory developed a DSOM system that consists of a set of computerized O&M tools that are based on plant design information and provides the plant staff with guidance on plant performance and safety conscious decisions.

Implementation of the project included an initial characterization to assess the plant's physical condition, the actual performance level of the facility, and its associated O&M infrastructure. The results of this characterization provided:

- baseline data to measure performance improvement

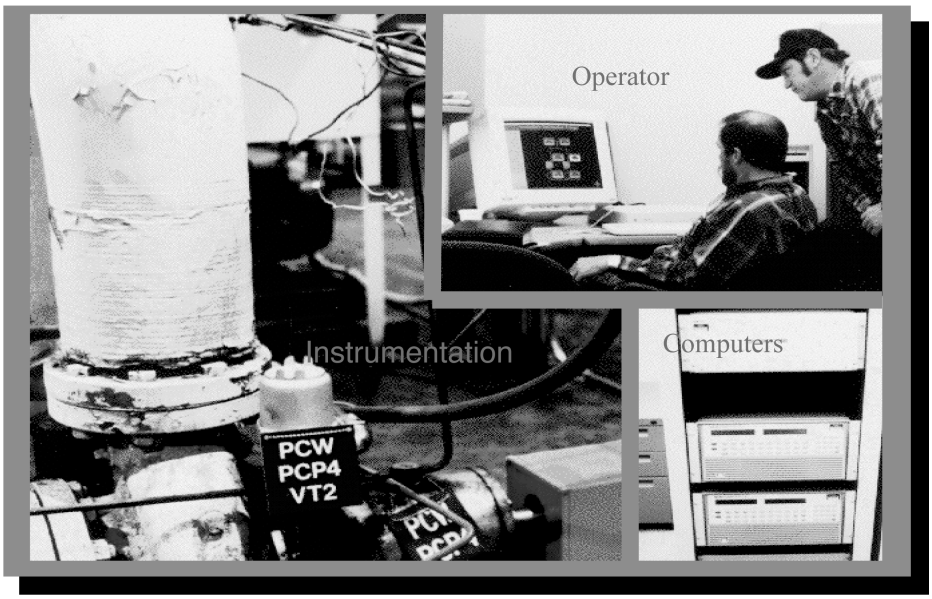


The Central Heating Plant at the USMC's Marine Corps Air Ground Combat Center, Twentynine Palms, California, gets technology boost to reduce O&M costs by 24%.

- the technical justification for implementing advanced O&M methods
- infrastructure upgrades.

New instruments were installed to provide accurate plant operational data to a central heating plant computer system. The computer provides the operators with easily accessible "point-and-click" information about the plant processes at the system and component levels. Both the safety and the efficiency of the process are monitored and

National laboratories assist Federal agencies implement cost-effective solutions under the DOE Work-for-Others program



CHP-installed instruments provide input to a data acquisition system that allows operators live information on plant operation, component conditions, and efficiency of boilers and overall plant configuration.

root-cause solutions to off-nominal operation, not simply operational problems, are automatically brought to the operator's attention.

An efficiency diagnostic monitor provides an on-line capability to recognize a below-standard process efficiency, alert the operator to what the operating conditions are, what they should be, and how to restore them to the optimum. The operator can also use a condition monitoring capability to anticipate systems or components that are degrading and subject to near-term failure to take proactive action before the failure can occur.

Optimum operation is achieved and maintained by continued upkeep of all the O&M infrastructure elements required to effectively run the entire process (Operations, Maintenance, Engineering, Training and Administration).

By making changes to its O&M infrastructure to integrate technology improvements, the plant staff and management have instituted a cultural change in the way the plant is maintained and operated. Plant operators now take a greater pride in how well they operate their plant and point to the DSOM system to prove it.

"To me, the most important factor is that my operators like the system and equally important is that they trust it. You are talking about some guys who have been boiler operators for over 20 years and to all of a sudden throw them in front of a computer is pretty scary. Good operators make a good running plant and that makes my job easier."

—Lew Fielding, Boiler Plant Supervisor, Marine Corps Air Ground Combat Center, Twentynine Palms

What are the benefits of this project?

The DSOM technology development and application under this project has provided many benefits:

- Immediate safety improvement: elimination of a serious water hammer condition threatening personnel and plant safety.
- Immediate capacity improvement: the plant is operated within design safety parameters to full capacity, providing a 30% capacity increase over previous operating restrictions. This has indefinitely delayed capital construction activities in excess of $1 million.
- Fuel savings: efficiency improvements are saving the plant approximately 17% ($280,000) per year in natural gas costs.
- Training value: training time for new operators has been reduced from 2 years to 6 months, minimizing training and manpower costs.
- Maintenance costs: the plant foreman has estimated that the system saves between $100,000 to $150,000 per year in prevented or anticipated component failures, based on actual decreases in the annual cost of labor and material for maintenance efforts.
- Reliability: the central heating plant has not had one unscheduled shutdown or any unexpected equipment failure for the 4 years since this project has been implemented.
- Emissions: the project has resulted in the reduction of over 3000 tons per year of greenhouse gases that do not go into the atmosphere.
- Life-cycle cost perspective: based on a comparison of current proactive O&M practices to the cost of previous O&M practices, the Twentynine Palms base is showing an annualized reduction of 24% in life-cycle labor and materials O&M costs.

How was the project funded?

Any Federal agency can use the national laboratories on a cost-reimbursable basis through FEMP. USMC headquarters funded the project working through an interagency agreement between USMC and FEMP. A cost-effective solution to a growing USMC problem was provided by Pacific Northwest National

Laboratory with a relatively short payback (approximately 3 years).

The DSOM technology is easily transferable to other government facilities or Federal agencies on a cost-reimbursable basis. It can also be made available to private industry.

Unique O&M Tools and Some Lessons Learned

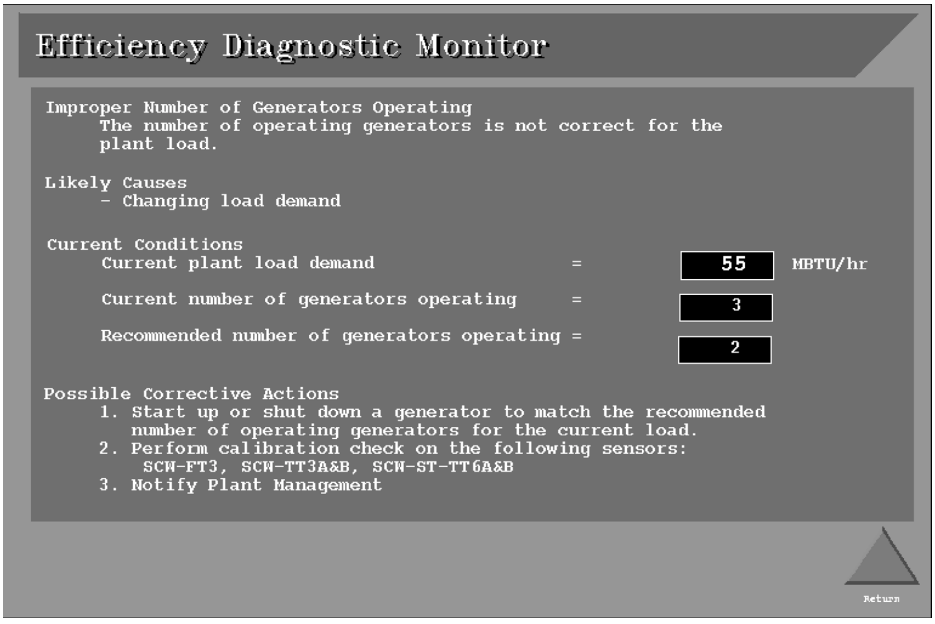
- Characterization of the process compared the Twentynine Palms central heating plant infrastructure to a standard plant metric. This provided a measurement of the organizational effectiveness of their O&M programs and a baseline of current operational condition.
- The DSOM computer system was designed to provide on-line engineering advice to allow operators to make informed decisions about how to operate their plant more effectively.
- Pacific Northwest National Laboratory provided a very easy- to-use human-computer interface to a complex program. Required operator training time was less than 2 hours.
- Operators and managers were involved in the system design process, providing ownership and buy-in to the computer system. This was very important to the success of the project.
- Pacific Northwest National Laboratory developed intuitive, object-orientated screen displays requiring no keyboard interface. Information is accessed with a mouse click.
- On-line component efficiency monitoring provides optimum configuration control and diagnostics. This provides specific problem description and recommended corrective actions.
- On-line condition monitoring of boilers and equipment provides early warning of degrading operation.
- The design safety parameter display shows operators exactly where their plant is operating relative to design specifications and safety guidelines.
- A holistic view of operations and maintenance was applied that included training, engineering, and administration functions.
- The necessary infrastructure was put in place to support the shift to this advanced continuous process improvement technology.
- The system is as used and effective today as it was when it was installed 4 years ago.

Pacific Northwest National Laboratory can:

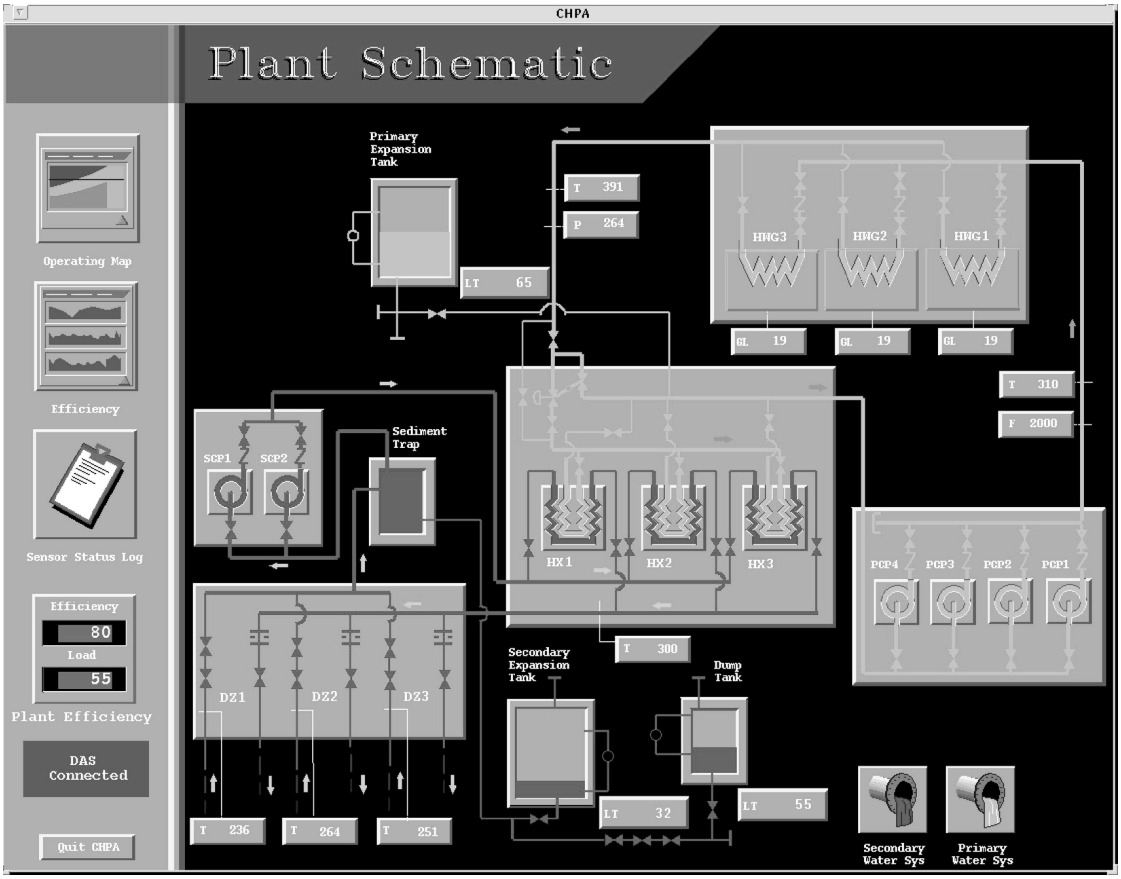
- assess current practices and identify cost-effective opportunities for improvements
- develop and implement complete O&M programs
- immediately identify and correct critical safety problems
- apply a broad range of technologies to solve chronic problems and implement improved practices
- develop new technologies to cost-effectively solve the unique problems of customers
- provide training programs to support applied technologies.

Utilizing the National Laboratories for cost-effective solutions

Under the Economy Act of 1932, as amended (31 U.S.C. 1535), all Federal agencies have the ability to place orders for goods and services with another government agency when the ordering agency determines that it is in the best interest of the Government. The Economy Act was established so Federal agencies could meet their mission goals without the need for unnecessary duplication of effort. This also allows the requesting agency the ability to have access to highly specialized or unique facilities, services, or technical



The Efficiency Diagnostic Monitor provides operators specific information and guidance to achieve optimum operating efficiency.



The CHP computer main screen shows the overview level of accessible information.

expertises that exist within DOE's national laboratory system.

The procedures for one Federal agency to place work with another Federal agency are outlined in Federal Acquisition Regulation 17.502, *Interagency Acquisitions Under the Economy Act*. The Department of Energy has implemented this regulation via DOE Order 481.1. Under that order, DOE accepts a request for goods or services if the requesting agency and the laboratory where the work will be assigned certify the following conditions have been met:

- A Memorandum of Understanding (MOU) must exist between DOE and the requesting agency.
- The request for goods or services is consistent with or complementary to DOE's missions and the mission of the laboratory performing the work.
- Acceptance of the work would not adversely impact the laboratory's execution of DOE-assigned projects.
- The proposed work would not place either DOE or the laboratory in direct competition with the domestic private sector.
- Work will be accomplished on a full cost-recovery basis.

This project was completed in compliance with the Economy Act to utilize the existing technical expertise of the Pacific Northwest National Laboratory in the most cost-effective manner in meeting the needs of the Department of Defense.

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