

Boiler Upgrades and Decentralizing Steam Systems Save Water and Energy at Naval Air Station Oceana



Project Location at NAS Oceana.

Photo Credit NAS Oceana

Naval Air Station (NAS) Oceana Dam Neck Annex is located in Virginia Beach, Virginia and was expanded in the 1950s to be a Master Jet Base to serve as the home to the tactical air units. NAS Oceana's primary mission is to train and deploy the Navy's Atlantic Fleet Strike Fighter squadrons. NAS Oceana is 10,500 acres, including obstruction clearances and flight easements, making it one of the largest air stations in the world.

The site has used steam from a central steam plant to provide process and comfort heating needs since 1989. To meet these needs, the central plant consumed approximately 1,178,300 million British thermal units (MBtu) annually and about 113,200 thousand gallons (Kgal) per year of water. NAS Oceana determined these heating needs could be met more efficiently by replacing the central plant with a combination of distributed boilers and ground source heat pumps (GSHP).

Project Summary

NAS Oceana, Naval Engineering Facilities Command Mid-Atlantic and Trane Corporation were contracting partners on an energy savings performance contract (ESPC) that replaced the inefficient, aging, above-ground steam pipes and boiler plant with a combination of distributed boilers and GSHP coupled to a condenser water loop. A total of 42 buildings on NAS Oceana were impacted

by these changes, including bachelor housing, hangers, the galley, office buildings, the chapel, and maintenance facilities.

This ESPC also included installing ground source heat pumps in three buildings, adding digital control systems to increase heating, ventilation and air conditioning (HVAC) efficiency, efficient lighting retrofits, and other water conservation measures. These other water conservation measures include over 5,000 water efficient domestic fixtures, including faucets, showerheads, and toilets being installed in 36 buildings across the base.

NAS Oceana decided to decentralize the heating and cooling system based on the calculated potential energy and water savings of the localized boilers and ground source heat pumps. The original central steam plant was built in 1952, and the original boilers were replaced in 1989. The central steam plant and associated distribution piping was demolished in 2010. The new system incorporated digital controls, allowing Navy personnel to maximize the efficiency of an individual building's heating system by optimizing temperature set back, scheduling, and economizer controls.

When the central plant was taken off line, 40 localized natural gas boilers and 15 new ground source heat pumps and

Steam Distribution on NAS Oceana

When NAS Oceana removed the 14 buildings from the central steam heating system, 20,000 linear feet of steam and condensate piping was demolished. This represented 27% of the steam distribution system on NAS Oceana.

well fields were installed to maximize energy and water savings across NAS Oceana.

This project installed 4,000 tons of GSHP systems and chillers. One hanger received a GSHP system, but did not receive a traditional well field because the hanger is surrounded by aircraft rated concrete. A steam-hot water heat exchanger and a cooling tower were installed to provide heating and cooling for the heat pumps, making it a "hybrid GSHP".

Instead of using drilled wells onsite, the GSHPs use the treated effluent from the nearby sanitation district as the heating and cooling condenser water loop. A total of 89 new GSHPs, 211 existing GSHPs and 4,000 tons of water-cooled chillers are serviced by this 10-mile distribution loop. See the Additional Best Management Practices at NAS Ocean highlight box for more information.

Cost and Savings Summary

Replacing the inefficient central steam system with a combination of distributed boilers and GSHPs and the additional water conservation measures has saved

	Centralized System Annual Consumption	Decentralized System Annual Consumption
Energy	1,178,288 MBtu	68,400 MBtu
Water	113,164 Kgal	93,590 Kgal

Additional Best Management Practices at NAS Oceana

The ground source heat pumps condenser water loop is cooled with effluent from nearby Hampton Roads Sanitation District, Atlantic Treatment Plant. 14 million gallons of treated effluent is used a day as a heat sink for the new and replaced chillers and heat pumps at NAS Oceana Dam Neck Annex.

NAS Oceana Dam Neck Annex 19,574 Kgal of water annually. This project has also saved 1,109,888 MBtu in energy by reducing energy loss from steam leaks and inefficient heat systems. The total cost savings from implementing all of the measures in this ESPC has been about \$3 million in fiscal year 2011.

NAS Oceana Dam Neck Annex spent \$33 million on the project. The combined ESPC project payback is expected to be within 17 years.

Additional environmental benefits included significant reduction in air emission of pollutants. This reduction has allowed NAS Oceana to change their operating permit to a permit with lower allowable emissions. The following table shows the reduction in air pollutants

Because of this project’s impressive savings, NAS Oceana earned the 2009 Presidential Award for Leadership in

Pollutant	Percent Reduction
Volatile Organic Compounds	41.4 %
Nitrogen Oxides	78.4%
Sulfur Dioxide	97.6%
Particulate Matter less than 10 microns in size	77.6%
Lead	99.9%
Carbon Oxide	86.7%
Particulate Matter less than 2.5 micron in size	85.1%
Ammonia	93.0%

Federal Energy Management, which recognizes Federal agencies for their support, leadership and efforts in promoting and improving Federal energy management. Other awards that this project has received include the 2008 Outstanding Engineering Achievement Award from the Engineers Club of Hampton Roads, a major contributor to the Department of the Navy’s 2009 Platts Award for “Green Energy Initiatives of the Year”, and the 2011 Green Innovation Award from Virginia Sustainable Building Network in the Best Green Commercial Project – Large category.

For More Information

About Naval Air Station Oceana Dam Neck Annex:
[www.military.com/base-guide/ naval-air-station-oceana-dam-neck-annex](http://www.military.com/base-guide/naval-air-station-oceana-dam-neck-annex)

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Project Team accepting 2009 Presidential Energy Award.

Photo Credit NAS Oceana