# NAVAL AIR STATION BRUNSWICK

## *Deploying Energy Restructuring at the Local Level*

**PROJECT SNAPSHOT**

**PROJECT**
Boiler decentralization and facility consolidation project

**TECHNOLOGY**
40 Cleaver Brooks package boilers

**PROJECTED $CO_2$ EMISSION REDUCTIONS**
5,000 – 6,000 tons annually

**INVESTMENT AND SAVINGS**
Demand-Side Management design-build contract cost of $9.6 million. Annual O&M savings are nearly $840,000.

**LESSONS LEARNED**
Early and frequent coordination with all parties is critical. Teamwork is essential. Energy project like this offers significant economic and environmental benefits for just about any facility.

**FUNDING SOURCES**
Combined Energies, Maine Department of Environmental Protection and various Navy offices

### INTRODUCTION

The Naval Air Station in Brunswick, Maine, has completed one of the largest demand-side energy management projects in the history of the U.S. Navy. This environmental Trafalgar is well on its way toward demonstrating that it pays to be lean, mean and local. The Naval base has replaced a centralized, aging and inefficient steam plant with 40 new boilers distributed around the 3,221-acre base, and has cut yearly fuel consumption by 25 percent. The project will pay for itself in 7.5 years out of annual labor and energy cost savings that total $838,000. As a result, the Naval Air Station Brunswick, NASB, has become the first of three military partners to enroll so far in U.S. EPA's Climate Wise Program.

### THE PROJECT

With a 45-year-old central steam plant and distribution system that achieved only 54 percent overall efficiency, the Naval Air Station Brunswick was in the market for something newer, cheaper and cleaner. So in 1999 it decided to decommission the old plant and replace it with a decentralized network of 40 smaller boilers in 20 locations that can operate at 85 percent efficiency – a 60 percent improvement. In addition to the new heating system, which became operational in time for the 1999-2000 heating season, NASB consolidated operations from 10 buildings to five, reducing its footprint from 105,000 square feet to 65,000. This saved more energy and money, and reduced pollution even further.

Taken out of service in May 1999, the old steam plant consisted of four boilers – two rated at 36 million British thermal units an hour (mmBtu/hr), and two at 60 mmBtu/hr – and an extensive steam distribution system with condensate piping. A 330,000-gallon underground storage tank supplied No. 4 fuel oil to four boilers, while a second underground tank, with capacity of 4,000 gallons, stored diesel fuel for a 900-kilowatt (kW) emergency generator. In 1997, the plant burned about 1.3 million gallons of No. 4 fuel oil, and the emergency generator's typical annual diesel fuel consumption was 3,000 gallons. In addition, the base used about 24 million kWh of electricity a year.

The new boiler network will improve these numbers considerably. Fuel oil consumption is expected to decline by about 456,100 gallons a year, or 25 percent. Annual electricity usage will decrease by some 1.1 million kilowatt-hours (kWh), savings that result from shutting down the old centralized steam-distribution system and consolidating facilities, and allow for conversion to much cleaner natural gas starting with the 2001-02 heating season.

The naval air station was aided in this endeavor by a number of project partners, including Combined Energies, a division of the Central Maine Power Group; a number of Navy departments and offices, both on and off the base; and, for modeling and air permits, the Maine Department of Environmental Protection. Among the subcontractors were HE Sargent, Dublois Electrical and Damon Mechanical.

### THE RESULTS

The capital cost of the boiler decentralization project is $9.6 million. This is a million dollars less than what it would have taken to repair the old central steam plant and keep it running. About $4 million of the total price tag came from special project funds once earmarked for centralized system repairs, while the remaining $5.6 million is being financed over the next decade. Base officials forecast that the project will pay for itself in 7.5 years, based on projected annual energy and labor savings of $838,000.

Variable costs also will decrease. Fuel, and operations and maintenance costs for facilities being decentralized will run about $597,650 annually. Another $100,000 a year is expected to be saved when natural gas becomes available.

The 25 percent reduction in fuel oil use will cut carbon dioxide emissions by about 5,105 tons a year.[1] This is equivalent to the $CO_2$ emitted by 800 typical passenger cars. The decrease in electricity use will slice yearly $CO_2$ emissions by

another 530 tons – equal to removing another 75 cars from the road. In addition, major air pollutant emissions from the boilers – sulfur dioxide, particulates, nitrogen oxides, carbon monoxide, hazardous air pollutants and volatile organic compounds – will be reduced by about 49 tons a year, or 34 percent.

Additional environmental benefits will accrue with the advent of fuel-switching. Using 1999 fuel use data as a baseline, conversion from oil to natural gas is expected to reduce $CO_2$ emissions by another 3,367 tons a year, a 21 percent drop, and major air pollutant emissions by an extra 66 tons a year, or 70 percent. These anticipated reductions are in addition to those achieved by the boiler decentralization and consolidation project.

As a result of the decentralization project, water use at the base will decrease by an estimated one million gallons a year, about 1.75 percent of total use. That will save an additional $1,000 and conserve a natural resource.

The project offers a variety of other benefits as well: (1) elimination of steam and its inherent risks; (2) use of systems composed of a large number of small, low-tech components that can easily be replaced at low cost and with minimal disruption; (3) through consolidation of its buildings, a more efficient operating profile; and (4) increased reliability and security by relying on many, independent heating systems, rather than one big one.

The Naval Air Station's Commanding Officer, Captain Keith Koon, noted: "In the process, we enhanced the mission readiness of the air station by eliminating our dependency on one single heating source, a 45-year-old aging central steam plant. These have been dramatic changes for NASB, and for our 4,600 military and civil employees."

## LESSONS LEARNED

Given the size of the project, it was essential to obtain buy-in from Navy officials. A tight design and construction timeline – from December 1998 to September 1999 – demanded fast and frequent coordination among all the parties. Early contact and the maintenance of good relations with the Maine Department of Environmental Protection helped ensure that air permitting was completed on time. As part of the permitting process, Maine DEP performed all of the required air modeling, saving the base months of time and thousands of dollars. Because the project called for integrative thinking – particularly on how to save money and energy, and improve the environment at the same time – it called for a high degree of teamwork among Navy officials and contractors. But in view of its apparent success, NASB has concluded that an energy project of this type can almost always deliver significant environmental and economic benefits. Recently, in fact, other Navy bases have initiated aggressive DSM projects of similar magnitude.

## FUTURE COMMITMENTS

In February 1999, NASB became the first military participant in EPA's Climate Wise Program. The December 1999 quarterly forum was held in Brunswick, at the base. The project also has been the subject of briefings at a number of Navy and community conferences and seminars.

The base is working with Central Maine Power's Combined Energies group to perform a base-wide energy audit. It also is working with Maine Gas to convert 33 of the new heating systems to natural gas for the 2001-02 heating season. For the 2002-03 season, it plans to do the same for the hot water and heating systems in housing units located outside the main base. Construction of new on-base housing and barrack complexes will take advantage of natural gas. Finally, NASB currently has two projects lined up for fiscal 2001 that involve the installation of water conservation fixtures and programmable thermostats for heating, ventilation and air conditioning systems.

## ORGANIZATIONAL PROFILE

NASB is located along the southeast coast of Maine, about 27 miles northeast of Portland. The station covers 3,221 acres in the town of Brunswick, Maine, and includes other more remote property. It features dual runways, as well as more than 400,000 square feet of hangar space, 550 facilities and structures, and 750 housing units. The station supports Commander Patrol and Reconnaissance Wing Five, and North Atlantic Treaty Organization Anti-submarine Warfare forces. About 4,850 military and civilian personnel are affiliated with the base.

## CONTACTS

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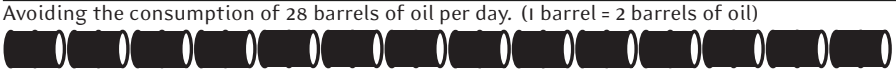
[1] All emission reductions cited here are calculated based on New England regional marginal emission rates, provided by ISO New England. See Appendix A for a discussion of these calculations.

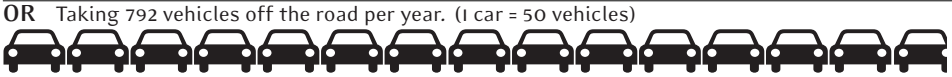
### CLEAN AIR-COOL PLANET CASE STUDY RATING

*This case study reduces $CO_2$ emissions equivalent to the following:*

Avoiding the consumption of 28 barrels of oil per day. (1 barrel = 2 barrels of oil)



**OR** Taking 792 vehicles off the road per year. (1 car = 50 vehicles)



Assumptions: 1,093 lbs of $CO_2$ per barrel of oil. Vehicles are average passenger cars (approximately 20 lbs $CO_2$ per gallon of gasoline - 22.5 miles per gallon, averaging 16,000 miles per year)