Neville Chemical Company: Management Pursues Five Projects Following Plant-Wide Energy-Efficiency Assessment

Benefits

- Identified savings of an estimated 436,200 kWh of electricity and 7,473 MMBtu of fuel annually
- Found potential annual savings of approximately $75,460 from energy reduction
- Facilitated assessment at a second, much-larger Neville plant
- Can achieve payback ranging from 0.9 to 2.1 years, depending on the project

Application

The Neville Chemical plant-wide energy assessment focused on the entire plant process from raw materials to the finished product. The assessment team identified those systems and operations that could save energy and money by consolidating thermal processes, using a lower-cost utility for heat, and adding advanced motor control. Neville pursued the audit with the intention of replicating the efficiency improvement projects at a much larger company plant in Pittsburgh.

Summary

Neville Chemical undertook a plant-wide energy-efficiency assessment of its Anaheim, California, plant beginning in the summer of 2001. The objectives of the assessment were to identify systems and operations that were good candidates for energy efficiency and waste minimization improvements, and then ascertain specific energy and cost-saving projects. The assessment team performed a comprehensive energy and waste audit that included detailed inspections of all equipment and processes. The assessment team carefully inspected the processes and equipment and analyzed data from detailed measurements to achieve a thorough understanding of energy usage in all of the plant's processes.

Through this assessment process, the company found strong economic justification for five projects that would significantly reduce electricity and fuel costs. Four of the five projects, when complete, will save the company 436,200 kilowatt-hours (kWh) or $31,840 of electrical energy each year. These savings will come from the use of new motor drives. The remaining project, that combines two thermal oxidizers into one, will save 7,473 million British thermal units (MMBtu) or $43,600 in fossil fuel each year. Perhaps the greatest benefit to Neville Chemical was the high applicability of the projects to its plant in Pittsburgh, Pennsylvania, which is 10 times larger. Late in 2001, the same assessment team applied its knowledge of Neville's processes in a very efficient plant-wide assessment at the Pittsburgh plant, and identified 15 projects with more than $715,000 in projected annual energy savings.

DOE-Industry Partnership

The U.S. Department of Energy's (DOE) Industrial Technologies Program (ITP) cosponsored the assessment through a competitive process. DOE promotes plant-wide energy-efficiency assessments that will lead to improvements in industrial energy efficiency, productivity, and global competitiveness, while reducing waste and environmental emissions. In this case, DOE contributed $72,350 of the total $144,700.

Company Background

The Neville Chemical Company produces hydrocarbon resins, hydrocarbon solutions, and coumarone-indene resins in plants in two U.S. locations (California and Pennsylvania) and one overseas location (Holland). Industries use these resins to produce consumer and commercial products, such as adhesives, rubber, plastics, paints, printing inks, and concrete cure.

Neville Chemical opened its hydrocarbon resin manufacturing facility in Anaheim, California, in 1950. This plant produces resin in batch processes, which are well suited for

Neville Chemical Plant in Anaheim

producing smaller quantities of specialty resins. The plant operates three shifts per day throughout the year while consuming about 1.42 million kWh of electricity. The 10-acre production site has a total enclosed area in major buildings of 20,000 square feet, and the plant employs about 30.

The Neville Chemical resin manufacturing facility in Pittsburgh, Pennsylvania, has a production capacity that is 10 times that of Anaheim. The Pittsburgh plant produces resin using both batch and continuous processes. The Pittsburgh plant benefits from electricity rates that are about 36% less than Anaheim's and natural gas (NG) rates that are about 20% less. The 35-acre plant operates three shifts per day in most process areas and employs 350 workers.

Assessment Approach

The plant-wide energy-efficiency assessment at Anaheim focused on the technical and economic evaluations of existing energy-consuming operations that could benefit from consolidating thermal processes, using a less costly utility for heat, and adding advanced controls. The consumption of fossil fuels, including NG and fuel oil, constitute a major cost in resin manufacturing facilities. For this reason, the assessment team paid close attention to energy use in the two steam boilers, thermal oil heater, and two thermal oxidizers. The equipment and processes consuming the most electricity at Anaheim are the cooling water system pumps, heat poly reactor, the flaking process, various blowers, and the compressed air system.

The assessment team consisted of members of Neville Chemical's management and maintenance staffs and BASE Energy, Inc. engineers. Neville Chemical performed the plant-wide assessment first at Anaheim, in part, to prepare an assessment team from BASE Energy to perform a similar assessment at the much larger Pittsburgh plant. Following guidance from the Anaheim assessment, BASE Energy successfully performed this second assessment, identifying 15 projects. The remainder of this case study, however, will focus mainly on the Anaheim plant-wide assessment.

Based on experience performing 350 plant assessments, BASE Energy, Inc. of San Francisco, California, led the technical activities associated with the Neville Chemical plant-wide assessment at Anaheim. BASE Energy performed the following steps: 1) obtained background information including production data and energy usage patterns; 2) organized data, analyzed utility bills, and interviewed the plant engineers to formulate preliminary ideas about energy-saving projects; 3) visited the plant to inspect processes, observe equipment operation, and make a large number of equipment energy usage measurements; 4) prepared the assessment report; 5) sent the report to the plant for comment; and 6) formally presented the report.

The Neville assessment team provided support to BASE Energy through many technical discussions and plant tours, and by providing them with flow sheets, piping and instrumentation diagrams, and utility bills. The management-led Neville team reviewed the assessment results and presented them to plant operations managers before project finalization. In specialized cases, such as for wastewater treatment, Neville consulted with outside experts.

Results

The plant-wide energy-efficiency assessment identified five projects for implementation at Neville's Anaheim plant. Table 1 lists these five projects and provides estimates of expected project costs, annual savings, and expected payback periods. Immediate implementation is planned only for Projects 2, 3, and 4. The first project in the table is designed to use NG instead of electricity for heating an accumulator, the second project will save on NG, and the remaining three projects will reduce consumption of electricity through the use of variable frequency drives (VFD). All of the projects have attractive paybacks of no more than 2.1 years. The following section provides brief project descriptions.

Table 1. Estimated Project Cost, Savings, and Payback for Recommended Energy-Efficiency Projects at Neville Chemical Company

Project	Project Cost ($)	Annual Savings ($)	Payback (yr)
1. Use hot oil for heating Accumulator 3	6,100	7,089	0.9
2. Combine the two thermal oxidizers into one	57,500	43,615	1.3
3. Install a VFD[1] on the HTO[2] pumps	5,104	2,406	2.1
4. Install a VFD on the cooling water pump	13,660	16,994	0.8
5. Control the cooling tower fan with a VFD	9,103	5,353	1.7
Totals	**91,467**	**75,457**	

[1]Variable frequency drive
[2]Heat transfer oil

Projects Identified

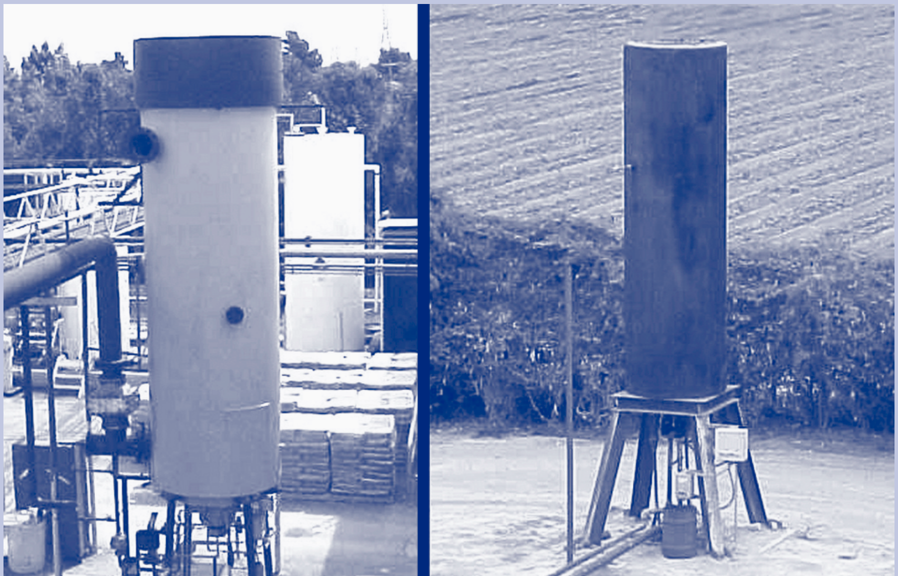
The following discussion provides details of the selected energy-efficiency projects developed during the plant-wide assessment. Neville is aggressively pursuing projects such as these at its Pittsburgh plant where it estimates annual energy savings in excess of $715,000. In addition, the fundamental technical aspects of most of these projects have applicability to other industries in general and to the chemical industry in particular.

Project 1—Use hot oil for heating Accumulator 3

After the resin is produced, and depending on the intended product, some resin blend may be sent to the flaking process. The primary holding tank (Accumulator 3) feeds the blend to the flaking belt where electric heaters maintain the holding temperature during flaking (solidification). The assessment team determined Neville could save money by using heating coils filled with heat transfer oil (HTO) at the flaking belt instead of electric heaters. NG is used to heat the HTO, using an additional 557 MMBtu per year to replace 114,318 kWh per year in electrical energy and to reduce associated electricity demand charges.

Project 2—Combine the two thermal oxidizers into one

Neville Chemical uses two NG-burning thermal oxidizers to reduce the plant's atmospheric emissions of volatile organic compounds (VOCs). One of the thermal oxidizers incinerates fumes from accumulators, a weir box, and



Project 2 - Thermal Oxidizers (fume burner and flare)

contaminated soil. The other uses a "flare" to incinerate VOCs from various tanks. The assessment team studied these pollution-reduction processes and determined that a single thermal oxidizer could process all of these fume and VOC streams more efficiently. The use of a single thermal oxidizer will conserve 8,031 MMBtu per year, reduce NO_x emissions by 853 pounds per year, and yield additional savings from pollution credits.

Project 3—Install a VFD on the HTO pumps

The batch resin production process uses HTO to heat the petroleum-derived monomer mixture, thus initiating the polymerization reaction in the reactor. Because the polymerization reaction is exothermic, the required flow rate of HTO gradually declines as the reaction builds up, until there is no need for HTO. The assessment team determined that a VFD should control this highly variable pumping operation rather than allow the pump to operate continuously at 100% rated power. The team estimated that the electrical savings would be about 30,800 kWh per year.

Project 4—Install a VFD on the cooling water pump

Based on measurements of operations data, the Neville assessment team determined that the pump for the cooling water system should respond to the variable system demand instead of operating continuously at 100% rated power. The team recommended installing a VFD with a controller that responds to changes in returning water pressure. The team estimated that the electrical savings resulting from this change would be 221,400 kWh per year with additional savings from reduced electricity demand charges.

Project 5—Control the cooling tower fan with a VFD

The assessment team noted that fan motors at the two Neville Chemical cooling towers run continuously throughout the year, despite the variable heat load that results from batch operations. Therefore, the team recommended installing VFDs for the fans to reduce speed (based on temperature) during periods of low cooling demands. This change will save an estimated 69,700 kWh per year.

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