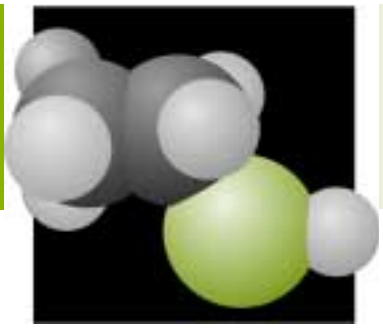
CHEMICALS

A Steam System Technical Case Study



INDUSTRIES OF THE FUTURE
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Benefits

- Saved $42,000 annually
- Saved 22,000 million Btu annually
- Reduced average specific steam demand

Applications

In the operation of a distillation column, system pressure can sometimes be reduced without affecting product quality. Lower distillation column pressure will establish lower condensing temperatures, leading to a reduction in reboiler steam demand and operating costs. The distillation process should be assessed to identify these optimization opportunities whenever production conditions change.

Reducing Steam Pressure Saves $42,000 Annually At Vulcan Chemicals

Summary

As part of their Operational Excellence Program, Vulcan Chemicals, a business group of the Vulcan Materials Company, implemented a process optimization project involving two chloromethane production units. This four-month project required no capital investment and resulted in a reduction in process steam demand and significant cost savings.

By lowering the steam system pressure produced in the distillation columns, Vulcan Chemicals reduced the average reboiler steam demand per unit of product by almost 6%. This resulted in an annual 22,000 million Btu reduction in steam demand, and yearly cost savings of $42,000. The plant received a 1997 Chemical Manufacturers Association Energy Efficiency Award for the project.

VMC Geismar Plant

Company Background

Located in Geismar, Louisiana, Vulcan Chemicals produces a variety of chlorinated organic chemicals. These chemicals, which include hydrochloric acid, chloroform, caustic soda, chlorine and others, are used by intermediate chemical producers. The finished products are widely used in the pulp and paper, textile and chemicals industries. Vulcan Chemicals also manufactures products for the environmental, water management, and specialty chemical markets.

Project Overview

In response to market conditions and changing product specifications, Vulcan Chemicals continually upgrades its production facilities. As an element of the Operation Excellence Program, production parameters are checked periodically to optimize operating efficiency while ensuring product quality. Under this program, a computer simulation model was used to analyze the chloromethane production unit processes. The data analysis revealed that energy demand, and consequently operating cost, could be reduced through a decrease in the system pressure of the distillation columns.

Chloromethane Production Unit

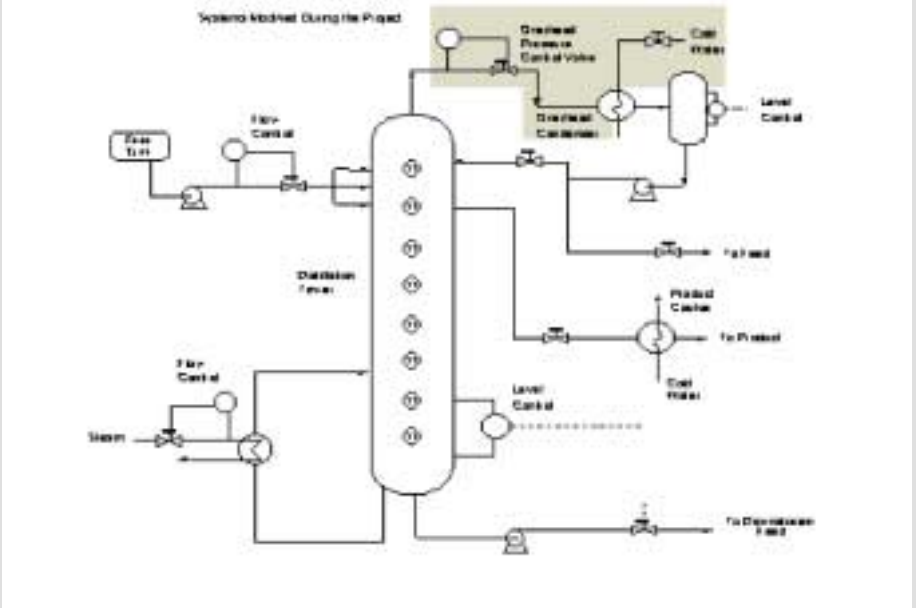
Based on a process assessment of Vulcan Chemicals' chloromethane production, energy and cost efficiency opportunities were identified in the distillation process that would potentially reduce operating costs while maintaining existing product quality and production stability. The computer simulation data showed that there was an opportunity to indirectly reduce the steam required by the reboiler by reducing the system pressure.

High-pressure steam use is a considerable component of energy demand in the chloromethane production units. These units consume over 12% of the high-pressure steam produced by the cogeneration facility at the Geismar plant. By reducing the system pressure in the distillation columns, the condensing temperatures were lowered, thereby requiring less reflux during component separation in the distillation columns. These conditions yielded significant savings in operating costs due to a reduction of steam required for the reboiler.

Results

After three months of development and planning, the project was implemented in a one-month period. The result was increased efficiency of the two chloromethane production units and better utilization of the capital assets. In the first distillation tower, the system pressure was decreased from 35 psig to 26 psig. The resulting lower condensing temperatures decreased the reboiler steam demand rate by 700 lbs/hr from the previous total of 15,850 lbs/hr. This 4% drop led to a decrease in energy consumption, totaling 12,100 million Btu per year.

Distillation Process



In the second distillation tower system, pressure was reduced from 15 psig to 11 psig, resulting in a reduction in the reboiler steam demand rate of 800 lbs/hr. Energy savings from the changes in the second tower totaled 9,900 million Btu per year.

Following the adjustment to the steam pressure for both distillation columns, the output was thoroughly checked for product quality and production stability. No adverse effects were found and some additional benefits, such as the use of a cascade control system, were discovered to improve production stability. Although the changes in system pressure increased the required capacity of the condensers, this was not a problem because additional condenser capacity was available from previous equipment upgrades. At the end of the project, total annual energy savings were 22,000 million Btu with associated cost savings of $42,000. Steam usage for the two units was reduced by 5.8%.

After the project was completed, another computer model simulation was performed varying the raw material feed rate. The model indicated that the steam flow rate per unit of product could be decreased even further by increasing the feed rate. It is estimated that a 10% increase in the rate would save an additional $39,000 in steam costs per year.

Lessons Learned

Since 1997, the Vulcan Chemicals Operational Excellence Program has undertaken nine steam optimization projects with potential savings of 185,000 million Btu. At the present time, Vulcan Chemicals has implemented over one-half of these projects, realizing significant cost and energy savings. The success of these projects is now being used to develop a management model for a systematic optimization procedure for plant life cycle analysis throughout the Chemicals Group.

Industries of the Future

The chemicals industry is one of several energy- and waste-intensive industries that participate in OIT's Industries of the Future initiative. In December 1996, the chemicals industry published a report, entitled Technology Vision 2020: The U.S. Chemicals Industry, that helps establish technical priorities for improving the industry's competitiveness and develops recommendations to strengthen cooperation among industry, government, and academia. It also provides direction for continuous improvement through step-change technology in new chemical science and engineering technology, supply chain management, information systems, and manufacturing and operations.

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BestPractices is part of the Office of Industrial Technologies' (OIT's) Industries of the Future strategy, which helps the country's most energy-intensive industries, improve competitiveness over the next 20 years. BestPractices brings together the best available and emerging technologies and practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices focuses on plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. Another component is the Industrial Assessments Centers, which provide comprehensive industrial assessments to small and medium-size manufacturers.

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