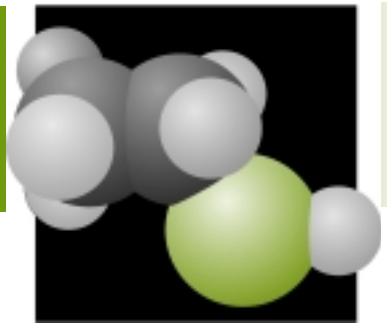
CHEMICALS

A Steam System Technical Case Study



INDUSTRIES OF THE FUTURE
BestPractices
Energy Smart Technology for Today

Benefits

- Saved over $2.3 million annually
- Reduced consumption of energy, water, and chemicals

Applications

Steam turbines used to generate electricity on-site are common throughout industry. In many cases, systems can be upgraded to improve efficiency, reduce costs, and improve production processes.

New Steam Turbine Saves Chemical Manufacturer $2.3 Million Annually

Summary

The Texas Petrochemicals Corporation (TPC) implemented a project improving the performance of a steam system that is used to generate on-site electricity and drive a distillation process compressor. This project consisted of several changes to the system configuration, and centered on the replacement of a steam turbine that was contaminating the system with oil.

These modifications, utilizing existing out-of-service equipment to minimize costs, improved the system's energy utilization and overall system efficiency. With a capital investment of $650,000, the annual savings totaled over $2.3 million in reduced energy, water, chemicals, and maintenance costs, resulting in a simple payback of just over 3 months. The plant received a 1997 Chemical Manufacturers Association Energy Efficiency Award for the project.

Company Background

Located in Houston, Texas, the Texas Petrochemicals Corporation is one of the largest manufacturers of an emission-reducing octane booster for gasoline. Along with producing this product, TPC produces petrochemical feedstocks for companies that manufacture products such as synthetic rubber, plastic resins, and lubricants. TPC also generates on-site electricity and sells excess power to facilities in the surrounding area.

Texas Petrochemicals Plant

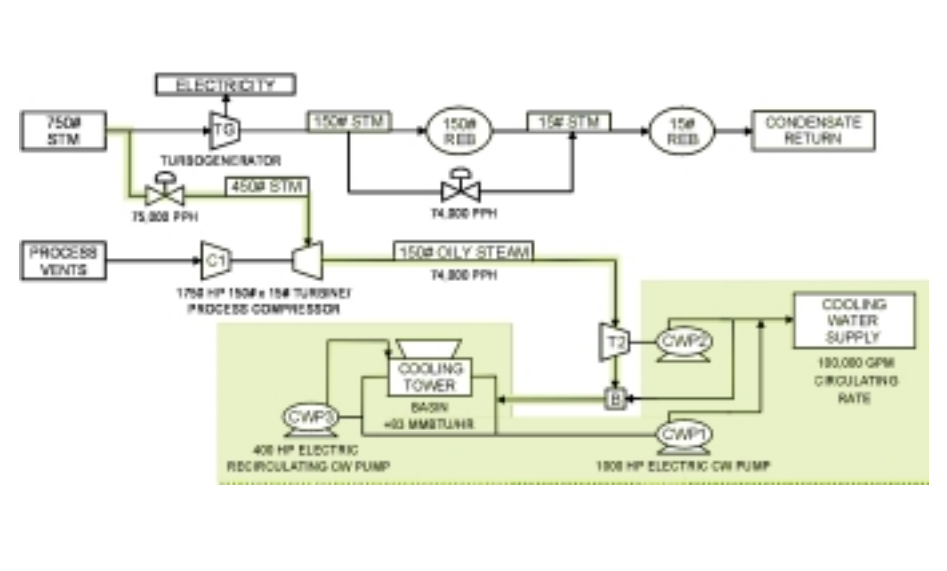
Project Overview

TPC utilizes a boiler system to produce steam that drives two turbines. One turbine powers a generator that produces electricity and the other drives a compressor used in the distillation process. The steam utilized by the 1,750 hp compressor turbine was branched off from the main 750 pound steam line and reduced to 450 pound steam through a valve as shown in original system diagram.

Because the compressor turbine leaked oil that was contaminating the steam, the turbine exhaust was diverted to the cooling system to avoid returning oily condensate to the plant boilers, as shown by the shaded path in the figure. This oily steam was used to drive three cooling water pumps before discharging the barometrically condensed steam into the cooling water basin.

The project recently completed by TPC consisted of several modifications to the steam system. These included the replacement of the compressor turbine and a system reconfiguration that utilized the steam more effectively. When the problem turbine was replaced, the contamination problem was eliminated and the system was modified to allow for the steam to return to the main steam line as shown in the shaded path in the “revised” system diagram. The turbines powering the water pumps, which had been using the oily steam, were reconfigured to use existing efficient electric motors.

Original Steam System Diagram

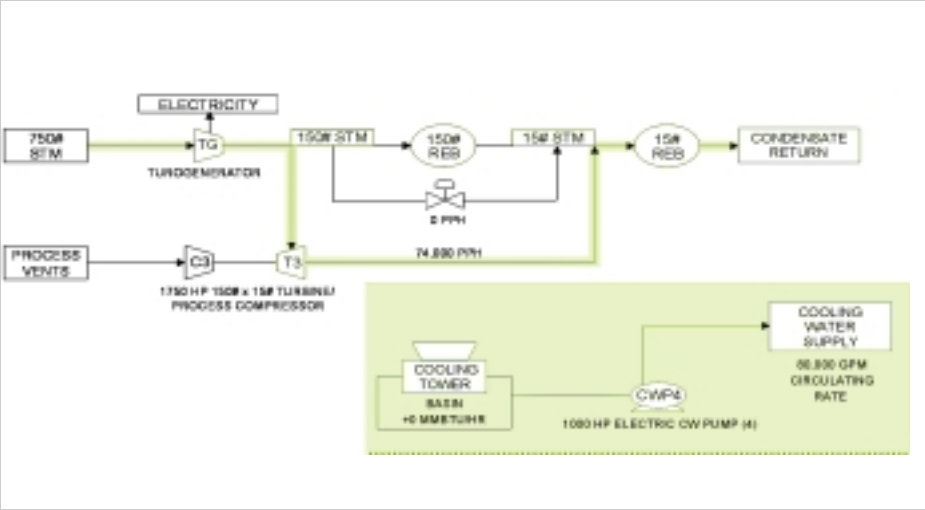


Results

Replacement of the faulty compressor turbine, along with the reconfiguration of the steam and cooling systems, improved the effectiveness of both systems. Because the retrofitted compressor turbine eliminated the steam contamination problem, the steam, and ensuing condensate, could be returned to the plant boilers. These modifications not only lowered the boiler energy demand, but also reduced the amount of additional chemicals and make-up water required in the system. These modifications also enabled the cooling water system to be isolated from the steam system.

Annual savings from reduced energy consumption, reduced chemical use, and lower maintenance totaled $2,300,000. Total project implementation cost was $650,000, resulting in a payback period of just over three months. Using the company's financial criteria, the project payout, using a discounted cash flow method, was 229%.

Revised Steam System Diagram



Lessons Learned

During the lifetime of a plant, modifications are made to improve process efficiency. Sometimes these modifications are made to optimize systems around improperly operating components. In TPC's previous system, a process turbine was discharging oil into the steam. Because the contaminated steam could not be recirculated to the boiler, the steam was diverted to drive other turbines, which was not the most efficient use of the steam.

Solving the actual problem, which involved replacing the faulty turbine that was allowing oil to enter into the system, proved to be much more effective than trying to work around it.

Gas Compressor

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.

PROJECT PARTNERS

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