# Faith Plating:

## CHP Revs Up Chrome Plating Facility

Faith Plating, a family-owned chrome plating company in Los Angeles, is one of the largest platers of remanufactured bumpers in the world. Since 1918, Faith Plating has been plating automobile and motorcycle parts, including those for another American institution—Harley Davidson.

Faith Plating's light industrial operation needed a reliable supply of electricity and hot water. Historically, the electric demand for the entire Faith Plating facility ranged from 280 to 300 kilowatts (kW), with electricity consumption ranging from 100,000 to 120,000 kilowatt-hours (kWh) per month. To better manage energy costs and improve operations, Faith Plating installed a combined heating and power (CHP) system in August of 2001.

High electricity prices and potential power interruptions played a large role in the decision to pursue the CHP project. Reducing dependency on electricity at a time of high regional price uncertainty and possible interruptions in service strengthened the case for natural gas fueled CHP. Another motivating factor for installing the CHP system was the need to replace an aging hot water boiler system that did not meet new stringent environmental emissions requirements. Installing the CHP system allowed the company to avoid the cost of purchasing a new boiler, and resulted in more efficient, less polluting, and cost-effective plant operations.

## System Technical Overview

The CHP system consists of four Capstone Model C30 microturbines and a Unifin gas-to-hot water heat exchanger. The Unifin heat exchanger converts most of the turbine exhaust heat to hot water for distribution to the heated dip tanks that are used to plate the bumpers and other vehicle components. The heat exchanger generates 40-90 gallons per minute (gpm) of hot water, raising the temperature of the water by 12-31°F. The hot water from the heat exchanger displaces either hot water from the existing boiler or electricity for electric immersion heaters used on some of the dip tanks. Further, the system allows for additional recovery of exhaust heat from the heat exchanger to be used to dry a recyclable precipitate, which is a by-product of the plating operations.

The turbines are scheduled to operate continuously during facility operations (three shifts per day/five days per week, or 6,864 hours/year). The CHP system provides a portion of the facility's electrical load and usually displaces the entire thermal load. All power is used on-site.

## Project Overview

### LOCATION

Los Angeles, CA

### DATE INSTALLED

2001

### ELECTRIC & THERMAL

- Four 30 kW Capstone Microturbines for 112 kW total
- 0.9 MMBTU/h thermal (hot water) output from Unifin heat exchanger to plating tanks
- 0.2 MMBTU/h exhaust heat for precipitate drying
- Overall efficiency of 72%

### ENERGY SAVINGS & PAYBACK

- 63-280 million BTU monthly
- 4 years (annual cost savings over $55,000)

### ENVIRONMENTAL BENEFITS

- No need to retrofit costly emission control equipment on boiler
- 1,080 lbs./yr. $NO_x$ avoided
- 240 lbs./yr. $SO_2$ avoided
- 316,000 lbs./yr. $CO_2$ avoided
- Reduction of solid waste discarded

### UNIQUE ASPECTS

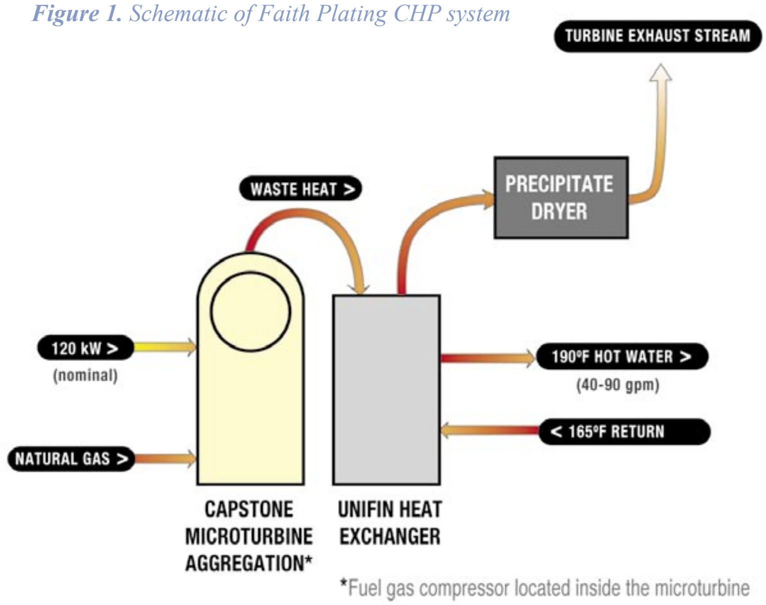
- Reduce grid power purchase up to 60% during peak periods
- Reduce cost and time to process precipitate
- Reduce landfill disposal costs by 60%

## System Design

The four microturbines and the exhaust gas-to-liquid heat exchanger are located in a small room that was built specifically for the CHP equipment in the middle of the plant near the existing hot water boiler. Both efficiency and capacity of the microturbines suffers as the inlet air temperature to the microturbines increases; therefore, three direct evaporative coolers and a large ventilation fan were installed to improve ventilation and aid in lowering the room's temperature.

The existing hot water boiler is used as an emergency backup source for hot water at the plant. The South Coast Air Quality Management District allowed the company to keep the boiler on standby status without having to retrofit costly emission control equipment. A gas meter was installed on the boiler to ensure that it operated within standards agreed upon by the District.

***Figure 1.*** *Schematic of Faith Plating CHP system*




## System Performance

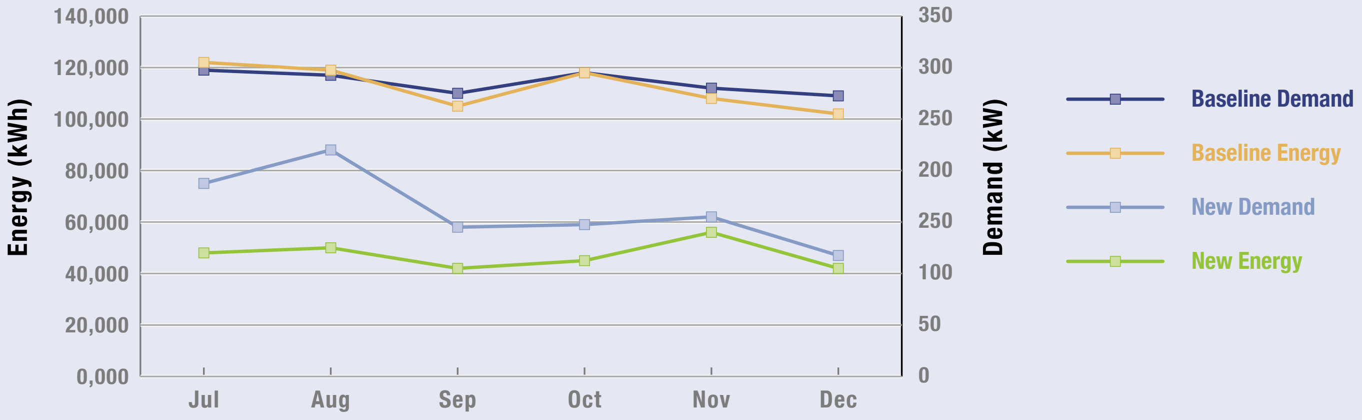
The performance of the CHP system was monitored and analyzed by Oak Ridge National Laboratory and the Energy Solutions Center, on behalf of the U.S. Department of Energy, beginning in June 2002 with data being acquired on a minute-by-minute basis. The CHP system resulted in notable savings and benefits. The data showed that the electric energy and demand decreased substantially. Electricity consumption and demand with the new CHP system was compared to the baseline non-CHP configuration, as is illustrated in Figure 4.

Additionally, the new recyclable precipitate dryer is much more efficient in removing moisture than the old electric dryer, thus resulting in both a significant decrease in labor requirements and in the shipping weight of hazardous waste that needs to be discarded. This decreased weight has resulted in 60% lower fees for landfill disposal.

***Figure 2.*** *Air can be ducted from an evaporative cooler to the intake of the microturbines for optimal performance in hot climates.*

***Figure 3.*** *Unifin Heat Exchanger*

***Figure 4.*** *Electric Energy and Demand - Baseline vs. New*



## Financing

The installation costs of the CHP system at Faith Plating correspond to approximately $2,200/kW. The system qualified for incentive payments from two California incentive programs, which combined covered more than a third of these costs ($88,210). The incentives reduced the installed cost to approximately $1,400/kW. Faith Plating covered the remaining costs through a leasing agreement. Project capital costs included the following:

| Item | Cost |
|---|---|
| **Hot Water Coils and Plumbing** | $14,194 |
| **Area Preparation (materials and labor)** | $20,472 |
| **Permitting and Interconnection** | $800 |
| **Equipment and Installation** | $218,220 |
| **TOTAL** | **$253,686** |

## Economic Analysis

Average maintenance costs are estimated to be 1.9 cents/kWh, based on 2004 data. Monthly electric bills were reduced substantially with operation of the CHP system. Electricity savings were as high as $6,000/month in the August/September billing cycle—a reduction of more than 40 percent.

Figure 5 below shows the electric cost savings over a twelve-month period. The CHP system not only led to reduced electric utility costs, but also resulted in substantial total operating cost reductions. The total cost savings over the twelve-month period are estimated to be between $55,500 and $143,300 depending on the type of tank heating (boiler or electric immersion heaters) displaced. The projected payback period for this project was approximately four years.

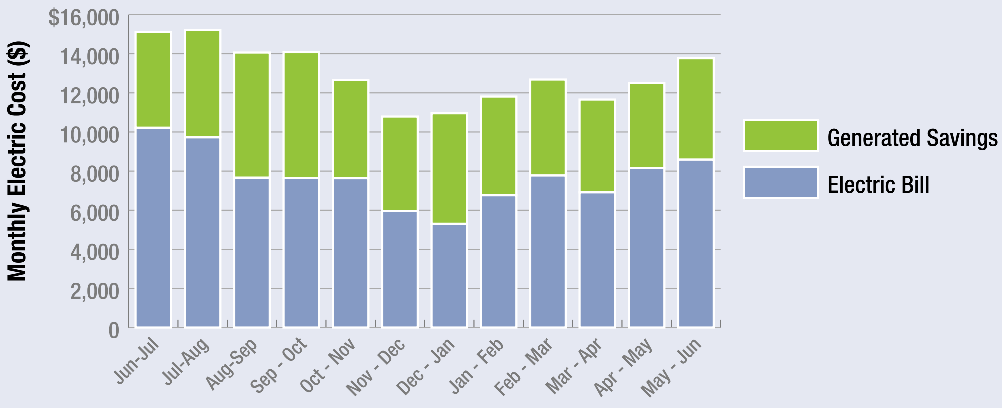
## Lessons Learned

Aging boiler equipment and high energy costs were two factors in Faith Plating's decision to implement a new CHP system that could meet the facility's energy demands efficiently and cost effectively. The company saved more than $55,000 in energy costs over the period of 12 months that the data was collected.

Several valuable lessons were learned as a result of this project and several key issues became apparent for optimizing the performance of a CHP system in this industry.

- First is the need for trained service personnel being available on a timely basis and the importance of regularly scheduled maintenance.
- Second is the impact of appropriate load settings of the turbines and operational scheduling on system economics. Both need to be analyzed in detail and optimized for ongoing plant operations in order to maximize cost savings.
- Finally, a number of design and operational issues needed to be solved in order to ensure efficient and reliable operation in an existing facility. Issues such as ensuring unrestricted inlet air flow to the microturbines and optimizing the manifolding of multiple turbines all needed to be analyzed and addressed for efficient long-term operation of the system.

***Figure 5.*** *Electric Generated Savings*



## Replicability

The Distributed Energy (DE) Program selects projects that are highly replicable, or that can be duplicated in applications with characteristics similar to DE Program supported projects. According to the 2002 Economic Census , there are 3,050 NAICS 332813, Electroplating, Plating, Polishing, Anodizing and Coloring, facilities in the United States employing 61,000 workers. These facilities represent almost $2 billion in annual payroll and $5.5 billion in annual value of shipments. Electricity and fuel costs represent 14% of the total cost of materials for this industry. Over 55% of the 3,050 plating facilities can be found in the states of California (570), Illinois (256), Ohio (256), Michigan (205), Texas (153), New York (121) and Pennsylvania (116).


*Figure 6. Faith Plating's new precipitate dryer. Exhaust from the microturbines enters at left, dries the precipitate, then exits at right.*

*Figure 7. A comparison of dried precipitate using old vs. new technologies.*

Based on the results of this demonstration and case study, plating facilities appear to be good candidates for CHP. Efficient generation of both electricity and thermal energy on-site can result in significant reduction in energy use, operational cost savings, and enhanced reliability. While early design and operational issues impacted initial CHP system operation at the demonstration site, continued experience with CHP in this industry and improving technologies should enhance the value of this technology to users looking to improve their competitive position in this industry.

Several plating companies have already visited the Faith Plating facility to learn how they might obtain similar operational benefits by installing a CHP system.

*"For a small system like this, plating applications are as good as it gets."*

**Rod Hite,**
*Energy and Environmental Analysis, Inc.*

### Helpful Web Sites

- **Distributed Energy Program**
  www.eere.energy.gov/de/
- **Energy Solutions Center**
  www.energysolutionscenter.org
- **Oak Ridge National Laboratory**
  *www.ornl.gov/sci/engineering_science_technology/cooling_heating_power*
- **Faith Plating Company**
  www.bumper.com
- **Capstone Turbine Corp.**
  www.micro-chp.com

### A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

2005

### For more information contact:

EERE Information Center • 1-877-EERE-INF (1-877-337-3463) • www.eere.energy.gov