# Industrial Turbine CHP Project Fact Sheet: Food Processing

**An Evaluation Supported by DOE, Yankee Gas and ESC**

# Combustion Turbine CHP System for Food Processing Industry

## Reducing Industry's Environmental Footprint and Easing Transmission Congestion

**Based at a large Frito-Lay food processing facility, this combined heat and power (CHP) demonstration project reduces the energy costs and environmental impact of the plant while easing congestion on the constrained Northeast power grid.**

## Introduction

Food processing is a high-growth industry with tremendous potential for combined heat and power (CHP) applications because of its need for significant amounts of both electrical and thermal energy. However, utilization of CHP technology is not widespread in the food processing industry at this time.

The purpose of this project is to evaluate the design, installation, and operation of a combustion turbine CHP system at a large food processing facility. The project's evaluation is based on the impact on and benefits for the host site and the local electric grid infrastructure. The project site is in Connecticut, where CHP is being promoted as one potential solution for severe transmission congestion.

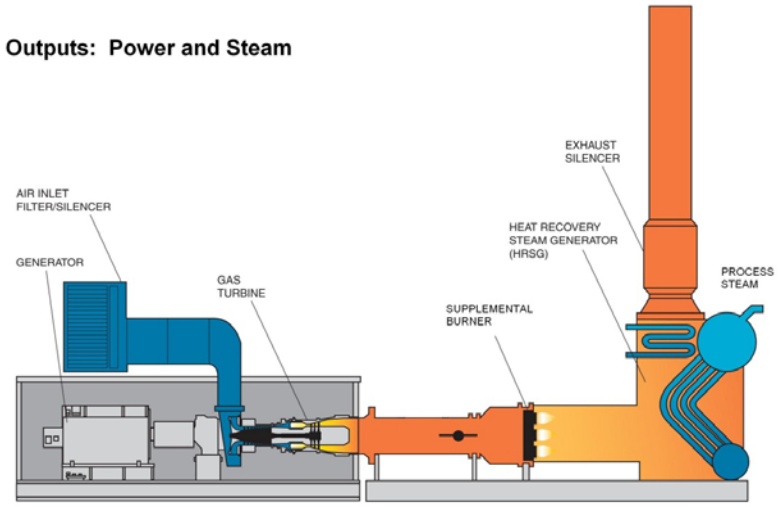


**Figure 1. Diagram of the Frito-Lay combined heat and power (CHP) system**

## Benefits for Our Industry and Our Nation

CHP systems are a proven, mature technology that can be utilized by many industrial facilities with concurrent electrical and thermal energy needs.

Benefits of more widespread utilization of CHP systems at industrial facilities, such as the Frito-Lay plant, include the following:

- Reduces energy costs
- Mitigates the strain on the local electricity grid because significant electricity is produced on-site and does not need to be delivered via the grid
- Enables continued facility operations during power shortages and blackouts
- Reduces the environmental impact of the facility.

## Applications in Our Nation's Industry

CHP systems can be utilized in a wide range of industrial facilities. Industries with high and continuous demand for both electrical and thermal energy are particularly well suited for CHP installations. Such energy-intensive industries include the following:

- Food processing
- Paper manufacturing
- Petroleum and biofuel refineries
- Chemical industry
- Metals production
- Pharmaceuticals

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## Project Description

The CHP system was installed at a Frito-Lay facility in Killingly, Connecticut. The system is based on a power island concept comprised of a 4.6 megawatt (MW) Solar Turbines Centaur 50 natural gas combustion turbine and a Rentech heat recovery steam generator equipped with supplemental duct firing. The system also includes combustion air inlet chilling to increase power generation in warm weather and a selective catalytic emission reduction system.

The Frito-Lay plant is a 275,000 square foot facility that began operation in 1988 and has over 400 employees. It processes over 250,000 pounds (lbs)per day of both corn and potatoes for snack foods. The plant operates 24 hours a day, seven days a week. Electricity and steam demand fluctuate based on production levels.

The unfired steam production from the gas turbine exhaust is approximately 24,000 lb/hour, and maximum supplementary fired steam production is as high as 60,000 lb/hour. The CHP system, designed to be electric load following, has the capacity to meet 100% of the plant's electrical power needs and is also designed to provide a majority of the facility's annual steam needs.

Performance of the system was collected over a 12-month operating period and the CHP system's energy and economic performance, its impact on plant operations and performance, and its effect on air emissions were analyzed. In addition to the system's direct emissions, its impact on displaced central station power generation emissions was also documented.

## Barriers

Despite the many economic, efficiency, and environmental benefits of CHP systems, obstacles to widespread utilization of the technology in industry still exist. Major barriers include the following:

- Need for significant upfront financial investment
- Commitment to maintaining on-site power generation
- Industries which have not traditionally utilized CHP systems, such as food processing, are seeking information on CHP economics and benefits
- The relief from recent high and volatile natural gas prices and the increase in gas supplies has not been recognized by industry

## Pathways

In the course of the project, the energy, emissions, reliability, and economic performance of the CHP system was evaluated and documented over a 12-month operating period. Data analysis was provided by the Energy Solutions Center, Inc. This information has proven valuable for understanding the role of CHP in providing economic and reliable energy services for small- and medium-sized industrial facilities. The project also documented the value of CHP in providing benefits to both the industrial facility and the local electric grid infrastructure. A case study of this installation has been completed and will be used to encourage the adoption of onsite power generation by other food processing facilities. For Frito-Lay, the CHP operation and economics exceeded their expectations.

## Milestones

July 2008: CHP system feasibility and engineering plan finished

April 2009: System commissioned on time.

May 2009: Data collection begun

May 2010: Data collection complete

Operating data shows the CHP system provided over 90% of the electrical demand and about 80% of the steam load for the facility. The performance of the CHP system continues to be excellent, with virtually no interruptions in operation and an overall CHP efficiency of 69% has been achieved.

## System Quick Facts

Location: Killingly, Connecticut
Equipment: 4.6 MW Solar Centaur 50 combustion turbine; Rentech heat recovery steam generator
Fuel: Natural gas
Use of thermal energy: Steam generation
Facility size: 275,000 sq. ft.; over 400 employees
Electricity demand: 1,500–3,770 kW
Steam demand: 12,000–90,000 lb/hr
Installation date: April 2009

## Project Partners

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