



# Sofidel Paper Manufacturing Facility Circleville, Ohio

## Two 8.0 MW Gas Turbine CHP Systems

### Background

Sofidel America Corp. (Sofidel) is the American subsidiary of the Sofidel Group, an Italian company and one of the leading manufacturers of paper for hygienic and domestic use worldwide. In October, 2018, Sofidel completed construction of a 1.8 million square foot manufacturing plant in Circleville, Ohio. The totally integrated plant includes two separate, independent, yet technology-wise identical paper producing lines. The finished products include toilet paper, paper towels, and napkins. The total production capacity of the plant is up to 140,000 tons of paper per year.

Each paper line includes its own dedicated Solar Turbines Taurus 70 natural gas fueled turbine/generator set with heat recovery. Each combined heat and power (CHP) system can produce 7.96 MW (at ISO conditions) of utility grade electric power on-site, substantially reducing the amount of electricity purchased from the local electric utility, AEP Ohio. Together, the two CHP systems (16 MW total) satisfy approximately 75% of the facility's average/normal electric needs, while providing a combined total of up to 56,000 lbs/hr of 260 psi steam for use in the plant process.

### Quick Facts

**Location:** Circleville, Ohio

**Market Sector:** Industrial, Paper Manufacturing  
**CHP Generation Capacity:** Total 16 MW (at ISO conditions)

**Prime Mover:** Two Solar Turbines Taurus 70 combustion turbines with SoLoNOx low NOx combustor

**CHP Fuel Source:** Natural gas

**CHP Heat Recovery:** Two heat recovery steam generators (HRSG), each producing 25,000 to 28,000 lbs/hr steam at 260 psi

**Total CHP Systems Cost:** \$25 M

**Estimated Incentive (AEP Ohio):** \$3.5 M over 5 yrs

**Projected Simple Payback:** 6 to 7 years

**Began Operation:**

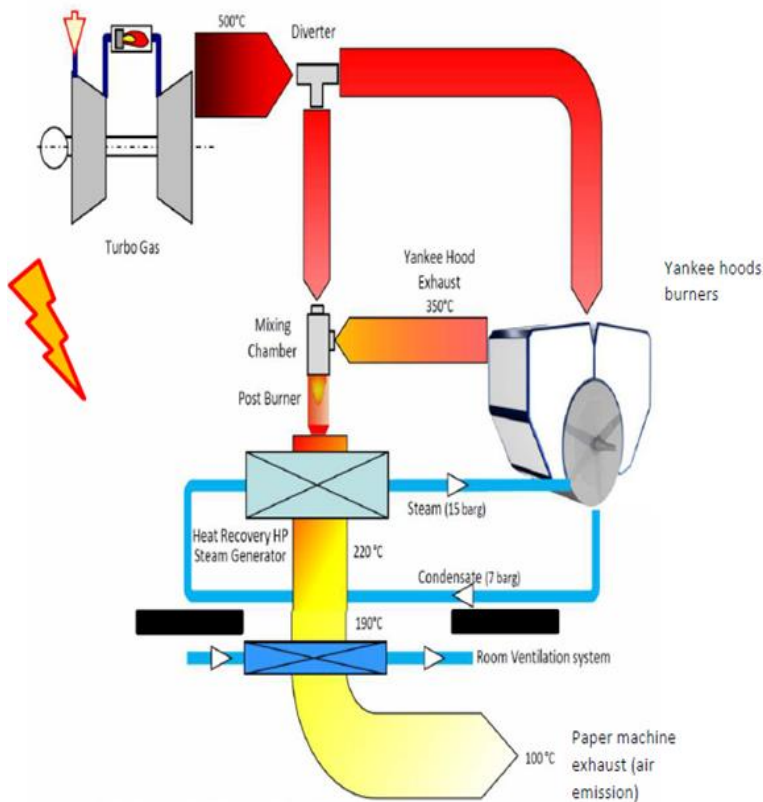
Unit 1 – October, 2018; Unit 2 – June, 2019

**Annual Emissions Saved:** 25,000 tons CO<sub>2</sub>

### Flexible Waste Heat Utilization Options

A unique feature of each of the identical CHP systems is how the exhaust heat from the turbine/generator set can be utilized to provide flexibility, efficiency, and reliability into the paper manufacturing process. Sofidel can operate each of the two CHP systems in three separate operating modes, depending on plant set-up, availability of plant equipment, and electric and thermal needs of the plant. In all three operating modes, the CHP systems provide up to 16 MW of onsite utility grade electric power.

- 1) **Integrated CHP – Paper Machine (PM) Operation:** This is the most energy efficient operation of the CHP systems, reaching total CHP system efficiencies  $\geq 75\%$ . In the Integrated CHP-PM mode, a portion of the turbine exhaust (960°F) is diverted to the paper machine hoods where the exhaust air is blown over the paper as it spins at about 6,000 ft/minute on the Yankee drum dryer system (a steam pressure vessel used to remove moisture from the paper sheet before the reel formation). The diverted exhaust air is then returned (at lower temperature and higher humidity) to the turbine exhaust stream that passes through a post exhaust burner (6 MMBtu natural gas fueled) before entering the heat recovery steam generator (HRSG). The post exhaust burner has two functions: removing impurities from the exhaust air after passing through the drying process and boosting the exhaust air temperature as required. The HRSG produces between 25,000 and 28,000 lbs/hr of steam at 260 psi which is fed into the steam headers, providing the process steam utilized throughout the plant. In this mode of operation, the recovered heat from the turbines provides approximately 85% of the thermal energy needs of the plant (depending on paper production).



Flow Diagram, CHP/Paper Machine  
(Source: Sofidel America Group)

2) **Standard CHP Operation:** In this mode of operation, none of the turbine exhaust is diverted to the paper machine hoods. The turbine exhaust goes directly to the HRSG and is converted to 260 psi steam that is injected into the steam headers providing process steam to the plant. In this mode of operation, the CHP system provides approximately 50% of the thermal energy needs of the plant.

3) **Turbine – PM Operation (HRSG in Maintenance):** This mode of operation is utilized if the HRSG is inoperative for whatever reason. The turbine-generator is still operating, providing the electrical power required by the facility and a portion of the turbine exhaust can be diverted to the paper machine hoods for the drying process. Since the HRSG is inoperative, the exhaust air returned from the paper machine hoods is exhausted to the atmosphere. This is the least efficient mode of operation of the CHP system since it utilizes the least amount of waste heat, but it does allow the facility to continue to generate onsite approximately 75% of its electric power requirements.

Finally, each CHP system includes a separate 46 MMBtu/hr packaged boiler, which together can produce the total steam requirements of the plant should either of the turbines or HRSGs be inoperative for whatever reason.

## Project Economics

The total cost of the 1.8 million square foot totally integrated plant is approximately \$400 million and the plant employs roughly 350 people. The estimated installed cost of the two complete CHP systems is approximately \$25 million. Sofidel, in partnership with its local electric utility (AEP Ohio), submitted a joint application to the Public Utility Commission of Ohio (PUCO), seeking approval to allow the energy efficiency benefits from the CHP systems to

“The Circleville, Ohio plant is one of Sofidel’s most technologically and environmentally advanced tissue paper manufacturing plants in the world, with innovative machinery and a CHP system that increases both the quality of its products and the energy efficiency of its operations”

*Antonio Cuccarese, Technical Machinery Manager, Sofidel America Corp.*

be credited to AEP Ohio’s energy efficiency state requirements. In exchange for the commitment of the CHP energy benefits, Sofidel would receive annual incentive payments over the first 5 years of CHP operation, based on both achieving the annual operating efficiency goals and the net kWh generated.

The PUCO approved the application, and although the actual total incentives will depend on how the CHP systems are operated, their operating performance, and actual energy costs, AEP has estimated the total incentives to Sofidel over the 5 year period to reach approximately \$3.5 Million. With the incentives, Sofidel estimates a simple payback on the CHP investment of 6 to 7 years.

## For More Information

U.S. DOE MIDWEST CHP Technical Assistance Partnership  
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