

HVAC/R ENGINEERING

# profile

## Tri-fuel Chiller Plant Delivers Significant Energy Savings to Owners of New York City's Time & Life Building



***New York City's Time & Life Building features a unique tri-fuel chiller plant that uses electric-, steam- and natural gas-powered chillers to meet cooling demands and achieve energy savings.***

*Photo courtesy of the Rockefeller Group*

When the Time & Life Building opened its doors in 1959, steam-turbine-drive chillers provided cooling for the 48-story building at 1271 Avenue of the Americas. An electric-drive chiller was added in the mid '80s to supply additional cooling and introduce an alternative-fuel option. Today, the building boasts a one-of-a-kind tri-fuel plant that uses electric-, steam- and natural gas-powered chillers to meet increased cooling demands and achieve substantial savings in energy costs. It also provides energy redundancy, something that has become critical in California and other parts of the country.

Owned and managed by the Rockefeller Group Development Corporation, the Time & Life Building is one of four the group owns and/or manages along the western corridor of Rockefeller Center on the Avenue of the Americas. Its primary tenant, Time, Inc., occupies 1.6 of the building's 1.9 million square feet and generates enough heat to require cooling 7 days a week, 365 days a year.

"Time has always been a high-tech organization," says William K. Stoddard, vice president of projects and engineering at the Rockefeller Group. "Computer rooms, photo labs and systems unique to the publishing industry create a demand for constant cooling. As demand increased, we recognized the need to replace the building's original chiller plant with a system capable of supporting current as well as future demands, while taking advantage of deregulation and the day-to-day pricing of different fuels."

Stoddard enlisted the services of Atkinson Koven Feinberg Engineers LLP (AKF) to help design the plant. "The Rockefeller Group charged us with designing a new, energy-efficient refrigeration plant that offered the quality and reliability demanded by a 24-hour operation," recalled John Farrell, partner at AKF.

 **YORK**<sup>®</sup>  
INTERNATIONAL

---

## Tri-fuel Approach Takes Advantage of Low Rates

AKF considered a number of options before selecting a unique design that incorporates equipment powered by electricity, steam and natural gas. “We saw what was happening in the energy market,” says Farrell. “Electric rates in Manhattan have increased dramatically during peak usage. We wanted the owners of the Time & Life Building to be in a good position to take advantage of lower natural-gas rates during peak electric-demand periods and reduce dependency on the electric grid.”

Excited about the concept of a tri-fuel system, both Farrell and Stoddard were, at the same time, grounded in the challenges of turning design into reality. “First,” Farrell explains, “we were attempting to do something that had never been accomplished in a New York City high-rise, or anywhere else, for that matter. Second, we were working within an existing structure, locked into dimensions and configurations that would shape our design. Finally, we needed to find a manufacturer with equipment that suited our design.”

James Haviaris, vice president of operations at the Rockefeller Group, participated in the equipment-selection process. “We toured a number of equipment manufacturers, seeing and touching the equipment, giving careful consideration to quality, size, ease of installation, service history and cost,” says Haviaris. “A tour of the YORK plant was most impressive, both from an operations and a personnel standpoint. Quality-assurance issues and automation struck a positive chord with us, and the engineering background of the YORK sales staff gave us a comfort level that eventually helped sell the product.”

Farrell agrees, adding, “YORK’s ability to furnish Caterpillar’s gas-engine technology as part of the package certainly influenced the decision to go with YORK. The concept of using a gas engine to drive a compressor or pump has been successfully applied in the oil industry for years. Therefore, we were confident that a YORK chiller equipped with a Caterpillar engine would produce the required refrigeration capacity and overcome any resistance in the exhaust piping.”

## YORK Chillers Offer Three Fuel Sources

The Rockefeller Group selected four YORK chillers for the Time & Life Building’s tri-fuel plant, including one 2100-TR electric-drive chiller, one 1500-TR steam-turbine-drive chiller, and two 1850-TR gas-engine-drive chillers. In addition, YORK provided one of the gas-engine-drive chillers with an 1850-TR electric-motor-drive parallel driveline, allowing operators to switch between gas and electric energy sources, depending on which source is most economical at a given time. In addition, the second gas-engine-drive chiller has provisions made for a parallel electric-motor driveline to be added in the future, if desired. The plant also features YorkTalk communication interfaces, linking the chillers to the facility’s existing Johnson Controls building-automation system.

According to Farrell, “The system is designed to run any combination of chillers, simultaneously or stand-alone, depending on cooling demands and utility rates. In the summer, when cooling demands and electric rates are highest, the two gas-engine-drive chillers are the lead chillers. During the winter, when cooling demands are low, we can select a lead chiller based on the most economical fuel source. We have the additional option of free cooling in the winter, relying on heat exchangers to cool the building using condenser water. The only expense we incur in this process is the cost of pumping water through the pipes.”

The Rockefeller Group awarded Fresh Meadow Mechanical Corporation responsibility for installation of the plant. Although the building’s original system was split between the 47th floor and the basement, plans for the new system called for a single plant located in the basement. “Phase One of the installation process began in October 1998,” says Michael Russo, executive vice president with Fresh Meadow. “We installed the heat exchangers and piping, relocated pumps and equipment and upgraded electrical service throughout the winter. Phase Two began the following October. We took advantage of winter’s lighter cooling loads and ran the cooling needs of the entire building from the upper plant. Meanwhile, we demolished and rebuilt the downstairs plant, relocating pipes, knocking out walls and moving equipment around to accommodate the new, larger plant. By April, most of our work was completed.”

## Exhaust Stack Vents Emissions 900 Feet to Roof

In addition to constraints imposed by the existing structure, the creation of an exhaust system challenged engineers and the mechanical contractor. "We were required to vent the exhaust from the natural-gas engines to the roof, 900 feet above the plant," explains Russo. An obsolete fire shaft, originally intended to draw smoke out of the building, provided a venting shaft from the fourth floor to the roof.

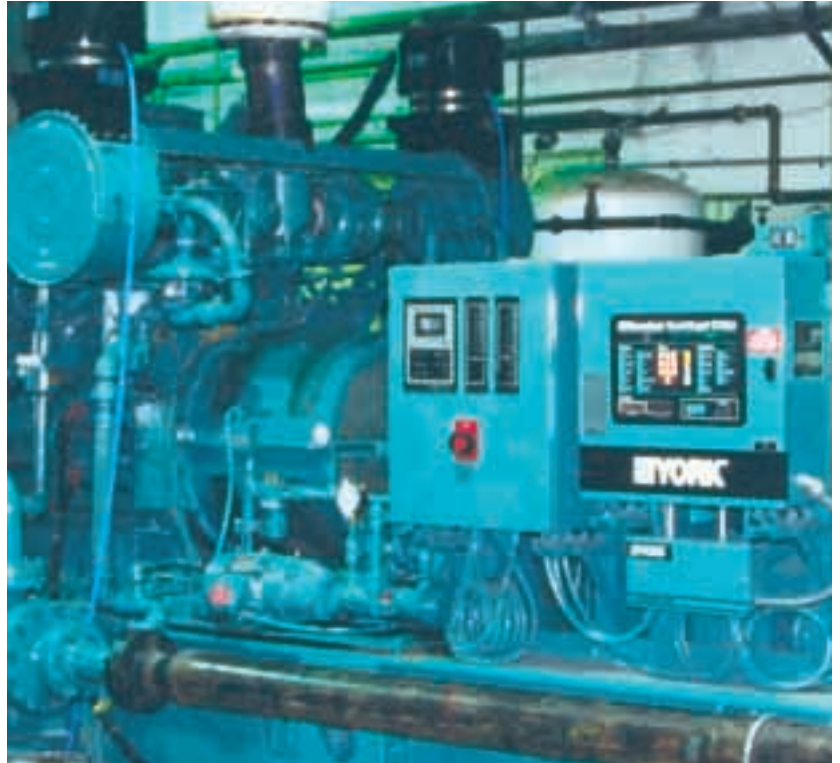
Engineers ran an exhaust pipe from each gas-engine-drive chiller, 300 feet across the basement and up to the fourth floor where the pipes joined in the fire shaft. Russo adds, "We lined the shaft with a 24-inch-diameter pipe. A stiff-leg derrick on the roof of the building lifted twelve 70-foot sections of pipe and lowered them down the shaft to form the exhaust stack. Because the exhaust pipe grows an additional 32 inches when fully heated, we installed pipe guides that accommodate horizontal growth in the basement and vertical growth in the fire shaft."

Haviaris worked closely with Russo's team to guarantee the project ran smoothly and resulted in few distractions for building tenants. "We scheduled just two shutdowns throughout the installation process," notes Haviaris, "and made sure we took full advantage of that limited window of opportunity. I thought that was pretty remarkable for a project of this scope."

## Estimated Savings on Target

The first chiller came on line March 2000, and the plant was fully operational in July. Already, the project is paying dividends. "We projected savings of \$750,000 per year in energy costs," reports Stoddard. "Initial results suggest our estimates are on target. In fact, they may be on the conservative side. During the worst weeks of the summer, we were able to run the two gas-engine-drive chillers, avoiding peak-demand electric and steam rates, and more than justifying the investment in the natural-gas component of the plant."

Improved equipment efficiencies also produce savings for the Rockefeller Group. The new steam-turbine-drive chiller consumes just 9.9 pounds of steam per TR-hr, compared to 15 pounds per TR-hr consumed by the two original steam-turbine-drive chillers.



**YORK supplied two, 1850-TR, gas-engine-drive chillers as part of the building's tri-fuel plant. One chiller is equipped with an electric-motor-drive parallel driveline that allows operators to switch between gas and electric energy sources.**

*Photo: AKF Engineers*



**The 0.60 kW/TR efficiency rating of the new 2100-TR electric-drive chiller (left) from YORK significantly improves upon the 0.76 kW/TR rating of the original electric-drive chiller.**

*Photo: AKF Engineers*

**A YORK 1500-TR steam-turbine-drive chiller (not pictured) completes the Time & Life Building's tri-fuel plant and consumes just 9.9 pounds per TR-hr.**

Similarly, the new electric-drive chiller, with a performance of 0.60 kW/TR, significantly improves upon the 0.76 kW/TR efficiency rating of the original electric chiller. "By adding two gas-engine-drive chillers, each with an impressive 1.8 coefficient of performance, along with plate heat exchangers for winter free-cooling," says Stoddard, "we have designed a plant capable of increasing overall performance efficiencies by 40 to 50 percent."

Is the Rockefeller Group pleased with the plant? "You bet we are," says Haviaris. "We're conserving energy with a system that is easy to

operate and allows us to play the energy market. What's more, the plant supplies enough cooling capacity to carry the building on just three of the four machines, reserving the fourth machine as a spare or as a source of additional cooling. We have the extra capacity to grow with the needs of our tenants."

"This project raises the bar for everyone," Farrell adds, "and demonstrates to owners, system designers, mechanical contractors and manufacturers that a tri-fuel plant does indeed deliver significant savings in energy costs and fuel consumption."

## Time & Life Building Tri-Fuel Chiller Plant

	ORIGINAL PLANT	NEW PLANT
Steam-chiller efficiency	15 lbs / TR-hr	9.9 lbs / TR-hr
Electric-chiller efficiency	0.76 kW / TR	0.60 kW / TR
Gas-chiller efficiency	N/A	1.8 COP

