

IN A MANHATTAN Heat Wave

Steam Often Brings Relief

ON A HOT SUMMER AFTERNOON, one can enjoy a panoramic view of Manhattan and hundreds of its spectacular buildings while sipping a cool drink in the Rainbow Room atop Rockefeller Center. The temperature outside may approach 100 degrees, but it remains cool in the Rainbow Room and in offices

throughout Manhattan. How do these offices and the people who work in them keep cool? With steam, of course – enough steam to offset the power that would be produced from a 375-megawatt electric power plant.

Consolidated Edison Company of New York, Inc., New York City's electric, gas, and steam utility, has the necessary steam (and then some) to drive the Dresser-Rand steam turbines that power the chillers manufactured by Johnson Controls, and other major air conditioning manufacturers. And if the major players using steam have their way, they could increase that amount by another 50 percent or more.

Manhattan has had steam piped to its buildings for more than 125 years, originally for heat and hot water. Con Edison bought the steam system in 1936 and by the 1940s air conditioning had become an additional product. Today, Con Edison's total steam sendout is more than 25 billion pounds a year, with half of it coming from cogeneration in its steam-electric power plants. "We have 370 customers using steam for cooling, most of them in mid-town and lower Manhattan," said Patrick Wheeler, department manager for business services and operations planning for Con Edison.

Con Edison Steam is the largest district steam system in the United States. The next nine largest steam districts total less than the 25 billion pounds that Con Edison produces.

Con Edison Steam's customers include historic buildings such as Rockefeller Center, Empire State Building, MetLife, and others. Dresser-Rand, through its recently acquired Murray line of steam turbines three years ago, is the dominant steam turbine provider. More than 500 have been installed since the 1940s and currently there are about 300 in operation,

according to Doug Martin, general manager of Dresser-Rand's steam turbine operation in Burlington, Iowa.

Dresser-Rand is also a leading steam turbine provider for air conditioning and cogeneration plants on university campuses throughout the United States and at many process industrial sites.

Generally, the steam turbines installed in Manhattan are in the 1,000 to 3,000 horsepower range, Martin explained. "Our typical client is the company that provides the entire package. We sell to York or Carrier and some others."

According to Martin, the systems work like this: Steam enters through the front of the turbine at 125 pounds of pressure and drops to a condensing pressure below atmospheric pressure of 14.7 pounds. "We take it down to two pounds absolute pressure or 12.5 pounds below atmospheric pressure. For reference, a household vacuum cleaner operates at only one pound below atmospheric pressure." The turbine drives the compressor, usually at 4,500 rpm, compressing Freon into the condenser, expanding it in the evaporator and in the process chilling water to 40 degrees. The chilled water is circulated throughout the building.

Con Edison provides steam heat for about 1,800 customers extending from Battery Park north to 96th Street on the west side and 89th street on the east side of Manhattan. For distribution to buildings, the temperature is 413 degrees at 200 psig. Total capacity is 13.0 million pounds an hour (Mlbs/hr), and its forecasted 2007/2008 peak load is 10.5 Mlbs/hr. Of those 1,800 customers, 370 use steam for air conditioning. This represents 625,000 tons of installed steam cooling capacity, according to Wheeler. "This frees up 375 megawatts of electric power," he added.

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“Steam heating is used in nearly 90 percent of major commercial buildings (greater than 250,000 square feet) within reach of the 105 miles of steam mains,” he said.

Because more than half the steam available is cogenerated in Con Edison’s existing power plants, it is ecologically sound, he explained. Steam-powered air conditioning also fits in nicely with the city’s recently renewed effort for a “greener” Manhattan. Con Edison is particularly interested in curtailing demand on its electric grid, especially during the summer months.

Steam for heating is more competitive in price to install and operate in new and existing buildings than other heating equipment. But that is not always the case for steam cooling. Steam equipment for cooling is presumed to be more costly to install than air-conditioning driven by electric motors, however, the benefits of steam cooling vary depending on the client’s situation. As a consequence, buildings being constructed or renovated may not have given steam-driven air conditioning enough consideration.

“Year in and year out we sell additional units. Now, a lot of the market demand is for more efficient replacement units.” ‘Old’ in the steam turbine industry is in the 30- to 40-year range. “Some units sold in the 1950s are still operating. We had a huge boom in the mid-1990s driven by a Con Edison electric demand side management rebate program and typically involving replacement of older, inefficient turbines,” Martin explained.

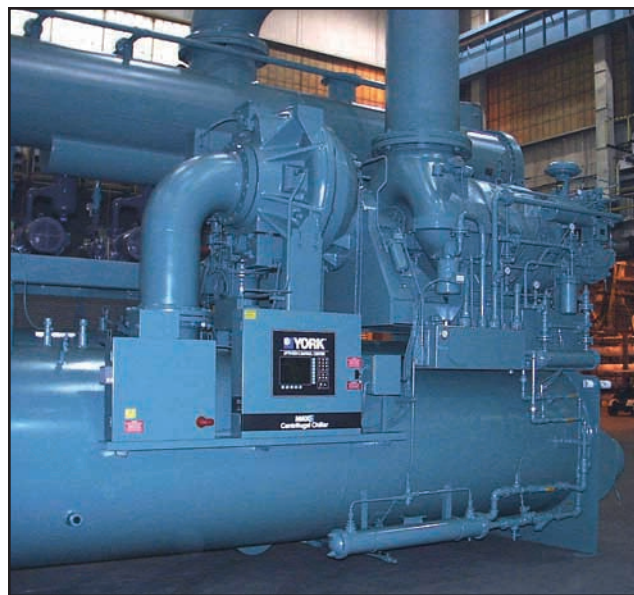
The utility was able to sell more building developers on steam in the 1980s and 1990s, according to George Gerritsen, project specialist with Con Edison. “Rebates from us and the state off-

set capital costs,” he said. But that was before the United States deregulated the electric power industry. “There have been no new steam chillers of significant size in at least five years because of capital and installation costs.”

Steam turbine air conditioning requires a surface condenser and a bigger cooling tower. However, it expands the operating window for “free cooling” and lessens a building’s electrical infrastructure requirements.

Incentives from New York State and Con Edison help defray setup costs. “With the current incentive levels,” Gerritsen said, “we can get a five-year payback on the additional cost of installing steam cooling, and in some circumstances we have shown three-year paybacks could be achieved.”

Con Edison is working with existing buildings using electric-driven air conditioning that are nearing the end of their operating life expectancy, Wheeler said. “It’s hybrid cooling,” he explained. “We’ve made proposals to steam heating customers currently using electric cooling. We’re offering a steam hybrid configuration. If they’re currently using three chillers, we’re proposing they make one of the chillers a steam turbine. They can use the steam chillers on the hottest days and shave their peak load. We’re approaching electric demand side management from an electric/steam hybrid peaking system perspective.”



Johnson Controls’ chiller drive packaged with D-R model K steam turbine (upper right).

“Steam cooling and hybrid operations free up electrical capacity for other purposes in the building,” Wheeler explained. “What we’re seeing now is an increase in electric growth usage because of computers and other electronics.”

Early in May 2007, Con Edison filed an electric rate petition with the New York Public Service Commission to expand its demand side management program and cover everything from light bulbs to steam turbine air conditioning.

Dresser-Rand’s Martin said his company would be able to meet renewed demand as a result of a program such as the one petitioned for by Con Edison to the Public Service Commission. “We experienced the results of a rebate program in the 1990s. We’re definitely interested in this one. We were able to meet the market demand then and we’re able to meet it now.”

So the next time New York has a heat wave, remember — it’s probably steam that’s cooling the town. ■