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The retrofit of the air-conditioning system in a large corporate headquarters building with the installation of the New York Metropolitan area's largest ice-storage-based system delivers dramatic energy savings.

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Two years ago, the investment firm of Morgan Stanley decided to renovate its large corporate office building in the town of Purchase in New York's Westchester County. A major part of this renovation was an upgrade of this financial services company's air-conditioning system. Aging equipment and the need for additional cooling capacity and site resiliency motivated us to investigate environmentally responsible solutions, explains James P. McAleer, vice president of facilities for Morgan Stanley.

sidebar

How a Chiller-Based System Works

Specifically, Morgan Stanley wanted its facility in general and its air-conditioning system in particular to:

- Be environmentally conscious
- Substantially reduce energy costs
- Reduce overall operating costs
- Add redundancy and flexibility
- Protect the company's mission-critical areas
- Qualify for rebates

To accomplish this, Morgan Stanley selected the energy services group of Trane's New York New Jersey offices to put together a team that included ECM Energy Services of Boston, CALMAC Manufacturing Corp. of Englewood, NJ, and the New York State Energy Research and Development Authority (NYSERDA). Trane was responsible from Day 1 for conceptual analysis, financial analysis, final design, installation, commissioning, and ongoing services.



Morgan Stanley had a 17-year-old air-conditioning system in place, recalls Scott Lewin, project manager for Trane. Our team's job was to upgrade the system and transform the aging infrastructure, bring it up to date, add needed greater capacity, and also add innovation to deliver cooling that would make the facility more efficient for Morgan Stanley operations.

The existing Morgan Stanley system consisted of a 1,000-ton gas absorber that we replaced with a 1,400-ton Trane chiller, and two smaller units, which we retained. The 1,400-ton Trane Earthwise CenTraVac chiller operates at 0.576 kilowatts per ton in day mode and at 733 kilowatts per ton in ice-making mode. The ice made by this chiller is stored in 48 CALMAC IceBank tanks with a total storage capacity of 9,000 ton-hours. Our replacement ice storage

system makes ice at night during off-peak hours to provide cooling the next day during peak hours. The system is designed to lower the facility's peak energy usage by 740 kilowatts, reduce its overall electric usage by 900,000 kilowatt-hours, and reduce its overall fuel consumption by 15,000 MMBtus—and in the process also improve the resiliency of the site.

Not only did this expand the Morgan Stanley facility's immediate cooling capacity, but it also enhanced the air cooling of the facility's mission-critical systems, most notably the trading floor. We added a separate plate frame exchanger into their dry cooler loop so that their critical systems have a backup, Lewin explains. If the chiller and the cooling system for the mission-critical loads ever fail, the ice or the chiller can be used to immediately back up that system. If they lose power, or if the dry coolers on the roof are disabled for any reason and the cooling system for their critical loads ever fails, the system can immediately back up all their mission-critical areas—including their computer room or telecommunications room—with ice even though they can't run the chiller.

The system also extends Morgan Stanley's free-cooling season, since it can use the ice just for cooling mission-critical areas in the months when it is not needed for comfort cooling. During this additional period, then, the company won't have to run compressors or the fans on the dry coolers. The system has the flexibility to run with the chiller only, with ice only, or with a combined operation. There is also an emergency mode that can provide comfort cooling while ice is being made in the evening.


The team did not have to make any changes to the air side of the air-conditioning system already in place at the Morgan Stanley facility. There was no need to go to the expense of replacing any air handlers or fans. One of the enhancements of ice is that when ice is used on top of the chiller, the chilled water temperature can be lowered a degree or two. Trane has done studies that show a reduction of as much as 10% in system kilowatts when the supply air temperatures drop. Thus, if a low-flow, low-temperature system is fully applied by reducing the temperatures of the air leaving the building air handling units, significant savings could result.

Moreover, these impressive energy savings are not the only benefits of the new system, points out David Pospisil, Trane's manager of strategic sales. For example, the environmental benefits are equivalent to Morgan Stanley planting 1.5 million acres of trees to absorb the carbon monoxide caused by the electrical usage from one year of usage or by removing 271 cars from Westchester County roads. Moreover, thermal storage systems improve the reliability of the electric grid by permanently shifting peak cooling loads from on-peak to off-peak.



Pospisil also emphasizes that while the Morgan Stanley system is certainly impressive, its development was not an R&D project in the usual sense. The system uses a standard Trane chiller with one of our largest compressors, he says. The strength of the Trane Energy Services Group is not so much in designing new equipment; rather it is putting together existing components and configuring a system that works best for a specific customer's facility needs. Thus, no R&D of any specific component was needed to develop the Morgan Stanley facility. The real task was to put together a knowledge-based system that we know will work at the levels specified.

Lewin amplified on this, describing the design process as follows. We spent about six months working with Morgan Stanley to understand how they operate, to understand the economics, and to tweak the design to make sure that what we would deliver would best meet their current and future application and needs. You can do a lot of different things with thermal storage, so we were able to design into our system at Morgan Stanley a great deal of flexibility to meet their needs. They can run just the chiller if they want to. They can run just the ice if they want to. They can run a little bit of ice and a lot of chiller, or they can run a lot of ice and just a little bit of chiller. We made it this flexible because that's what they needed.

That's the type of engineering that goes into projects like this:  Getting an in-depth level of understanding of how the facility of a client like Morgan Stanley operates and determining what their current and future needs are enabled us to maximize their long-term benefits. We work with modeling software that ECM has designed and updates for Trane. We use it to run simulations to help us understand the cause and effect of what we are planning so we know how the system we are configuring will work.

And the system is working quite well, Pospisil says. It has been up and delivering the promised benefits since May 2006. And two months later, on June 27, the New York State

Energy Research and Development Authority presented Morgan Stanley with a ceremonial incentive check in the amount of \$314,000. (NYSERDA provides technical and financial assistance to businesses that reduce their energy costs and improve the reliability of the state's electrical grid—especially in the New York metropolitan area, where peak demand reductions have an impact.)

In making the presentation, Peter R. Smith, president and chief executive officer of NYSERDA, said, "NYSERDA offers financial and technical assistance initiatives to help with identifying and installing projects which address the energy efficiency needs of our partners in a way that improves the environment and lessens our dependence on foreign oil. Morgan Stanley took the initiative to form a partnership with NYSERDA, Trane, and CALMAC, and an innovative solution to tackle the company's energy needs through the use of an ice storage system was developed.

And Morgan Stanley's McAleer expressed great satisfaction with the facility's upgraded air-conditioning system and predicted that "the Purchase site will be a beta for similar projects at Morgan Stanley facilities around the globe.



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