TISHMAN SPEYER

OPERATIONAL EXCELLENCE

Combining innovative technology with efficient operations at 520 Madison Avenue, 11 West 42nd Street and Beverly Hills Portfolio.

407 N. Maple

TISHMAN SPEYER

OVERVIEW

Tishman Speyer aims to achieve operational excellence across its properties, utilizing the latest technology to support this. While there are shared aspirations across buildings, each is unique. Tishman Speyer regularly assesses the mechanical equipment and operating routines of its properties to determine the best solution for each one.

Here we review the operation of Tishman Speyer assets at three key locations and demonstrate the application of different types of technology.

520 MADISON AVENUE

The emphasis at 520 Madison Avenue has been on capital investment to improve the plant room. This has included an ice storage system to shift peak demand, and the addition of sensors and controls throughout the building to enhance the sophistication of operations. These changes have enabled more efficient operation and resulted in significant energy savings. Other initiatives have driven reductions in energy, water and waste, and further greening the building's cleaning program.

520 Madison Avenue has been certified LEED® (Leadership in Energy & Environmental Design) Silver Existing Buildings since 2008.

11 WEST 42ND STREET

Always at the cutting edge of technological development, 11 West 42nd Street was one of the first commercial buildings in New York City to install a cogeneration system. A series of upgrades to the 6 MWe system, along with the addition of various sensors and controls, means as much waste heat as possible is utilized to meet building heating and cooling demands.

BEVERLY HILLS PORTFOLIO

Technology-driven solutions within our Beverly Hills portfolio (Maple Plaza, 407 North Maple, Beverly Place), have focused on reconfiguring the aging heating ventilation and air conditioning (HVAC) system to a variable refrigerant flow (VRF) system. Operational practices have been improved with an emphasis on efficiency. The new smart system enables better energy monitoring and the ability to recoup costs from tenants.

In 2016, Maple Plaza won the Building Owners and Managers Association (BOMA) Outstanding Building of the Year (TOBY) award.

5
BUILDINGS

3
HEATING/COOLING STRATEGIES

AWARD WINNING

TECHNOLOGY

Tishman Speyer has a multi-year capital plan in place for each building to guarantee that it remains a leader in premier office space worldwide. The capital improvements detailed here cover a range of categories, but there are clear cross-cutting themes across the three buildings. At the same time, capital improvements are considered on a building by building basis to ensure each individual building's operations are optimized.

HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

Improvements to the HVAC system are the heart of building operations and fundamental to occupant thermal comfort. Examples of the technologies used in the portfolio of buildings include:

- An ice storage system
- State-of-the-art chillers
- Cogeneration and trigeneration schemes
- Variable refrigerant flow (VRF) for both heating and cooling
- Cooling tower replacement

SENSORS, CONTROLS AND BUILDING MANAGEMENT SYSTEMS

Intelligent building management is necessary if efficiencies are to be optimized. Tishman Speyer has introduced several measures:

- Sensors to measure a range of key operating parameters
- Variable frequency drives on all applicable mechanical equipment
- State-of-the-art Schneider Building Management Systems
- Cutting-edge Energy Monitoring Systems (EMS) linked directly to Energy Star rating system
- Cloud-based HVAC control systems to enable tenants to program after-hour requests

TENANT SPACE

User experience is a key sustainability goal for Tishman Speyer and measures seek to enhance tenant space. Initiatives have included:

- Maximizing daylight harvesting, and installing shading systems to minimize solar gain.
- Retrofitting LED lighting to save energy.
- Improving building performance through window replacement or tinting programs.
- Installing destination dispatch elevators to improve wait and travel times for occupants, or refurbishing elevator cabs.
- Introducing sub-metering on a tenant-by-tenant basis.
- Upgrading to water-efficient flush and flow fixtures.
- Encouraging alternative transport such as electric vehicles and active travel modes such as bicycle use.

OPERATION

The value of installing new technology can only be realized through meticulous attention during operation. Tishman Speyer's operations teams play a key role in ensuring that buildings run efficiently, as well as engaging with tenants and local communities.

OPERATIONAL EFFICIENCY

Capital improvements coupled with the underlying sensors, controls and Building Management System (BMS) allow operators to run the plant as efficiently as possible to meet tenant needs, and reduce energy consumption and carbon emissions.

520 Madison: Use of the ice storage tanks shifts 8 GWh of cooling capacity from peak daytime hours to off-peak night-time hours. This reduces strain on the grid and enables Tishman Speyer to benefit from cheaper off-peak electricity rates as well as take advantage of utility incentives.

11 West 42nd Street: New sensors, controls and Building Management System have allowed for an increase in waste heat utilization for both heating and cooling. This along with other measures has resulted in a 30% energy saving.

Beverly Hills portfolio: Utilizing a variable refrigerant flow system is expected to yield savings greater than 50% as compared to a traditional system.

PEOPLE

Tishman Speyer invests in staff education and training, regularly running seminars on green building practices, code compliance, disaster preparedness, as well as various other training sessions including LEED® (Leadership in Energy & Environmental Design) and Building Owners and Managers Association (BOMA) certification. Tishman Speyer has a dedicated team of specialists who are highly experienced in building operations.

COMMUNITY ENGAGEMENT

Tishman Speyer participates in many regular events to help enhance community connectivity, such as the Health and Sustainability Fair, Earth Day and the City Harvest/Westside Food Bank drive, as well as running an annual coat drive, toy drive and blood donation drive. In addition, Tishman Speyer hosts cultural events such as musical performances and art exhibitions, including an annual children's art show.

TISHMAN SPEYER

TECHNICAL INSIGHTS

520 Madison Avenue, New York

The installation of a 31-tank ice storage system at 520 Madison has curtailed peak energy demand, reducing strain on the power grid and delivering significant cost and carbon savings. Smart sequencing is maximizing gains.

THE BUILDING

520 Madison Avenue is one of the most prestigious business addresses in New York City. Located on Madison Avenue between 53rd and 54th Streets in the Plaza District of Midtown Manhattan, it is a 43-story office high-rise.

Building amenities include two first-class restaurants, a sundry shop, a barbershop, immediate access to multiple subway lines, an outdoor plaza, paddle tennis court and a dynamic art program that includes a segment of the Berlin Wall permanently on display.

MINIMIZING PAYBACK PERIOD

Recent years have seen an almost complete replacement of building-wide HVAC equipment, as well as the introduction of new cutting-edge technologies. These investment programs have resulted in significant energy savings with low payback periods. In addition, 520 Madison has taken advantage of utility incentives from Con Edison to minimize capital outlay.

MAIN PLANT UPGRADES

The main plant room was completely gutted and rebuilt during 2016 to optimize the use of space. This included the following:

- Installing a 31-tank ice storage system totaling 6,200-ton hours (22,000 kWh) per day
- Installing two new state-of-the-art electric chillers, each 1,100-ton (3,900 kW)
- Replacing all pumps
- Replacing the steam condensate heat recovery unit

SENSORS, CONTROLS AND THE BUILDING MANAGEMENT SYSTEM

Sensors and controls have been installed in over 70% of the building's heating, cooling and ventilation equipment to enable efficient operation of equipment, including installation of the following:

- Sensors such as outdoor air temperature, mixed air, static pressure, differential pressure and enthalpy
- The old pneumatic controls system has been replaced with a digital monitoring system
- Combined sensor and control units, such as Belimo energy valves fitted on chilled water lines
- Variable frequency drives have been fitted to all pumps, chillers, fans and compressors
- State-of-the-art Schneider StruxureWare™ Building Management System
- Outdoor air and return air dampers

OTHER MEASURES

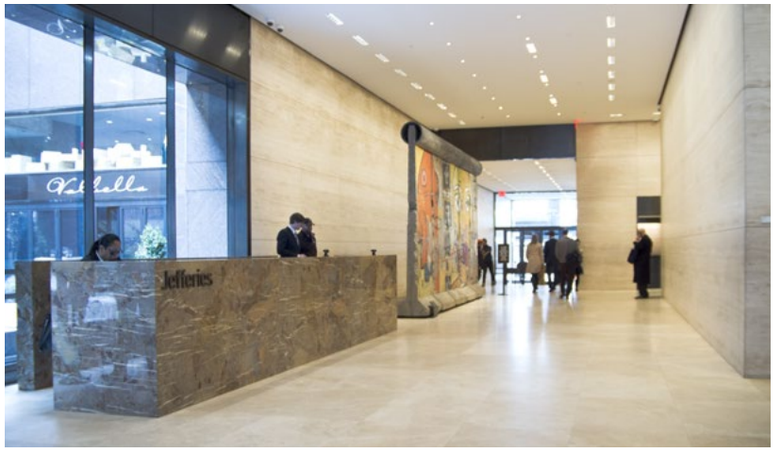
Additional measures include the installation of destination dispatch elevators, LED lighting and sub-metering.

PLANNED FUTURE IMPROVEMENTS

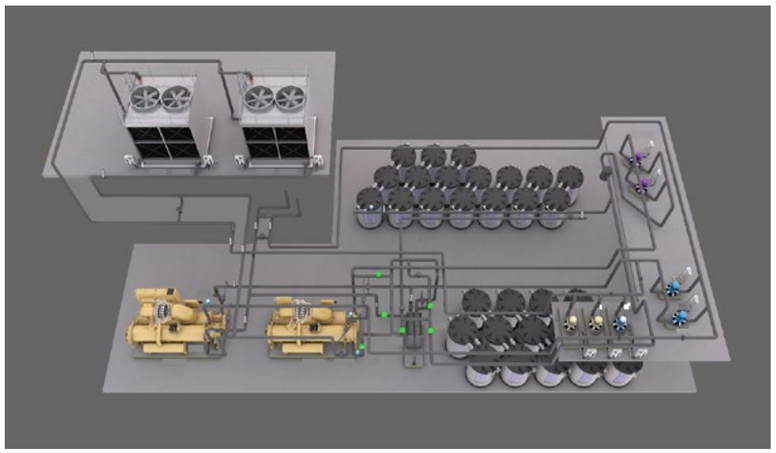
520 Madison is also looking to the future. This will include continued plans to switch from pneumatic to electric controls, installation of a state-of-the-art hot water heater, retrofitting turning vanes in ductwork to reduce head loss, and continued LED lighting retrofits.

BUILDING FACTS

Location: New York City
Use: Commercial (including financial centre)
Sq. ft.: 1,050,000
Owned since: 1982
LEED® EB Silver



Lobby with segment of Berlin Wall on permanent display



BMS schematic of main cooling plant

520 Madison Avenue, New York

The capital improvements undertaken have ensured that 520 Madison has the most appropriate technologies to meet tenant needs as efficiently as possible. The addition of sensors, controls and the Building Management System have enabled the operations team to save energy and money, without compromising space temperature requirements and tenant comfort.

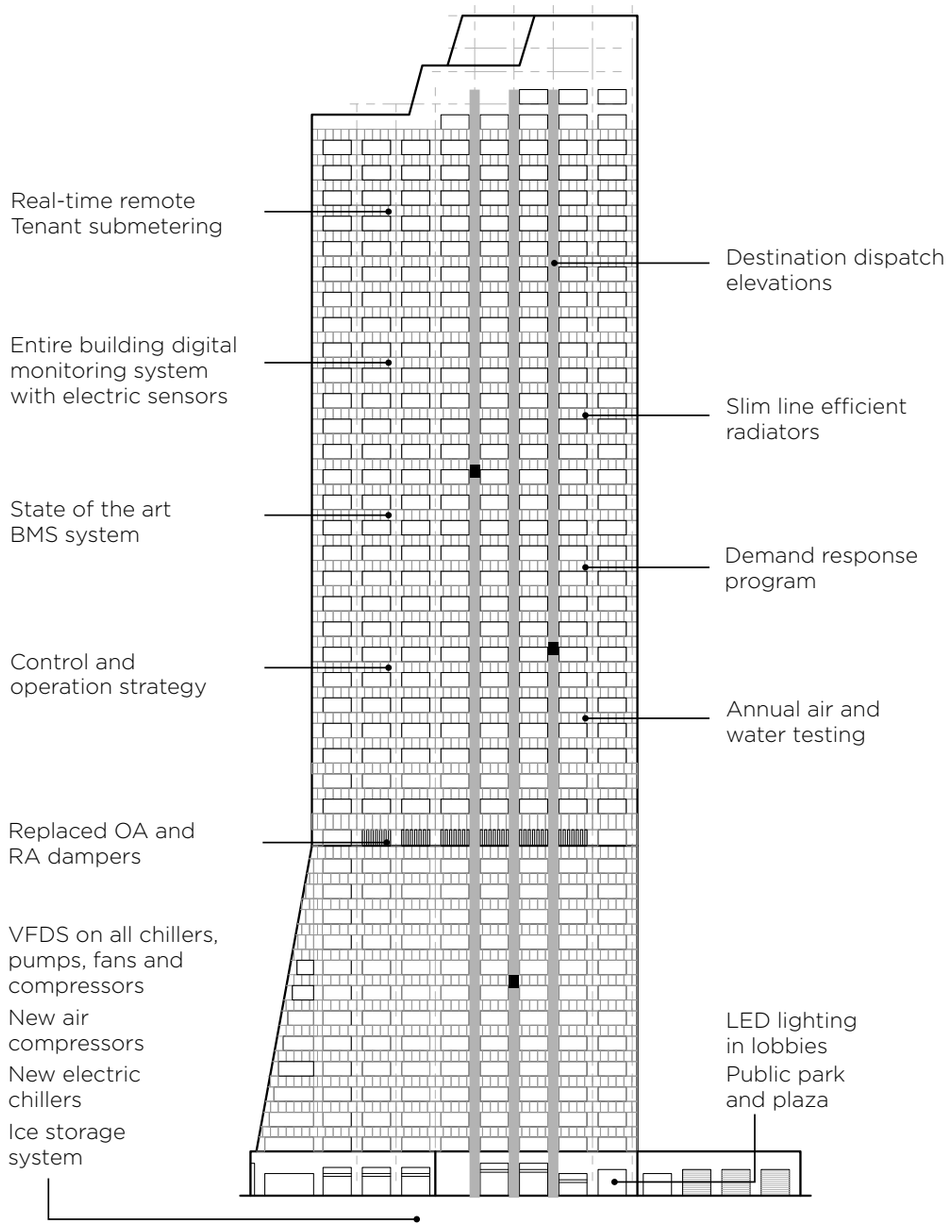
ICE STORAGE SYSTEM

Ice storage provides a cost-efficient way to cool commercial buildings, while optimizing the power grid.

Daily operating regimen: The 31-tank ice storage system is charged to full during off-peak electricity hours (6pm-6am) using a dedicated chiller. Between peak energy hours (10am-6pm) the operating engineers optimize the use of the ice burn, ensuring they use the total capacity before 6pm, thereby minimizing daytime peak cooling requirements.

Outcome: In excess of 8 GWh of cooling capacity is shifted from peak daytime hours to off-peak night-time hours. This reduces strain on the grid and enables Tishman Speyer to benefit from cheaper off-peak electricity rates. Thanks to these savings and Con Edison incentives, the payback on the ice storage system was less than 3 years. The system also reduces the carbon emissions per kWh produced as New York State's base load power plants are less carbon intensive than those brought online to meet peak demand during the middle of the day.

This ice storage system is currently being used as part of Con Edisons' Demand Response Program to reduce summer peak daytime demand in the building from 3.3MW to 2.2 MW.



66%
REDUCTION IN STEAM CONSUMPTION

1.1
MW PEAK REDUCTION

8
GWH COOLING SHIFTED TO OFF-PEAK PER YEAR

31
TANK ICE STORAGE SYSTEM

520 Madison Avenue, New York

MAIN PLANT COOLING OPERATIONS

The operating regimen of the main cooling plant is just as important as the equipment itself.

Year-round: The ice storage system is charged every night so that it can be used as the first cooling strategy regardless of the time of year.

Normal summer: In addition to the ice storage system, the chiller with a variable frequency drive (VFD) will be brought online and modulated to the required demand.

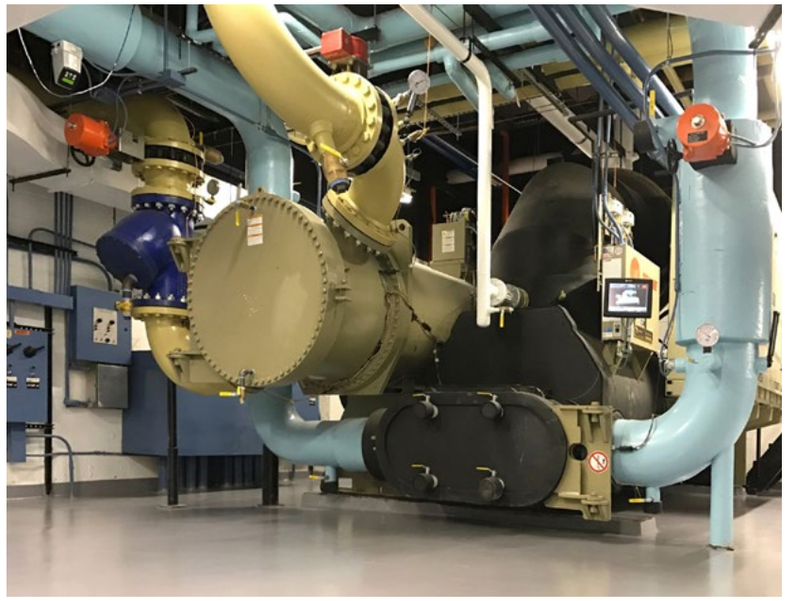
Peak/hot summer: The dedicated ice chiller with no VFD will be brought online at full capacity, with the VFD chiller modulating as required to meet the remainder of the load.

SAVINGS

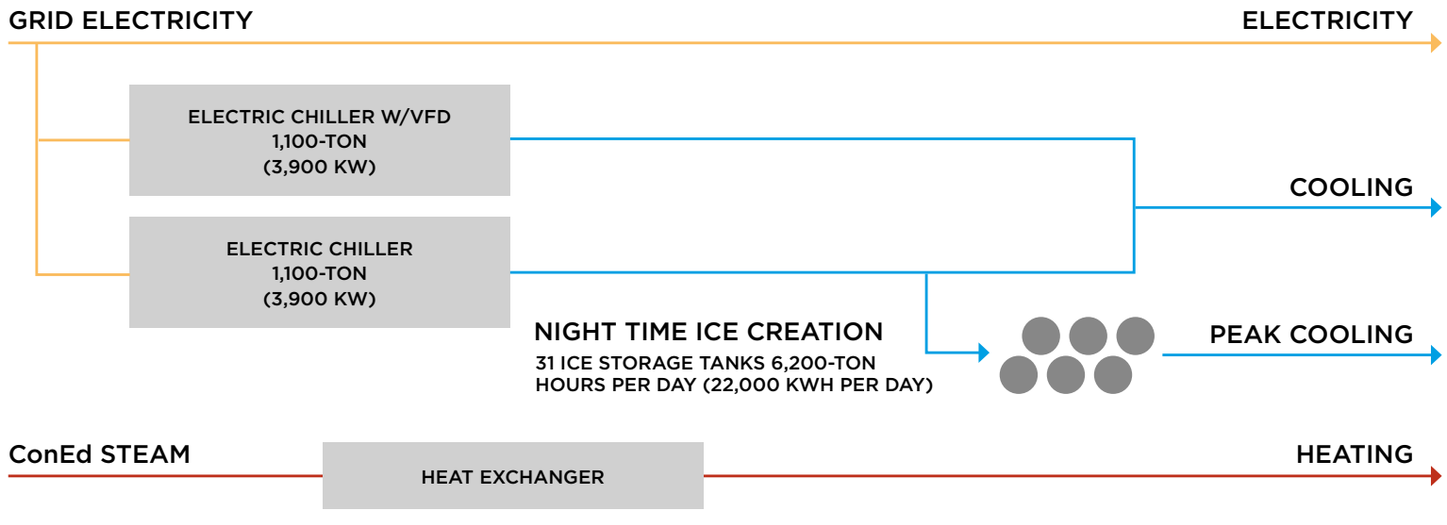
Chilled water system: The Belimo energy valve project combined with the installation of VFDs on the chilled water pumps means that the cooling plant can operate on a low flow, low temperature (LFLT) control strategy, rather than on a high flow, high temperature (HFHT) control strategy. This has resulted in 44% energy savings associated with pumping, 18% energy savings associated with chiller operation and a 60% reduction in peak airside kW demand.

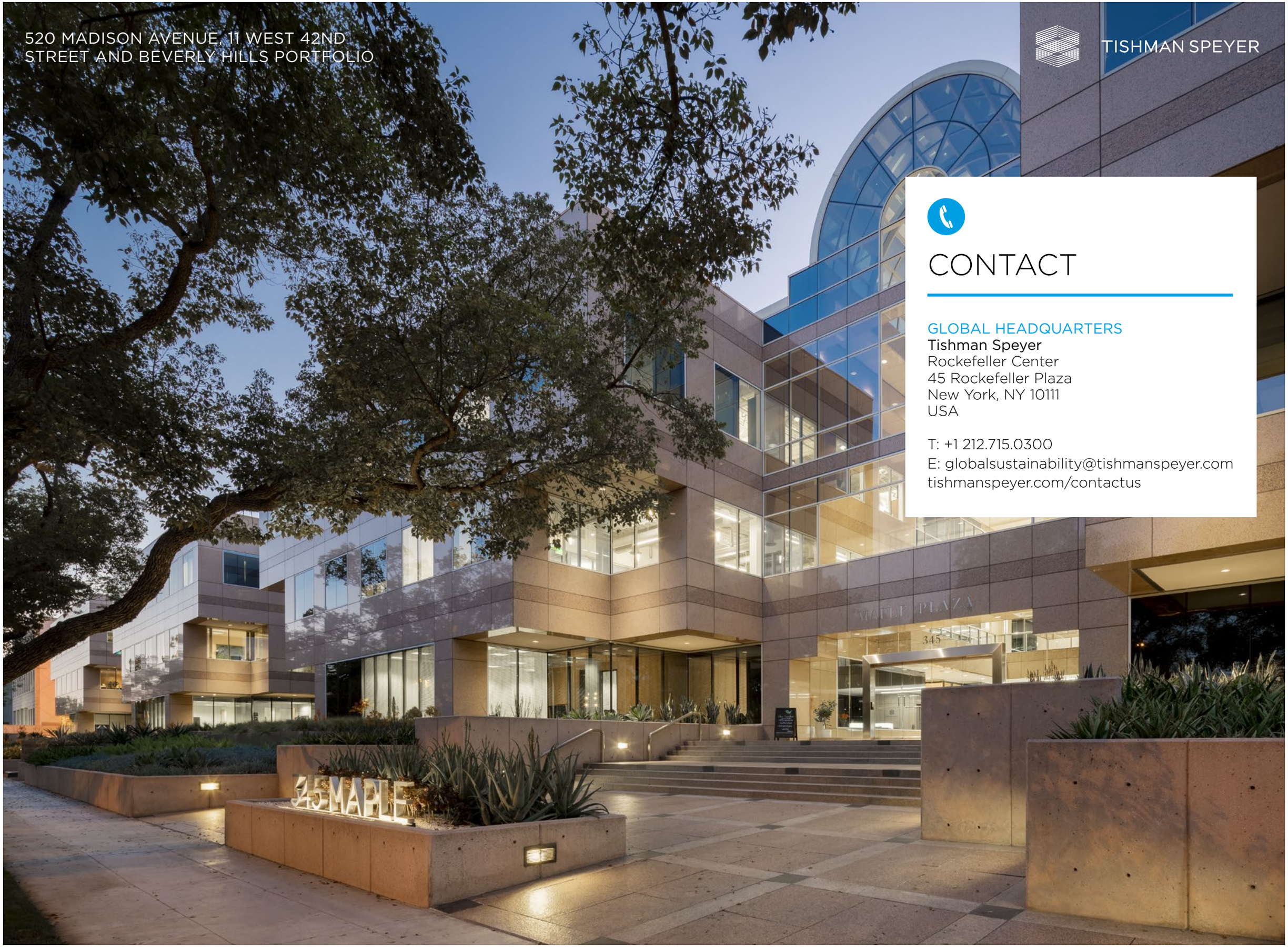
HVAC fans: Rather than simply operating at full speed, the installation of variable frequency drives means all twelve fans run at low speed and meet ventilation requirements exactly, thereby saving energy.

The steam system: This previously had limited controllability and was effectively all on or all off. The new digital monitoring system has introduced a granular level of control and has resulted in a decrease in steam consumption of 66%.



Main cooling plant





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