Fashion Institute of Technology By implementing an energy efficiency master plan, FIT reduced their energy use by 50% over twelve years, saving more than \$3.1 million annually.





building energy exchange



ive Energy Management

project overview

Project Type Energy Efficiency Master Plan Location Manhattan, NY Year Project Completed 2007-Ongoing Year Base Buildings Completed 1956-1988 **Project Size** 1.8 million sf; 9 buildings **Building Types** Campus: **Residential & Mixed Academic**

project team

Project Owners FIT Administration & NYC Department of Citywide Administrative Services' Division of Energy Management (DCAS DEM) **Oversight**, Energy Management. & **Planning Services** FIT Facilities; ABM: Kallen & Lemelson Grant Funding Provider DCAS DEM

primary energy figures

Grant Funding 97% capital costs Simple Payback 6.6 years Annual Savings \$3.1 million Percentage Energy Use Reduction (2005–2017)

Before

• After Percentage Carbon Reduction (2005–2017)

Before

After

strategies at-a-glance

Since adopting their Climate Action Plan (CAP) in 2007, FIT has completed an impressive array of energy efficiency upgrades, with crucial funding provided by NYC DCAS Energy Management. FIT has prioritized measures based on projected energy, carbon, and cost savings (analyzed in the CAP), as well as alignment with other scheduled capital projects. FIT's adherence to a long-term master plan has enabled them to dramatically cut energy use. Below are highlights of the work completed to date:

Heating, Cooling, & Ventilation

- Refurbished three existing steam turbine chillers and replaced one electric chiller with more efficient variable speed drive model
- Upgraded to a higher capacity, more efficient cooling tower that better meets cooling demand
- Installed variable frequency drives (VFDs) on pumps and motors to modulate speed and save energy
- Installed HVAC with temperature and humidity controls in museum and library storage spaces
- Upgraded ventilation systems in 50,000 sf of renovated lab space
- Installed CO2 sensors and fan VFDs in academic buildings and demand controlled ventilation in single-zone units, to reduce ventilation energy use

benefits at-a-glance

- Improved heating, cooling, and lighting efficiency
- Reduced total energy consumption with significant peak demand reductions

Domestic Hot Water (DHW)

- Replaced ten DHW heaters with instantaneous heaters to reduce standby heat waste
- Refurbished steam condensate recovery units and installed heat exchangers to pre-heat DHW

Lighting

- Converted more than 20,000 fixtures from fluorescent lamps to high-efficiency LEDs
- Installed occupancy and daylight sensors to reduce unnecessary lighting use

Controls

- Upgraded elevator, escalator, HVAC, and chiller plant controls
- Upgraded the building management system (BMS), for better monitoring & management of campus energy systems
- Reduced utility & operating costs
- Reduced carbon footprint
- Eligibility for competitive funding through NYC DCAS DEM

Envelope

- Installed highly insulated windows in one residence hall to reduce unwanted heat loss and gain
- Installed 17,000 sf of vegetated green roof to help insulate buildings and decrease heating and cooling loads
- Painted 10,000 sf of roof with white reflective paint to reduce cooling loads

Additional Measures

- Installed efficient, instantaneous hot water heaters and ENERGY STAR refrigerators and washer/ dryers in residence halls
- Installed 65kW of rooftop solar PV
- Ongoing participation in demand response program to reduce energy loads at times of peak demand on the electric grid
- Improved ability to coordinate, schedule, and budget for projects using multiyear strategic plan



project description

The FIT Administration has a deep commitment to sustainability that filters through to all levels of the institution. All Facilities conversations are conversations about energy. – George Jefremow, PE, Executive Director, FIT Facilities

The Fashion Institute of Technology (FIT), a leading art and design school in New York City, has made impressive strides to reduce its energy and carbon footprints. By implementing an energy efficiency master plan and integrating it into the college's broader capital planning process, FIT has reduced its energy use by 50% and carbon emissions by 55%, saving more than \$3.1 million a year. Funding from NYC DCAS Energy Management, leadership from the college's administration, and a strong campus culture of sustainability have been essential to FIT's success.

summary

Under the leadership of President Dr. Joyce Brown, FIT joined the NYC Carbon Challenge in 2007 with a pledge to reduce the school's carbon emissions 30% by the year 2030. To meet this ambitious goal, FIT engaged the engineering firm Kallen & Lemelson to develop a Climate Action Plan – a master plan for campus-wide energy efficiency upgrades. FIT's adoption of this strategic multiyear plan marked a proactive new approach to their energy and facilities management.

The Climate Action Plan (CAP) provided FIT with a road map to implement a comprehensive scope of efficiency upgrades, and included an analysis of the potential cost, payback, and energy and carbon savings for each recommended measure. Drawing on this analysis, FIT was able to win competitive funding from the NYC Department of Citywide Administrative Services' Division of Energy Management (DCAS DEM), which covered 97% of CAP project capital costs.

With this generous funding and a blend of internal resources, FIT Facilities and their engineering contractor began to systematically work through the list of recommended CAP projects. Facilities prioritized measures with the greatest projected savings, and those that could be implemented at the time of other scheduled capital projects, such as major space renovations. In 2010, only three years after initiating the CAP, FIT became the first NYC Carbon Challenge participant to meet their goal. FIT immediately committed to an even more ambitious target, pledging to cut emissions 50% by 2025. The college's progress toward this new goal has been equally swift. As of 2017, FIT has already surpassed the target, having reduced emissions by 55% and energy use by 50%, compared to 2005 levels.

These savings have been achieved through an impressive array of efficiency measures, including upgrades to the school's heating, cooling, and ventilation systems, as well as domestic hot water, lighting, and controls. Building envelope improvements and appliance upgrades have also yielded significant savings. Additionally, FIT participates in a demand response program to reduce energy use during times of peak demand on the regional electric grid. FIT receives substantial utility bill savings for participating.

More than any single efficiency measure alone, FIT's adherence to the long-term CAP has enabled them to dramatically reduce energy use and cut carbon emissions. FIT's success is a testament not only to the quality of their master plan, but to the leadership and commitment demonstrated by FIT Administration and Facilities in upholding the plan, and to the vital support provided by DCAS DEM.

existing conditions

Prior to adopting the CAP in 2007, FIT had taken a more reactive, ad hoc approach to physical plant upgrades, often repairing or replacing equipment only after it had failed. Capital planning at that time typically did not account for energy efficiency as an asset.

FIT's campus occupies one and a half blocks in New York City's Garment District. It includes nine buildings built between 1956 and 1988: five mixed-use academic buildings with classroom, laboratory, museum, library, and office space; and four residence halls that house approximately 2,300 students.

As a college in the State University of New York system, FIT's academic buildings are owned by the City of New York, with utility bills paid by DCAS DEM. FIT owns the residence halls and pays for utilities in those buildings. This dual ownership structure has created an incentive for both FIT and DCAS DEM to reduce the school's energy use.

In 2007, FIT began to undertake a number of efficiency upgrades with support from DCAS DEM. These included phasing out old refrigerants in the campus chiller plant, reducing steam consumption for summer cooling, and upgrading fluorescent lighting fixtures. With much of the college's major mechanical equipment also approaching end-ofuseful-life around this time, FIT and DCAS DEM decided that the time was right to invest in more comprehensive energy upgrades.

about NYC DCAS Energy Management (DCAS DEM)

As part of a suite of programs to help New York City government agencies advance their energy management efforts, the Department of Citywide Administrative Services' Division of Energy Management (DCAS DEM) provides competitive grant funding opportunities for energy retrofit projects and operations and maintenance measures.

Since 2006 DCAS DEM has invested \$675.5M in energy retrofit projects that advance the City's greenhouse gas reduction goals and deliver energy usage reductions, cost savings and resiliency benefits. These projects represent investments in over 1,050 buildings that cumulatively reduce the city's carbon emissions by 187,749MT across 27 City agencies.

To learn more, visit: nyc.gov/dem

project details

FIT's adherence to a long-term, energy efficiency master plan has been essential to their dramatic and cost-effective energy reductions.

Energy Efficiency Master Plan

FIT's adoption of the CAP marked an important shift away from reactive maintenance practices, to proactive planning. The CAP made energy efficiency a top priority for FIT's Facilities Department, and gave them a road map to achieve their goals. Following the multiyear plan helped Facilities better anticipate scheduling and budgeting needs for projects. It also made it easier to coordinate with FIT Administration to integrate energy efficiency into capital projects more broadly (e.g., installing efficient lighting and controls at the time of major renovations).

The CAP analysis of efficiency measures' projected costs and savings also enabled FIT to win competitive funding through two DCAS DEM programs: Expenses for Conservation and Efficiency Leadership (ExCEL) and Accelerated Conservation and Efficiency (ACE), which have covered 97% of all CAP project capital costs to date. Without this funding, most of these projects would not have been possible.

Since implementing the CAP in 2007, FIT has upgraded multiple systems across their physical plant. Highlights include:

Heating, Cooling & Ventilation

Α Chiller plant upgrades account for FIT's most significant savings. Between 2007 and 2009, Facilities refurbished three steam turbine chillers to improve performance. This included replacing turbines, refrigerant compressors, and evaporator and condenser tubes. In 2014, Facilities upgraded a 25-year old electric chiller to a more efficient, variable speed model. The existing cooling tower was also replaced with a higher-capacity tower that better meets the school's cooling demand. Variable frequency drives (VFDs) were installed to modulate pump and motor speeds for more efficient, controlled cooling. Together, these upgrades cut chiller plant energy use roughly in half, saving more than \$1.1 million each year.

FIT has also completed extensive ventilation upgrades across campus. A 2010 renovation of 50,000 square feet of academic lab space included installation of a new, high-efficiency ventilation system. In 2016, FIT installed HVAC systems with cutting-edge temperature and humidity climatecontrols in the Museum and in the Library's Special **Collections & College Archives. Most recently,** FIT installed VFDs on air-handling unit (AHU) fans in five academic buildings, and installed

demand-controlled ventilation in single-zone units. Occupancy and carbon dioxide sensors installed in these spaces communicate with the Building Management System (BMS), and turn down AHUs at night and other times when spaces are unoccupied, slashing energy use while maintaining excellent ventilation. AHU VFDs alone have reduced FIT's ventilation energy use by more than 30%, saving over \$780,000 a year.

B Domestic Hot Water

In 2016, Facilities replaced ten existing DHW heaters with instantaneous heaters that reduce standby heat losses. They also refurbished an outof-service steam condensate tank and installed five heat exchangers, enabling the DHW supply to be preheated using recovered steam heat. These measures have dramatically decreased DHW energy inputs, saving the college more than \$170,000 each year.

C Lighting

In 2013, Facilities converted over 16,000 florescent fixtures from T12 lamps to more efficient T8s. A few years later, they upgraded those T8s and an additional 4,000 fixtures to highefficiency LEDs. Facilities also installed occupancy and daylight sensors across campus to cut down on unnecessary lighting use. Together, these upgrades save over \$830,000 a year.

D Controls & Sensors

In addition to installing occupancy, daylight, and carbon dioxide sensors across campus, FIT upgraded controls for the chiller plant, HVAC systems, elevators, and escalators, and installed climate-controls in the Museum and Library. The college's BMS was upgraded and integrated with these new sensors and controls, enabling real-time monitoring for more efficient system operation and proactive maintenance.

E Envelope

In 2011, FIT replaced windows in one of its four residence halls with highly-insulated, low-e windows. Facilities also painted 10,000 square feet of roof space with white reflective paint to reduce summer cooling demands, and installed a vegetative green roof on an additional 17,000 square feet, helping to insulate buildings, decrease heating and cooling loads, and absorb CO2.

F Additional Measures

FIT achieved additional energy and carbon reductions by upgrading refrigerators, washers, and dryers in residence halls to ENERGY STAR models. FIT also installed rooftop solar panels with 65kW of generating capacity. Additionally, through DCAS DEM, FIT participates in a demand









From Top: Refurbished steam turbine chiller; new 6-cell cooling tower; steam heat recovery system used to preheat domestic hot water (DHW) supply; and new LED lighting fixtures.









From Top: Screenshot from BMS used to manage FIT's energy systems; The Museum at FIT, which features cutting-edge climate and temperature controls; vegetated green roof; and graph of FIT load-shedding during a demand response program period.

response program to reduce the school's energy load at times of peak demand on the electric grid. In 2017, FIT received over \$110,000 in utility bill savings for participating in the program.

summary of benefits

All together, the efficiency measures implemented under FIT's CAP have cut the college's energy use by 50% (compared to 2005 levels) and have reduced utility and operating expenses by an impressive \$3.1 million each year.

Cumulatively, the CAP efficiency upgrades have also reduced the college's carbon footprint by 55%, making FIT a leader in the fight against climate change and an example to other institutions. Furthermore, adhering to a multiyear energy efficiency master plan has streamlined FIT's maintenance and capital planning practices, and has enabled the college to access crucial project funding.

lessons learned

"Changing mindsets to predictive, proactive maintenance – funding for that is difficult. That's why DCAS DEM's programs are so important – they're helping the school rebuild infrastructure and decrease operating and maintenance costs. And it's all paid for by energy savings." – Al Palmaccio, Director, FIT Physical Plant

Quality Planning

Developing a comprehensive, long-term plan (and sticking to it) has been essential to FIT's success. FIT has deviated very little from the CAP as it was originally laid out in 2007, which speaks both to the plan's robustness and to the school's commitment to its sustainability goals.

The CAP has helped FIT Facilities become more strategic in their approach to physical plant maintenance. Having a planning document that they can share with other departments has made it easier to coordinate project scheduling and budgeting. Piggybacking CAP measures on top of other scheduled capital projects has also enabled FIT to complete energy upgrades cost-effectively and with minimal disruption to occupants.

Perhaps most importantly, having a master plan that analyzes the costs and benefits of potential projects has enabled FIT to access crucial funding from DCAS DEM's ACE and ExCEL programs. Without DCAS support, many of FIT's efficiency projects would not have been possible.

Commissioning and Training

FIT Facilities has learned that simply upgrading equipment is not enough to guarantee energy savings. Equipment must also be properly commissioned and maintained to achieve the performance outcomes anticipated. As Al Palmaccio, Director of FIT's Physical Plant has said: "I can't emphasize the importance of maintenance enough. Without it, efficiency improvements can quickly erode."

To ensure that the physical plant continues to operate reliably and efficiently, FIT trains Facilities staff whenever new equipment is installed. Lead Facilities staff also attend periodic DCAS DEM forums to exchange information on energy efficiency best-practices with other institutions.

Monitoring and Data Collection

In addition to performing annual energy benchmarking (as required by NYC Local Law 84), FIT Facilities monitors real-time physical plant performance using BMS and LogCheck software. As Facilities has integrated more sensors and equipment with the BMS, their ability to maximize operational efficiency and identify preventative maintenance measures has also improved.

Furthermore, Facilities maintains a historical database on physical plant performance and energy use. This has been useful for demonstrating the impact of upgrades completed to date, and for identifying opportunities for future improvements.

Community Engagement

Generating buy-in from FIT's community of students, staff, and faculty has been essential to maintaining momentum for the college's energy efficiency efforts. Starting at the top with leadership from FIT's Administration, the college has worked hard to make sustainability a cornerstone of campus culture.

After joining the NYC Carbon Challenge in 2007, FIT Facilities worked with the school's Sustainability Council to facilitate greater understanding among students and faculty about the importance of energy efficiency upgrades, and to engage the broader college community in the carbon reduction efforts. That year, FIT also founded an annual Sustainability Conference, which serves as a forum for Facilities to share updates on its progress to goals, and for the community to discuss and develop new initiatives.

As student interest has surged, FIT has also expanded sustainability-related course offerings and invested in campus upgrades that can serve as teaching tools. This includes installation of the campus green roof, beehives, solar panels, and a "natural dye garden," where students grow plants used in the production of eco-friendly clothing.

looking ahead

With additional efficiency projects planned through 2025, FIT anticipates achieving even greater energy and carbon savings in the future.

FIT remains committed to its long-term CAP and has a number of new efficiency projects in the pipeline. Recently, DCAS DEM awarded FIT funding for an additional electric chiller that will serve a new 100,000 square foot academic building currently under construction. FIT is developing a master plan for the chiller plant to ensure that new and existing equipment are properly integrated, optimized, and able to meet the heating and cooling demands of an expanded campus. The new academic building will incorporate many other green features, including a green roof and sophisticated daylighting controls.

The FIT Facilities Department and their partners at Kallen & Lemelson Engineers continue to seek out new energy saving opportunities. FIT recently completed energy system auditing and retrocommissioning required by NYC Local Law 87. FIT is currently reviewing the LL87 audits for new efficiency opportunities not previously identified in the CAP. FIT also hopes to install submeters across more of the school's energy systems. Expanded submetering will improve FIT's ability to zero in on areas of higher-than-average energy use, and to more accurately model the energy savings and payback of discrete projects.



FIT's new academic building will incorporate many green features (rendering by SHoP Architects).

The Department of Citywide Administrative Services' (DCAS) Division of Energy Management (DEM) serves as the hub for energy management for New York City government operations, serving 80 agencies and more than 4,000 buildings. DEM is tasked with leading the City's efforts to reduce greenhouse gas emissions emissions by 80% by 2050 from a 2005 baseline, with a near-term goal to reduce emissions from government buildings 35% by 2025.

Visit nyc.gov/dem

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