case study

MechoSystems HQ Renovation

Pioneering daylighting provides the foundation for this comprehensive repurposing of MechoSystems' former factory into a modern, LEED Gold corporate headquarters.

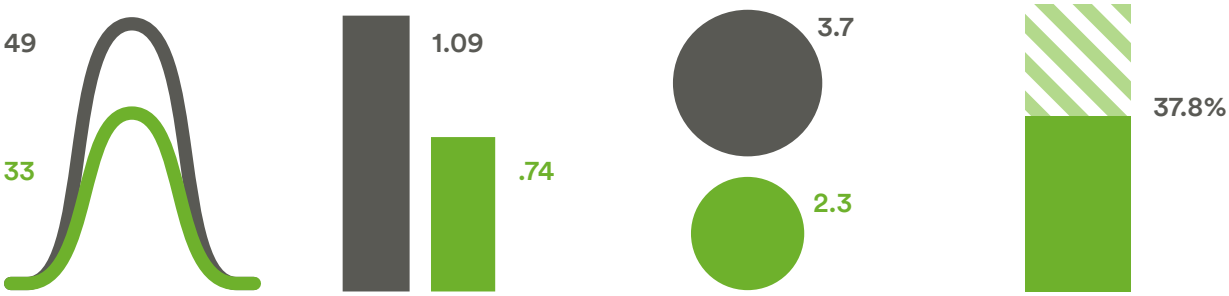
be ex

building energy exchange

savings & strategies

Project type	Adaptive Reuse
Location	Queens, NYC
Year of project completion	2013
Base building completed	1918
Project size	47,500 square feet
Occupied during the retrofit?	Yes

primary energy figures



Lighting Peak Demand (kw)

Lighting Power Density (W/sf)

Lighting Energy Consumption (kWh/sf/yr)

Lighting Energy Savings

Actual Performance Code Standards

strategies

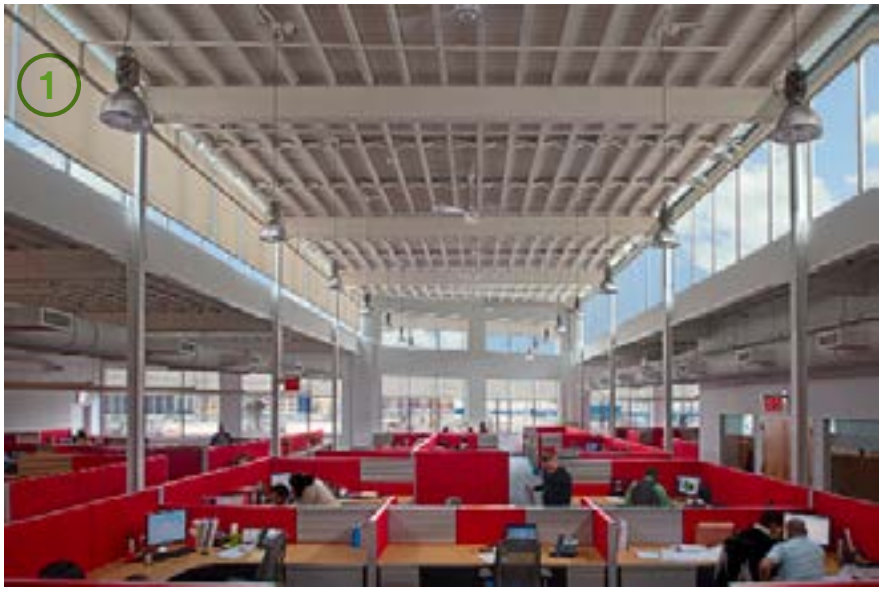
- Open plan office layout
- Automated shading system
- Dimmable, automated lighting
- Gas-powered, stratified air HVAC system
- New low-e windows
- Reflective and highly insulated roof
- Solar panels

benefits

- Maximizes use of daylight
- Increases lighting efficiency
- Overall energy consumption reduction
- Significant peak demand reductions
- Eligibility for NYSERDA incentives
- Increases occupant comfort and well being

products / systems

The design of this complete renovation of a 1918 factory was driven by a holistic approach to daylighting, providing stunning, comfortable, open office areas with limited reliance on electric lighting.



1 MechoSystems SolarTrac®
This system automatically raises or lowers roller shades to optimize natural light. With roof-mounted radiometers and software that accounts for the building's unique geospatial relationship to the sun, SolarTrac controls glare, brightness, and heat gain, while increasing the amount of usable daylight, views to the outside, and energy savings. In the photo, the shades are up in the right-hand clerestory, down on the left, and partially down at the far end.

2 Photodiode Sensor
Daylight harvesting is enabled by photo sensors that allow luminaires to be dimmed or turned off.

3 Switches
Scene setting and zone control wall stations with programmed light levels allow for easy lighting adjustments while eliminating excessive lighting energy consumption.

4 Occupancy/Vacancy Sensor
Private office lighting sensors run on vacancy mode. Lights must be activated manually but turn off automatically after a period of vacancy. Open area lighting sensors run on occupancy mode. Lights dim or turn off based on scheduled office hours and activity.

project team

MechoSystems
Project Owner

MechoSystems & Encelium
Products & Installation

NYSERDA
Energy Incentive Provider

project description

Our building was designed in the early 1900s, when electricity and lighting were far less efficient. So the building was specifically designed to maximize daylight. Our strategy was to utilize this original design as much as possible, but updated with the latest technology. The result is a delightful space that allows staff and guests a sense of the changing light and weather outside, while maintaining comfort and a fabulous work environment.
—Jan Berman, MechoSystems

MechoSystems completed a system-by-system renovation of their former factory, transforming it into a state-of-the-art office. Their new space showcases their technology and serves as a model for energy efficiency and occupant comfort. Since completion, the project has reported a nearly 40% reduction in lighting energy use relative to estimated consumption. The project has also cut peak energy demand and lighting power density. The new systems improve space flexibility, visual and thermal comfort, and occupant satisfaction.

summary

MechoSystems' retrofit aspirations were significant. The company turned its own old manufacturing building into a state-of-the-art office facility by addressing every system in the building and taking advantage of the unique qualities of the space.

MechoSystems virtually created the automated shading market in the 1970s. Despite occupying a dominant position in this market, the company continually challenges itself. It is now a company that develops innovative motors, controls, automation software, and technology to produce systems that optimize interior daylight and maximize views and energy savings. Defining itself as “a technology company that happens to do shading,” MechoSystems transformed its existing factory into an efficient and modern office space to meet growing operational needs. The redesign incorporates state-of-the-art technology to take advantage of the features of the existing building and create a comfortable, contemporary, day-lit workspace.

MechoSystems replaced or retrofitted all of the building’s systems. This included installing a renovated gas-powered HVAC system, all-new windows, and automated lighting and shading. Additionally, they installed a new highly reflective roof and 25 kW of solar panels. These physical changes, including an open-plan workspace, altered the office culture and improved employee efficiency and well-being. Energy use and peak demand were each reduced by roughly a quarter compared to code.

existing conditions

The MechoSystems building was originally a manufacturing space with outdated lighting, shading, heating, cooling, and ventilation systems. Through this redesign, the space was completely repurposed.

Built in 1918, the MechoSystems building was originally a mattress factory. At that time, electricity was expensive and not typically provided in all spaces. As a result, the building was designed to maximize daylighting, with large north, east, and west facing windows, as

well as skylights and clerestory windows. The original design placed large manufacturing space in the basement and first floor, with very high ceilings, and lofted office space on the third floor. The heating system in place at the time of the retrofit was a steam boiler powered by heavy fuel oil. When Joel Berman, founder and CEO of MechoSystems, bought the warehouse in 1980, much of the heating equipment and layout were similar to the original design. As an architect, Joel was impressed by the natural daylight and opportunity that the space presented. Not only was it versatile enough to include both office and manufacturing spaces, it was accessible by public transportation and conveniently located near La Guardia airport, midtown tunnel, and the Queensboro Bridge into Manhattan.

In the 1980s, MechoSystems invested about $1 million into piecemeal retrofits. Some were large projects, such as upgrading the boiler, putting in additional bathrooms, replacing the flooring and the roof, and installing double-paned windows. Others were less intensive but still added to the functionality of the space, such as removing interior walls and installing insulating plastic panels in the skylights to improve interior comfort. However, by 2004 the company's needs had changed. Manufacturing was moved to New Jersey and Arizona in order to open up space to accommodate the growing staff. As their focus shifted toward controls, electronics, software development, and programming technology, MechoSystems wanted to create a space that mirrored its aspirations and showcased its technologies. MechoSystems used this major retrofit as a means to carefully adjust its culture to attract and retain high-level talent and to make a strong corporate statement about sustainability.

process & challenges

The MechoSystems redesign was a lengthy, complicated project.

With these goals in mind, the project began in 2009. In addition to the challenges a century-old building presents, MechoSystems continued to work in the building during the retrofit. These barriers were overcome by working with a strong team of engineers, architects, and consultants who determined early on that the phasing of the project should be system-by-system, rather than floor-by-floor as originally planned. The building was divided between east and west sides, and employees were housed in temporary office units in the building that shifted with construction.

MechoSystems began by tackling all floors on the east side, which housed most of the building's systems, including the bulk of the plumbing, electrical, and HVAC equipment. Upgrades included changing to a hot-water fin-tube radiation system, converting the boiler from steam to hot water, and installing gas-fired HVAC units on the roof. Additionally, an 180-kW emergency generator was installed, as well as a new server room with its own cooling system.

The team had to bring its creativity to bear on structural and permit challenges as well. For example, it was critical for MechoSystems that the retrofit not dramatically alter the original feel of the building – with it's open spaces and exposed structure. Maintaining that feel while meeting code sometimes required choosing a difficult and expensive option, such as developing a fire shutter system instead of building more interior walls.

Retaining the building's many large window openings, built when people in manufacturing worked mostly by daylight, was critical to the elevated atmosphere of the workspace. Significant effort was expended selecting windows and glazing that provided adequate thermal and UV protection while maximizing visible light. The lack of windows on the south side of the building was actually a benefit, since this dramatically limited solar heat gain, while other openings provided ample natural light for the workspaces.

performance benefits & savings

The redesign created a more modern, comfortable, productive, and sustainable work environment.

In addition to creating a modern office that would reflect the high-tech aspirations of the company, MechoSystems wanted to demonstrate its commitment to sustainability by pursuing LEED Gold certification. This included installing solar PV, sourcing sustainable materials, and using green construction practices. Jan Berman, president of MechoSystems, saw the retrofit as "an opportunity to create a living laboratory, a showroom for our products, and an enhanced work environment." Because the function of the building changed so dramatically (from mostly manufacturing to all offices), a direct comparison of pre- and post-retrofit energy use is not useful. To estimate the impact of its advanced systems on energy use, MechoSystems used computer-modeling to compare their actual energy use with a similar project that meets code, but lacks these controls. MechoSystems was able to significantly reduce both their total overall energy consumption and their peak demand for electricity, but here we will focus on the energy used by their lighting systems.

Due to the daylighting and lighting controls implemented during the retrofit, MechoSystems' was able to achieve impressive lighting energy savings. The lighting power density was scaled back from 1.09 W/sf to 0.74 W/sf, a 32% savings from the model and well below code. This helped reduce peak lighting demand from 49 kW to 33 kW, a savings of 33%, and their overall lighting consumption from 3.7 kWh/sf/yr to 2.3 kWh/sf/yr, a 37.8% savings.

These reductions in energy use allowed the project to benefit from several NYSERDA incentive programs. The approval process for solar PV system incentives was simple and took less than three months. Other programs had a longer approval process of six to eight months, with funding received only after the systems were in place and specific performance criteria had been met.

The company ensured that its employees were aware of these improvements by continuously monitoring energy usage and displaying it on dashboards throughout the building. Employees seem to really enjoy the additional daylight made possible by the advanced shading and lighting controls, and they have reported feeling more energized and productive during the day.

lessons learned

The MechoSystems project demonstrated the importance of thoughtfulness, flexibility, and patience when embarking on a major retrofit or redesign.

The MechoSystems renovation was a constantly evolving project that benefited from foresight and creativity. Having a well-oiled team and an experienced project manager was crucial. The team learned early that to keep the building open during construction, a systems-based (versus an area-based) renovation approach was necessary. The team made sure to use the existing building advantages, such as availability of daylight, to maximize its energy savings and retain the character of the space. Additionally, this strategy reduced the amount of materials needed for the project. MechoSystems actively worked to prevent a "set it and forget it" attitude towards its advanced systems by continuously monitoring their energy use and making adjustments as needed.

conclusion

The MechoSystems redesign was a long journey. However, due to strong leadership, the new space is an optimal work environment and a model for energy efficiency.

The conversion from factory to office space was a visionary decision by the MechoSystems leadership. The company has produced an office headquarters that acts as a showroom for its products and services, and which has far more character than a standard office space. The design provides a place that enhances the well-being of staff, significantly reduces energy use, and allows for the continuous monitoring and optimizing of systems over time. The MechoSystems project demonstrates that repurposing older buildings, while a significant investment of time and money, can be extremely rewarding. Coupled with advanced systems, these spaces can be among the most comfortable available while also minimizing energy use.

Building Energy Exchange is an independent, non-profit organization that is creating an energy efficiency resource center for education and innovation in New York City. Initially focused on lighting, the be-ex center will be a venue to see the best practices, view displays, experience new technology, take a class, receive assistance, test ideas through mock-ups and models, as well as provide a forum for progressive discourse.