



Henry Ford Centennial Library



CASE STUDY

Dearborn HVAC Infrastructure & Energy Initiative



In 2016, the City of Dearborn, Michigan, launched an initiative to turn its 80-acre building complex across from the Ford World Headquarters into a world-class, energy-efficient, sustainable municipal campus. The project included upgrading HVAC, chilled and hot water heating systems, electric infrastructure, and other energy-consuming systems to the most current technology in six key buildings.

Millenium Energy Company worked with Larkin Engineering to develop a long-term energy-savings infrastructure plan. Millenium's E~flow control system was selected to convert all heating and cooling systems from constant volume to variable flow based on building system demand.

Project of the Year 2021
Association for Energy Engineers (AEE)
Region III

Project of the Year 2021
American Public Works Association (APWA)
Michigan Chapter

Nominated for APWA National Project of the Year



FACILITY SIZE

.5M
SQUARE FEET



ELECTRIC SAVINGS

4M
KILOWATT HOURS



ENERGY SAVINGS

\$600K
DOLLARS PER YEAR



LABOR SAVINGS

\$.5M
DOLLARS PER YEAR



CITY OF DEARBORN MUNICIPAL CAMPUS

- 1 Dearborn Administrative Building (DAC)
- 2 Henry Ford Centennial Library
- 3 Police Building and Jail
- 4 Dearborn 19th District Court Building
- 5 Ford Community and Performing Arts Center
- 6 Central Cooling and Electrical Distribution Plant (the Powerhouse)

CHALLENGE

The City of Dearborn's Powerhouse and much of the energy infrastructure was built in the 1960s, and the energy costs had risen to over \$1 million per year. Aging HVAC systems, along with the inefficient heating, cooling, and control technologies lagged far behind that which was considered state-of-the-art in 2016 when the project was initiated. City leadership saw it as an opportunity to initiate a comprehensive infrastructure project to design and install HVAC and electrical solutions that would bring it to the forefront of municipal energy management. It wanted reliable equipment that would operate effectively for years, with minimal annual maintenance costs.

The City contracted Millenium Energy Company and Larkin Engineering to conduct a complete HVAC and energy assessment of Dearborn's six-building campus.

The project had two objectives:

Replace all heating and cooling infrastructure with new "future-proof" equipment.

Design the new system with the most current and energy-efficient technology to best serve the community in a sustainable manner and minimize the City's energy use and carbon footprint.

SOLUTION

Millenium worked with Larkin Engineering to design an innovative, comprehensive solution to upgrade heating and cooling infrastructure that would maximize energy efficiency and minimize future energy and maintenance costs.

At the heart of this solution is Millenium's patented E~flow control algorithm, which uses a building's real-time heating and cooling demand to deliver the right amount of energy to each building and system at just the right time

Larkin Engineering completed all designs. CSM Mechanical and CSM Energy Solutions performed almost all installation work and E~flow programming.

New variable speed drives were installed on all pumps in the City of Dearborn's Powerhouse to reduce electric consumption during periods of low cooling demand from the buildings on the campus. The entire campus chilled water distribution system and flow control based on building cooling demand is made possible by the E~flow controls centralized and distributed throughout the campus.

“The project has been extremely successful, with significant savings in both energy and personnel costs. Most of the work was implemented during the COVID-19 pandemic, while the buildings were occupied and operating. I have to thank all who were involved for their commitment to successfully completing the project, under some very extenuating circumstances.”

ERIC WITTE,
DEPUTY DIRECTOR DEARBORN PUBLIC WORKS

OUTCOME

The entire project is expected to save approximately 4,000,000 kilowatt-hours of electricity, and nearly \$500,000 annually in natural gas and electric energy costs compared to the baseline use.

The cost savings are derived from Millenium Energy’s innovative strategy, working closely with the Powerhouse staff to minimize both energy and maintenance costs for all mechanical systems. The electric peak demand has been reduced to less than 1.0 MW, and natural gas use for heating will be reduced by over 50%.

This extensive mechanical renovation and energy initiative has resulted in wide recognition concerning the innovative and successful energy efficiency measures that have been implemented, at times under difficult conditions due the COVID-19 pandemic.

This initiative places the City of Dearborn building complex at the forefront of energy efficiency and sustainability with the integration



of diverse energy-efficient technologies to improve comfort and reduce energy use, while providing significant savings on operating and maintenance costs.

The new energy infrastructure will also increase occupant comfort in all buildings while greatly reducing energy use, reducing the carbon footprint, enhancing campus sustainability, and maximizing energy efficiency throughout the entire campus.

The ultimate objective is to maximize efficiency and minimize cost, while achieving as close to Net Zero Electric Demand as possible.

The large majority of the project was completed in 2020. The remainder is expected to be complete in 2021, though the efforts for continuing energy efficiency and sustainability will be on-going.



JUST-IN-TIME ENERGY, BASED ON BUILDING ENERGY DEMAND

E~flow is a patented mathematical algorithm that uses real-time building energy demand (rather than pressure) as the primary control variable to slow down or speed up a hydronic pump with a variable speed drive, thereby increasing or decreasing volume flow.

A building’s heating and cooling load can be affected by occupancy, lighting and equipment use, and outside temperature. E~flow responds directly to the cumulative effects of each of these variables.

It is a simple, yet uncomplicated, energy-efficient method of variable heating/cooling demand control.

The E~flow control process is operating in more than 2 million square feet of facilities of various types.

It has been proven to reduce energy cost by eliminating over-pumping, optimizing instantaneous energy delivery to a system or load, and minimizing incremental electric and/or thermal energy waste.

E~flow is compatible with any off-the-shelf variable speed drive and installed via a simple control box—no expensive flow meters or pressure sensing devices are required.

PROJECT HIGHLIGHTS

- Integrated the patented E~flow variable heating and cooling pumping volume control system into the new Tridium building automation system. E~flow manages the variable flow of the 22,000-gallon chilled water tunnel distribution system from the central plant. It delivers the chilled water to each of the buildings on the main loop, totaling almost 0.5 million square feet, based on thermal energy demand. E~flow also stages and optimizes the operation of the two 600-ton chillers to minimize electric demand. E~flow also controls the variable hot water flow in each building based on heating demand.
- Reduced energy use by installing new energy-efficient equipment such as direct-drive fans, variable speed pumps, variable capacity chillers, LED lighting, and state-of-the-art temperature and energy demand controls.
- Installed a new state-of-the-art distributed building automation system (dBAS) utilizing on-board chiller, boiler, VFD, and HVAC unit controls for comfort control and energy management, and to minimize costs.
- Shifted the cooling load from inefficient air-cooled R-22 rooftop units to the new high-efficiency central cooling plant.
- Applied energy-efficient operations strategies for real time optimized high-efficiency centralized cooling, distributed heating, and building ventilation determined by building occupancy to control thermal and electric demand.
- The entire system is designed to utilize an Energy Dashboard for all campus buildings with real-time, on-line metering to track energy usage and costs.

COLLABORATORS

Vytautas K. Virskus M.E., JD
Millenium Energy Company
Energy, Building Automation
System, and Variable Flow
Distribution Design

Jim Larkin, P.E., MEP Design

Eric Witte, Deputy Director DPW

Anthony Belzak, Powerhouse
Superintendent

David Norwood, Sustainability
Coordinator Mayor's Office

Craig Mortz, CEO CSM
Mechanical, HVAC Installation
Contractor



Ford Community and Performing Arts Center

ABOUT MILLENIUM ENERGY COMPANY

Founded in 1998, Millenium Energy Company uses the most current technologies available to integrate legacy systems with the newest open protocol energy management solutions.

We have developed proprietary analytical tools to analyze each aspect of energy acquisition, conversion efficiency, and distribution, and we leverage advanced technology and regulatory advantages to maximize energy cost reduction while increasing energy efficiency for long-term sustainability.

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