



## SHOWCASE PROJECT: CITY OF CHATTANOOGA: MOCCASIN BEND ENVIRONMENTAL CAMPUS

### SOLUTION OVERVIEW

After joining the Better Buildings Challenge in 2015, the City of Chattanooga reduced its energy usage by 23% percent (from a 2013 baseline of 541,748,000 kBtus) in only four years, meeting their goal six years ahead of schedule. Building on this achievement, the city made the ambitious goal of upgrading its facilities as they face challenges from extreme weather events and environmental impacts. From 2018 to 2021, the Moccasin Bend Environmental Campus (MBEC) underwent several structural improvements to ensure long-term effective wastewater treatment for its growing population, even in times of extreme events.

The wastewater treatment plant was constructed in 1961 and services a six-county area with over 400,000 residents. It remains the largest energy consumer of the city's owned and operated facilities, treating 140 MGD (million gallons per day) with a peak hydraulic capacity of 230 MGD, and producing approximately 70,000 wet tons of biosolids per year, which are treated with lime and land applied as a Class B biosolid. MBEC reduced its energy usage from 59.32 GWh in 2012 to 41.16 GWh in 2021, saving 18.16 GWh total. To minimize the impacts of future climate threats and move toward a resilient future, the City of Chattanooga identified and made strategic upgrades to the MBEC. This holistic approach has resulted in 27% energy and 24% water savings annually at the campus, ultimately saving \$1.4 million per year.

### SECTOR TYPE

Local Government

### LOCATION

Chattanooga, Tennessee

### SOLUTIONS

The City of Chattanooga took a holistic approach to support their energy, water, and cost savings at the Moccasin Bend Environmental Campus. The city reviewed many of the process efficiencies and systems currently in place to evaluate progress being made toward energy-efficiency goals and identified the areas in need of improvement. All projects were funded with capital funding through

the City of Chattanooga.

Below are details about the major projects completed in different buildings throughout the facility. They include Solar PV installation, EQ Blower upgrades, an LED Lighting retrofit, VFD controls updates, and Water Efficiency improvements.

Project	Cost (\$)	ROI Timeline (years)
Solar	\$5,250,000	11
Equalization (EQ) Blower	\$20,700,000	27.5
Lighting	\$201,150	3.25
Variable Frequency Drive (VFD)	\$429,325	0.75
Water Efficiency	\$1,972,000	5

## Solar

Installing a 10-acre solar array cost approximately \$5,250,000 and is expected to save 6,000 MWh or approximately \$400,000 in avoided energy expenditures per year with an estimate payback of 11 years. The 9,360 south facing solar panels with 40 (60 kW) string inverters were installed and have been providing green energy to the Campus since the end of October 2020. To ensure the success of this project, the city analyzed historic utility bills for consumption patterns and rate tariffs, while also determining suitable site locations based upon open space and plans for future expansions. Overall, the 10-acre solar farm helps to reduce the overall annual power demand from the MBEC by approximately 10 percent of the current energy use and saves taxpayers more than \$400,000 every year.

## EQ Blower

The City of Chattanooga made upgrades to the equalization (EQ) blower costing approximately \$20,700,000 with expected savings of 10,000,000 kWh a year.

The aeration system is one of the highest energy consumers at the wastewater treatment plant. To save energy, the city reviewed the existing EQ basin piping and operations and evaluated various configurations to increase the EQ basin storage, flow and process efficiencies, and plant operations efficiencies. The upgrades to the MBEC's EQ blowers helped to create consistent air flow to offset the higher energy requirements. This provided the most efficient flow rate by preventing high volumes of incoming flow from forcing solids and organic material through each stage of the treatment system, and therefore reducing the amount of energy needed for operation. Project details include:

- Compartmentalizing the basins
- Modifying mixing and aeration system including aeration piping and diffusers

- Providing flexibility for current and future nutrient removal processes
- Modifying plant piping to allow for improvements in operations with the EQPS, EQ Basins, and Wet Weather Treatment System
- Establishing Equalization Basin Wash-down and Cleanout methods for continued maintenance
- Evaluating alternative blower designs (sizes and quantity) to determine the best overall cost including potential operating savings derived from the use of new high efficiency single-stage blowers and automated dissolved oxygen (DO) based aeration systems
- Evaluating electrical improvements such as new variable-frequency drives (VFD)
- Evaluating architectural components of the existing blower building including potential roof rehabilitation or replacement

## Lighting

The LED lighting retrofits cost approximately \$201,150 and are expected to save an average of \$61,722 a year. The city replaced old, inefficient lighting systems with more energy efficient LED lights. The facilities team also added occupancy sensors throughout the buildings at the MBEC that detect when a space is unoccupied and automatically turn off the lights. Project details include:

- Dilution – Replaced 300W incandescent lamps with 25W LED
- Blower – Replaced 300W incandescent lamps with 25W LED
- Filter Press High Bay – Replaced 400W HPS with 200W induction lights
- Filter Press Office – Replaced T12 with T8 and added occupancy sensors
- O&C – Added occupancy sensors to control T8 fixtures
- Sewer Maintenance – Replaced 400W HPS with 200W induction
- Sewer Maintenance – Replaced 400W HPS with 150W induction
- Primary Sludge PS1 & PS2 – Replaced 175W HPS with 52W screw in LED
- I/I Building – Replaced 250W MH with 150W induction

## Variable Frequency Drive (VFD)

The city installed Variable Frequency Drive (VFD) controls for a cost of \$429,325 with annual savings of 5,759,700 kWh which is equivalent to \$552,931. VFDs are often used in wastewater stations that transport sewage. They are used to control the flow of sewage through the pumps and help wastewater treatment plants achieve the required flow. Like any piece of equipment, it must work with the whole system to be truly effective. The VFD controls were installed in the UNOX building where the oxygenation tank mixers are kept. Making sure the controls were updated and installed properly will help control overall energy savings.

## Water Efficiency

Improvements to the Plant's water systems cost \$1,972,000 with energy savings totaling 305,140 kWh a year and water savings of 85,598,600 gallons a year.

This project includes improvements to the MBEC potable and plant water systems to reduce overall

water use by substituting lower-grade water for certain non-potable water process uses and finding and eliminating leaks in the water system. These improvements will increase the overall reliability and operation of the plant water system.

This upgrade will reduce power use for supplying the spray water for the gravity thickeners by reducing their operating pressure and downsizing the plant water pumps. This project also involves modifying the hydrant water pump to be a second source for plant water. After modification, the plant water can be supplied by either the pumps in the basement of the Chlorine Building or by the hydrant pumps in the Dilution Water Pump Station. This adds an overall resiliency factor to the plant. Also, the plant water system will be more energy efficient when plant water is supplied to the in-plant distribution system in two locations. Project details include:

- Removed the six bowls on the existing hydrant pump and replace with three new ones
- Replaced the 75 hp motor with a 40hp motor and add a VFD. Install an automated pressure control system
- Added a second hydrant pump as a standby by removing the chlorine injector pump (after the hypochlorite feed system is installed)
- Added a motorized basket strainer and a flow meter to the discharge piping

## **OTHER BENEFITS**

In addition to the energy savings, the Moccasin Bend Environmental Campus project also includes making improvements to a 10-million-gallon wet weather sewer storage tank that will improve plant reliability and flow equalization to reduce sanitary sewer overflows in the area.

## Annual Energy Use

Baseline(2013)  
588,744,133  
kBtu

Actual(2021)  
430,774,007  
kBtu

**Energy Savings**  
**27%**

## Annual Energy Cost

Baseline(2013)  
\$4,530,000

Actual(2021)  
\$3,137,000

**Cost Savings**  
**\$1,393,000**



Moccasin Bend Environmental Campus Solar Panels



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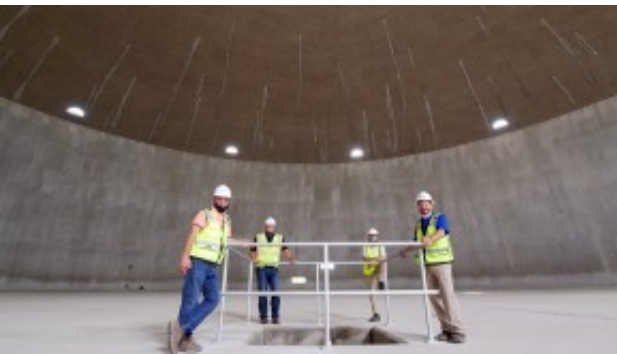
Moccasin Bend Environmental Campus EQ Basin



Moccasin Bend Environmental Campus VFD



Moccasin Bend Environmental Campus EQ Station Exterior



Moccasin Bend Environmental Campus EQ Station Interior