

ANNUAL DEPARTMENT REPORT
ELECTRIC PRODUCTION
December 2024

EQUIPMENT/PHYSICAL FACILITIES

Unit #6 (15.2 MW combustion turbine installed in 1973):

This unit can operate on natural gas or No. 2 fuel oil. Natural gas is the preferred choice because it is generally less expensive. This unit is used mostly for emergencies and during high electric loads. This is basically a peaking unit which can be started and fully loaded in approximately 45 minutes. It is often needed during the summer's peak electric loads. During the last few years, it has been dispatched more in the winter and its ability to operate during the winter months is essential to our operations. In August of 2022, MMU personnel erected a building to house the reverse osmosis system along with the MEE fogging system and treated water storage tank. For years the fogging equipment sat under an awning outside and the treated water came from inside the old steam power plant. The R.O. system was inside the plant as well as the treated water tank which was piped to the fogger outside. The piping and fogger were drained in the winter but sometimes still had freezing issues. Having a climate-controlled area for this equipment is a great improvement in protecting it from the elements and increases reliability. In the spring of 2023, the controls on the fogger were upgraded with a touch screen and a new PLC. This update gave the operator the ability to monitor and control the fogger from the computer in the control room. At the end of 2021, an inspection was performed by ETHOS Energy on the turbine and generator ends of the unit. The borescope inspection of the turbine showed normal pitting and wear with nothing remarkable and was in overall good condition. A gap inspection and polarization index (PI) test were performed on the generator end. There was some dust and contamination on the windings that required cleaning and some recoating with Glyptal insulating enamel. In 2019 an AMOT thermostatically controlled valve was installed. The AMOT valve circulates the warm oil and gradually opens as the oil heats introducing the cold oil into the system slowly maintaining a very consistent oil temperature making cold weather starts a lot less problematic. This unit has emergency black-start capabilities and was utilized in August 2011 to help restore power during a city-wide outage. The last major overhaul on this unit was in the fall of 2004. On March 1st 2014, this unit was submitted into the Southwest Power Pool (SPP) through MoPEP for generation if needed. In February of 2021 during winter storm Uri, unit #6 generated using diesel fuel due to the extremely high price and limited quantities of natural gas. A total of 252,890 gallons of diesel fuel was consumed during those 6 days as we generated around the clock. In March of 2021, unit #6 was again dispatched by SPP to generate 24 hours a day on natural gas for a 23-day period due to constraints on the system caused by a river crossing being replaced by Evergy. Unit #6 was dispatched a total of 663 hours generating 9,433,650 kilowatt hours through September of 2021.

Beginning in June of 2023, there was some noticeable loss in load from unit #6, along with some vibration. This prompted inspections and assistance from Ethos Energy. After a bore scope inspection of the turbine, it was decided that a major overhaul was due. Ethos Energy arrived onsite in October of 2023 and began the overhaul process. The major components of the unit were shipped to Ethos shop in Houston TX in January of 2024 and are currently still there with the repair process continuing. The estimated date for reassembly of the unit is February of 2025. During the disassembly process it was determined that the entire exhaust plenum of the unit was severely deteriorated. In house crews spent many hours fabricating a new exhaust plenum for the unit.



New exhaust plenum



Rotor at Houston shop



Rotor reassembly at Houston shop

In 2022 we installed an inverter to replace the depleted UPS system. In 2016, we replaced the batteries which provide control power and DC power to some of the equipment. In 2016, we started a control upgrade on this unit. The old Bailey Infi-90 controls were installed in 1998. We purchased new Allen-Bradley PLC-based controls and performed our own programming and installation in-house. We also replaced the generator protective relays which were 1972 vintage. Lutz, Daily & Brain (LD&B) was hired to help us with this phase of the project. This project was completed in December of 2016. The capacity payment from MoPEP for this unit is \$20,512.79 per month.

Units #7, #8, #9 (1 MW diesel engine generators installed in 1988/89):

Units #7 and #8 are located at the Marshall Water Treatment Plant, and Unit #9 is located at the Marshall Wastewater Treatment Plant. These units burn No. 2 fuel oil. They were installed to provide extra generating capacity and for emergency power at the Water and Wastewater Treatment Plants. These units run for capacity testing and emergencies. In February 2021 these units were called on by MoPEP to generate during winter storm Uri. These units can be started and be put online to generate quickly and also have black start capability. Replacing batteries, hoses, filters, and changing oil and belts are the types of maintenance performed on these units each year. New digital panel meters with communication capabilities were added in 2008. In the spring of 2013, we added new diesel oxidation catalysts to these engines. This was to comply with the EPA NESHAP RICE regulation. The rule required a reduction of CO (carbon monoxide) by 70% with a compliance date of May 2013. These units are tested to meet these regulations every three years. They will be up for testing in 2025. In 2013, we upgraded the controls on Unit #9 at the Wastewater Treatment Plant. A new digital control system from Cummins was installed. An automatic recloser was also added by Electric Distribution. This upgrade now allows the generator to automatically start and provide power to the plant during an outage, which is critical to their operation. In 2014, we also upgraded Units #7 and #8 at the Water Treatment Plant with the same Cummins control system. The only difference is the engines at the Water Treatment Plant have to be started manually during an outage if needed. New digital generation meters were also installed in 2016. The capacity payment from MoPEP for these units is \$2237.93 per month.



New Control Panels



Units 7 & 8 (Unit 7 is in the foreground)

Units #10 and #11 (6.3 MW diesel engine generators installed in 1990 and 1993):

These units operate on natural gas and No. 2 oil. Proper startup requires less than 30 minutes. They have the best efficiency of the Marshall units. These are the first units dispatched by MoPEP during peak load hours. A new water softener was added to the water treatment system in 2022. In May of 2021, a Cooper Machinery Representative was on site to help adjust change over instrumentation and balance cylinders. The rods on both units were replaced in 2001 due to a manufacturer recall program, which will help prevent future cracks. New engine controls were installed on Unit #10 in 2006 and Unit #11 in 2007. In May 2009, we purchased a new Schweitzer multi-function relay for Unit #10. The relay provides additional protection for the generator. These units are subject to the EPA NESHAP RICE rule which requires a reduction in carbon monoxide (CO) by 70%, achieved by adding oxidation catalysts. In addition, crankcase filtration systems are required to reduce HAP emissions by filtering the crankcase exhaust stream. We installed this new equipment in the fall of 2011. In 2012, we performed inspections on both engines. There were no major issues found. The two large diesel storage tanks were painted as well. In October 2014, we attempted an emission test for the NESHAP RICE Rule requirement. Neither engine was meeting the required reduction in CO. We sent a catalyst from each unit out for analysis and the results showed they were meeting the CO reduction requirement. After further investigation, we discovered that it was a gasket sealing problem. All of the gaskets were replaced. In January 2015, we retested with both engines meeting the NESHAP RICE emission requirement. These units require NESHAP RICE testing every three years. These units were due for testing in 2023. BHMG Engineering Inc. performed the testing in June of 2023. These tests were completed without any issues or discrepancies. Testing is scheduled to take place again in 2026. In 2016, we discovered several piping expansion joints on these units were cracking and deteriorated. All the expansion joints for the water and oil lines of both units were replaced. This project was completed at the beginning of the 2017 year. The capacity payment from MoPEP for these units is \$19,806.12 per month.



Units #10 and #11 Building



Units #10 (right) and #11



Unit # 10 and #11 Controls



Diesel Storage Tanks

The bulk diesel fuel storage tanks pictured above received an API 653 out-of-service inspection during the first week of February 2020. The diesel fuel levels were such that all fuel could be pumped into one tank. This allowed for cleaning inside the tanks and an interior and exterior inspection of each tank while empty. We also used this opportunity to replace all the valves and check valves. These valves had been outside since their 1973 installation and rarely operated making them extremely hard to move. A schedule has been implemented to maintain and operate the valves on a regular basis. The exterior of both tanks, ladders, and piping were power washed and painted in July of 2021. In 2023 we started having the circulating water pumps for both #10 & #11 rebuilt. Each unit has two pumps, a primary and a secondary. We were able to take one pump out of each unit to be rebuilt without needing to take the unit out of service. Two of the pumps are complete and back in service and we are waiting for the other two pumps to be completed. In 2024 we added water treatment to units 10 & 11. This system will constantly monitor the water chemistry and use chemicals in the cooling tower system and the closed system to help with corrosion of the piping system and other components.



Units 10 & 11 water treatment

The 2019 year brought a change in billing that made a big difference in the revenue received from our generation. The income from MMU's six generating units was based on an exhibit that used diesel fuel as an index which varied from natural gas prices at times. This method also resulted in a fixed dollar amount per megawatt hour which left a high exposure to loss during high gas pricing, especially during the winter months. With the new energy credit system MMU is made whole on operating costs and guaranteed a minimum of 10% profit on generation with the possibility of up to an additional 7 ½% depending on the situation.

Electric Production was scheduled to complete our bi-annual capacity test in 2023. Due to the issues with unit #6, we did not complete this test. We will be able to carry over our capacity test from 2021 until we can have unit #6 back in the pool. This test consists of running all units at maximum load for two hours at the same time to determine our generating capacity. The amount of our generating capacity determines the amount of our monthly capacity payment. Our previous total generation was 30 megawatts. On our 2021 test, we generated 29.7 megawatts. Although all units ran well there was a slight decrease in generation due to the extreme heat the day of testing. Another piece to our monthly cost is our peak demand. Peak demand is the highest consumption of electricity for our city along with the other cities in the Missouri Public Energy Pool at any given time. These peaks generally were on the hottest days of the year. MoPEP now uses an average of six peaks throughout the year to determine this demand. Of the current peaks, the highest was 37.3 megawatts on July 31, 2024.

SCADA:

Our main System Control and Data Acquisition (SCADA) system monitors and controls our electric distribution and production systems, water distribution system, and parts of the wastewater collection system. The software has three servers in the Business Office for the electric distribution and water systems and another for generation. With this new software, we can have as many monitoring stations as desired. Currently, there are several monitors in the Electric Production Dispatch Office and various staff have monitoring software on their computers. In addition, the Water Treatment Plant is able to access the system remotely.

The Electric Distribution server has KEPServer Electric Distribution Suite software on it that provides the actual communication to the field devices. OPC Systems is the software that handles the tag database and all the client computers. On this server, we have a license for 2500 items to monitor and control. We are able to monitor all the substations and reclosers, two remotely operated switches, and have added several remotely operated capacitor banks.

The Water server has KEPServer Manufacturing Suite software for device communication. This provides similar drivers to the Distribution server but has more drivers for communication with PLCs. The OPC Systems software on this server has a license for 1000 points. It also has the ability to log data to a database, and some of the other servers go through this one for that reason. This server monitors all the pump stations, all lift stations (except N. Miami), and the water tower. We are also using this server to handle some of the Wastewater Treatment Plant SCADA.

The Generation server has software to communicate with Allen Bradley devices. This includes Units #6, #10, and #11. The OPC Systems software has a license for 2,500 points and also has a database logging function. We will need to add some redundancy in case the server dies. This may involve adding another server or increasing the tag limit on one of the others. The other generating units are still on the Electric Distribution server.

Generating SCADA:

- Unit #6: The controls for this unit were updated to an Allen Bradley PLC system. This project was completed at the end of 2016. We are monitoring and controlling this unit from the computer. The fogger system controls were upgraded in 2023 with a new PLC and touch screen. We now have the ability to monitor and control the fogger from the computer in the control room.
- Unit #7 and Unit #8 have new controls and we are getting information on the SCADA monitoring the units, as well as exhaust temperatures and differential pressures for rules compliance.
- Unit #9 has been added to the SCADA at both the Wastewater Treatment Plant and Power Plant. We monitor the unit itself, the exhaust temperatures and pressures, and the new recloser that was added.
- Unit #10 and Unit #11 are self-contained with touch screens for control. We have added these to the Generation server for monitoring.
- We have added monitoring for the meter and recloser at the solar farm.

Recycling Facility (installed in 1996):

A recycling drop-off facility was opened in June 1996. We accept glass, metal cans, aluminum, #1 and #2 plastic, electronics, cardboard, and all paper products at this public drop-off center. For a period of time, we pelletized paper to be used for building heat and shredded paper materials for the public. A 6,000 sq. ft. storage building was built in 1998, using a DNR grant, to store larger amounts of paper pellets. In 2016 the pelletizing equipment was removed to make room for the auto-tie American baler. As a result, we no longer provide shredding of confidential papers for the public. At the present time, this building is used for storing recycling equipment and recycled material. We added approximately 3,000 square feet of covered recycle product storage in 2002 using Solid Waste District grant money. The steam-to-hot water heating system that was installed in the pelletizing building in 2003 was replaced by a 285,000 BTU package boiler in November 2020 due to the demolition of the steam Power Plant building.

In January 2008, we started recycling electronic equipment at the drop-off center. We average collecting and recycling approximately 12 tons of electronics per year which would have gone to the landfill as waste. We also installed a new entrance door to the processing building for public safety and convenience. In 2011, we added a new spillway on the east side to help control runoff from the Benton Street property. We also received grant money from the Solid Waste District to help fund the purchase of a new skid steer loader. The old 2011 Gehl 4640E skid steer was replaced with a new 2018 GEHL R165 from Riggins with a grant from the Solid Waste District. In 2018, we received grant money from the Solid Waste District and purchased a new forklift for the recycling center in 2019.

The truck scales at the facility were brought in from the city landfill in the mid 1990's. Repairs to the weigh scales were made for their continued use. Over the years the piers and the scales have deteriorated and need to be replaced. The Solid Waste District approved a grant to replace the scales and the new scales were installed by Accurate Superior Scale in March of 2023. All recycle products coming in or going out of the facility are weighed and recorded using these scales.

In 2024 we received a new glass crusher that was purchased in 2023 using another grant form the Region F solid waste district. The old glass crusher had been in service since the facility started in 1996 and had been used many times per week over that last 29 years. It was starting to show its age and needed to be replaced.



Entrance to recycling drop-off facility



Recycling drop off Area



2019 Toyota forklift



2019 Skid Steer



New Weigh Scale



Baled Mixed Paper, Cardboard, and #2 Plastic



Baled steel cans (left) Aluminum cans (right)

#2



Baled #1 PETE and Cardboard



Crushed Clear, Brown and Green Glass



New Glass Crusher

**MARSHALL MUNICIPAL UTILITIES
RECYCLE CENTER
FINANCIALS
2018-2024**

	<u>9/30/2018</u>	<u>9/30/2019</u>	<u>9/30/2020</u>	<u>9/30/2021</u>	<u>9/30/2022</u>	<u>9/30/2023</u>	<u>9/30/2024</u>	<u>TOTAL</u>
Revenue								
City of Marshall	\$ 63,324	\$ 39,579	\$ 35,245	\$ 115,837	\$ 104,467	\$ 13,246	\$ 63,899	\$ 435,596
Conagra	255,047	175,855	184,019	208,613	-	-	-	823,534
Total Revenue	318,371	215,434	219,264	324,450	104,467	13,246	63,899	1,259,130
Expense								
City of Marshall	156,093	72,827	49,380	95,223	173,792	133,027	132,779	813,120
Conagra	273,505	321,339	296,802	175,689	-	-	-	1,067,334
Total Expense	429,597	394,166	346,182	270,912	173,792	133,027	132,779	1,880,454
Net Income								
City of Marshall	(92,769)	(33,248)	(14,135)	20,614	(69,325)	(119,781)	(68,880)	(377,524)
Conagra	(18,458)	(145,484)	(112,783)	32,925	-	-	-	(243,800)
Net Income	\$ (111,226)	\$ (178,732)	\$ (126,918)	\$ 53,539	\$ (69,325)	\$ (119,781)	\$ (68,880)	\$ (621,324)
Avg \$ of Cardboard Per Ton								
	\$87	\$55	\$75	\$115	\$171	\$72	\$111	\$98
Cardboard \$ Per Ton								
High	\$115	\$85	\$135	\$200	\$200	\$100	\$140	
Low	\$80	\$45	\$45	\$70	\$100	\$55	\$70	

Historic Electric Peaks:

Peak net load 1993 = 37,719 KW, 4:00 p.m., Tuesday, 8/17/93
Peak net load 1994 = 35,952 KW, 5:00 p.m., Wednesday, 7/6/94
Peak net load 1995 = 39,447 KW, 4:00 p.m., Monday, 8/14/95
Peak net load 1996 = 39,924 KW, 4:00 p.m., Friday 7/19/96
Peak net load 1997 = 40,786 KW, 4:00 p.m., Friday, 7/25/97
Peak net load 1998 = 41,200 KW, 3:00 p.m., Tuesday, 8/18/98
Peak net load 1999 = 43,500 KW, 4:00 p.m., Thursday, 7/29/99
Peak net load 2000 = 45,340 KW, 4:00 p.m., Thursday, 8/31/00
Peak net load 2001 = 42,479 KW, 2:00 p.m., Tuesday, 7/24/01
Peak net load 2002 = 39,300 KW, 5:00 p.m., Tuesday, 7/9/02
Peak net load 2003 = 42,401 KW, 4:00 p.m., Thursday, 8/21/03
Peak net load 2004 = 40,176 KW, 4:00 p.m., Wednesday, 7/25/04
Peak net load 2005 = 41,401 KW, 4:00 p.m., Wednesday, 8/10/05
Peak net load 2006 = 42,661 KW, 5:00 p.m., Monday, 7/17/06
Peak net load 2007 = 41,128 KW, 5:00 p.m., Wednesday, 8/15/07
Peak net load 2008 = 36,659 KW, 5:00 p.m., Monday, 8/4/08
Peak net load 2009 = 39,433 KW, 3:00 p.m., Tuesday, 6/23/09
Peak net load 2010 = 40,062 KW, 4:00 p.m., Thursday, 8/12/10
Peak net load 2011 = 41,944 KW, 4:00 p.m., Tuesday, 8/2/11
Peak net load 2012 = 40,022 KW, 4:00 p.m., Wednesday, 7/25/12
Peak net load 2013 = 38,600 KW, 4:00 p.m., Thursday, 7/18/13
Peak net load 2014 = 37,800 KW, 4:00 p.m., Monday, 8/25/14
Peak net load 2015 = 38,351 KW, 4:00 p.m., Tuesday, 7/28/15
Peak net load 2016 = 38,600 KW, 4:00 p.m., Tuesday, 7/20/16
Peak net load 2017 = 37,200 KW, 4:00 p.m., Thursday, 7/20/17
Peak net load 2018 = 38,200 KW, 4:00 p.m., Thursday, 7/12/18
Peak net load 2019 = 36,800 KW, 3:00 p.m., Friday, 7/19/19
Peak net load 2020 = 35,730 KW, 4:00 p.m., Tuesday, 8/25/20
Peak net load 2021 = 37,781 KW, 4:00 p.m., Wednesday, 8/11/21
Peak net load 2022 = 36,790 KW, 4:00 p.m., Thursday, 6/16/22
Peak net load 2023 = 38,666 KW, 4:00 p.m., Thursday, 8/24/23
Peak net load 2024 = 37,320 KW, 4:00 p.m., Wednesday, 7/31/24

Historic peak net load to date = 45,340 KW, 4:00 p.m., Thursday, 8/31/00



Power Plant Building at 765 W. North Street (erected in 1935, 1948, 1955, 1967)

Power Plant Demolition Project:

Unit #5 (16.5 MW steam turbine installed in 1967) was the last operational steam unit in the Power Plant building housing MMU's steam generators. The last time this unit was operated was in March 2015. On February 17th, 2017, the Board authorized management to notify the MoPEP pool to remove unit #5's generation capacity from the South West Power Pool and MoPEP energy reserves. On July 12th, 2018, due to the extremely high cost of start-up and check-out of this unit for safe operation, it was decided by Management the needed repair cost to ensure its safe operation would permanently stop this unit from any future operation. The consensus of the Board was to include unit #5 in the future demolition along with units #1, #2, #3, and #4.

The cost of using the Power Plant building for offices, storage, and maintenance areas was a significant amount due to the inefficiency having the number of transformers that had to remain in use to keep the necessary lighting and equipment working. There was considerable interest in possibly repurposing the building for something else. Upon closer inspection, it was decided that the original design of the building being for electrical power generation made it economically unfeasible to be used for anything else.

A bid spec for the demolition of the old steam Power Plant was written and sealed bids were accepted. There were 11 vendors at the walk-through of the Power Plant and a total of 5 bids were received. The bid opening was on February 25th, 2020 at 1:30 p.m. This project was awarded to Ahrens Contracting Inc. The asbestos abatement part of the project was subcontracted by Ahrens to ARSI Environmental. Although the contractors were not supposed to take possession of the building until August 31st, 2020. ARSI made a requested to get an

early start to avoid cold weather and were allowed to start their preliminary work around mid-June. The demolition project was completed in September of 2021.



*Where the Steam Power Plant used to stand
with unit #6 in the background.*

In 2023 Electric production continued to make improvements to the Benton building that now houses Electric production staff, Dispatch room, Electric production shop area, the Electricians, and their shop area. New task lighting was installed over certain equipment in the shop to help improve safety on these machines. The Dispatch room is staffed 24 hours a day 7 days a week. If a tornado hits the area there will be someone in the Dispatch room. A concrete storm shelter was added just outside the back door to give staff a place to go in case of such an emergency.



New Maintenance Shop



New Task lighting



Storm Shelter



Storm Shelter

Dispatching Room at the Benton Street building:

The new dispatching room, located at the Benton Street building, monitors the electrical distribution system, water tower and reservoirs, water pressure, security cameras, logs truck weights going in and out across the scales, and answers incoming calls after business hours. The Dispatcher also applies hot line tags for linemen working on or near energized power lines. A new addition in 2019 was the Command Center which will allow the dispatcher to connect or disconnect an electric meter with the click of the mouse. The Command Center also shows any area or meters that is without power in an outage.

The old Power Plant had several brass plaques on the wall by the front door. We removed these plaques and put them up in the new Electric production office. Some of these plaques also have all the 25-year employees and past board members.

