Newman Units 3&4 Condition Assessment

El Paso Electric

El Paso Electric, Inc.

Condition Assessment
Project No. 101995

Revision 2
4/14/2021

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
°C	Degrees Celsius
°F	Degrees Fahrenheit
1898 & Co.	1898 & Co., a part of Burns & McDonnell Engineering Company, Inc.
AC	Alternate Current
AF	Availability Factor
ASME	American Society of Mechanical Engineers
AVR	Automatic Voltage Regulator
BFP	Boiler Feed Pump
Btu	British Thermal Units
CCW	Closed Cooling Water
CEMS	Continuous Emissions Monitoring System
COD	Commercial Operation Date
CT1	Newman CT 1
CT2	Newman CT 2
CTG	Combustion Turbine Generator
CT	Combustion Turbine
DCS	Distributed Control System
EPE	El Paso Electric, Inc.
FAC	Flow-Accelerated Corrosion

Abbreviation	Term/Phrase/Name
Facility	Newman Power Station
FD	Forced Draft
FERC	Federal Energy Regulatory Commission
FGR	Fuel Gas Recirculation
FOR	Forced Outage Rate
FWH	Feedwater Heater
GADS	Generating Availability Data System
GCB	Generator Circuit Breaker
GSU	Generator Step-Up
HEP	High Energy Piping
HGP	Hot Gas Path
HP	High Pressure
HRSG1	Newman HRSG 1
HRSG2	Newman HRSG 2
Hz	Hertz
HRSG	Heat Recovery Steam Generator
IGV	Inlet Guide Vane
in HgA	Inches of Mercury
kVA	Kilovolt Ampere
kW	Kilowatt

Abbreviation	Term/Phrase/Name
kWh	Kilowatt-Hour
L-type	Left-Modal Type
lb/hr	Pounds Per Hour
MCC	Motor Control Center
MCR	Maximum Continuous Rating
MI	Major Inspection
MV	Medium Voltage
MVA	Megavolt Ampere
MW	Megawatt
MWhs	Megawatt Hour
NDE	Non-Destructive Evaluation
NERC	North American Electric Reliability Corporation
Newman	Newman Power Station
NFPA	National Fire Protection Association
O&M	Operation and Maintenance
OA/FA/FA	Oil Air/Forced Air/Forced Air
OEM	Original Equipment Manufacturer
PF	Power Factor
Plant	Newman Power Station
psig	Pounds Per Square Inch Gauge

Abbreviation	Term/Phrase/Name
PRC	Protection and Control
RO	Reverse Osmosis
R-type	Right-Modal Type
ST	Steam Turbine
Study	Condition Assessment
S-type	Symmetrical-Modal Type
TE	Trailing Edge
TGTS	Turbine Generator Technical Services
Thielsch	Thielsch Engineering, Inc.
UAT	Unit Auxiliary Transformer
Unit 3	Newman Unit 3
Unit 4	Newman Unit 4
UPS	Uninterruptible Power Supply
V	Volt
Vdc	Volts Direct Current
Yr	Year

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1.0 EXECUTIVE SUMMARY

1.1 Objective & Background

El Paso Electric, Inc. ("EPE") retained the services of 1898 & Co., a part of Burns & McDonnell Engineering Company, Inc., ("1898 & Co.") to perform a study to assess the condition of Newman Unit 3 ("Unit 3") and Unit 4 ("Unit 4") of the Newman Power Station ("Plant", "Newman", or "Facility"). The study identifies the overall costs to continue operation of Unit 3 and Unit 4 until retirement in each of the following scenarios ("Study"). Table 1-1 presents the retirement scenarios that were considered for Newman.

Table 1-1: Newman Retirement Scenarios

Scenario	Unit 3	Unit 4
Scenario 1	2026	2026
Scenario 2	2031	2031
Scenario 3	2041	NA

This Study includes an analysis of the current condition of the Plant given the expected service life of Unit 3 and Unit 4, as well as any matters of concern with current and expected operations, maintenance, external, and environmental factors. 1898 & Co. has included estimated capital and incremental operation and maintenance ("O&M") costs associated with operating Unit 3 and Unit 4 safely and reliably until the retirement dates outlined above.

Unit 3, which commenced commercial operations in 1966, consists of a Babcock & Wilcox natural gas-fired boiler which supplies steam to a General Electric steam turbine ("ST"). Unit 3 currently has a unit nameplate capacity of 105 megawatts ("MW"). Unit 4, which commenced commercial operations in 1975, consists of two Westinghouse combustion turbines ("CTs") and two Westinghouse heat recovery steam generators ("HRSGs") which supply steam to a Westinghouse ST. Unit 4 currently has a unit nameplate capacity of 223 MW.

The analysis conducted herein is based on historical operations data, maintenance and operating practices of units similar to Unit 3 and Unit 4, condition information provided by EPE, feedback from EPE personnel, and the professional opinion of 1898 & Co.. 1898 & Co. also analyzed necessary updates for the Units and need for capital replacements to continue to operate Unit 3 and Unit 4.

1.2 Results

1.2.1 Performance & Benchmark

1.2.1.1 Unit 3

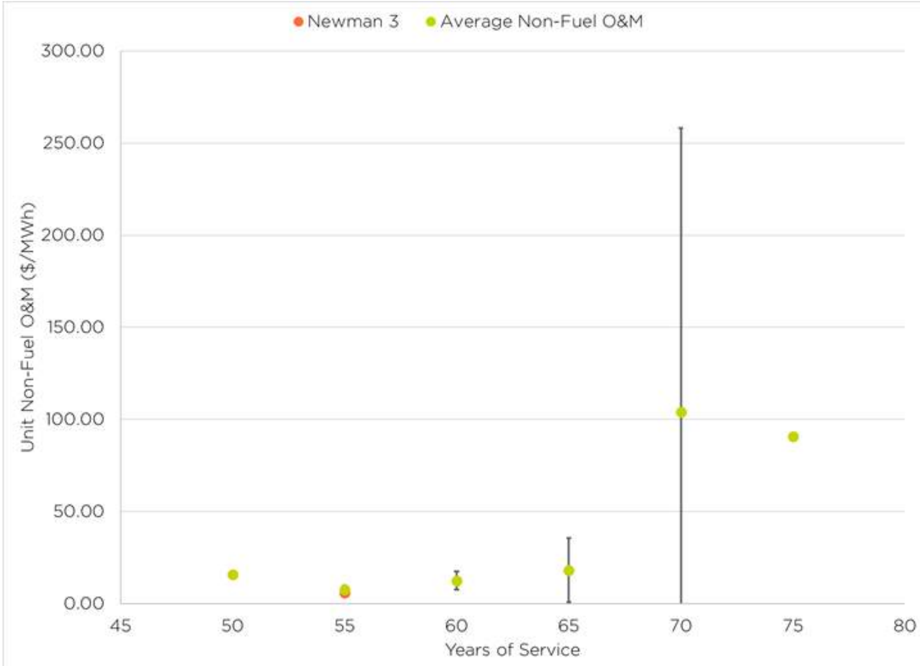
1898 & Co. evaluated overall reliability and performance of Unit 3 against a fleet average of similar generating stations. The data used to determine the fleet averages of similar generating stations was obtained from the North American Electric Reliability Corporation ("NERC") Generating Availability Data System ("GADS") for natural gas-fired assets between 75 MW and 200 MW.

1898 & Co. compared the availability and reliability statistics of Unit 3 to national and regional benchmark groups. Unit 3 has had a slightly worse availability factor ("AF") and better forced outage rate ("FOR") than the average of the units included in the benchmark groups. Over the past five years, the AF of Unit 3 has been approximately 3 percent less than (worse) the national fleet benchmark and approximately 5 percent less than (worse) the regional fleet benchmark. Additionally, over the five-year period the FOR of Unit 3 was approximately 12 percent better than the national fleet benchmark and approximately 14 percent better than the regional fleet benchmark. From these analyses, 1898 & Co. determined that Unit 3 has operated in line with industry availability and reliability standards over the past five years.

1898 & Co. evaluated the overall capacity factor and net generation of Unit 3 against a fleet average of similar generating units. Unit 3 has experienced significantly higher capacity factors and net generation compared to the national and regional fleet benchmarks.

1898 & Co. evaluated the trend in non-fuel O&M costs associated with similar natural gas-fired units which are required to report O&M costs as part of the Federal Energy Regulatory Commission ("FERC") Form 1 submission. 1898 & Co. developed an industry trend by grouping units based on current service life. The analysis determined that the overall cost required to operate and maintain natural gas-fired units appear to increase with age. Figure 1-1 presents the relationship between average non-fuel O&M costs by commercial operation date ("COD"), in green, and the previous five years of non-fuel O&M costs for Unit 3, in orange. Figure 1-1 also includes one standard deviation for each benchmarking group. Each plant included in the benchmark is represented as a single data point defined by the five-year average non-fuel O&M cost.

Figure 1-1: Unit 3 Non-Fuel O&M Cost Trend Evaluation



Units experience relatively consistent non-fuel O&M costs, if not slightly increasing, until operator/owners decide whether a unit should continue to operate or be retired around 60 years of service. At that point, operators have two decisions; invest in the unit to continue available and reliable operations or operate the unit without investment until failure. The decision can lead to a wide spread of non-fuel O&M costs. Units operated until failure experience lower O&M cost, but at the sacrifice of unit reliability. Conversely, units that require higher reliability and availability will experience an increase in O&M costs to repair and replace components to maintain its performance.

1.2.1.2 Unit 4

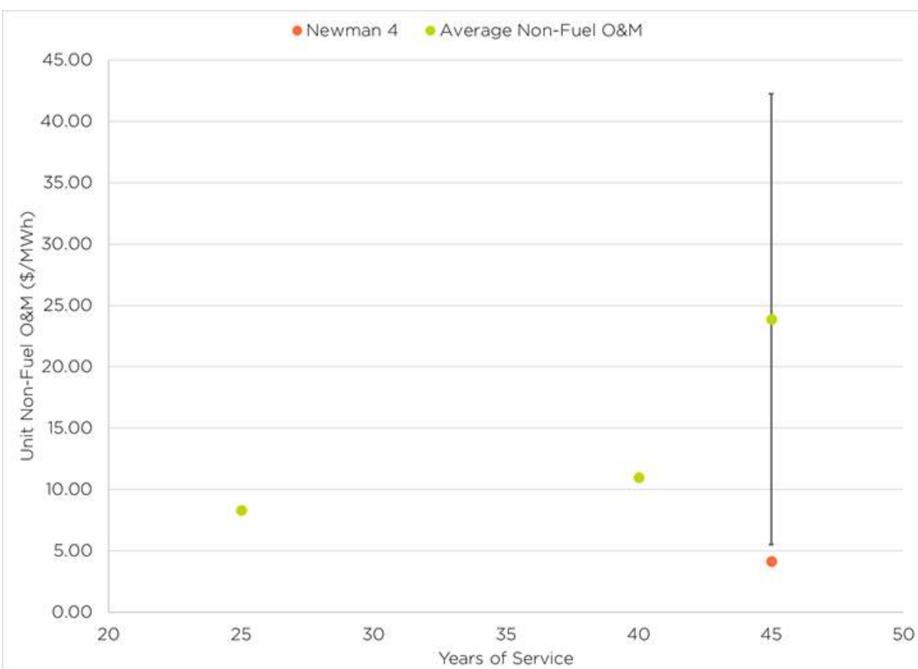
1898 & Co. evaluated the overall reliability and performance of Unit 4 against a fleet average of similar generating stations. The data used to determine the fleet averages of similar generating stations was obtained from the NERC GADS for combined cycle assets between 200 MW and 350 MW.

1898 & Co. compared the availability and reliability statistics of Unit 4 to national and regional benchmark groups. Unit 4 has had a worse AF and worse FOR than the average of the units included in the benchmark groups. Over the past five years the availability of Unit 4 has been approximately 9 percent less than (worse) the national fleet benchmark and approximately 10 percent less than (worse) the regional fleet benchmark. Additionally, over the five-year period the Unit 4 FOR was approximately 6 percent lower (better) than the national fleet benchmark and approximately 3 percent lower (better) than the regional fleet benchmark. From these analyses, 1898 & Co. determined that Unit 4 has operated below industry availability and reliability standards over the past five years.

1898 & Co. evaluated the overall capacity factor and net generation of Unit 4 against a fleet average of similar generating units. Generally, Unit 4 has experienced higher net capacity factors compared to the national and regional benchmarks, while only consistently operating above the regional net generation benchmark.

1898 & Co. evaluated the trend in non-fuel O&M costs associated with similar combined cycle units which are required to report O&M costs as part of the FERC Form 1 submission. 1898 & Co. developed an industry trend by grouping units based on current service life. The analysis determined the overall costs required to operate and maintain combined cycle units appear to increase with age. Figure 1-2 presents the relationship between average non-fuel O&M costs by COD, in green, the previous five years of non-fuel O&M costs for Unit 4, in orange. Figure 1-2 also includes one standard deviation for each benchmarking group. Each plant included in the benchmark is represented as a single data point defined by the five-year average non-fuel O&M cost at the facility.

Figure 1-2: Unit 4 Non-Fuel O&M Cost Trend Evaluation



Based on the experience of 1898 & Co., units experience escalating O&M cost until the first major outage on the unit. After the major inspection ("MI"), O&M cost will directly correlate with operating philosophy. Units operated until failure experience lower O&M, while units needed for reliability reason will experience an increase in O&M cost to repair and replace components. Small sample sizes in Figure 1-2 does not allow for the trends common in the industry to develop.

1.2.2 Cost Projections

1.2.2.1 Unit 3

1898 & Co. evaluated the overall costs for operating and maintaining Unit 3. Figure 1-3 presents non-fuel O&M expenses and capital expenditures required to operate Unit 3 through 2026 excluding major variable costs such as fuel, water, chemicals, etc. and fixed costs such as taxes, insurance, overheads, etc. O&M expenses are shown in orange and the capital expenditures are shown in green.

Figure 1-3: Unit 3 Scenario 1 Total Annual Project Cost Summary

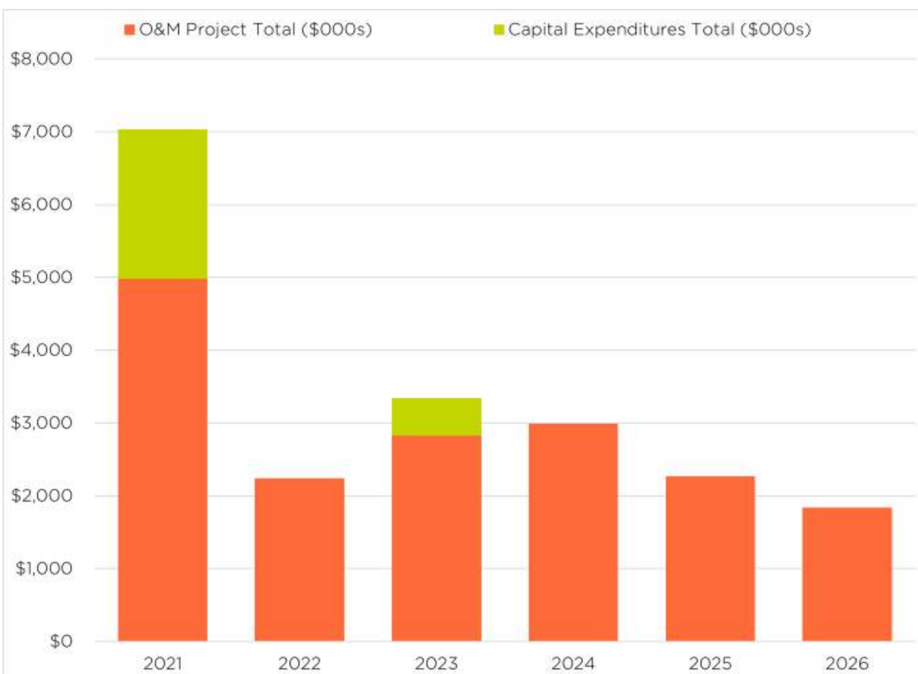


Figure 1-4 presents non-fuel O&M expenses and capital expenditures required to operate Unit 3 through 2031 excluding major variable costs such as fuel, water, chemicals, etc. and fixed costs such as taxes, insurance, overheads, etc. O&M expenses are shown in orange, and the capital expenditures are shown in green. The expenditures have been broken out to indicate how cost will be affected by continuing to operate Unit 3 past 2026.

Figure 1-4: Unit 3 Scenario 2 Total Annual Project Cost Summary

Figure 1-5 presents O&M expenses and capital expenditures required to operate Unit 3 through 2041 excluding major variable costs such as fuel, water, chemicals, etc. and fixed costs such as taxes, insurance, overheads, etc. O&M expenses are shown in orange, and the capital expenditures are shown in green. The expenditures have been broken out to indicate how cost will be affected by continuing to operate Unit 3 past 2031.

Figure 1-5: Unit 3 Scenario 3 Total Annual Project Cost Summary

Appendix A of this report provides a breakdown of component replacements, year the project will occur, frequency, and cost. The costs presented are based on current market prices and do not include major changes in market dynamics that may influence future project costs. Additionally, all costs are presented in 2020 dollars with no inflation adjustment. 1898 & Co. has also assumed that costs would taper as Unit 3 nears the end of useful life as major maintenance activities would be deferred and equipment would be run to failure. This assumption has resulted in an overall reduction in O&M costs and capital expenditures during these years.

1.2.2.2 Unit 4

1898 & Co. evaluated the overall costs for operating and maintaining Unit 4. Figure 1-6 presents non-fuel O&M expenses and capital expenditures required to operate Unit 4 through 2026 excluding major variable costs such as fuel, water, chemicals, etc. and fixed costs such as taxes, insurance, overheads, etc. O&M expenses are shown in orange and the capital expenditures are shown in green.

Figure 1-6: Unit 4 Scenario 1 Total Annual Project Cost Summary

Figure 1-7 presents non-fuel O&M expenses and capital expenditures required to operate Unit 4 through 2031 excluding major variable costs such as fuel, water, chemicals, etc. and fixed costs such as taxes, insurance, overheads, etc. O&M expenses are shown in orange, and the capital expenditures are shown in green. The expenditures have been broken out to indicate how cost will be affected by continuing to operate Unit 4 past 2026.

Figure 1-7: Unit 4 Scenario 2 Total Annual Project Cost Summary

Appendix B of this report provides a breakdown of component replacements, year the project will occur, frequency, and cost. The costs presented are based on current market prices and do not include major changes in market dynamics that may influence future project costs. Additionally, all costs are presented in 2020 dollars with no inflation adjustment. 1898 & Co. has also assumed that costs would taper as Unit 4 nears the end of useful life as major maintenance activities would be deferred and equipment would be run to failure. This assumption has resulted in an overall reduction in O&M costs and capital expenditures during these years.

1.3 Conclusions

1.3.1 Unit 3

The following conclusions and recommendations for Unit 3 are based on the observations and analysis from this Study.

1. Unit 3 was placed into commercial service in 1966, meaning Unit 3 has provided 54 years of service. The typical power plant has a design life of approximately 30 to 40 years; therefore Unit 3 has served beyond the typical design life of a power generation facility. Many power plant operators have been able to operate the units past the typical design life by replacing or refurbishing many critical components.

2. Overall, the Plant's AF is below (worse than) the fleet average and FOR is lower (better than) than the fleet average as compared to data obtained through the NERC GADS data base for similarly sized units. The net capacity factors and net generation statistics for Unit 3 has been higher than the fleet benchmarks.
3. Several of the major components and equipment for Unit 3 will need to be repaired or replaced to provide reliable operation in any of the scenarios expected at the Plant. Currently most of this work is scheduled to take place in 2021. If Unit 3 operates until at least 2031 a rewind of the generator is recommended in 2022. Additionally, the circulating water piping will need to be replaced to maintain reliable operation of Unit 3.
4. EPE should perform boiler and high energy piping ("HEP") condition assessments on a regular basis. Condition assessments of the reheat outlet header and hot reheat piping on Unit 3 are especially critical as the reheat outlet header has experienced considerable wear. The continued practice of a regular non-destructive evaluation ("NDE") program would be prudent to provide early warning of major component deterioration.
5. 1898 & Co. recommends a cumulative O&M spend for:
   a. Scenario 1 (retirement in 2026): $17.1 million or $27.20/kW-yr and cumulative capital expenditures of $2.54 million and $4.03/kW-yr.
   b. Scenario 2 (2031 retirement): $35.4 million or $30.66/kW-yr and cumulative capital expenditures of $9.46 million and $8.19/kW-yr.
   c. Scenario 3 (2041 retirement): $69.1 million or $31.32/kW-yr and cumulative capital expenditures of $12.9 million and $5.86/kW-yr.

1.3.2 Unit 4

The following conclusions and recommendations for Unit 4 are based on the observations and analysis from this Study.

1. Unit 4 was placed into commercial service in 1975, meaning Unit 4 has provided 45 years of service. The typical combined cycle power plant design assumes a component life of approximately 25 to 30 years meaning Unit 4 has exceed the end of its design life. Many power plant operator/owners continue to operate these facilities well past the original design life by replacing or refurbishing critical components.
2. Overall, the Plant's reliability is below (worse than) the fleet average as measured by the AF and higher (worse than) than the fleet average as measured by FOR against data obtained through the NERC GADS data base for similarly sized

units. Additionally, Unit 4 has operated above the national and regional net capacity factor fleet benchmarks.

3. Several of the major components and equipment for Unit 4 will need to be repaired or replaced to provide reliable operation in any of the scenarios expected at the Plant. Currently most of this work is scheduled to take place in 2024, when the ST is scheduled for a major overhaul. Each CT is scheduled for at least one more MI if Unit 4 operates until 2026 but could experience two MIs if Unit 4 operates until 2031.
4. EPE should perform boiler and HEP condition assessments on a regular basis. The continued practice of a regular NDE program would be prudent to provide early warning of major component deterioration.
5. 1898 & Co. recommends a cumulative O&M spend for:
    a. Scenario 1 (retirement in 2026): $44.8 million or $33.38/kW-yr and cumulative capital expenditures of $10.8 million and $8.05/kW-yr.
    b. Scenario 2 (2031 retirement): $89.0 million or $36.22/kW-yr and cumulative capital expenditures of $29.9 million and $12.15/kW-yr.

2.0 INTRODUCTION

2.1 General Facility Description

EPE is an investor-owned electrical utility responsible for supplying power through an interconnected system to a service territory encompassing approximately 424,000 customers in the Rio Grande Valley in west Texas and southern New Mexico. Unit 3 began commercial operation in March 1966 and Unit 4 began commercial operation in August 1975.

Unit 3 includes a natural circulation boiler designed by Babcock and Wilcox for 700,000 pounds per hour ("lb/hr") steam flow at 1,954 pounds per square inch gauge ("psig") outlet pressure and 1,005 degrees Fahrenheit ("°F") superheater and reheater outlet temperatures. The boiler has a pressurized furnace, and a single regenerative Ljungstrom air preheater. The General Electric ST is a tandem compound, double-flow condensing unit. The ST/generator has a nameplate rating of 105 MW. Cooling water is circulated through a crossflow cooling tower.

Unit 4 is a Westinghouse PACE 260 plant consisting of Westinghouse 501B gas turbines in a 2 x 1 combined cycle configuration. The total unit is rated at 223.5 MW at 4,065 feet elevation, 80°F ambient air and 3.5 inches Hg condenser pressure. The gas turbines, originally Westinghouse 501B2 units, were upgraded to 501B6 models in 1994 and 1995. The HRSGs are single pressure vertical flow with an unfired rating of 443,477 lb/hr steam flow at 1,277 psig outlet pressure and 952 °F steam outlet temperature. When duct firing is utilized the rating of the HRSGs changes to 887,000 lb/hr steam flow at 1,277 psig outlet pressure and 925°F steam outlet temperature. The ST is a Westinghouse single case, non-reheat, single flow, axial exhaust condensing unit rated at 107 MW. Cooling water is circulated through a crossflow cooling tower.

2.2 Study Objectives & Overview

EPE retained the services of 1898 & Co. to perform a study to assess whether Newman Units 3 and 4 could operate reliably until various retirement dates.

1898 & Co. has estimated capital and incremental O&M costs for recommendations made to maintain unit reliability and availability. This study includes a review of the current condition of the plant and current plant maintenance and operations practices. 1898 & Co. evaluated various retirement scenarios for Unit 3 and Unit 4, which is presented below in Table 2-1.

Table 2-1: Newman Retirement Scenarios

Scenario	Unit 3	Unit 4
Scenario 1	2026	2026
Scenario 2	2031	2031
Scenario 3	2041	NA

To complete this assessment, the 1898 & Co. team reviewed plant documentation and interviewed plant personnel to obtain information on the condition of the Newman Units.

2.3 Study Contents

The following report details the current condition of the units, their predicted future operating capability, and recommendations for improvements / additional testing or inspections. This information was compiled based on existing plant records, comparison to similar units and equipment, and in-house expertise.

Since virtually every single component within a power plant can be replaced, the remaining life of a plant is typically driven by the economics of replacing the various components as necessary to keep the plant operating versus shutting it down and either purchasing power or building a replacement facility. For this reason, it is important for EPE to periodically update the condition assessment of the Newman Units to project out the major future expenditures that will be required to maintain the Facility. Specifically, the critical physical components that will likely determine the facility's remaining life include the following:

- Steam generator drum, tubing, headers, and downcomers.
- HRSG drum, headers, modules, and downcomers
- HEP systems.
- ST rotor shaft, valves, and steam chest.
- Gas turbine rotor shaft.
- Generator rotor shaft(s), stator and rotor windings, stator and rotor insulator, and retaining rings.

The following items, although not as critical as the above, are also influential components that will also play a role in determining the remaining life of the plant:

- Steam generator tubing, ductwork, expansion joints, insulation, casing, structure, air preheater and FD fan.
- HRSG casing, insulation, and structure
- ST blades, diaphragms, nozzle blocks, and casing and shells.
- Gas turbine blades, diaphragms, combustors, casing and shells.
- Generator stator-winding bracing, DC exciter, and voltage regulator.
- Balance of plant condenser, cooling tower, circulating water piping, feedwater heaters ("FWHs"), feedwater pumps and motors, controls, and auxiliary switchgear.
- Cooling tower structure, structural steel, stack, concrete structures, and station main generator step-up ("GSU") and auxiliary transformers.

External influences that will potentially be a major determinant of the future life of the units include:

- Environmental influences, including water availability and future environmental compliance requirements such as NO_x and CO_2 emissions.
- Economics, including fuel costs, comparative plant efficiency, and system needs.
- Obsolescence such as the inability to obtain replacement parts and supplies for controls system, instrumentation, drives or other plant equipment.

3.0 SITE VISIT / PLANT INTERVIEWS

Representatives from 1898 & Co., along with EPE staff, virtually interviewed the Facility personnel on August 3, 2020 and August 5, 2020. The interviews aimed to gather information above and beyond the extensive information provided by EPE staff and Facility personnel while also clarifying questions 1898 & Co. had about the Facility for this Study.

The following representatives from the EPE and Facility provided information during the interviews:

- Manny Gomez, Lead EPE Engineer
- Fred Prutch, Plant Manager
- Kyle Olson, Engineering Manager
- Steven Wall, Operations Superintendent
- Adam Davila, Maintenance Superintendent
- Jose (Louis) Guaderrama, Operations Director
- Jamie Viramontes, PdM Manager
- Adam Hokit
- Jesus Marquez
- Chris Carroll
- Carlos Venegas, Newman Engineer

The following 1898 & Co. representatives comprised the Study team:

- Kyle Haas, Project Manager
- Tom Stauffer, Mechanical Engineer
- Tommy Della Rocca, Electrical Engineer
- Thomas Ruddy, Analyst

- Jacob Waller, Analyst

Generally, Newman personnel indicated that the Facility was in good condition which was confirmed through the review of the provided inspection information. 1898 & Co. was unable to visit the site due to concerns associated with travel during the COVID-19 outbreak.

4.0 UNIT 3

4.1 Boiler

Unit 3 is a natural circulation, pressurized furnace unit designed by Babcock and Wilcox to burn natural gas using nine burners. The unit was originally designed for a maximum continuous rating ("MCR") of 700,000 lb/hr main steam at a superheater outlet condition of 1,954 psig and 1,005 °F. The outlet reheat conditions are 390 psig and 1,005 °F. The superheater and reheater outlet temperatures are controlled by de-superheater sprays. The boiler design also includes an economizer and Ljungstrom type air heater for flue gas heat recovery.

Tube samples have been taken in the boiler, but Newman personnel could not recall the last chemical clean conducted. Additionally, infrared scans are taken of the boiler to determine where hot spots are developing. Areas identified during the infrared scans are addressed during the annual outages.

1898 & Co. recommends annual boiler inspections to inspect and repair or replace boiler tubes and other components as required. If the unit is to be operated until 2031 or beyond, chemical cleaning of the boiler is recommended in 2025.

4.1.1 Waterwalls

The inner walls of the boiler are made up of vertical boiler waterwalls, which are comprised of tubes welded together into panel sections. Subcritical fluid is supplied from the steam drum to the waterwalls and is heated by the furnace flames before recirculating back to the steam drum.

The waterwalls have experienced under corrosion pitting on the bull noose. Additionally, Newman personnel indicted that the roof tubes experience circulation deficiencies. The circulation deficiencies result in failures on branches.

The annual boiler inspection recommended by 1898 & Co. should include inspecting waterwalls and replacing deficient tubes and sections as necessary.

4.1.2 Superheater

The superheater sections of the boiler are used to raise the temperature of the steam above the saturation temperature (i.e. superheat the steam). Saturated steam exiting the top of the steam drum passes through the various sections of the superheater and the temperature is continually increased until the steam finally exits the superheater outlet header and continues through the main steam line towards the high pressure (“HP”) ST. The superheater is divided into two stages, primary and secondary, with attemperators positioned in between.

Newman personnel indicated two primary superheater tubes have experienced minor tube issues. One of the tubes was repaired with a weld overlay, while the other tube received a patch repair. The secondary superheater is scheduled for replacement in 2021. A significant driver of the replacement is cracks in the secondary superheater tubes that cannot be reached for maintenance. No issues were reported with the superheater steam attemperator, but concerns persist with the control valve. Additionally, the superheater steam attemperator line was relined within the last four years.

4.1.3 Reheater

In the reheater section of the boiler the superheat of the steam discharged from the HP turbine is increased. Steam exiting the HP turbine is transported by the cold reheat steam lines to the reheater inlet header. As the steam passes through the reheater its temperature continually increases until the steam finally exits the reheater outlet header to continue through the hot reheat steam line towards the intermediate pressure ST.

The reheater has experienced short-term overheating as a damage mechanism. Newman personnel indicated that 10 loops of the reheater are planned for replacement in 2021. Additionally, the reheater steam attemperator liners where replaced in the past four years.

4.1.4 Economizer

The economizer section of the boiler is used to improve the efficiency of the thermal cycle by using the exhaust gases to raise the temperature of the feedwater entering the boiler. The boiler feedwater system receives feedwater from the condensate system through the deaerator storage tank and utilizes the boiler feed pumps to convey feedwater through the HP FWHs before arriving at the economizer inlet header. From the economizer inlet header, the feedwater temperature is then increased throughout the economizer tube sections in the boiler before exiting through the economizer outlet header and traveling to the steam drum.

Newman personnel indicated the economizer is original and has recently experienced many tube leaks. The tube leaks are a byproduct of short-term overheating and flow-accelerated corrosion (“FAC”).

4.1.5 Steam Drums and Headers

The boiler drum is used to receive feedwater from the economizer and distribute it to the downcomers. The steam/water mixture from the waterwalls recirculates back through the steam drum, which separates the steam from the saturated mixture before being sent to the superheater. Headers act as reservoirs throughout the boiler that collect steam in the various boiler sections. Since the drum is most susceptible to fatigue and corrosion damage, 1898 & Co. recommends regular steam drum inspections including a detailed visual inspection with internals removed, magnetic particle examination of all girth, socket, and nozzle welds, as well as ultrasonic inspection of the welds and thickness readings at the normal water level. Newman personnel did not report any issues with cracking or internals in the steam drum.

The lower temperature headers include the economizer inlet and outlet headers. Despite being at a relatively low temperature, these headers, in particular the economizer inlet header, tend to be susceptible to ligament cracking caused by thermal stresses incurred during startups and shutdowns. Based on the findings of the initial examination, 1898 & Co. recommends these headers be inspected periodically to monitor for signs of such damage. FAC has also been an industry wide problem in many economizers.

The high temperature headers are the primary and secondary superheater outlet and reheat outlet headers. These headers operate under severe conditions and are particularly susceptible to localized overheating, which leads to creep damage and other stress related cracks caused by temperature imbalances applied side-to-side across the headers.

4.1.6 Safety Valves

Safety valves are installed on the Unit to protect the equipment from over-pressurization events such as a turbine trip or a boiler feed pump control issue.

1898 & Co. recommends the valves be tested in accordance with the American Society of Mechanical Engineers (“ASME”) code requirements. Annual inspections by the safety valves’ original equipment manufacturer (“OEM”) are recommended to determine if refurbishment or replacement is required.

4.2 Boiler Auxiliary Systems

4.2.1 FD Fan

Unit 3 utilizes one forced draft ("FD") fan that provides combustion air to the furnace. The air is heated in the air heater and is then delivered to the furnace through the boiler wind boxes.

Newman personnel indicated that annually the inlet guide vanes ("IGVs"), motor, linkages, and wheel are inspected. The FD fan was rebuilt approximately five years ago. The rebuild included a new motor and regular bearing maintenance. A spare FD fan motor is present on-site.

1898 & Co. recommends that Newman conducts annual inspections on the FD fans. The inspection should include the repair or replacement of unsatisfactory components.

4.2.2 FGR Fan

Unit 3 utilizes one fuel gas recirculation ("FGR") fan that recirculates combustion air back into the furnace for NOx control.

The FGR fan was installed approximately 15 years ago. Newman personnel was unsure to the utilization of the FGR fan, but when operating the FGR fan provides approximately 10 percent circulation.

4.2.3 Air Heater

Unit 3 utilizes one bi-sector, radial Ljungstrom type regenerative air heater for air preheating.

Newman personnel indicated that cracking in has been experienced in the hub and housing. The air seals and baskets are in good condition

1898 & Co. recommends that Newman conducts inspections on the air heater on a ten-year interval, with the next inspection due in 2028 if the unit's retirement is delayed. The inspection should include the repair or replacement of unsatisfactory components.

4.2.4 Burners

Unit 3 utilizes nine gas burners located near the base of the furnace. There are three levels of burners with three burners on each level. Combustion gases and radiant energy from the burners flow upwards through the furnace heating the water/steam in the boiler tubes.

Newman personnel did not report any issues with the burner throats and flame scanners. During summer preparation outages the scanners were pulled, checked gas and fixed face burners. The burner management system was recently upgraded, but the ignitors need to be upgraded.

The burner valves are pneumatic, with 4-5 valves per burner. Plant personnel indicated the main valves have been replaced but minimum flow and startup regulators, vents, and ignitors would require replacement if Unit 3 was planned to be operated beyond 2026.

Additionally, the fuel gas responsible for transporting natural gas to the boiler has not experienced any corrosion or control valve issues.

4.2.5 Flues & Ducts

The ductwork transports combustion air to the boiler and also transports hot flue gas away from the boiler, through the air heater, and on to the stack. Newman personnel did not report any issues with the flues, ducts, or expansion joints.

1898 & Co. recommends including an inspection of the flues and ducts in the recommended annual boiler inspection.

4.2.6 Stack

Flue gas from the boiler back pass is directed from the boiler through duct work to the air heaters and finally to the stack. The stack is brick lined and does not have any issues according to Newman personnel.

1898 & Co. recommends Newman conduct an inspection on the stack every 10 years, with the next inspection due in 2029 if the unit's service life is continued.

4.2.7 Blowdown System

Unit 3 utilizes a blowoff tank and a continuous blowdown flash tank to control water silica levels and remove sludge formations from the steam drum. The continuous blowdown from the steam drum is flashed into the blowdown tank where the flash steam is exhausted to the deaerating heater.

4.3 Steam Turbine

4.3.1 Turbine

The STG was manufactured by General Electric and is an extraction, condensing unit with a turbine rating of 105 MW. The ST turns the thermal energy of steam into rotational energy for the STG. The turbine is designed for initial steam conditions of 1,800 psig at

1,000 °F and an exhaust pressure 2 inches of mercury ("in HgA"). Extraction ports service Unit 3's feedwater heating systems.

In 2017, Turbine Generator Technical Services ("TGTS") performed a MI. During the MI the HP/IP section, LP sections and turning gear were evaluated. Steam components were blast cleaned prior to visual, dimensional and NDE inspections, but steam components were found to be in good condition during the inspection. The HP/IP section was found to have loose shell bolting during disassembly. The loose shell bolting is a byproduct of inadequate washer height which does not allow for the correct geometric contact on the shell. HP/IP clearance were found to be acceptable. During the NDE inspection of the HP/IP rotor a crack indication was found at the N2 gland area. Additionally, the reheat stage 9 buckets were found to have moderate to heavy foreign object damage. The HP/IP diaphragms and packing were inspected and found to be in good condition. Solid particle erosion was identified on the nozzle plates sealing surface indicating steam leakage was present during operation. Also, the NDE inspections revealed a significant shell crack in the lower inner HP shell. Newman personnel did not report any systemic issues with the HP/IP turbine. Additionally, no journals or seal issues and a few cracks were reported.

During the inspection of the LP turbine all clearances were found to be acceptable and no hardware issues were identified as part of disassembly. The LP diaphragm were removed for inspection and was found to be in good condition with only minor foreign object damage. The LP shaft and diaphragm packing were visually inspected and was determined to be in good condition with only minor rubs identified. Newman personnel indicated that some erosion was found on the backend of the turbine, but no corrosion issues has been identified on the rotor. Additionally, a significant amount of work has not been performed which included not replacing the flow guides.

During 2017 the HP/IP rotor and LP rotor, were sent to Midwest Service Center for repair of the wire cracks identified during the NDE inspections. While the rotor was pulled, EPE elected to have MSC conduct an ultrasonic bore inspection. The ultrasonic bore inspection did not reveal any significant bore indication and was returned to service.

Cross over connection flanges were contact checked and found with poor or no contact.

The turning gear assembly, in the front standard assembly, was found to have chains with excessive wear and stretch. Replacement chains were installed to address the address the issues with the chains. Additionally, the lube oil system was inspected during the outage. The motors were sent to a local repair shop and Turbine Pros inspected the pumps onsite. The pumps were determined to be in good condition and returned to service. Newman personnel did not report any issues with the lube oil system. The results of lube oil PdM monitoring indicate that the system is in good condition. Additionally, the lube oil coolers were identified to be in good condition.

TGTS made the following recommendations for the HP/IP turbine at the conclusion of the MI:

- Diaphragm and shaft packing should be replaced during the next outage to maintain thermal efficiency
- Visually inspect the lower HP inner shell during the next outage
- Inspect the nozzle plate for shell bridge cracks
- Conduct a borescope inspection of the rotor
- Rotor circumferential cracks identified at the N2 gland area should be monitored during the next inspection

TGTS made the following recommendations for the LP turbine at the conclusion of the MI:

- EPE should consider implementing GE TIL-1121-3AR1 which will result in the removal of the L-0 buckets. Since new oversize bucket pins and cover material will be needed so upfront planning will be required.
- Due to wear, the L-0 bucket erosion shields should be considered for replacement during the next outage

TGTS made the following recommendations for the lube oil system at the conclusion of the MI:

- Before the next outage wear rings of the emergency bearing oil pump should be made available
- Make supplies necessary for flushing the lube oil system available before the next outage

Plant personnel indicated MIs occur on Unit 3 every 7-10 years, with the next MI scheduled for 2024.

1898 & Co. recommends completing the scheduled MI and testing in 2024. Turbine majors are recommended every 60,000 hours. Given current dispatch profile a major will occur approximately every 5-7 years until the unit retires. As part of each MI, components in unsatisfactory condition should be repaired or replaced.

4.3.2 Turbine Valves

The ST valve trains consist of one main steam stop valve, six control valves, two intercept reheat valves, and blowdown valves. The function of the stop valves is to shut off the flow of steam in the event of an emergency condition. The function of the control valves is to regulate the steam flow during normal operations. There are additional turbine valves that control the extraction of steam throughout the ST. Steam that is not extracted from the ST is directed through the turbine's blading to the condenser.

Provided documentation indicates that TurbinePROs conducted an inspection and overhaul of the main stop valve, two combined reheat valves, and blowdown valves in 2016. The valves were removed, disassembled, and completely cleaned and blasted to return the valves as close to OEM specifications as possible.

Newman personnel indicated that all turbine valves are inspected every 30,000 hours. Cracking has been seen in the valve bodies, but no other findings have been abnormal.

1898 & Co. recommends continuing the current turbine valve inspection interval of 30,000 service hours. Based on the current dispatch profile of the unit, it is projected the next inspection will occur in 2021 and will be repeated approximately every five years.

4.4 High Energy Piping Systems

4.4.1 Main Steam Piping

The main steam piping transfers steam from the superheater to the HP ST. The main steam piping operating temperature is greater than 800°F; therefore, the main steam piping is susceptible to creep: a high temperature, time dependent phenomenon that can progressively occur at the highest stress locations in the piping system (specifically near weld locations). As such, this piping system carries a high priority for inspections and maintenance. No issues have been reported with the pipe hanger systems. The steam desuperheaters that control the outlet steam temperatures are installed in the main steam piping.

In 2018 Thielsch Engineering, Inc. ("Thielsch") conducted visual examination, diameter measurements, magnetic particle examination, ultrasonic wall thickness measurements, ultrasonic phased-array examination, replication, and hardness determinations on the main steam piping. Visual examination, diameter measurements, ultrasonic wall thickness measurements ultrasonic phased-array examination, replication and hardness determinations did not reveal any significant issues. The magnetic particle examination identified a longitudinal indication on the drain pot side.

1898 & Co. recommends that a HEP analysis and inspections are made on a periodic basis. Included in the HEP inspection is an annual visual inspection of the pipe support system. The pipe supports (spring and constant types) should be inspected to verify operation within the indicated travel range, that the position has not significantly changed since previous inspections, that the pipe is expanding or contracting in the correct directions between the cold and hot positions, that the actual load being carried is close to its design point and has not changed, and that the pipe support hardware is intact and operating as designed. In addition, 1898 & Co. recommends that the spring hangers be load tested to determine their actual current loading and that a piping system stress analysis be completed to verify that all loads and stresses are within the allowable limits.

1898 & Co. recommends non-destructive testing such as metallurgical replication that should be performed on the HEP every five years, with the next inspection due in 2023. Additionally, 1898 & Co. recommends conducting a creep inspection in 2021.

4.4.2 Hot Reheat Steam Piping

The hot reheat piping transfers steam discharged from the reheater outlet header to the IP ST. The hot reheat piping operating temperature is also within the creep range (greater than 800°F) meaning this piping system also carries a high priority for inspections and maintenance.

In 2018 Thielsch conducted visual examination, diameter measurements, magnetic particle examination, ultrasonic wall thickness measurements, ultrasonic phased-array examination, replication, and hardness determinations on the hot reheat steam piping. None of the tests or examinations revealed any indications in the hot reheat steam piping.

1898 & Co. recommends that the pipe support system be visually inspected annually. The hangers should be inspected to verify that they are operating within their indicated travel range and are not bottomed out, that their position has not significantly changed since previous inspections, that the pipe is growing (contracting) in the right directions between cold and hot positions, and that the actual load being carried is close to its design point and has not changed.

1898 & Co. recommends non-destructive testing such as metallurgical replication that should be performed on the HEP every five years, with the next inspection due in 2023. Additionally, 1898 & Co. recommends conducting a creep inspection in 2021.

4.4.3 Cold Reheat Steam Piping

The cold reheat piping transfers steam discharged by the HP ST to the boiler reheater inlet header connections. The cold reheat piping operating temperature is below the creep range (less than 800°F) and as such creep is not a concern for this system. Thus, the cold reheat piping system should not require the level of examination recommended on the main steam and hot reheat system. Burns & McDonnell, however, still recommends inspecting the highest stress weld locations using replication examination to determine the extent of any carbide graphitization that may have occurred from occasional high temperature operations during startup or shutdown.

1898 & Co. recommends that the pipe support system be visually inspected annually. The hangers should be inspected to verify that they are operating within their indicated travel range and are not bottomed out, that their position has not significantly changed since previous inspections, that the pipe is growing (contracting) in the right directions between cold and hot positions, and that the actual load being carried is close to its design point and has not changed.

1898 & Co. also recommends non-destructive testing such as metallurgical replication that should be performed on the HEP every five years, with the next inspection due in 2023.

4.4.4 Extraction Piping

The extraction piping transfers steam from the various ST extraction locations to the FWHs. These piping systems are not typically a major concern for most utilities and are not examined to the same extent as the main and reheat steam systems; however, the extraction steam non-return valves should be tested on a regular basis to confirm proper operation and reduce the risk of turbine water induction. Plant personnel indicated no major issues are associated with the extraction piping.

1898 & Co. recommends that the pipe support system be visually inspected annually. The hangers should be inspected to verify that they are operating within their indicated travel range and are not bottomed out, that their position has not significantly changed since previous inspections, that the pipe is growing (contracting) in the right directions between cold and hot positions, and that the actual load being carried is close to its design point and has not changed.

1898 & Co. also recommends non-destructive testing such as metallurgical replication that should be performed on the HEP every five years, with the next inspection due in 2023.

4.4.5 Feedwater Piping

The feedwater piping system transfers water from the outlet of the condensate system to the boiler feedwater pumps, through the high-pressure FWHs, and eventually to the boiler economizer inlet header. Although this system operates at a relatively low temperature, the discharge of the boiler feedwater pumps is the highest-pressure location in the Plant and thus should be monitored and regularly inspected. Testing should focus on thinning on the extrados of the sweeping elbows, where turbulence can occur, causing excessive erosion and corrosion. Plant personnel indicated no major issues are associated with the feedwater piping.

1898 & Co. recommends measuring and monitoring feedwater piping wall thickness every five years for FAC. UT can be used if the pipe is easily accessible.

4.5 Balance of Plant

4.5.1 Condensate System

The condensate system transfers the latent heat of vaporization from the steam to the atmosphere via the surface condenser and cooling tower. Once enough heat has left the steam, the steam condenses into water for use in the condensate system and make-up for Unit 3's feedwater and steam cycle. There is one cooling tower on the east side of the site that services Unit 3's condensate system.

4.5.1.1 Condenser

Unit 3 is equipped with a single pressure, two pass condenser. The condenser removes the latent heat of vaporization from the saturated steam at the outlet of the LP turbine, allowing Unit 3 to use the condensate in the steam cycle. The condenser was designed to operate at a backpressure of 1.56 in HgA. The MCW system circulates cooling water between the condenser and the cooling tower.

Newman personnel indicated that the condenser was retubed to admiralty brass in 2007. Since the retubing minimal tube leaks have occurred and Newman personnel could not recall plugging any tubes in the past five years. Additionally, the waterboxes were coated last year.

1898 & Co. recommends inspecting the condenser in 2021, paying special attention to the condenser's expansion joint, to help maintain reliability of the unit.

4.5.1.2 Condenser Vacuum System

The condenser vacuum system establishes a negative pressure in the condensers during Unit 3's start-up by removing non-condensable gases. The condenser holding system is comprised of two 100 percent capacity vacuum pumps.

Newman personnel indicated that vacuum pumps are relatively new and have been reliable. The vacuum pumps are monitored during annual maintenance outages and receive standard maintenance. Additionally, Newman personnel indicated the bypass solenoids have recently experienced issues. Plant personnel reported the vacuum pumps are inspected during summer outages and rebuilt based on condition rather than set intervals.

4.5.1.3 Condensate Pumps

Unit 3 is equipped with two 50 percent vertical motor-driven condensate pumps. The condensate pumps are used to move the condensate from the condenser hotwell, through the steam jet air ejector, gland steam condenser, LP FWHs and to the deaerator.

Newman personnel indicated that the pumps have been rebuilt in the last three years which included a motor repair. Major repairs are conducted approximately every five years. Annually the condensate pumps are monitored with oil samples, vibration testing and current testing. No performance or PdM issues have been identified accordingly to Newman personnel. Additionally, Newman personnel indicated that OEM support may be an issue moving forward.

1898 & Co. recommends continuing to rebuild the pumps and repair the motors every five years. The next rebuild is due to occur in 2023.

4.5.1.4 Low Pressure Feedwater Heaters

There are two LP closed FWHs installed downstream of the condensate pumps. The LP heaters warm the condensate water by transferring heat from the turbine extraction steam to the condensate water in the closed shell and tube, U-tube design heat exchangers.

Newman personnel indicated that both LP FWHs have been replaced in the past five years. Additionally, the LP FWHs have significantly less than ten percent of tubes plugged. No issues have been reported with the tubes or shells.

1898 & Co. recommends performing inspections on the LP FWH's every seven years beginning in 2024. If Unit 3 operates beyond 2026, then 1898 & Co. recommends replacing a LP FWH.

4.5.1.5 Deaerator Heater & Storage Tank

The deaerator heater section separates the non-condensable gases from the saturated water by spraying incoming condensate counterflow to deaerating steam. The heated condensate waterfalls over stainless steel trays from the deaerator heater section and, enters the storage tank where it is stored before being pumped back to the boiler. The deaerator was designed to provide feedwater at 75 psig and 320 °F. Due to the deaerating process and differential thermal stresses occurring in deaerators, deaerators are susceptible to cracks in welds and heat-affected zones of longitudinal and circumferential welded seams due to corrosion fatigue.

In 2018 Thielsch conducted an inspection of the deaerator which included visual examination, magnetic particle examination and ultrasonic wall thickness measurements. The visual examination did not shown signs of service-related deterioration. The magnetic particle examination revealed several indications and six indications required repairs. The ultrasonic wall thickness measurements did not reveal any issues in the tank.

Newman personnel has not experienced any issues with the deaerator shell, but the gaskets and sightglass has experienced issues that have not affected generation. The trays are inspected annually, but no issues have been identified.

1898 & Co. recommends Newman conducts inspections on the deaerator every other year beginning in 2021.

4.5.2 Feedwater System

The feedwater system transfers water from the deaerator storage tank to the boiler feedwater pumps and then on through the HP FWHs and eventually to the boiler economizer inlet header.

4.5.2.1 Boiler Feedwater Pumps

Unit 3 is equipped with two 50 percent capacity multi-stage boiler feed pumps ("BFPs"). The BFPs have recirculation ARC valves on the pump side of the discharge valves for pump minimum flow protection.

The BFPs have been rebuilt within the last two years. Newman has two spare motors and spare impellers onsite. Newman personnel indicated that the pump elements may need to be replaced due to diffusor thinning. Annually, the BFPs are monitored with oil samples, vibration testing and current testing. No performance or PdM issues have been identified accordingly to Newman personnel. Additionally, the recirculation ARC valves are inspected annually, but no issues were reported.

The BFPs utilizes a forced lube oils system, but no issues have been experienced according to Newman personnel.

1898 & Co. recommends Newman continues to inspect and overhaul the boiler feed pumps and motors on five-year intervals. As part of the inspection, components in unsatisfactory condition should be repaired or replaced. If Unit 3 is operated until 2041, 1898 & Co. recommends replacing the BFPs in 2030 as the pumps currently have around ten years of useful life remaining.

4.5.2.2 High Pressure Feedwater Heaters

There are two HP closed FWHs installed downstream of the feedwater pumps. The HP heaters increase the efficiency of the Plant by transferring heat from the turbine extraction steam to the feedwater in the closed shell and tube, U-tube design heat exchangers.

Newman personnel indicated that the HP FWHs had been replaced but could not recall the date of the replacements.

1898 & Co. recommends performing inspections on the HP FWH's every seven years beginning in 2024. If Unit 3 operates beyond 2026, then 1898 & Co. recommends replacing a HP FWH.

4.5.3 Main Cooling Water System

MCW is supplied to the condenser to condense the steam exhausted from the LP turbine and transfer it to the atmosphere via the cooling towers. Unit 3 utilizes a six-cell mechanical draft cooling tower, two nominal 50 percent capacity MCW pumps, and a surface condenser. The cooling water pumps take suction from the cooling tower basin and supplies MCW to the condenser inlet water boxes. The MCW flows through the condenser tubes, extracts heat from the LP turbine exhaust steam, and exits the condenser outlet water boxes. A main cooling water flow parallel to the condenser flows through the closed cooling heat exchangers. The hot cooling water existing the condenser and the closed cooling heat exchangers enters the top of the cooling tower via a riser. The hot water is cooled, through evaporative cooling, and collected in the basin of the cooling tower.

The MCW pumps have been rebuilt within the last three years and. The maintenance cycle for the MCW pumps can extend seven years out, but the MCW pumps are usually rebuilt every 5 years. During rebuild the pump components experiencing wear are replaced and motors are sent out of the Plant for service. Annually the MCW pumps are monitored with oil samples, vibration testing and current testing. Newman personnel indicated that no spare MCW pumps are available onsite.

1898 & Co. recommends continuing to rebuild the MCW pumps and repair the motors every five years. The next rebuild is due to occur in 2023. Additionally, plant personnel indicated that the MCW lines received spray coating to temporarily repair the damaged steel lines. The MCW lines have experienced multiple issues which extend to the isolation valves.

1898 & Co. recommends replacing the entire MCW pipes in 2021.

Newman trends the cooling tower performance and conducts repairs needed base on the condition of the system. Newman conducts inspections of the cooling tower every spring which revealed issues with some structural supports. Over the past three years Newman personnel reported replaced cooling tower bracing and fill. Newman personnel did not report any issues with cooling tower fans, motors, or gearboxes, but a complete spare is maintained onsite. Additionally, Newman personnel indicated that all six cells are needed when operating Unit 3 at full load during summer operation.

1898 & Co. recommends continuing the annual cooling tower inspections.

4.5.4 Closed Cooling Water

The closed cooling water ("CCW") system includes CCW pumps, CCW heat exchangers, and the associated piping, valves, and instrumentation. The purpose of the CCW system is to provide treated, high purity cooling water for Unit 3's equipment requiring cooling such as BFP bearings and oil coolers. Plant personnel reported there are no issues with the CCW system.

4.5.5 Bridge Crane

Unit 3 utilizes a bridge crane during outages to efficiently move components such as the turbine casing. Newman personnel indicated that Unit 3's crane is in poor condition and should be upgraded. Personnel also indicated they would like remote operation to be an option for Unit 3's crane after the upgrade.

1898 & Co. recommends completing the crane upgrades in 2023.

4.5.6 House Elevators

There are two elevators associated with Unit 3. Plant personnel indicated one elevator is located outside and is fairly new and in adequate shape. It was noted that the house elevator (shared with Newman Units 1 and 2) is not in adequate shape and will require maintenance to alleviate condition concerns.

1898 & Co. recommends repairing/upgrading the shared house elevator in 2021.

4.6 Electrical and Controls

4.6.1 Electrical System Overview

Unit 3 consists of a GE generator, one GSU transformer, one auxiliary transformer, 4,160 volt ("V") and 480 V switchgears, 2,400-480 V station service transformers, 480 V motor control centers ("MCCs"), and small distribution transformers and panels. Unit 3 interconnects with the transmission system at 115 kilovolts ("kVs").

This Study stops at the high side of GSU transformer. Therefore, this assessment does not include the overhead line to the switchyard and does not include the switchyard itself.

Generally, 1898 & Co. recommends routine infrared surveys of electrical equipment.

4.6.2 Steam Turbine Generator

The STG is a 3,600 revolutions per minute ("RPM"), two pole, three phase, hydrogen cooled unit manufactured by General Electric originally manufactured in 1965. The STG is rated at a maximum of 135,300 kilovolt amperes ("kVA") with a 0.90 power factor ("PF"), supplying three phase alternate current ("AC") power output at 13,800 V and constant frequency of 60 hertz ("Hz").

The exciter, excitation transformer, and automatic voltage regulator ("AVR") were upgraded in 2014-2015. The new exciter is a static exciter, fed by a static excitation transformer. Both the upgraded exciter and AVR are manufactured by Emerson.

In 2017 the generator underwent a full generator inspection conducted by TGTS which included the removal of the generator field. EPE elected to conduct a bore inspection of the rotor which did not reveal any significant indications. TGTS contracted with Turbine Pros to perform visual inspections and electrical tests on the generator stator and field. The stator was electrically tested and was cleared for a return to service, but grease and end winding with broken ties were identified as part of the visual inspection. A recommendation was made to rewedge the stator which EPE elected to conduct. Generator Technical Services conducted the stator rewedge and cleaned the bushing box. TGTS inspected the stator coolers and found the equipment in poor condition which resulted in the four hydrogen coolers experiencing a retubing and new gaskets. The field was visually inspected and electrically tested during the outage. The electrical tests deemed the field to be in acceptable condition, but the visual inspection revealed contamination under the retaining rings. A recommendation was made to remove the retaining rings before the cleaning but EPE elected not to conduct the removal. The field main lead seal was tested during the outage which indicated the seal was in acceptable condition. Hydrogen seals and casings were inspected during the generator disassembly. The hydrogen rings and casings showed signs of heating, so they were sent off for replacements.

TGTS made the following recommendations for the generator at the conclusion of the MI:

- The stator winding should be monitored for lead carbonate during the next generator disassembly
- Retaining rings should be removed before the next inspection to allow for the cleaning and removal of large contamination debris
- The bearing proximity probe journal surfaces should be burnished to obtain the correct surface finish to correct the current electrical runout
- New oil deflectors should be obtained before the next inspection for implementation
- The field collector rings should be machined during the next outage
- When seal oil is placed into service the float trap bypass must be open prior to pressurizing the casing with air,

Per provided documentation, the generator was last rewound in 1993. Plant personnel also reported that substantial greasing occurs in the generator, and that periodically red eyes are added to minimize movement occurring in the end windings. The last reported red eye occurred in 2017. Plant personnel indicated that if Unit 3 were to operate beyond 2026, the generator would likely need to be rewound. Plant personnel indicate that MIs occur on Unit 3 every 5-10 years, with the next major scheduled in 2024. Newman personnel do not expect any actions further than normal cleaning and testing to be required in this major.
Bearings are typically removed and rolled out during majors.

Per plant personnel, there are no current issues with the exciter or AVR. Power system stability results look good, and no capital projects on this equipment are planned.

Plant personnel also indicated that they do not typically stock any extra parts for the generators. Unit 3 does not have a backup generator.

If Unit 3 operates until 2031, 1898 & Co. recommends rewinding the generator stator and rotor in 2024 to maintain reliability. Across all scenarios, a generator MI is recommended every 5-7 years; the next major is recommended to occur in 2024. The AVR will be approaching end of design life and is recommended for digital front-end upgrade in 2030.

4.6.3 Transformers

There are two main power transformers associated with Unit 3, including one GSU transformer and one auxiliary transformer.

Generally, 1898 & Co. recommends that Newman conduct annual maintenance, testing and repairs on Unit 3's transformers.

4.6.3.1 Generator Step-Up Transformer

The GSU transformer is not original and has been replaced by a Waukesha model which steps up the STG output voltage from 13.8 kV to 115 kV. The three-phase, two winding GSU transformer is rated at 70/90/112 MVA ONAN/ONAF/ONAF at 55 degree Celsius ("°C"). The STG GSU has online dissolved gas monitors.

The GSU was replaced in 2014. Plant personnel reported there are not existing issues for the GSU. Operations typically does daily rounds on the transformer checking winding temps, cooling fans, etc. The GSU is maintained by EPE's substation group. EPE has reportedly been working on its spare transformer inventory and may have a spare GSU available in its fleet, although confirmation of a spare GSU for Unit 3 was not provided to 1898 & Co.

4.6.3.2 Unit Auxiliary Transformers

Unit 3 has one-unit auxiliary transformers ("UAT"). The transformer is not original and has been replaced by a Waukesha three-phase, two winding transformer that is used to step down the 13.8 kV output of the generator to 2.4 kV. The power generated is used for the unit load and common load during normal operation. The auxiliary transformer is rated at 7.5/10 megavolt ampere ("MVA") ONAN/ONAF at 55 °C.

No inspection documentation was provided for Unit 3's aux transformer. Plant personnel reported no significant issue during the site interviews. During the site interview it was indicated that regular rounds are conducted on to monitor and maintain the site's transformers as needed.

4.6.4 Critical Cabling

Plant personnel indicated that some critical cabling is nearing its end of design life, especially near heat sources such as near or under the boiler or near heat sources on the aux floor. While the BFP cabling has been replaced recently, personnel reported that other equipment such as the circulation water pumps as well as FD fans, etc. will require replacement if the unit continues operation.

1898 & Co. has included extra projected costs in the recommended switchgear and MCC replacement line items in Appendix A for the replacement of critical cabling.

4.6.5 Medium Voltage Switchgear

4.6.5.1 2,400 V Switchgear

Unit 3 utilizes the original GE medium voltage switchgear with Magne Blast breakers to serve the 2,400 V loads.

Plant documentation indicates that the switchgear and breakers are inspected, cleaned, and tested every 5 years.

Newman personnel report that the switchgear and breakers are on a regular maintenance plan. A contractor is brought in each summer to inspect the switchgear during a two-week outage. It was also noted that the protection was upgraded to SEL protection relays in 2018/2019.

Plant personnel indicate that the switchgear and breakers are nearing their end of design life and will require breaker replacements before 2026 and complete switchgear replacement if the unit continues service beyond 2026. Newman personnel report they have 1-2 spare breakers for each size of medium voltage ("MV") switchgear (2,000 amp and 1,200 amp). Plant maintenance personnel stated that replacement parts are becoming difficult to find and O&M costs are increasing every year as they age.

If Unit 3 is to be operated until at least 2031, 1898 & Co. recommends full replacement of the 2400V switchgear due to the limited availability of replacement parts and the corresponding increasing O&M costs. If the Unit is to be retired in 2026, replacing the breakers in the worst condition as required is recommended.

4.6.5.2 Medium Voltage Motors

Plant personnel indicate the motors are monitored under a conditions-based maintenance program to indicate if they require testing. Offline testing is performed every year, and each motor is sent out to a motor shop for cleaning and testing during majors. Offline testing is typically performed annually.

It was also reported that they have a stock of critical spare motors. For each system, their spares are either entirely redundant or provide enough power to derate 50 percent.

4.6.6 Low Voltage Switchgear and Motor Control Centers

4.6.6.1 480 V Switchgear and MCCs

Unit 3's low voltage distribution system has seven ITE type 480 V breakers and three MCC lineups. The 480 V switchgear receives its power via a 750 kVA transformer powered from the 2,400 V switchgear. The 480 V switchgear serves two pumps and the three MCC lineups. The 480 V MCCs provide power to motors, heaters, battery chargers, small power transformers, lighting transformers, and other miscellaneous loads.

The 480 V switchgear and MCCs were all originally manufactured in 1966. Plant documentation indicates that the switchgear and switchgear breakers are inspected, cleaned and lubricated every 5 years. Plant personnel report the breakers are worn out and the switchgear needs to be upgraded. If Unit 3 is retired in 2026, it is recommended the breakers in the worst shape be replaced. To continue the unit's service life, it is recommended that the entire switchgear lineup be replacement. Personnel indicated capital funds are available for these replacements and that sufficient spare breakers are currently stocked. The DC and 120 panels require evaluation for replacement.

Plant personnel also indicated that the MCCs are in adequate shape, although replacement parts such as molded case breakers, control power transformers, and contactors are difficult to find for this aged equipment. Due to the limited parts available for this vintage, plant personnel reported that replacing the MCC is in consideration.

If Unit 3 is to be operated until at least 2031, 1898 & Co. recommends replacing the 480 V switchgear in 2023 due to the limited spare parts availability and corresponding increasing O&M costs. If the Unit is to be retired in 2026, replacing the breakers in the worst condition as needed is recommended. If Unit 3 is operated until 2031 and beyond, it is also recommended that MCC 3A, 3B, and the cooling tower MCC are replaced in 2021, 2024, and 2025, respectively, due to limited spare parts availability.

4.6.6.2 Low Voltage Motors

Low voltage motors are fed from the 480 V MCC's. Plant personnel indicate the low voltage motors are maintained with the same philosophy as medium voltage motors, which is rare. Low voltage motors are monitored to indicate if they require further testing by the M&D department. Each motor is sent out to a motor shop for cleaning and testing during majors, and static and impedance tests are typically performed annually.

It was also reported that they have a stock of critical spare motors. For each system, their spares are either entirely redundant or provide enough power to derate 50 percent.

4.6.7 Station Emergency Power Systems

Unit 3 is designed with one station battery for both control and backup along with one battery charger. The station batteries utilize lead calcium and produce emergency power at 125 volts direct current ("Vdc"). Unit 3's turbine is equipped with a VLA 132 DC battery bank. Unit 3's uninterruptible power supply ("UPS") has been recently replaced as well.

According to plant documentation, the battery bank is subject to cell voltage/electrolyte testing every four months, terminal and plate resistance testing every 18 months, and discharge testing every 6 years. All these tests have been performed as recently as 2019.

The Unit 3 battery bank was originally manufactured in 2013. Capacity testing completed in November 2019 by Nolan Power Group indicated the battery has a capacity of 111.8 percent (of design capacity) with a total run time of 1:05:23. The test provided overall satisfactory results, but indicated that several broken or missing flame arrestors should be replaced and the battery rack should be replaced with a Seismic Zone 1 rated rack. Similar testing was recommended to be completed on three-year increments.

Plant personnel indicate that they test water level, cell voltage, and specific gravity of the batteries according to WECC standards. It was also indicated that based off insurance recommendations, the battery rack has recently been placed in a new environmentally controlled room which holds the temperature at approximately 75 °F to better maintain the batteries.

If Unit 3 is operated until 2041, 1898 & Co. recommends replacing turbine switchgear battery and charger in 2033 due to the equipment's design life.

4.6.8 Electrical Protection

Plant personnel reported the Unit upgraded to microprocessor protection in the early 2000's, and recently upgraded the electrical protection in 2018. Relay testing is conducted in accordance with NERC protection and control ("PRC") reliability standards.

4.6.9 Control Systems

Unit 3's distributed control system ("DCS") has been completely upgraded to Emerson Ovation 3.6 with OCR 1100 controllers. Evergreens are completed every four years, unless the Unit will be retired within two years of the respective Evergreen. Each Evergreen includes HMI and software updates. Plant personnel indicated that the plant is in discussions with Emerson about upgrading to Ovation 3.8 during the next Evergreen in 2022. Unit 3 has two redundant plant historians which will be upgraded in 2022. Plant personnel reported that several panel mounts still run on Windows 7 but will be upgraded to Windows 10 sometime before 2022. It was also reported that the majority of instrumentation has been replaced recently and would not require replacement before 2030. However, it was noted that the actuators on the boiler's nine burners may need to be upgraded if the unit operates beyond 2026. There are 2 valves and two regulators per burner.

It was also indicated that the plant is in discussion to sign a SureService agreement with Emerson to maintain Unit 3's DCS.

Plant personnel indicated some electrical equipment exhibits significant incident energy and will require arc flash mitigation. It was reported that incident energy exceeds 40 calories / centimeter squared, a typical safety threshold found in the National Fire Protection Association ("NFPA") "Standard for Electrical Safety in the Workplace." Upgrading the electrical distribution equipment to modern arc resistant gear will help reduce the incident energy levels. Extra costs are included in the switchgear and MCC replacement projects to upgrade to arc resistant gear.

1898 & Co. recommends completing the arrangements to sign a SureService agreement with the DCS vendor, Emerson. If the unit is to be operated until 2041, it is also recommended that an Evergreen upgrade is completed on the DCS system every 4-5 years with the next upgrade due in 2022.

4.6.10 Continuous Emissions Monitoring System

Unit 3 utilizes a continuous emissions monitoring system ("CEMS") to comply with the Newman Environmental Protection Agency permit. Newman personnel indicate the CEMS system has been upgraded within the last decade and will be due for another refresh soon. The analyzer and sensor are approaching the end of their design lives, which can lead to analyzer drift and inaccurate reading.

1898 & Co. recommends completing a CEMS analyzer upgrade every 10-15 years, with the next upgrade due in 2023.

5.0 UNIT 4

5.1 Combustion Turbines

Unit 4 has of two Westinghouse W501 CTs that supply waste heat to the HRSGs. The Newman CT 1 and CT 2 (“CT1”, “CT2”) have a turbine rating of 75 MW. Ambient air enters the axial compressor and is compressed to a high-pressure prior to entering the combustors. The high-pressure, high-temperature mixture of air and gas from the combustors is directed through the turbine which converts the energy of the motive air into mechanical energy in the shaft.

Newman personnel indicated that CT1 and CT2 have approximately 300,000 hours of service. Annually, CT1 and CT2 experience approximately 6,800 hours of service and ten starts. The maintenance interval for CT1 and CT2 are driven fired operating hours. Combustion inspections occur at 8,000 and 24,000 hours, hot gas path (“HGP”) inspections occur at 16,000 hours and MIs occur at 32,000 hours during the maintenance cycle.

5.1.1 Combustion Turbine Unit 1

Provided documentation indicated that a NDE MI on CT1 in January 2019 and that a forced outage in May 2019 also resulted in a modified HGP and an additional borescope inspection. The MI included a rotor exchange as well as borescope and visual inspections. A forced outage in May 2019 also resulted in a modified HGP and an additional borescope inspection.

In May 2019, vibration step and phase angle changes were noted in CT1 by EPE. Row 4 turbine blades were discovered to have major impact damage leading to a modified HGP outage performed by Siemens. This inspection found significant damage in both Row 3 and Row 4 caused by the breaking off of about 1/3 of a Row three blade airfoil. Each of these rows had their turbine ring segments and turbine vanes replaced. Row 3 and 4 turbine blades were replaced with the blades which had been removed in the previous (January 2019) outage. These new blades were subjected to visual and Eddy current inspections and found to be in acceptable conditions. The interstage seals for Rows 3 and 4 were cleaned and refurbished. The borescope inspection found an IGV with impact damage along the trailing edge (“TE”). Tip discoloration, mushrooming, and coating loss were noted on the second stage blades and intermittent rubbing found throughout the Row 2 ring segments, although no immediate actions were deemed necessary. Twenty-six cracks were found ranging from 1-24 inches throughout the exhaust manifold.

Newman personnel did not report any issues with the compressor, but the blades have shown considerable wear.

1898 & Co. recommends performing major maintenance on CT1 via the intervals presented in Table 5-1. Over the past five years (2015-2019), CT1 has averaged 6,960 hours of service time annually according to the EIA-860 database. The Table includes a column detailing when the next inspection is projected to occur as well as projected intervals between maintenance cycles based off the CT's current dispatch profile.

Table 5-1: Combustion Turbine 1 Recommended Inspection Intervals

Inspection	Frequency	Next Due	Interval (years)
Combustion Inspection	8,000 hours	2021	1.15
Hot Gas Path Inspection	16,000 hours	2022	2.30
Major Inspection	32,000 hours	2024	4.60

Based on CT1's current dispatch profile, a turbine inspection is inspected approximately every year. It should be noted that in years where more thorough inspections occur, less thorough inspections are not required. Table 5-2 details one full maintenance cycle which will take approximately five years. Appendix B further details the maintenance recommended annually for each Scenario.

Table 5-2: Combustion Turbine 1 Recommended Maintenance Cycle

	Year 1	Year 2	Year 3	Year 4	Year 5
Inspection	CI	HGP	CI	MI	None

As part of the next MI, 1898 & Co. recommends that Newman be refurbished with the critical spare parts inventory for CT1 on an annual basis. Additionally, upgrading the and repairing the inlet cooling system will be necessary to continue operation until 2031.

5.1.2 Combustion Turbine Unit 2

Siemens performed NDE combustor and borescope inspection as well as an HGP inspection in early 2019. The tests found coating loss and oil buildup on the leading edges of the IGVs. Oil buildup was also noted on the inlet bellmouth. Coating loss was found on the Row 1-3 turbine blades, in the combustor baskets, and on the inlet and exhaust mouth of the transitions. Minor coating loss, erosion, and rubs were also noted on the Row 1-3 turbine ring segments and vane segments. Several crack indications were repaired on combustor rotor air cooler pipes and two crack indications were found on the exhaust manifold. During the HGP, the combustor baskets, gas nozzles, service run seals, and other degraded parts were replaced. Several Row 1 turbine vanes also required replacement due to thermal barrier coating loss.

Newman personnel indicated that CT2 received CT1's refurbished rotor in 2017. The refurbished rotor included a new turbine section and used compressor section. Newman personnel anticipates the need for a compressor upgrade during the next major outage.

1898 & Co. recommends performing major maintenance on CT2 via the intervals presented in Table 5-3. Over the past five years (2015-2019), CT2 has averaged 5,600 hours of service time annually according to the EIA-860 database. The Table includes a column detailing when the next inspection is projected to occur as well as projected intervals between maintenance cycles based off the CT's current dispatch profile.

Table 5-3: Combustion Turbine 2 Recommended Inspection Intervals

Inspection	Frequency	Next Due	Interval (years)
Combustion Inspection	8,000 hours	2021	1.43
Hot Gas Path Inspection	16,000 hours	2022	2.86
Major Inspection	32,000 hours	2024	5.72

Based on CT2's current dispatch profile, a turbine inspection is inspected approximately every 1.5 years. It should be noted that in years where more thorough inspections occur, less thorough inspections are not required. Table 5-4 details one full maintenance cycle which will take approximately five years. Appendix B further details the maintenance recommended annually for each Scenario.

Table 5-4: Combustion Turbine 2 Recommended Maintenance Cycle

	Year 1	Year 2	Year 3	Year 4	Year 5
Inspection	CI	HGP	CI	MI	None

As part of the next MI, 1898 & Co. recommends that Newman be refurbished with the critical spare parts inventory for CT2 on an annual basis. Additionally, upgrading the and repairing the inlet cooling system will be necessary to continue operation until 2031.

5.1.3 Combustion Turbine Auxiliaries

The CT auxiliaries include the mechanical air inlet filter system and lube oil system.

5.1.3.1 Air Inlet System

The CTs have inlet pre-filters and final filters which remove airborne particles from the ambient air. Removing large particles from the ambient air increases the performance and reliability of the CT by reducing the likelihood of erosion, compressor fouling, and reduced CT performance. The CTs utilize evaporative cooling systems to reduce the dry bulb temperature of the inlet air. Decreasing the dry bulb temperature of the inlet air increases the efficiency and power output of the system.

Newman personnel indicated that the evaporative cooling system is in poor condition and requires repairs.

5.1.3.2 Lube Oil System

The CT lube oil system servicing each CT is a combined system and consists of an oil reservoir, main lube oil pumps, emergency lube oil pump, and cooler.

The 2019 CT 2 HGP test indicated the lube oil vapor extraction lines were found with heavy clogging and coking. Both the inlet and exhaust vapor extraction line were cleaned and reinstalled with the proper slope.

Newman personnel did not report any issues with the lube oil system.

5.2 Heat Recovery Steam Generators

5.2.1 Heat Recovery Steam Generator Overview

Newman HRSG 1 and HRSG 2 (“HRSG1” and “HRSG2”) were manufactured by Westinghouse. The HRSGs are outdoor, single pressure units designed to take hot exhaust gas from the CTs to create steam that drives the ST. The units were designed for a 443,000 lb/hr at the superheater outlet with a pressure of 1,277 pounds per square inch absolute and a temperature of 952°F. The HRSG designs include economizers, superheaters, evaporators and steam drums. There are no simple cycle stack bypasses on the HRSGs, but 100 percent of the HP steam flow produced by the HRSGs can bypass the ST directly to the condenser.

For both HRSG 1 and HRSG2, 1898 & Co. recommends completing a boiler inspection in 2021. As part of the boiler inspections, and components or tubes in unsatisfactory shape should be repaired or replaced.

5.2.1.1 Heat Recovery Steam Generator 1

5.2.1.1.1 Superheater

The superheater sections of the HRSGs are used to raise the temperature of the steam above the saturation temperature (i.e. superheat the steam). Saturated steam exiting the top of the steam drum passes through the various sections of the superheater and the temperature is continually increased until the steam finally exits the superheater outlet header and continues through the main steam line towards the HP ST. The superheater is divided into two stages, primary and secondary, with attemperators positioned in between. The design of both stages allows for draining the superheaters during outages and/or startup.

Newman personnel did not report any issues with the superheater.

5.2.1.1.2 HP Evaporator

Water from the steam drum is circulated through the HP evaporator by a HP circulating pump.

Newman personnel did not report any issues with the HP evaporator, but 1898 & Co. recommends replacing the high-pressure circulating water pump if the unit will continue operation until 2031.

5.2.1.1.3 HP Economizer

The HP economizer section of the HRSG is used to improve the efficiency of the thermal cycle by using the exhaust gases to raise the temperature of the feedwater entering the steam drum. The integral deaerator receives condensate from the condensate pumps and preheats the condensate to 250°F. A portion of this water is conveyed through the HP economizer by the boiler feed pump. From the economizer inlet header, the feedwater temperature is then increased throughout the economizer tube sections in the boiler before exiting through the economizer outlet header and traveling to the steam drum.

Newman personnel indicated that FAC was found in the vents and the inlet of the headers.

5.2.1.1.4 LP Evaporator

A portion of the water in the integral deaerator is circulated through the LP evaporator to form pegging steam for the deaerator. Water is taken from the storage tank and pumped through the LP evaporator where a water-steam mixture is generated for heating condensate in the deaerator.

Newman personnel did not report any issues with the LP evaporator.

5.2.1.1.5 Drums and Headers

The lower temperature headers include the LP evaporator inlet and outlet headers, the HP economizer inlet and outlet headers, and the HP evaporator inlet header. Despite being at a relatively low temperature, these headers, in particular the economizer inlet header, tends to be susceptible to ligament cracking caused by thermal stresses incurred during startups and shutdowns.

The high temperature headers include the superheater outlet headers. These headers operate under severe conditions and are particularly susceptible to localized overheating, leading to creep damage, and other stress related cracks caused by temperature imbalances side-to-side across the headers.

Additionally, there is one steam drum on HRSG1. The HP steam drum has been designed to consist of two stages of separation, a primary centrifugal stage and secondary chevron stage.

Newman personnel did not report any issues with HRSG 1's. FAC has not been found in the drums.

5.2.1.1.6 Safety Valves

Safety valves are installed on the Unit to protect the equipment from over-pressurization events such as a turbine trip or a boiler feed pump control issue.

Newman personnel did not report any issues with the safety valves on HRSG1.

5.2.1.1.7 Duct Burners

Unit 4 has duct burners designed to burn natural gas which increases the steam production from the HRSG. Duct burners allow Unit 4 to generate an additional power from the STG.

Newman personnel indicated that the duct burners where not experiencing any issues.

5.2.1.1.8 Casing & Insulation

The HRSG outer plate steel casing encloses all insulation and heat transfer surfaces within the HRSG and protects the HRSG internals from ambient weather conditions. Insulation between the liner and the outer casing of the HRSG reduces thermal losses in the system. Insulation degradation can lead to the development of hot spots in the HRSG. The insulation is held in place with metal pins. Hot spots can be identified in the HRSG with the use of thermography when Unit 4 is online. Insulation degrades over time due to thermal cycling and is considered a normal maintenance activity for the Facility.

Newman personnel did not report any issues with the casing or insulation.

5.2.1.1.9 Stack

Flue gas from the HRSGs is directed out of the HRSGs through the stack. The stack can be exposed to temperatures near the acid dew point for flue gas, thus exposing the stack to a high risk of corrosion. Stack corrosion is common if units are exposed to low load operation. The prefabricated steel stack rests on HRSG structural steel.

Newman personnel did not report any issues with the stack.

5.2.1.2 Heat Recovery Steam Generator 2

A description of the major HRSG components is provided above. Based on discussion with Newman personnel and information provided for review, the condition of the various HRSG2 components is provided below.

5.2.1.2.1 Superheater

Newman personnel did not report any issues with the superheater.

5.2.1.2.2 HP Evaporator

Newman personnel did not report any issues with the HP evaporator, but 1898 & Co. recommends replacing the high-pressure circulating water pump if the unit will continue operation until 2031.

5.2.1.2.3 HP Economizer

Newman personnel indicated that the economizer had been replaced in HRSG2.

5.2.1.2.4 LP Evaporator

Newman personnel did not report any issues with the LP evaporator.

5.2.1.2.5 Drums and Headers

Newman personnel did not report any issues with HRSG2's. FAC has not been found in the drums.

5.2.1.2.6 Safety Valves

Newman personnel did not report any issues with the safety valves on HRSG2.

5.2.1.2.7 Duct Burners

Newman personnel indicated that the duct burners where not experiencing any issues.

5.2.1.2.8 Casing & Insulation

Newman personnel did not report any issues with the casing or insulation for HRSG2.

5.2.1.2.9 Stack

Newman personnel did not report any issues with the stack.

5.3 Steam Turbine

5.3.1 Turbine

The ST was manufactured by Westinghouse and is a single cylinder, non-reheat axial exhaust, condensing unit with a turbine rating of 107 MW. The ST turns the thermal energy of steam into rotational energy for the STG. The turbine is designed for initial steam conditions of 1,150 psig at 943°F and an exhaust pressure 2.5 in HgA. The single casing is comprised of a dual pressure turbine. The ST has one extraction stage for feedwater heating.

Newman personnel indicated that the ST undergoes a MI after 60,000 hours of service. The last major, conducted in 2016, resulted in the rotor being swapped except for the L-0 disks. No issues were reported with the shell or seals. Additionally, no issues were reported with the lube oil system, but electronic hydraulic control system is being evaluated for an upgrade this fall.

1898 & Co. recommends completing a MI and overhaul on the Unit 4 ST every 60,000 service hours, with the next projected major occurring in 2024. Additionally, 1889 & Co. recommends inspecting and repairing the turning gear, lube oil system and electro-hydraulic controls system in 2024 if Unit 4 continues operation until 2031.

5.3.2 Turbine Valves

The ST valve trains have two main control-stop valve assemblies which are controlled by an electro-hydraulic governing system. The function of the stop valves is to shut off the flow of steam in the event of an emergency condition. The function of the control valves is to regulate the steam flow during normal operations. Steam that is not extracted from the ST is directed through the turbine's blading to the condenser.

Newman personnel indicated that the ST valves undergoes inspection after 30,000 hours of service. No cracking or issues with the valves was reported.

1898 & Co. recommends continuing to inspect the ST valves every 30,000 service hours. The next projected inspection will occur in 2021.

5.4 High Energy Piping Systems

5.4.1 Main Steam Piping

The main steam piping, composed of ASTM A335 P-11, transfers steam from the HRSG superheater outlet headers to the HP ST. The system operates at approximately 1,250 psig and 950°F.

Since the main steam piping operating temperature is greater than 800°F; therefore, the main steam piping is susceptible to creep: a high temperature, time dependent phenomenon that can progressively occur at the highest stress locations in the piping system (specifically near weld locations). As such, this piping system carries a high priority for inspections and maintenance. No issues have been reported with the pipe hanger systems. The steam desuperheaters that control the HRSG outlet steam temperatures are installed in the main steam piping.

Newman personnel indicated that the main steam HEP has not been inspected, but leak by in the main steam check and power check valves replacements are planned for installation in 2021. 1898 & Co. recommends completing the planned project to replace the main steam check and power check valves.

1898 & Co. recommends that a HEP analysis and inspections are made on a periodic basis. Included in the HEP inspection is an annual visual inspection of the pipe support system. The pipe supports (spring and constant types) should be inspected to verify operation within the indicated travel range, that the position has not significantly changed since previous inspections, that the pipe is expanding or contracting in the correct directions between the cold and hot positions, that the actual load being carried is close to its design point and has not changed, and that the pipe support hardware is intact and operating as designed. In addition, 1898 & Co. recommends that the spring hangers be load tested to determine their actual current loading and that a piping system stress analysis be completed to verify that all loads and stresses are within the allowable limits.

1898 & Co. recommends non-destructive testing such as metallurgical replication that should be performed on the HEP every five years, with the next inspection due in 2021. Additionally, 1898 & Co. conducting a creep inspection 2022.

5.4.2 Feedwater Piping

The feedwater piping system transfers water through the HRSG via the BFP. Although this system operates at a relatively low temperature (below 800°F), the discharge piping sections between BFPs and the HRSG economizers are the highest-pressure locations in the Facility, which makes the pipe wall thickness subject to thinning due to FAC.

1898 & Co. recommends measuring and monitoring feedwater piping wall thickness every five years for FAC. UT can be used if the pipe is easily accessible.

5.5 Balance of Plant

5.5.1 Condensate System

The condensate system transfers the latent heat of vaporization from the steam to the atmosphere via the surface condenser and cooling tower. Once enough heat has left the steam, the steam condenses into water for use in the condensate system and make-up to the Facility feedwater and steam cycle. There is one cooling tower on the east side of the site that services Unit 4's condensate system.

5.5.1.1 Condenser

Unit 4 is equipped with a single pressure, coated, two pass surface condenser with copper nickel tubes. The condenser was designed to operate at a backpressure of 3 in HgA. The MCW system circulates cooling water between the condenser and the cooling tower.

Newman personnel did not report any issues with the condenser and the tubes have not been replaced within the last ten years. No air in leakage or backpressure issues have been experience in the condenser and less than 10 percent of tubes have been plugged. Debris from the circulating water lines has been found on the condenser, but the material is removed during outages.

1898 & Co. recommends conducting a condenser retubing in 2024.

5.5.1.2 Condenser Vacuum System

The condenser vacuum system establishes a negative pressure in the condensers during unit 4's start-up by removing non-condensable gases. The condenser holding system is comprised of one 100 percent capacity steam air ejector and one 100 percent capacity hogging ejector.

Newman personnel did not report any issues with the steam air or hogging ejector. Typical maintenance and rebuilds has been conducted on the steam air and hogging ejectors. Additionally, the condenser vacuum pumps designed for the system have been removed and installed on a different unit onsite.

5.5.1.3 Condensate Pumps

Unit 4 is equipped with two 50 percent vertical motor-driven condensate pumps. The condensate pumps are used to move the condensate from the condenser hotwell, through the steam jet air ejectors, gland steam condenser, and to the deaerator.

Newman personnel did not report any issues with the condensate pumps and unsure when the last repairs were conducted. Unit 4 has a spare condensate pump onsite.

1898 & Co. recommends rebuilding the condensate pumps on a five-year interval, with the next rebuild due in 2022.

5.5.1.4 Deaerator Heater & Storage Tank

The deaerator heater section separates the non-condensable gases from the saturated water by spraying incoming condensate counterflow to deaerating steam. The heated condensate waterfalls over stainless steel trays from the deaerator heater section and, enters the storage tank where it is stored before being pumped back to feedwater system. Additionally, the deaerator storage tank is designed to provide five minutes of storage based on the maximum design feedwater flow rate. Due to the deaerating process and differential thermal stresses occurring in deaerators, deaerators are susceptible to cracks in welds and heat-affected zones of longitudinal and circumferential welded seams due to corrosion fatigue. If Unit 4 operates until 2031, 1898 & Co. recommends continuing inspections and repairs of the deaerator.

5.5.2 Feedwater System

The feedwater system supplies treated, high purity boiler feedwater from the deaerator storage tank through the economizer and to the steam drum.

5.5.2.1 Boiler Feedwater Pumps

Unit 4 is equipped with two 50 percent capacity BFPs which are motor-driven. The BFPs have recirculation ARC valves on the pump side of the discharge valves for pump minimum flow protection.

Plant personnel reported no significant issues with Unit 4's BFPs.

1898 & Co. recommends continuing to rebuild the BFPs on five-year intervals. The next rebuild is scheduled for 2022.

5.5.3 Main Cooling Water System

MCW is supplied to the condenser to condense the steam exhausted from the LP turbine and transfer it to the atmosphere via the cooling towers. Unit 4 utilizes a mechanical draft cooling tower, two 50 percent capacity main cooling water pumps, and a surface condenser. The cooling water pumps take suction from the cooling tower basin and supplies MCW to the condenser inlet water boxes. The MCW flows through the condenser tubes, extracts heat from the LP turbine exhaust steam, and exits the condenser outlet water boxes. A main cooling water flow parallel to the condenser flows through the closed cooling heat exchangers. The hot cooling water existing the condenser and the closed cooling heat exchangers enters the top of the cooling tower via a riser. The hot water is cooled, through evaporative cooling, and collected in the basin of the cooling tower.

The circulating water pumps have been rebuilt within the last ten years. Newman personnel indicated the that the motors were inspected in 2020 and the pumps are planned for replacement for this fall. Although circulating water line debris has been found in the condenser, Newman personnel did not report any issues with the circulating water lines.

1898 & Co. recommends rebuilding the circulating water pumps every five years. The pumps are scheduled to be rebuilt in 2020; the next scheduled rebuild will be in 2025.

Unit 4 utilizes four cell, mechanical draft, crossflow type, cooling tower for heat rejection.

Newman personnel indicated that the performance of the cooling towers is trended. Repairs are conducted based on the condition of the equipment, but visual inspections are conducted during the spring outage. Over the past three years bracing and fill has been replaced. No issues were reported with fan motors and gearboxes. Additionally, all cooling tower cells are needed to reach full load during summer operation.

1898 & Co. recommends completing annual inspections on Unit 4's cooling towers. As part of the inspections, any components found to be in unsatisfactory condition should be repaired or replaced. If Unit 4 continues operation until 2031, 1898 & Co. anticipates replacing cooling tower structures and fans to support reliable generation.

5.5.4 Closed Cooling Water

The CCW system includes two 50 percent CCW pumps and the associated piping, valves, and instrumentation. The purpose of the CCW system is to provide treated, high purity cooling water for equipment requiring cooling such as BFP bearings and oil coolers.

The auxiliary cooling water pumps have been rebuilt within the last ten years. Newman personnel indicated the that the motors were inspected in 2020 and the pumps are planned for replacement for this fall. The auxiliary cooling water lines have experienced corrosion. The corrosion failures have been repaired which required the lines to be rerouted above ground.

1898 & Co. recommends rebuilding the auxiliary cooling water pumps every five years. The pumps are scheduled to be rebuilt in 2020; the next scheduled rebuild will be in 2025.

5.5.5 Bridge Crane

Unit 4 utilizes a bridge crane during outages to efficiently move components such as the turbine casing. Newman personnel indicated that Unit 4's crane is in poor condition and should be upgraded. Personnel also indicated they would like remote operation to be an option for Unit 4's crane after the upgrade. 1898 & Co. recommends completing the crane upgrades in 2023.

5.6 Electrical and Controls

5.6.1 Electrical System Overview

Unit 4 consists of three Westinghouse generators, three GSU transformers, one auxiliary transformer and one startup transformer, 4.16 kV and 480 V switchgears, 4,160 V station service switchgear, 480 V switchgears, MCCs, and small distribution transformers and panels. Unit 4's GSUs are interconnect with the transmission system at 115 kV.

This Study stops at the high side of each unit's GSU transformer. Therefore, this assessment does not include the overhead line to the switchyard and does not include the switchyard itself.

Generally, 1898 & Co. recommends routine infrared surveys of electrical equipment.

5.6.2 Combustion Turbine Generators

The combustion turbine generators ("CTGs") are 3,600 RPM, two pole, three phase, hydrogen cooled units manufactured by Westinghouse. The CTGs are rated at a maximum of 94,444 kVA with a 0.90 PF, supplying three-phase AC power output at 13,800 V and constant frequency of 60 Hz.

5.6.2.1 Combustion Turbine Unit 1 Generator

CTG1 had a generator inspection, an exciter inspection, and bump tests performed by Siemens throughout early 2019. This was performed during a scheduled outage and included a rotor in generator inspection. Repairs of note included a stator core tightening, replacing diamond spacers, repairing four damaged connections and an overhaul to the exciter diode wheel. A bump test was failed after the initial inspection and repairs were completed. As a result, additional diamond spacers were installed along with core blocks and additional wicking resin. The exciter end basket was also found to be unsatisfactory and several corrective options were recommended by Siemens. The exciter was found to be suitable for normal service after several minor overhauls were completed as part of the exciter inspection. A complete overhaul of the exciter was recommended by Siemens on a five-year interval (2024).

Plant Personnel reported that greasing is typical on the CTG1 end windings. Wicking resin has been injected to help tighten up the generator windings. All of the generators for Unit 4 were reported to need a rewind on both the stator and the field in the case of operating beyond 2026. However, provided generator reports do not indicate the need for a rewind. The 2019 generator inspection required minor repairs primarily centered around insulation blocking but is in other expected condition for a unit of that age. The plant personnel were not aware of any outstanding service bulletins on CTG1. Unit 4 does not have a backup generator.

The CTG1 brushless exciter is original and last inspected in 2019; a complete overhaul was recommended very five years. Plant personnel also reported the AVR will be upgraded to Emerson Ovation in fall 2020. It was also indicated that field breaker maintenance is performed regularly.

1898 & Co. recommends performing a generator MI and bump test every 5-7 years beginning in 2022. The 2019 generator inspection showed resonant frequency at 122 Hz at CE. A bump test and changes to the blocking to shift the resonant frequency away from 120 Hz is recommended to prevent stator bar movement. Also, during the 2022 outage 1898 & Co. recommends that CTG1 undergo stator rewind. Additionally, if the unit is to be operated until 2031, 1898 & Co. recommends overhauling the exciter in 2024.

5.6.2.2 Combustion Turbine Unit 2 Generator

In 2019 CTG2 underwent a rotor out generator MI. During the inspection two minor side filler migrations were repaired and a small piece of sagging tapping was removed. Additionally, partial discharge testing and recurrent surge oscillograph testing was conducted on the stator windings.

The exciter was disassembled which resulted in the exciter rotor, exciter air cooler and exciter baffles being removed. The exciter end and turbine end stators were found to be in fair condition, but the winding was dirty due to oil adhesion. The exciter end and turbine end stators were not found to have greasing or dusting and the turbine block and banding was determined to be in satisfactory condition. Siemens recommended that the wiring on the terminal boards to the exciter due to wear and dry conditions.

The inspection of the stator did not reveal any loose or greasing wedges or evidence of wedge filler migration. The stator iron was determined to be in satisfactory condition with no evidence of blockage of the core ventilation paths.

The inspection of the rotor indicated the component is in satisfactory condition. Although, dirt was identified under the retaining rings. The end winding bracing box and insulation was intact with no evidence of movement. Heating damage was not identified in the retaining rings, wedges, or rotor body.

In 2020 CTG2 underwent a bump test to identify components that might have natural mechanical resonant frequencies near the magnetic frequency of the unit. After testing various components, including phase leads, the 2-lobe mid-basket was found to be in an unsatisfactory frequency range. Siemens recommended the installation of core blocks and replacement of diamond spacers. After the recommendations were implemented the 2-lobe mid-basket fell outside the unsatisfactory frequency range.

Plant Personnel reported that greasing is typical on the CTG2 end windings. Wicking resin has been injected to help tighten up the generator windings. All of the generators for Unit 4 were reported to need a rewind on both the stator and the field in the case of operating beyond 2026. However, provided generator reports do not indicate the need for a rewind. The generator is in expected condition for its age and is recommended for operations with regular inspections. The plant personnel were not aware of any outstanding service bulletins on CTG2. Newman does not have backup generators for any Unit 4 generator.

The CTG2 brushless exciter is original equipment. Plant personnel reported the AVR will be upgraded to Emerson Ovation in Fall 2020. It was also indicated that field breaker maintenance is performed regularly.

1898 & Co. recommends performing a generator MI and bump test every 5-7 years beginning in 2024. The generator was last inspected in 2019/2020. Additionally, if the unit is to be operated until 2031, 1898 & Co. recommends overhauling the exciter in 2024.

5.6.3 Steam Turbine Generator

The STG is a 3,600 RPM, two pole, three phase, hydrogen cooled unit manufactured by Westinghouse. The STG is rated at a maximum of 133 MVA with a 0.90 PF, supplying three phase AC power output at 13,800 V and constant frequency of 60 Hz.

Inspection documentation for the Unit 4 STG was not provided. The last MI was completed in 2019.

The STG brushless exciter is original equipment. Plant personnel reported the AVR will be upgraded to Emerson Ovation in the fall of 2020. It was also indicated that field breaker maintenance is performed regularly.

According to plant personnel, the next major on the Unit 4's STG is scheduled for 2029, but a minor inspection is anticipated in 2021. 1898 & Co. recommends continuing the scheduled maintenance cycle and completing MIs every 5-7 years. If the combined cycle block is to be operated until 2031, it is recommended that an exciter overhaul is completed in 2024.

5.6.4 Transformers

There are three main power transformers associated with Unit 4 as well as two auxiliary transformers. CTG1, CTG2, and the STG each feed their own GSU transformers. The auxiliary transformers for the combined cycle block include one main auxiliary transformer and one startup transformer.

Generally, 1898 & Co. recommends that EPE conduct annual maintenance, testing and repairs on Unit 4's transformers.

5.6.4.1 Combustion Turbine Generator Step-Up Transformers

The CT GSU transformers manufactured by GE step up the CTG output voltage from 13.8 kV to 115 kV. Each three-phase CT GSU transformer is rated at 70/90/112 MVA oil air/forced air/forced air ("OA/FA/FA") at 55 °C. The GSU low voltage terminals are connected to the Isophase Bus Duct.

Inspection data for the Unit 4 transformers was not provided. Provided documentation indicated the GSUs are not original equipment. Plant personnel reported there are no significant existing issues for the GSUs. Operations typically does daily rounds on each transformer checking winding temps, cooling fans, etc. The GSUs are maintained by EPE's substation group. EPE has reportedly been working on its spare transformer inventory and may have spare GSUs available in its fleet, although confirmation of available spare inventory was not provided to 1898 & Co.

5.6.4.2 Steam Turbine Generator Step-Up Transformer

The STG GSU transformer manufactured by GE steps up the STG output voltage from 13.8 kV to 115 kV. All GSU transformers are rated at 125 MVA with forced air with a 65C rise. The GSU low voltage terminals are connected to isolated phase bus.

Inspection data for the Unit 4 transformers was not provided. Provided documentation indicated the GSU is not original equipment. Plant personnel reported there are no significant existing issues for the GSU. Operations typically does daily rounds on the transformer checking winding temps, cooling fans, etc. The GSU is maintained by EPE's substation group. EPE has reportedly been working on its spare transformer inventory and may have spare GSUs available in its fleet, although confirmation of available spare inventory was not provided to 1898 & Co.

5.6.4.3 Unit Auxiliary Transformers

Unit 4 has one-UAT. The AUT is a Westinghouse three-phase transformer that is used to step down the 13.8 kV output of the generator to 4,160 V. The AUT is sized at 7.5/9.4 MVA OA/FA at 55°C and 8.4/10.5 MVA OA/FA at 65°C. The unit startup transformer is a GE Prolec three-phase transformer that is used to step down the 115 kV output off the grid to 4,160 V during startup. Provided documentation has indicated the AUT is original equipment. The power generated is used for the unit load and common load during normal operation. The UAT high voltage bushings are directly connected to the Isophase.

Inspection data for the Unit 4 transformers was not provided. Plant personnel reported there are no significant existing issues for the AUT or startup transformer. Operations typically does daily rounds on the transformers checking winding temps, cooling fans, etc.

The Unit 4 UAT is original equipment and is past its design life. 1898 & Co. recommends replacing the UAT in 2023 if the Unit is operated until 2031.

5.6.4.4 Start-up Transformer

Unit 4 has one start-up transformer which steps down voltage from 115 kV to 4,160 V. The start-up transformer is fed from the 115 kV bus and is rated at 12/16/20 MVA ONAN/ONAF/ONAF at 55°C. Plant documentation indicates the transformer was originally the alternate auxiliary transformer for the unit. The start-up transformer is not original equipment and has been replaced.

Inspection data for the Unit 4 transformers was not provided. Plant personnel reported there are no significant existing issues for the startup transformer. Operations typically does daily rounds on the transformers checking winding temps, cooling fans, etc.

5.6.5 Generator Circuit Breakers

Each Unit 4 CTG has an associated Generator Circuit Breaker ("GCB"). The GCB is connected by isophase bus to the generator on one side, and to the GTG's GSU on the other side. Each GCB is rated for 4,000 A at 14.4 kV. Each GCB is used for synchronizing its associated generator to the external power grid.

Plant personnel indicate the CTG circuit breakers are original breakers and are maintained by the substation group. There are no current plans to replace the breakers although they may require replacement if Unit 4 is operated beyond 2026. It was indicated that the breakers are inspected every five years and have PMs performed every major.

If the unit is operated until 2031, 1898 & Co. recommends replacing the GCBs in 2024 due to the equipment approaching its design life.

5.6.6 Isolated Phase Bus Duct

Isophase connects the three-phase CT GSU transformers to the UAT and GCBs, and from the GCBs to the generator terminals. Plant personnel indicated no significant issues with the isophase duct.

5.6.7 Bus Duct

Bus duct, rated at 13.8 kV and 6,000 A, connects the ST generator to the ST GSU. Plant personnel indicate no significant issues with the bus duct.

5.6.7.1 Critical Cabling

Plant personnel indicated that some critical cabling is located outside and exposed to the sun. It was reported that Unit 4 cabling is in worse shape than Unit 3's and is nearing at its end of design life. Much of the MV cabling runs to the outdoor switchgear underground, passing through manholes and ducts all the way to the auxiliaries such as cooling towers, the reverse osmosis ("RO") building, etc. Plant personnel believed significant cabling will require replacement if the unit continues operation beyond 20026.

An allowance is included in the switchgear/MCC replacement projects to replace critical cabling, but additional funding has been allocated to replace critical high, medium and low voltage cabling if Unit 4 continues operation until 2031.

5.6.8 Medium Voltage Switchgear

Unit 4 has four 4,160 V lineups, one 3,000 A, one 2,000 A and two 1,200 A switchgears. The 4,160 V switchgears source power from either the startup transformer of the auxiliary transformer.

Newman personnel report that the switchgears are on a regular maintenance plan. A contractor is brought in each summer to inspect the switchgear during a two-week outage. Some of the Unit 4 switchgears are outdoor gear. Plant personnel indicate the MV switchgear are nearing their end of design life, and a full replacement is planned for 2021. This replacement will include all electrical and mechanical components. Newman personnel report they have 1-2 spare breakers for each size of MV switchgear (2,000 A and 1,200 A).

Regardless of retirement scenario, 1898 & Co. recommends replacing the outdoor 4,160 V switchgear in 2021. Provided documentation indicates this project is already included in Newman's capital plan. If the unit is operated until 2031, it is recommended that 4,160 V switchgear 1A and 1B are replaced in 2022 and 2023, respectively, due to design life, limited spare parts availability, and corresponding increasing O&M costs.

5.6.8.1 Medium Voltage Motors

Motors requiring 4,160 V are fed from the 4,160 switchgear. Plant personnel indicate the motors are monitored under a conditions-based maintenance program to indicate if they require testing. Offline testing is performed every year, and each motor is sent out to a motor shop for cleaning and testing during majors, and static and impedance tests are typically performed annually.

It was also reported that they have a stock of critical spare motors. For each system, their spares are either entirely redundant or provide enough power to operate the plant at 50 percent power.

5.6.9 Low Voltage Switchgear and MCCs

5.6.9.1 480V Switchgear and Motor Control Centers

Unit 4's low voltage distribution system also has several 480 V switchgear lineups and MCC lineups. The SSTs are AKD-5 Powermaster switchgear originally manufactured by GE and the MCCs are Type W's manufactured by Westinghouse. The SSTs provide power to the 480 V switchgear and the 480 V switchgear provides power to all of the 480V MCCs and 480 V power panels. The 480 V MCCs provide power to motors, heaters, battery chargers, and other miscellaneous loads. Plant documentation indicates that the switchgear breakers are inspected, cleaned, and tested every five years.

Plant personnel reported the low voltage switchgear experience issues with the coils being burned up. The breakers are very worn out and will require replacement if the service life of the unit is continued beyond 2026. During the interview with site personnel, it was also indicated that some capital investment is available for replacement if the unit's service life is continued beyond 2026.

The low voltage MCCs are reported to be in adequate condition, although finding replacement parts for the vintage MCCs is proving difficult.

If the unit is to be operated until 2031, 1898 & Co. recommends replacing the 480 V CT switchgear and the 480 V water treatment switchgear (including the associated transformer) in 2024 and 2025, respectively. Additionally, if the unit's service life is continued beyond 2026, 1898 & Co. recommends replacing the 480 V water treatment MCC, the 480 V cooling tower MCC, and the 480 V fuel oil MCC in 2022, 2025, and 2021, respectively.

5.6.9.2 Low Voltage Motors

Low voltage motors are fed from the 480 V MCC's. Plant personnel indicate the low voltage motors are maintained with the same philosophy as medium voltage motors, which is rare. Low voltage motors are monitored to indicate if they require further testing by the M&D department. Each motor is sent out to a motor shop for cleaning and testing during majors, and static and impedance tests are typically performed annually.

It was also reported that they have a stock of critical spare motors. For each system, their spares are either entirely redundant or provide enough power to derate 50 percent.

5.6.10 Station Emergency Power Systems

Unit 4 is designed with three station batteries and associated chargers. The station batteries utilize lead calcium and produce emergency power at 125 Vdc, while the station control batteries utilize lead calcium and produce emergency power at 24 Vdc. Each CT and the ST are equipped with an EnerSYS EC-13M DC battery bank. According to plant documentation, each battery bank is subject to cell voltage/electrolyte testing every four months, terminal and plate resistance testing every 18 months, and discharge testing every 6 years. All of these tests have been performed on each rack as recently as 2019.

5.6.10.1 Gas Turbine 1 Battery Bank

The GT1 battery bank was originally manufactured in 2009. Capacity testing completed in November 2019 by Nolan Power Group indicated the battery has a capacity of 122.9 percent (of design capacity) with a total run time of 1:13:46. The test provided overall satisfactory results, but indicated that several broken or missing flame arrestors should be replaced and that the battery rack should be replaced with a Seismic Zone 1 rated rack. Similar testing was recommended to be completed on 3-year increments.

Plant personnel confirmed capacity testing is performed on three-year intervals and the batteries are in adequate condition. Cooling has been added to the CTG battery banks to better maintain the batteries. It was also indicated that the UPS is scheduled to be upgraded in 2021.

5.6.10.2 Gas Turbine 2 Battery Bank

The GT2 battery bank was originally manufactured in 2014. Capacity testing completed in November 2019 by Nolan Power Group indicated the battery has a capacity of 105.1 percent (of design capacity) with a total run time of 1:01:13. The test provided overall satisfactory results, but indicated that and inter-tier cable is not properly sized and should be replaced, several broken or missing flame arrestors should be replaced, and that the battery rack should be replaced with a Seismic Zone 1 rated rack. Similar testing was recommended to be completed on three-year increments.

Plant personnel confirmed capacity testing is performed on three-year intervals and the batteries are in adequate condition. Cooling has been added to the CTG battery banks to better maintain the batteries. It was also indicated that the UPS is scheduled to be upgraded in 2021.

5.6.10.3 Steam Turbine Battery Bank

The ST battery bank was originally manufactured in 2014. Capacity testing completed in November 2019 by Nolan Power Group indicated the battery has a capacity of 120.7 percent (of design capacity) with a total run time of 1:09:33. The test provided overall satisfactory results, but indicated that and inter-tier cable is not properly sized and should be replaced and that the battery rack should be replaced with a Seismic Zone 1 rated rack. Similar testing was recommended to be completed on three-year increments.

Plant personnel confirmed capacity testing is performed on three-year intervals and the batteries are in adequate condition. It was also indicated that the UPS is scheduled to be upgraded in 2021.

5.6.11 Electrical Protection

EPE personnel indicated that all relays at Unit 4 are electromechanical. Plant personnel indicated that Unit 4 is receiving a protection relay upgrade during the DCS upgrade in 2021. The maintenance plan call for relay procedure in accordance with the NERC PRC reliability standards.

5.6.12 Control Systems

As of Fall 2020, the unit is to be equipped with Emerson Ovation 3.7 for all controls. Plant personnel indicate an Evergreen is planned every four years unless they are within two years of retirement. During the 2020 upgrade, all critical instrumentation such as drum levels, pressure sensors, will be replaced. Plant personnel believe at least 90 percent of the instrumentation will be in adequate shape until at least 2030. It was also indicated that discussions are underway with Emerson to enter the plant into a SureService agreement.

Plant personnel indicated some electrical equipment exhibits significant incident energy and will require arc flash mitigation. It was reported that incident energy exceeds 40 calories / centimeter squared, a typical safety threshold found in the NFPA "Standard for Electrical Safety in the Workplace." Upgrading the electrical distribution equipment to modern arc resistant gear will help reduce the incident energy levels. Extra costs are included in the switchgear and MCC replacement projects to upgrade to arc resistant gear.

1898 & Co. recommends completing the planned SureService agreement with Emerson to maintain the DCS system.

5.6.13 Continuous Emissions Monitoring System

Unit 4 utilizes a CEMS to comply with the Newman Environmental Protection Agency permit. Plant personnel indicate the CEMS system has been upgraded within the last decade and will be due for another refresh soon. The analyzer and sensor are approaching the end of their design lives, which can lead to analyzer drift and inaccurate reading.

1898 & Co. recommends completing a CEMS analyzer upgrade every 10-15 years, with the next upgrade due in 2023.

6.0 COMMON

6.1 Balance of Plant

6.1.1 Water Treatment System

The water treatment system consists of a demineralized water treatment plant and demineralized water storage system. The demineralized water system utilizes RO skids.

The service water system is shared by Units 1, 2, and 3. Newman has two water wells and treated wastewater effluent for supply. The water treatment system is supplied from local deep wells. The water is filtered and sent through two stages of RO and is further demineralized as it passes through a single mixed bed polisher before being directed to the storage tanks. Newman has 4 total trains for water treatment, including two older RO trains and two newer RO trains that were added with the addition of Unit 5.

Newman personnel indicated that the RO skids are in good condition. The RO membranes are replaced and cleaned based on differential pressure. The last major replacements to the RO system were conducted in 2018.

6.1.2 Wastewater Discharge

Wastewater from the boiler blowdown, laboratory drains, sampling streams, and floor drains is routed through an oil/water separator which is discharged to on-site sumps. Cooling tower blowdown is routed to separate sumps without treatment.

The Plant installed a zero-liquid discharge system in the 2007 timeframe, with the addition of Unit 5. It is possible that the Newman was required to install a partial zero-liquid discharge system since the permits would not allow any additional discharge with the addition of Unit 5. All wastewater is pumped to the zero-discharge wastewater system. This wastewater treatment system effluent is of better quality than the existing cooling tower makeup feed and is utilized as makeup to the cooling tower. The new wastewater treatment is essentially zero-discharge and the concentrated solids are landfilled.

6.1.3 Instrument Air

The Facility is equipped with control and service air systems. Additionally, there are instrument air dryers that remove moisture from the process air to prevent corrosion and clogging of pneumatic parts. The system is equipped with the associated piping, valves, and instrumentation and controls. The separate control and service air lines provide air for the Facility. Newman personnel did not report any issues with the instrument air systems, but if Unit 4 continues operation until 2031 1898 & Co. anticipates a replacement of the atomizing air compressor motor.

6.2 Electrical and Controls

6.2.1 Emergency Generator & Facility Black Start Capability

Newman personnel reported there is no emergency generator or black start unit on site.

6.2.2 Cathodic Protection

Anodes were replaced in 2014 or 2015 and cathodic protection surveys are performed regularly according to plant personnel. It is recommended that the plant continue to perform surveys to determine when corrective action must be taken.

6.2.3 Miscellaneous Electrical Systems

Lighting, welding receptacles, and convenience receptacles are not a part of the power production process but should be maintained regularly for safety concerns and Facility maintenance. With regular and proactive lamp and fixture replacement, the lighting systems should function reliably and provide safe lighting levels for tasks at hand.

Miscellaneous equipment such as variable frequency drives, local disconnect switches, small dry-type transformers, low voltage power panels and switchboards, should receive visual, mechanical, and electrical inspections and testing in accordance with NETA Maintenance Testing Standard guidelines. Some of these are viewed in the industry as unrealistically frequent for small apparatus, so Newman's discretion is recommended for these items.

Plant personnel also indicated the controls on the common gas blending skid were upgraded to an Allen Bradley PLC in 2017. The plant has expressed interest in converting to Emerson based PLCs or Ovation if the plant life is continued beyond 2026 and the current PLC requires an upgrade.

7.0 INCIDENT EVENT ANALYSIS

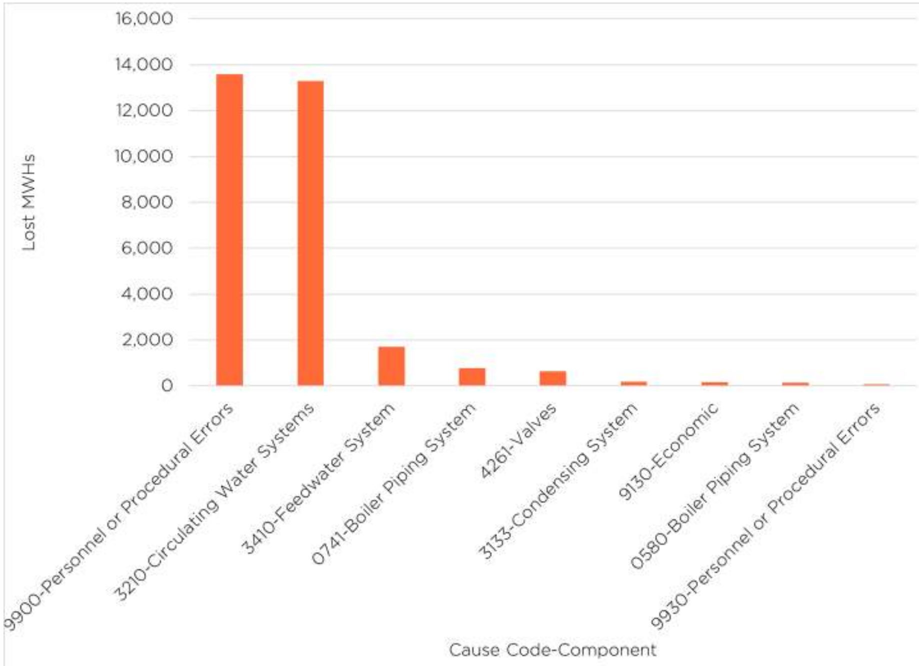
1898 & Co. reviewed the Facility's historical incidents to determine were the Facility has experienced the largest drivers of lost megawatt hours ("MWhs"). The analysis was compared with the interviews with Plant personnel and condition documents to determine the cause of the events and the likelihood of recurrence. Additionally, systemic incidents were addressed in the Appendix section of this report. Addressing the systemic incidents should help mitigate many of the failure risks for the components in the future.

1898 & Co.'s analysis focused on incidents that were not anticipated or planned by the Facility over the past five years. The incidents that qualified were classified as forced derating, forced outage, risk condition or startup failures. Additional data associated with each event allowed 1898 & Co. to conduct a thorough analysis of the Newman's components. The incidents were not classified by component; thus 1898 & Co. used the cause codes of the incident to classify each component. Additionally, using the duration and derated load during the incident 1898 & Co. could determine the lost energy (MWhs) associated with a single event.

7.1 Unit 3

1898 & Co. summed the lost energy (MWhs) associated with each component to determine the total lost energy (MWhs) over the past five years. Evaluating all components experiencing incidents, 1898 & Co. was able to determine the top 10 lost energy (MWh) drivers for Unit 3, which can be seen below in Figure 7-1.

Figure 7-1: Unit 3 Top 10 Lost Energy (MWh) Drivers



Unit 3's top 10 components are mostly associated with the boiler and BOP systems. 1898 & Co. had anticipated the boiler driving a significant portion of the lost energy (MWhs) for Unit 3 since many issues with boiler had been reported.

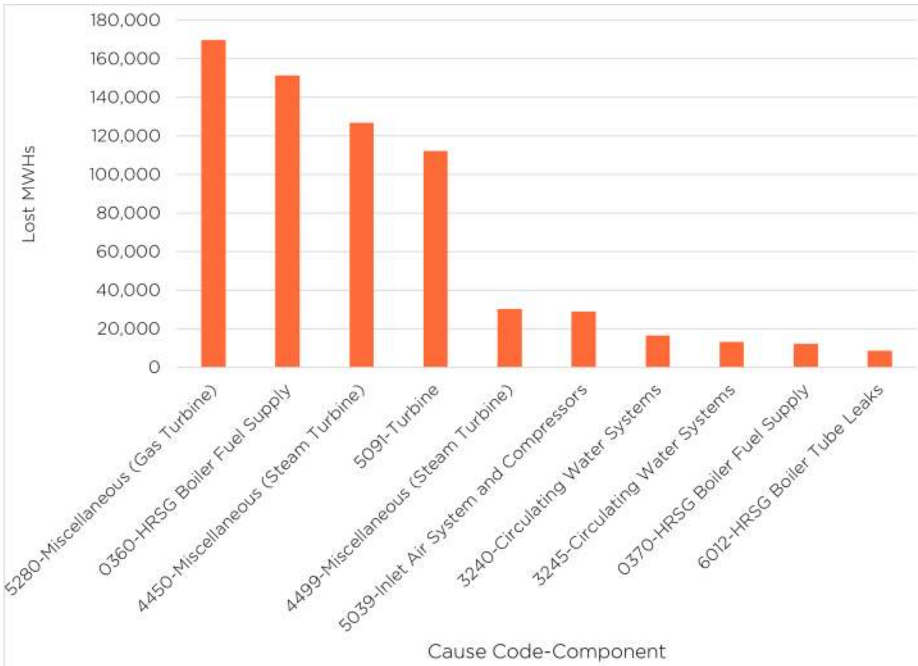
Operator error was the largest driver of lost energy (MWhs) for Unit 3, but 1898 & Co. does not anticipate operator error becoming a systemic issue for Unit 3. Newman personnel indicated that the largest concern in the circulating water system exists in the circulating water lines, but the lost energy (MWh) event was cause by a circulating water pump failure. The circulating water pumps were rebuilt within the last three years; thus 1898 & Co. does not anticipate the event to be a systemic problem for Unit 3. Temporary repairs have been made to the circulating water piping, but additional work will be needed to reduce the concern associated with a significant failure. Newman personnel indicated that significant valve cracking has been experienced particularly in the stop and reheat valves. Continued maintenance on the turbine valves should reduce the future risk. Boiler tube leaks are common for Unit 3. Most commonly occurring in the economizer, approximately three boiler tubes are experienced on an annual basis. 1898 & Co. anticipates Unit 3 experiencing boiler tube leaks in the future due to the age of the boiler tubes but does not expect the failures to cause significant operational issues.

In Appendix A, 1898 & Co. has included projects that will continuously address Unit 3's top 10 lost energy (MWh) drivers identified by Newman personnel and the incident analysis.

7.2 Unit 4

1898 & Co. summed the lost energy (MWhs) associated with each component to determine the total lost energy (MWhs) over the past five years. Evaluating all components experiencing incidents, 1898 & Co. was able to determine the top 10 lost energy (MWh) drivers for Unit 4, which can be seen below in Figure 7-2.

Figure 7-2: Unit 4 Top 10 Lost Energy (MWh) Drivers



Unit 4's top 10 components are mostly associated with the CTs, HRSGs and ST.

The largest driver of lost energy (MWh) events has been caused by multiple vibration issues in the gas turbines and ST. Of the 11 vibration events experienced by Unit 4 an immediate unplanned outage only occurred twice. The other nine vibration events caused delayed unplanned outages or derates. Only one of the immediate unplanned outages extended beyond one day indicating that the vibration issue should not cause significant operational issues for Unit 4. Newman personnel should closely monitor the vibration of the gas and STs onsite to reduce the likelihood of lost energy (MWh) events. When possible, Newman should monitor the condition of bearing to verify the condition of the components. The lost energy (MWhs) associated with HRSG burners has been caused by 12 events in 2019. All the burner failures have caused derate events that have varied in length. Most of the events have been addressed within a single day, but five events have extended beyond five days. 1898 & Co. recommends monitoring burners when possible to gauge the condition of the components. When necessary burners should be repaired or replaced to avoid unplanned outages or derates. Water induction events occurred in ST in 2016, resulting in an unplanned outage for the ST and causing a derate event for the CTs. Each derate extended beyond 16 days which could poses an operational problem for the gas turbines. Since a water induction event has not been experienced since 2016 the issues that caused the water induction events appear to have been addressed. In 2015 and 2016, the LP turbine A bearing experienced four maintenance derates. Each maintenance derate event lasted longer than five days, but all events occurred over a five-month span. The ST rotor was replaced in 2016 which should have provided Newman personnel ample time to address the issues with the LP turbine A bearing. There has not been a maintenance derate since March 2016 indicating the issues responsible for the events have been addressed.

In Appendix B, 1898 & Co. has included projects that will continuously address Unit 4's top 10 components identified by Newman personnel and the incident analysis.

8.0 UNIT BENCHMARKING

1898 & Co. benchmarked information provided for Newman to similarly sized facilities to make observations regarding availability, reliability and O&M expenditures. 1898 & Co. also used operating and retirement data for similar facilities to create useful life curves. These curves can help EPE plan for the anticipated retirement of the Facility in the future based on the distribution of retirements for other similar sized facilities.

8.1 Historical Performance

The monthly operating statistics over the last five years were provided to 1898 & Co. by EPE for Unit 3 and Unit 4. The information provided to 1898 & Co. included data from January 2015 to December 2019.

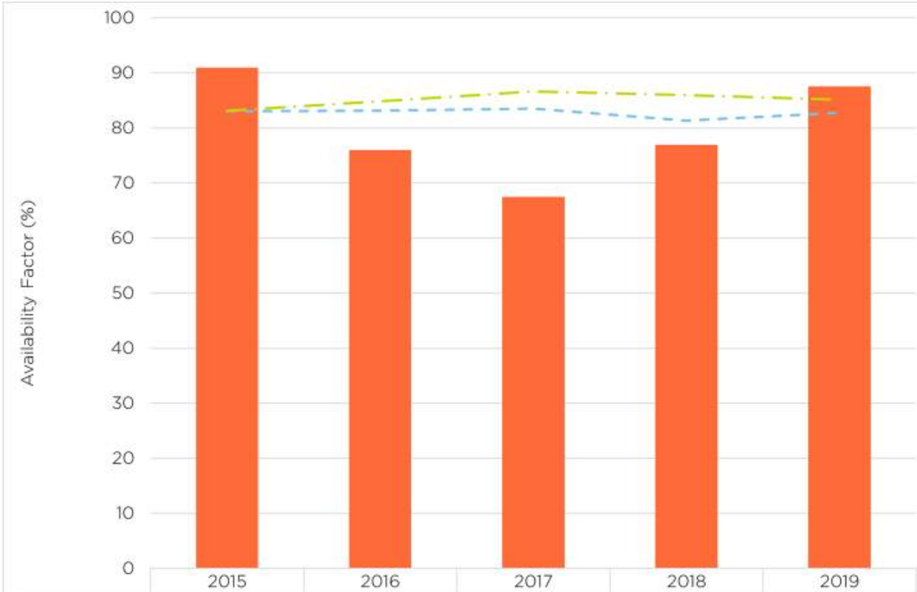
8.1.1 Unit 3

1898 & Co. benchmarked the historical performance of the Facility against other similarly natural gas-fired steam units. 1898 & Co.'s analysis included natural gas-fired boilers with a rated operating capacity between 75 and 200 MWs. Data used in the benchmarking analysis was derived from either NERC's GADS or the EIA-860 database. All benchmarking statistics utilized in the unit benchmarking analysis are unweighted averages of the annual operating statistics of the peer group.

8.1.1.1 Availability and Reliability

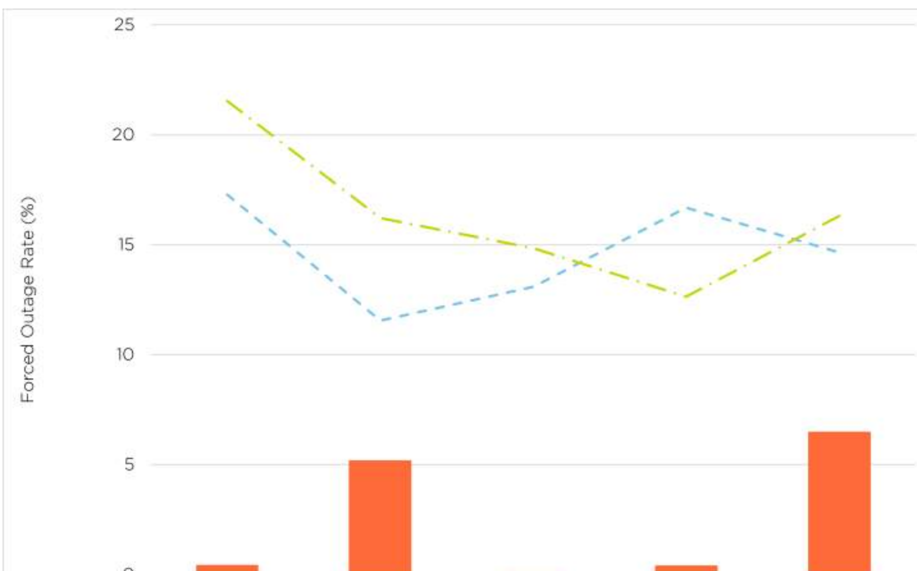
1898 & Co. evaluated the Unit's overall availability and reliability performance against a fleet average of similar generating units. Figure 8-1 presents the AF for Unit 3 against the fleet benchmark data as obtained from NERC GADS. Similarly, Figure 8-2 presents the FOR for Unit 3 against the fleet benchmark.

Figure 8-1: Unit 3 Availability Factor Benchmark



	2015	2016	2017	2018	2019
Newman 3	90.82	75.88	67.42	76.90	87.50
National	83.09	83.13	83.54	81.39	82.79
Regional	83.14	84.83	86.64	86.02	85.16

Figure 8-2: Unit 3 Forced Outage Rate Benchmark



	2015	2016	2017	2018	2019
Newman 3	0.41	5.16	0.01	0.38	6.47
National	17.28	11.54	13.08	16.68	14.65
Regional	21.54	16.22	14.85	12.63	16.31

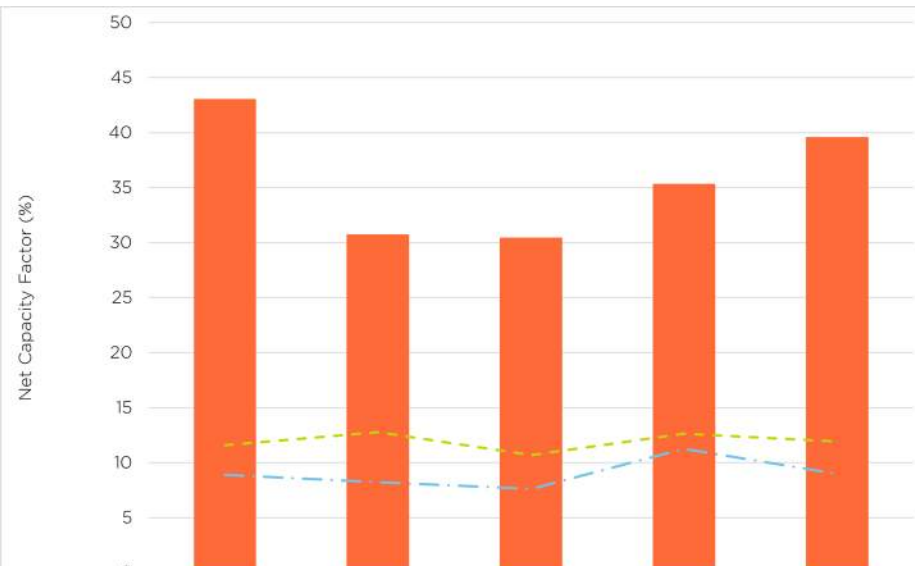
As depicted in Figure 8-1, Unit 3 was above (better than) the AF fleet benchmark in two of the past five years. Over the past five years the Unit 3's availability has been approximately 3 percent less than (worse) the national fleet benchmark and approximately 5 percent less than (worse) the regional fleet benchmark. Due to the high AF performance, Unit

3 has operated below the industry availability standards over the past five years. In Figure 8-2, Unit 3's FOR was lower (better) than the fleet benchmark in each of the past five years. Over the five-year period the FOR at the Facility was approximately 12 percent better than the national fleet benchmark and approximately 14 percent better than the regional fleet benchmark. Due to the Facility's low FOR performance, the Facility has operated better than the industry reliability standards over the past five years.

8.1.1.2 Energy Production

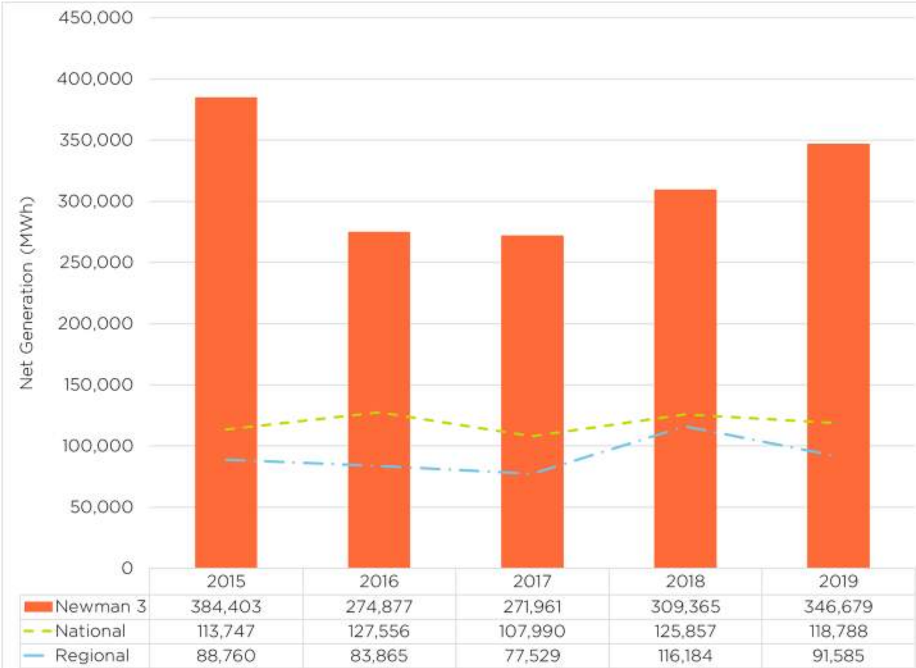
1898 & Co. evaluated Unit 3's overall generation performance against a fleet average of similar generating units. Figure 8-3 presents the net capacity factor for Unit 3 against the fleet benchmark data as obtained from NERC GADS. Similarly, Figure 8-4 presents the net generation for Unit 3 against the fleet benchmark data as obtained from NERC GADS.

Figure 8-3: Unit 3 Net Capacity Factor Benchmark



	2015	2016	2017	2018	2019
Newman 3	43.02	30.68	30.44	35.32	39.58
National	11.58	12.78	10.69	12.62	11.92
Regional	8.90	8.22	7.60	11.28	9.00

Figure 8-4: Unit 3 Net Generation Benchmark



As depicted in Figure 8-3 and Figure 8-4, Unit 3 has operated consistently above the fleet benchmark in each of the past five years. Over the past five years the Unit 3's net capacity factor has been approximately 24 percent greater than (better) the national fleet benchmark and approximately 27 percent greater than (better) the regional fleet benchmark. Due to the high net capacity factor performance, Unit 3 has operated above the industry generation standards over the past five years.

Since net heat rate information could not be obtained from NERC GADS, 1898 & Co. used information from EIA-860 to benchmark Unit 3's net heat rate. Figure 8-5 presents the net heat rate for Unit 3 against the fleet benchmark data.

Figure 8-5: Unit 3 Net Heat Rate Benchmark

	2015	2016	2017	2018	2019
Newman 3	11,922	13,372	11,502	11,752	11,525
National	12,565	12,891	13,267	13,621	13,433
Regional	13,091	12,879	13,627	12,957	13,074

As depicted in Figure 8-5, Unit 3 operated consistently below (better than) the fleet benchmark in the past five years. On average Unit 3 has reported a unit net heat rate of 12,015 Btu/kWh, while the national fleet benchmark has experienced an average unit net heat rate of 13,155 Btu/kWh and the regional fleet benchmark has experienced an average unit net heat rate of 13,126 Btu/kWh. The heat rate benchmark indicated Unit 3 is operating in a more efficient manner when compared to peer units. The relatively low heat rate indicates that Unit 3 is being properly operated and maintained. Maintaining the relatively low heat rate should allow Unit 3 to provide efficient reliable and available generation.

8.1.2 Unit 4

1898 & Co. benchmarked the historical performance of Unit 4 against other similarly sized combined cycle units. 1898 & Co.'s analysis included combined cycle unit with a rated operating capacity between 200 and 350 MWs. Data used in the benchmarking analysis was derived from either NERC's GADS or the EIA-860 database. All benchmarking statistics utilized in the unit benchmarking analysis are unweighted averages of the annual operating statistics of the peer group.

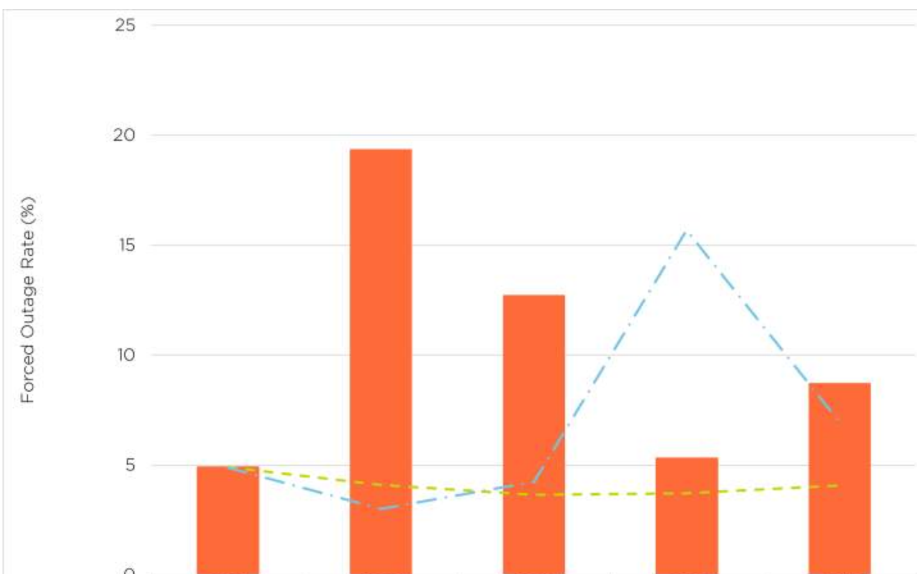
8.1.2.1 Availability and Reliability

1898 & Co. evaluated the Unit's overall availability and reliability performance against a fleet average of similar generating units. Figure 8-6 presents the AF for Unit 4 against the fleet benchmark data as obtained from NERC GADS. Similarly, Figure 8-7 presents the FOR for Unit 4 against the fleet benchmark.

Figure 8-6: Unit 4 Availability Factor Benchmark

	2015	2016	2017	2018	2019
Newman 4	82.49	67.96	72.48	89.25	78.05
National	87.53	85.18	87.51	87.90	87.03
Regional	89.30	84.94	91.50	87.45	88.30

Figure 8-7: Unit 4 Forced Outage Rate Benchmark



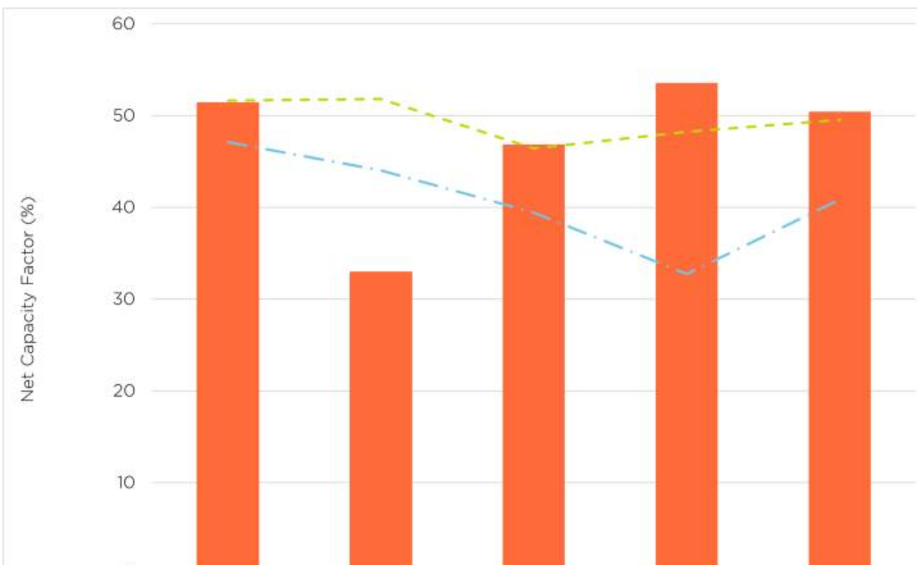
	2015	2016	2017	2018	2019
Newman 4	4.93	19.35	12.72	5.32	8.70
National	4.90	4.09	3.64	3.72	4.09
Regional	4.88	3.00	4.25	15.68	6.95

As depicted in Figure 8-6, Unit 4 was below (better than) the AF fleet benchmarks in four of the past five years. Over the past five years, Unit 4's availability has been approximately 9 percent less than (worse) the national fleet benchmark and approximately 10 percent less than (worse) the regional fleet benchmark. Due to the low AF performance, Unit 4 has operated below the industry availability standards over the past five years. Similarly, as illustrated in Figure 8-7 the Facility's FOR was higher (worse) than the national fleet benchmark in each of the past five years. Over the five-year period the Unit 4 FOR was approximately 6 percent lower than the national fleet benchmark and approximately 3 percent lower than the regional fleet benchmark. Due to the Facility's high FOR performance, the Facility has operated below the industry reliability standards over the past five years.

8.1.2.2 Energy Production

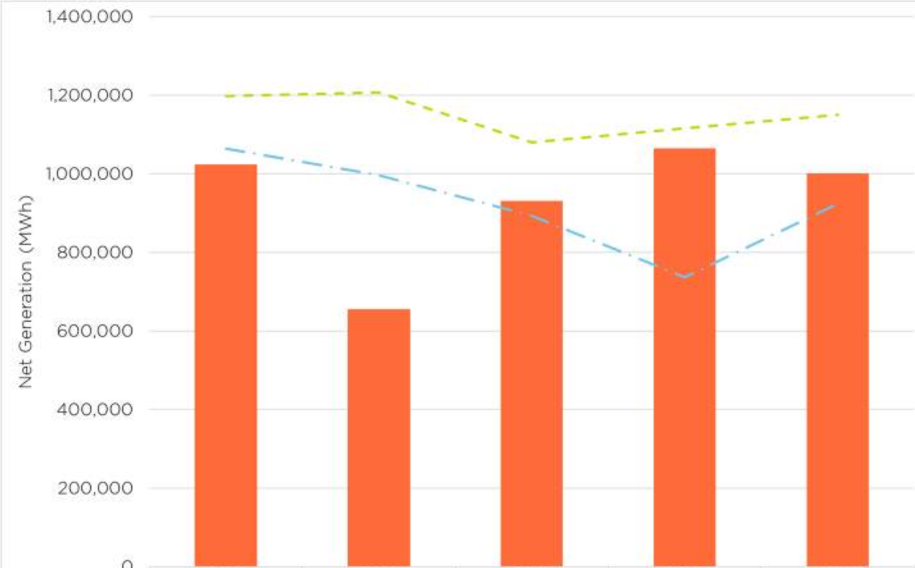
1898 & Co. evaluated Unit 4's overall generation performance against a fleet average of similar generating units. Figure 8-8 presents the net capacity factor for Unit 4 against the fleet benchmark data as obtained from NERC GADS. Similarly, Figure 8-9 presents the net generation for Unit 4 against the fleet benchmark data as obtained from NERC GADS.

Figure 8-8: Unit 4 Net Capacity Factor Benchmark



	2015	2016	2017	2018	2019
Newman 4	51.42	32.93	46.79	53.50	50.34
National	51.67	51.81	46.42	48.25	49.54
Regional	47.13	44.03	39.47	32.72	40.84

Figure 8-9: Unit 4 Net Generation Benchmark

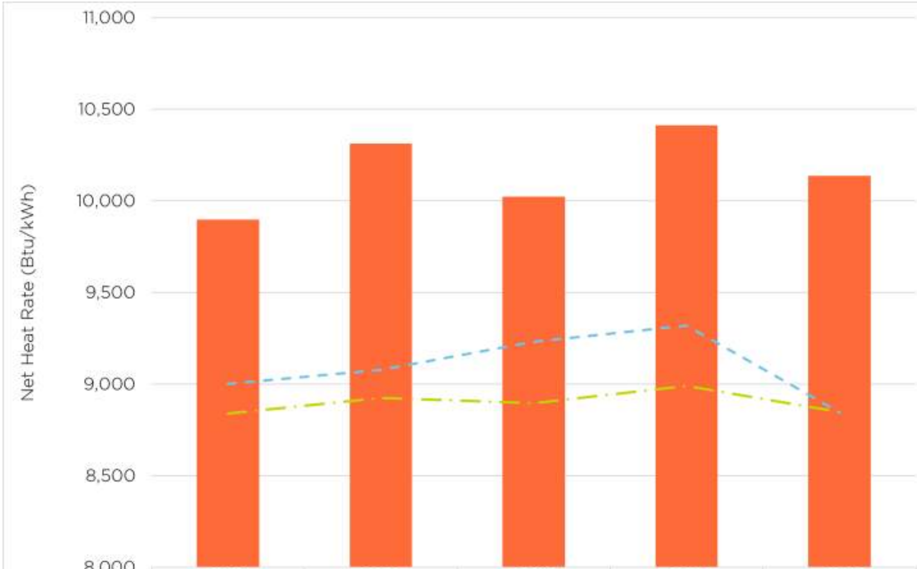


	2015	2016	2017	2018	2019
Newman 4	1,022,499	654,791	930,473	1,063,890	1,001,113
National	1,198,925	1,207,713	1,080,885	1,116,222	1,150,936
Regional	1,065,388	997,445	894,386	738,162	923,845

As depicted in Figure 8-8 and Figure 8-9, Unit 4 has operated consistently above the regional fleet benchmark over the past five years, but below the national fleet benchmark in the past five years. Over the past five years the Unit 4's net capacity factor has been approximately 3 percent less than (worse) the national fleet benchmark and approximately 6 percent greater than (better) the regional fleet benchmark. Due to the average net capacity factor performance, Unit 4 has operated in line with the industry generation standards over the past five years.

Since net heat rate information could not be obtained from NERC GADS, 1898 & Co. used information from EIA-860 to benchmark Unit 4's net heat rate. Figure 8-10 presents the net heat rate for Unit 4 against the fleet benchmark data.

Figure 8-10: Unit 4 Net Heat Rate Benchmark



	2015	2016	2017	2018	2019
Newman 4	9,897	10,311	10,021	10,409	10,135
National	8,841	8,925	8,897	8,991	8,849
Regional	9,004	9,080	9,234	9,320	8,845

As depicted in Figure 8-10, Unit 4 has operated consistently above (worse than) the fleet benchmark in the past five years. On average Unit 4 has reported a unit net heat rate of 10,155 Btu/kWh, while the national fleet benchmark has experienced an average unit net heat rate of 8,901 Btu/kWh and the regional fleet benchmark has experienced an average unit net heat rate of 9,097 Btu/kWh. The heat rate benchmark indicated Unit 4 is operating in a less efficient manner when compared to peer units most likely due to the vintage of the CTs.

8.2 Historical O&M Costs

8.2.1 Unit 3

1898 & Co. evaluated non-fuel O&M costs associated with similar natural gas-fire steam units which are required to report O&M costs as part of the FERC Form 1 submission. 1898 & Co. developed an industry trend by grouping units based on current service life. Figure 8-11 presents the relationship between average non-fuel O&M costs by COD, in green, and the previous five years of non-fuel O&M costs for Unit 3, in orange. Figure 8-11 also includes one standard deviation for each benchmarking group. Each plant included in the benchmark is represented as a single data point defined by the five-year average non-fuel O&M cost.

Figure 8-11: Unit 3 Non-Fuel O&M Cost Trend Evaluation

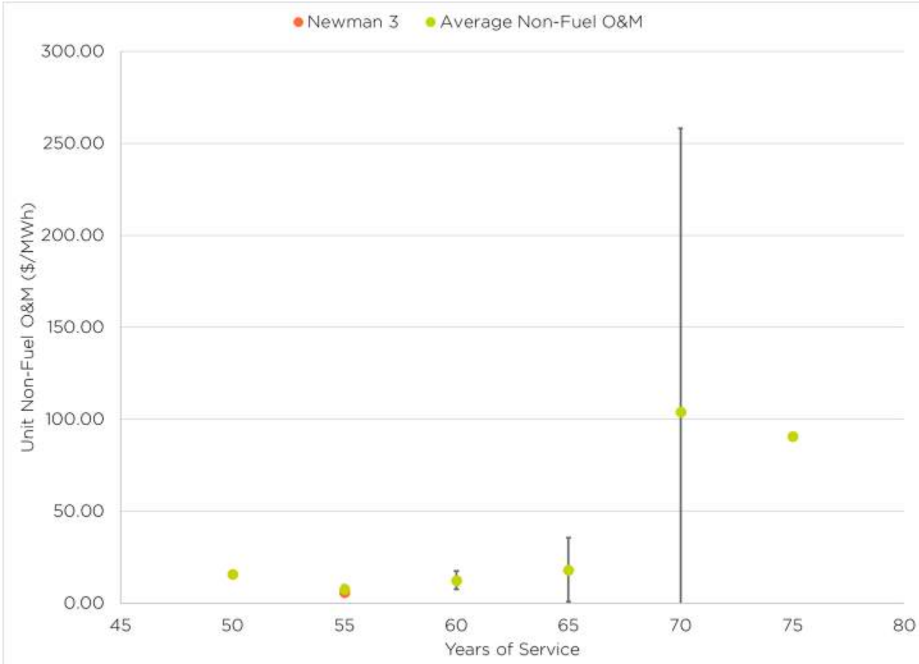


Table 8-1: Unit 3 Non-Fuel O&M Cost Sample Size

Age Range	50	55	60	65	70	75
Count	2	2	5	4	9	1

Figure 8-11 indicates that the O&M costs for Unit 3 are below the national average for its vintage class, but that the costs are still within the expected range. The data shows that when a plant reaches approximately 60 years of service, the owner/operator usually chooses whether to reinvest in the unit to maintain reliability for the remaining operating life or to run the unit as-is with greater reliability risks. This trend can be seen in the high standard deviation at and around this service age. From that point on, O&M costs tend to decrease as owner/operators make the decision to operate the unit to failure.

8.2.2 Unit 4

1898 & Co. evaluated the trend in non-fuel O&M costs associated with combined cycle units which are required to report O&M costs as part of the FERC Form 1 submission. 1898 & Co. developed an industry trend by grouping units based on current service life. Figure 8-12 presents the relationship between average non-fuel O&M costs by COD, in green, the previous five years of non-fuel O&M costs for Unit 4, in orange. Figure 8-12 also includes one standard deviation for each benchmarking group. Each plant included in the benchmark is represented as a single data point defined by the five-year average non-fuel O&M cost at the facility.

Figure 8-12: Unit 4 Non-Fuel O&M Cost Trend Evaluation

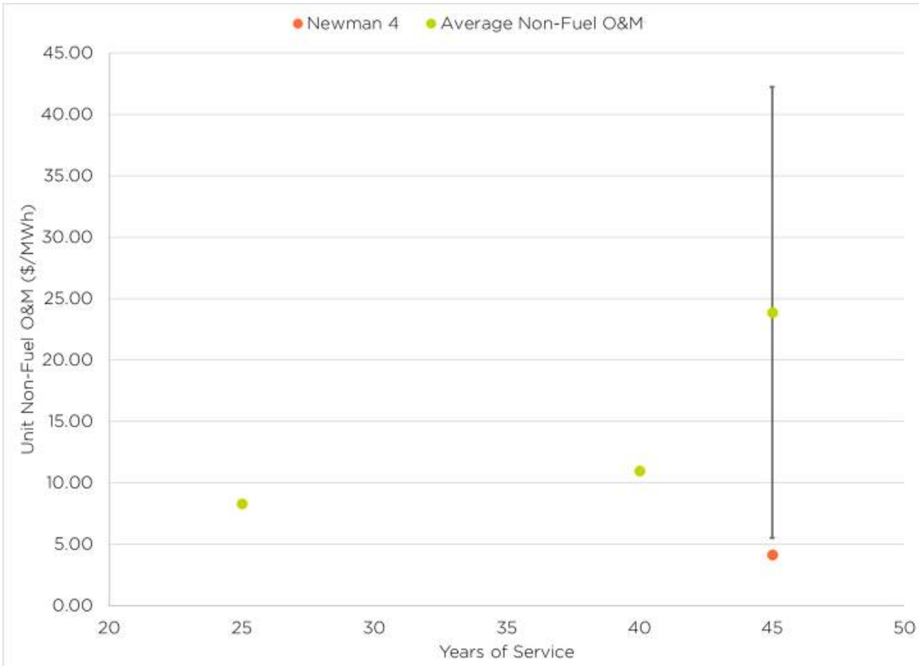


Table 8-2: Unit 4 Non-Fuel O&M Cost Sample Size

Age Range	25	30	40	45
Count	1	0	1	2

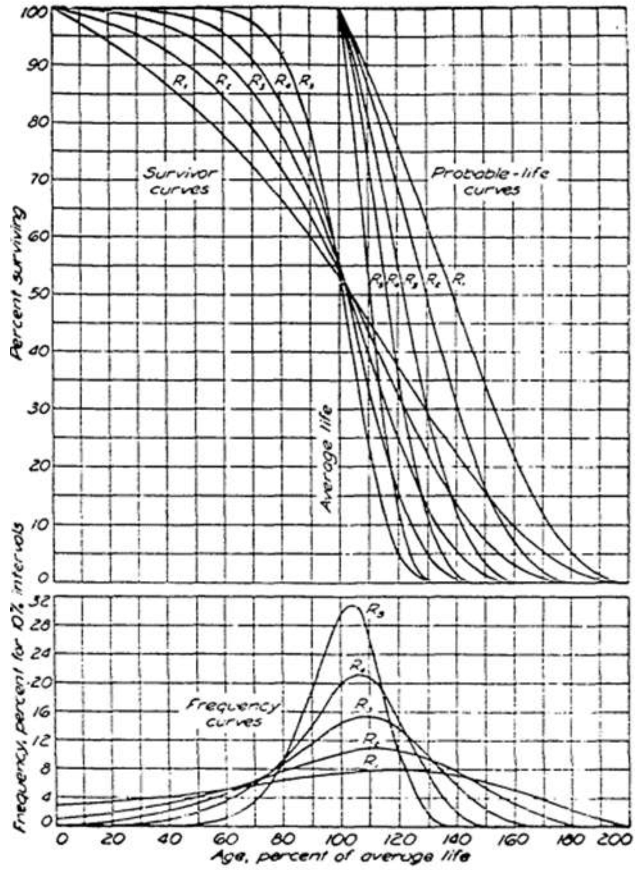
Based on Figure 8-12, the expenditures at Unit 4 has been below similarly sized combined cycle facilities nationwide. Unit 4 has experienced lower non-fuel O&M costs compared peer facilities. The reason for the lower costs is not clear to 1898 & Co., but without a larger sample size 1898 & Co. compared the Facility to the entire non-fuel O&M trend to determine conclusions. The small sample size is due to the limited 2x1 combined cycles with similar output capacities. Additionally, Figure 8-12 indicates the facility's within the sample group experience slightly increasing O&M cost between the 25, 40 and 45-year vintage groups. According to the data collected by 1898 & Co., the non-fuel O&M costs associated with operating a combined cycle facility increases after approximately 25 years of service. As units' approach 30 years of service operators have two decisions; invest in the unit to continue available and reliable operations or operate the unit without investment until failure. The decision can lead to a wide spread of non-fuel O&M costs at the facilities. If an operator wants to continue unit operation after 30 years of service, capital and maintenance expenditures should be anticipated an operator.

8.3 Useful Life Evaluation

1898 & Co. approximated the probability of Unit 3 and 4's survival with the use of Iowa-Type Survivor Curves that are a set of standardized curves used to approximate useful life of varying technologies. Survivor curves are commonly utilized in asset management solutions to estimate the percentage of a population in an asset class that survives over time. Iowa Survivor Curves, specifically, are widely used in the utility industry in depreciation studies for establishing the useful life of generating assets and performing statistical analyses of transmission and distribution equipment.

The curves are fitted to the specific asset types based on the frequency distribution of a dataset. The frequency distribution determines whether a Right-modal type ("R-type"), Left-modal type ("L-type") or Symmetrical-modal type ("S-type") curve is used. Figure 8-13 displays the varying R-type survivor curves and how the survivor curves relate to frequency distributions.

Figure 8-13: R-type Survivor Curve Example [1]



Based on the dataset 1898 & Co. obtained for total service life, units were fitted with R-type survivor curves. Once a frequency distribution is determined, Iowa-Type Survivor Curves require two steps to fit a curve to the dataset. The first step requires assumption of the average service life for similar technologies. For the second step, 1898 & Co. fit the dataset as closely as possible with one of the standard Iowa-Type Curves. 1898 & Co. possesses R0.5, R1, R1.5, R2, R2.5, R3, R4, and R5 Iowa-Type Survivor Curves. R0.5 curves have the least difference between peak and minimum frequency, while R5 curves have the greatest disparity between peak and minimum frequency. Based on the data 1898 & Co. obtained, R5 Iowa-Type Survivor Curves fit the datasets most effectively for similar technologies.

[1] See "Revalidation of Iowa Type Survivor Curves" by John George Russo

8.3.1 Unit 3

Figure 8-14 displays the survivor data for natural gas-fired steam units, in grey, and three Iowa-Type Survivor Curves that fit the modified data. The three survivor curves are used to help 1898 & Co. to determine a range of expected useful lives for combined cycle units based on a national database.

Figure 8-14: Natural Gas Unit Survival Curves

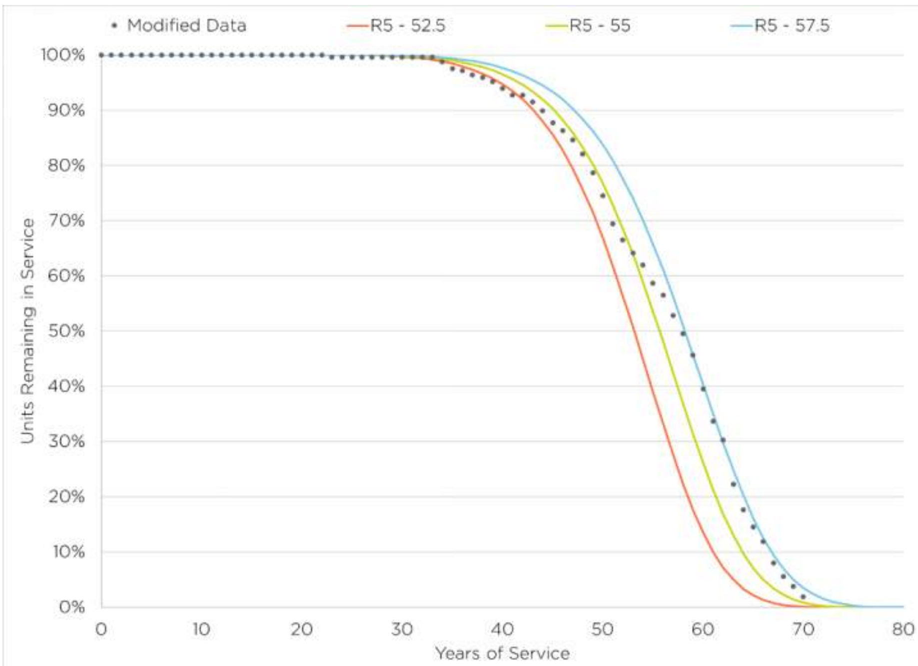


Figure 8-14 indicates natural gas-fired STG units begin retiring around 35 years of service. By year 56, approximately 52 percent of natural gas-fired STG units will have been retired according to the R5 curve. Burns & McDonnell cannot determine from the data obtained the exact reasoning of the retirements but acknowledges many of the retirements may be a byproduct of newer technologies displacing older and less efficient natural gas-fired steam units.

In Scenario 3 it is assumed that Unit 3 will retire in 2041 and will have reached 75 years of operation. As indicated in Figure 8-14 there are no peer units within the benchmarking group to have reached 75 years of service. Although no units have reached 75 years of service in the benchmarking group this does not indicate 75 years of service is not possible. There are 47 units within the benchmarking group that are currently operating and have reached 60 years of service. Thus, if those units are maintained in accordance with best industry standards and practices there is no physical reason the units could not reach 75 years of service.

8.3.2 Unit 4

Figure 8-15 displays the survivor data for combined cycle units, in grey, and three Iowa-Type Survivor Curves that fit the modified data. The three survivor curves are used to help 1898 & Co. to determine a range of expected useful lives for combined cycle units based on a national database.

Figure 8-15: Combined Cycle Survival Curves

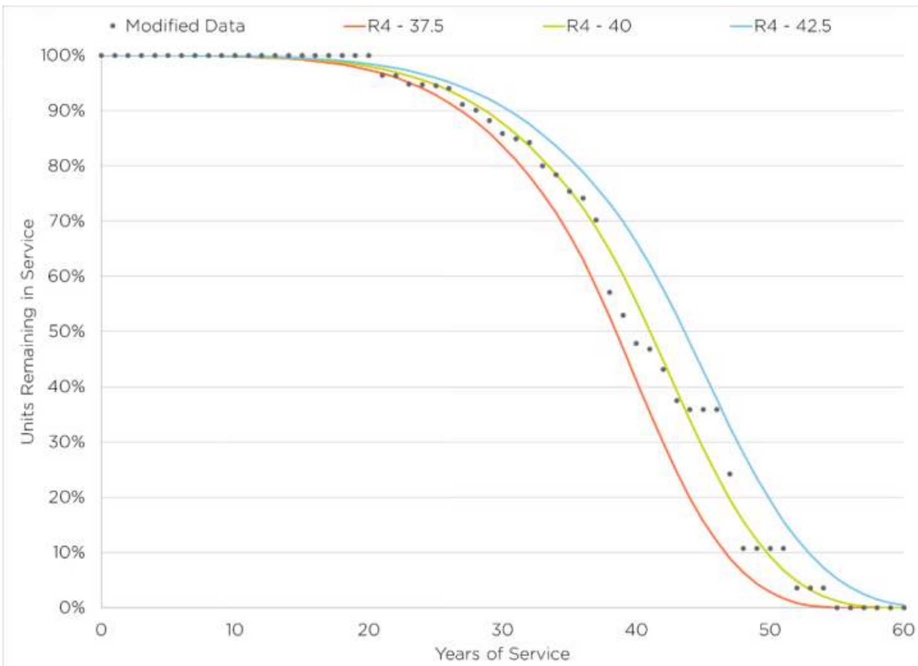


Figure 8-15 indicates that combined cycle facilities begin retiring around 21 years of service. By 41 years of service, approximately 50 percent of combined cycle facilities will have been retired. 1898 & Co. cannot determine from the data obtained the exact reasoning for the retirements but acknowledges many of the retirements may have been a byproduct of changing economic and environmental factors that impact the viability of the combined cycle unit. The data set gathered by 1898 & Co. may be skewed since only 28 units have been retired out of the 175-unit sample size. Most units have operated between 20 and 40 years and have not reached a service life when retirement is anticipated. Thus 1898 & Co. would not suggest using the survivor curve alone when anticipating the useful life for Unit 4. Instead, 1898 & Co. suggests Unit 4 use information provided by CT, HRSG and ST manufacturers when determining the anticipated useful life.

9.0 COST PROJECTIONS

Unit 3 is currently scheduled to operate through 2026, which would reflect 60 years of service. Typical natural gas-fire steam unit design assumes a 50-year service life, yet the service life of the unit may last longer than its design life if equipment is refurbished or replaced. Unit 4 is currently scheduled to operate through 2026, which would reflect 51 years of service. Typical combined cycle design assumes a 30-year service life, yet the service life of a unit can be continued if equipment is refurbished or replaced. As such, it is expected that additional expenditures will be required for reliable operation through the study periods. 1898 & Co. developed forecasts of specific capital and major maintenance project cost expenditures and baseline O&M expenditures that would likely be required. The forecast was developed based on findings from Facility documentation and interviews with Facility personnel. The historical capital expenditures should help maintain the availability and reliability of the Units, while also reducing the annual maintenance expenditures on those components. Combining the historical capital expenditures with the 1898 & Co. projected costs should provide a holistic view of the maintenance and capital costs requirements for the Unit 3 and 4.

1898 & Co. used historical cost information to determine the fixed O&M cost for the Facility. In addition to normal maintenance items at the Facility, 1898 & Co. included reoccurring inspections and maintenance events the Facility is not currently conducting. Items that will need to be inspected include the turbine valves, main turbine, the BFP, BFP hydraulic coupling, boiler, and the transformers. The cost projections, seen in Appendix A and Appendix B of this report, provides a detailed schedule of the forecasted estimated cost expenditures and maintenance costs required for reliable operation. The costs at the Units could be heavily influenced by cycling if renewable penetration influences the Units' dispatch more often in the future. Cycling can accelerate damage mechanisms throughout the Plant and increase the frequency of many of the maintenance cycles at the Plant.

9.1 Scenario 1

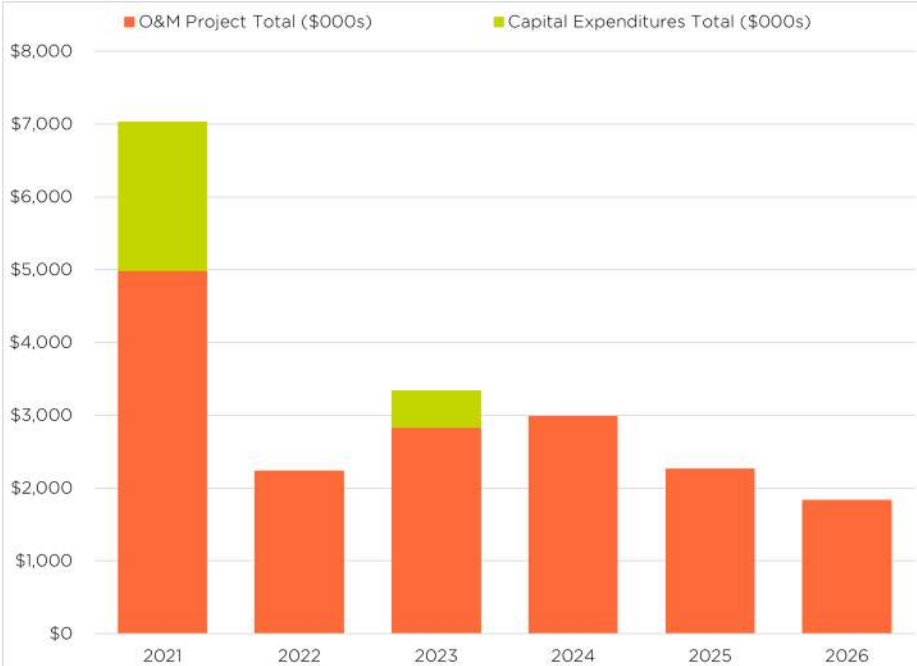
9.1.1 Unit 3

Figure 9-1 presents a summary of the cost projection estimates derived by 1898 & Co. for Unit 3 excluding major variable costs such as fuel, water, chemicals, etc. and fixed costs such as taxes, insurance, overheads, etc. Assuming Unit 3 is in service through 2026 infrastructure replacements and equipment upgrades will be required. If Unit 3 continues to operate at a gross capacity of 105 MW, a cost of approximately $19.7 million will be required to cover unit expenditures over the next six-years, or $31.23/kW-yr.

Figure 9-1: Unit 3 Project Cost Forecast

Overall, these costs are based on current market prices and do not include major changes in market dynamics that may influence future project costs. 1898 & Co. has also assumed that costs would taper as Unit 3 nears retirement as major maintenance activities would be deferred and equipment would be run to failure. This assumption has resulted in an overall reduction in O&M costs and capital expenditures during these years. Figure 9-2 presents the total annual projected costs associated with non-fuel O&M expenditures and capital expenditures.

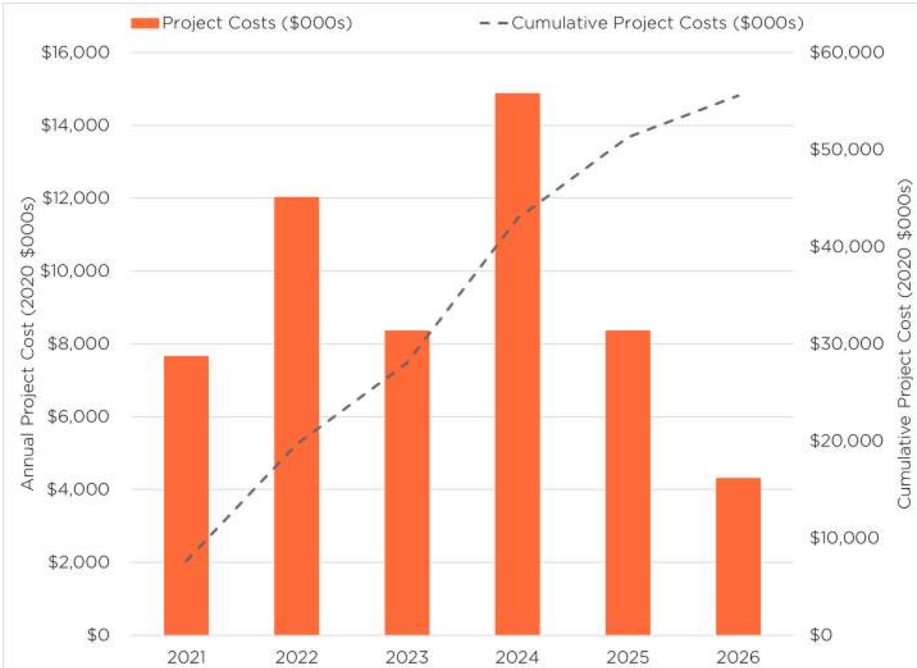
Figure 9-2: Unit 3 Total Annual O&M Cost Summary



9.1.2 Unit 4

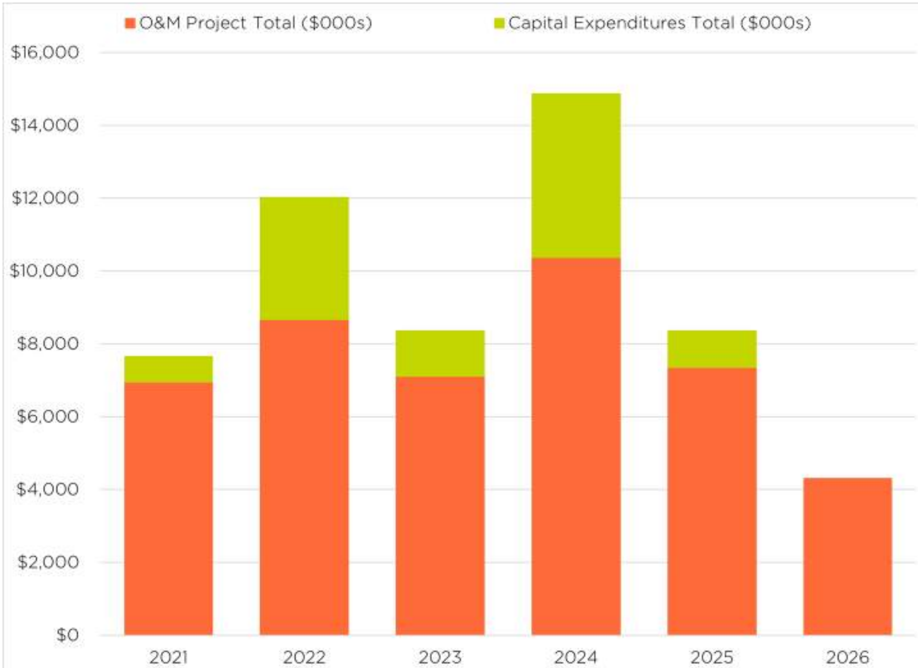
Figure 9-3 presents a summary of the cost projection estimates derived by 1898 & Co. for Unit 4 excluding major variable costs such as fuel, water, chemicals, etc. and fixed costs such as taxes, insurance, overheads, etc. Assuming Unit 4 is in service through 20426 infrastructure replacements and equipment upgrades will be required. If Unit 4 operates at a gross capacity of 223.5 MW, a cost of approximately $55.6 million will be required to cover unit expenditures over a six-year term, or $41.44/kW-yr.

Figure 9-3: Unit 4 Project Cost Forecast



Overall, these costs are based on current market prices and do not include major changes in market dynamics that may influence future project costs. 1898 & Co. has also assumed that costs would taper as Unit 4 nears retirement as major maintenance activities would be deferred and equipment would be run to failure. This assumption has resulted in an overall reduction in O&M costs and capital expenditures during these years. Figure 9-4 presents the total annual projected costs associated with non-fuel O&M expenditures and capital expenditures.

Figure 9-4: Unit 4 Total Annual O&M Cost Summary

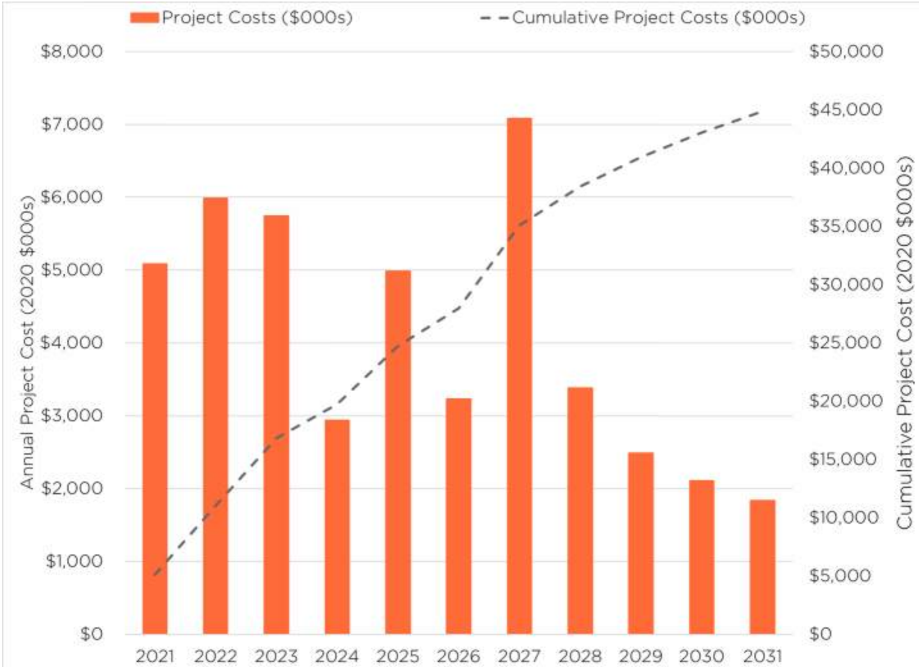


9.2 Scenario 2

9.2.1 Unit 3

Figure 9-5 presents a summary of the cost projection estimates derived by 1898 & Co. for Unit 3 excluding major variable costs such as fuel, water, chemicals, etc. and fixed costs such as taxes, insurance, overheads, etc. Assuming Unit 3 is in service through 2031, infrastructure replacements and equipment upgrades will be required. If Unit 3 continues to operate at a gross capacity of 105 MW, a cost of approximately $44.9 million will be required to cover unit expenditures over the next 11-years, or $38.85/kW-yr.

Figure 9-5: Unit 3 Project Cost Forecast



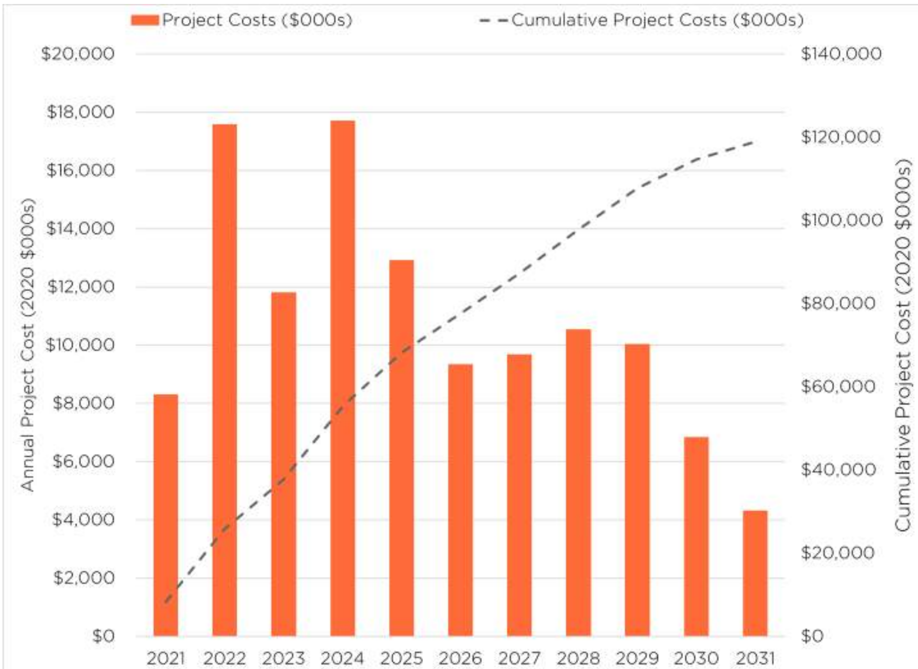
Overall, these costs are based on current market prices and do not include major changes in market dynamics that may influence future project costs. 1898 & Co. has also assumed that costs would taper as Unit 3 nears retirement as major maintenance activities would be deferred and equipment would be run to failure. This assumption has resulted in an overall reduction in O&M costs and capital expenditures during these years. Figure 9-6 presents the total annual projected costs associated with non-fuel O&M expenditures and capital expenditures. O&M expenses are shown in orange, and the capital expenditures are shown in green. The expenditures have been broken out to indicate how cost will be affected by continuing to operate Unit 3 past 2026.

Figure 9-6: Unit 3 Total Annual O&M Cost Summary

9.2.2 Unit 4

Figure 9-7 presents a summary of the cost projection estimates derived by 1898 & Co. for Unit 4 excluding major variable costs such as fuel, water, chemicals, etc. and fixed costs such as taxes, insurance, overheads, etc. Assuming Unit 4 is in service through 2031, infrastructure replacements and equipment upgrades will be required. If Unit 4 operates at a gross capacity of 223.5 MW, a cost of approximately $118.9 million will be required to cover project maintenance expenditures over a 11-year term, or $48.37/kW-yr.

Figure 9-7: Unit 4 Project Cost Forecast



Overall, these costs are based on current market prices and do not include major changes in market dynamics that may influence future project costs. 1898 & Co. has also assumed that costs would taper as Unit 4 nears retirement as major maintenance activities would be deferred and equipment would be run to failure. This assumption has resulted in an overall reduction in O&M costs and capital expenditures during these years. Figure 9-8 presents the total annual projected costs associated with non-fuel O&M expenditures and capital expenditures. O&M expenses are shown in orange, and the capital expenditures are shown in green. The expenditures have been broken out to indicate how cost will be affected by continuing to operate Unit 3 past 2026.

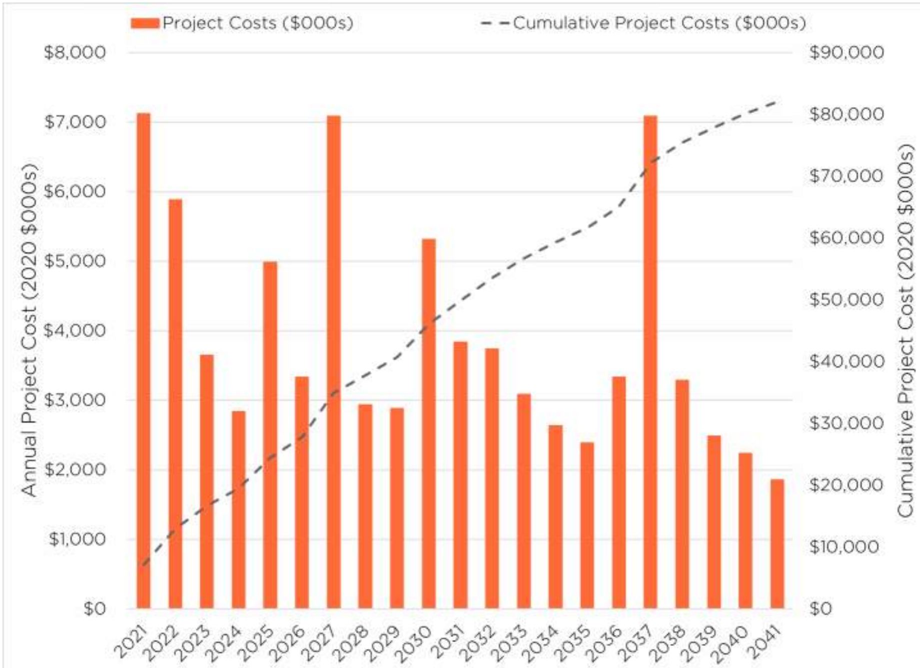
Figure 9-8: Unit 4 Total Annual O&M Cost Summary

9.3 Scenario 3

9.3.1 Unit 3

Figure 9-9 presents a summary of the cost projection estimates derived by 1898 & Co. for Unit 3 excluding major variable costs such as fuel, water, chemicals, etc. and fixed costs such as taxes, insurance, overheads, etc. Assuming Unit 3 is in service through 2041, infrastructure replacements and equipment upgrades will be required. If Unit 3 continues to operate at a gross capacity of 105 MW, a cost of approximately $82.0 million will be required to cover unit expenditures over the next 16-years, or $37.19/kW-yr.

Figure 9-9: Unit 3 Project Cost Forecast



Overall, these costs are based on current market prices and do not include major changes in market dynamics that may influence future project costs. 1898 & Co. has also assumed that costs would taper as Unit 3 nears retirement as major maintenance activities would be deferred and equipment would be run to failure. This assumption has resulted in an overall reduction in O&M costs and capital expenditures during these years. Figure 9-10 presents the total annual projected costs associated with non-fuel O&M expenditures and capital expenditures. O&M expenses are shown in orange, and the capital expenditures are shown in green. The expenditures have been broken out to indicate how cost will be affected by continuing to operate Unit 3 past 2026.

Figure 9-10: Unit 3 Total Annual O&M Cost Summary

10.0 CONCLUSIONS

10.1 Conclusions

10.1.1 Unit 3

The following conclusions and recommendations for Unit 3 are based on the observations and analysis from this Study.

1. Unit 3 was placed into commercial service in 1966, meaning Unit 3 has provided 54 years of service. The typical power plant has a design life of approximately 30 to 40 years; therefore Unit 3 has served beyond the typical design life of a power generation facility. Many power plant operators have been able to operate the units past the typical design life by replacing or refurbishing many critical components.
2. Overall, the Plant's AF is below (worse than) the fleet average and FOR is lower (better than) than the fleet average as compared to data obtained through the NERC GADS data base for similarly sized units. The net capacity factors and net generation statistics for Unit 3 has been higher than the fleet benchmarks.
3. Several of the major components and equipment for Unit 3 will need to be repaired or replaced to provide reliable operation in any of the scenarios expected at the Plant. Currently most of this work is scheduled to take place in 2021. If Unit 3 operates until at least 2031 a rewind of the generator is recommended in 2022. Additionally, the circulating water piping will need to be replaced to maintain reliable operation of Unit 3.
4. EPE should perform boiler and high energy piping ("HEP") condition assessments on a regular basis. Condition assessments of the reheat outlet header and hot reheat piping on Unit 3 are especially critical as the reheat outlet header has experienced considerable wear. The continued practice of a regular non-destructive evaluation ("NDE") program would be prudent to provide early warning of major component deterioration.
5. 1898 & Co. recommends a cumulative O&M spend for:
   a. Scenario 1 (retirement in 2026): $17.1 million or $27.20/kW-yr and cumulative capital expenditures of $2.54 million and $4.03/kW-yr.
   b. Scenario 2 (2031 retirement): $35.4 million or $30.66/kW-yr and cumulative capital expenditures of $9.46 million and $8.19/kW-yr.
   c. Scenario 3 (2041 retirement): $69.1 million or $31.32/kW-yr and cumulative capital expenditures of $12.9 million and $5.86/kW-yr.

10.1.2 Unit 4

The following conclusions and recommendations for Unit 4 are based on the observations and analysis from this Study.

1. Unit 4 was placed into commercial service in 1975, meaning Unit 4 has provided 45 years of service. The typical combined cycle power plant design assumes a component life of approximately 25 to 30 years meaning Unit 4 has exceed the end of its design life. Many power plant operator/owners continue to operate these facilities well past the original design life by replacing or refurbishing critical components.
2. Overall, the Plant's reliability is below (worse than) the fleet average as measured by the AF and higher (worse than) than the fleet average as measured by FOR against data obtained through the NERC GADS data base for similarly sized units. Additionally, Unit 4 has operated above the national and regional net capacity factor fleet benchmarks.
3. Several of the major components and equipment for Unit 4 will need to be repaired or replaced to provide reliable operation in any of the scenarios expected at the Plant. Currently most of this work is scheduled to take place in 2024, when the ST is scheduled for a major overhaul. Each CT is scheduled for at least one more MI if Unit 4 operates until 2026 but could experience two MIs if Unit 4 operates until 2031.
4. EPE should perform boiler and HEP condition assessments on a regular basis. The continued practice of a regular NDE program would be prudent to provide early warning of major component deterioration.
5. 1898 & Co. recommends a cumulative O&M spend for:
    a. Scenario 1 (retirement in 2026): $44.8 million or $33.38/kW-yr and cumulative capital expenditures of $10.8 million and $8.05/kW-yr.
    b. Scenario 2 (2031 retirement): $89.0 million or $36.22/kW-yr and cumulative capital expenditures of $29.9 million and $12.15/kW-yr.

APPENDIX A – NEWMAN UNIT 3 PROJECTED COST

Appendix A - Newman Unit 3 Projected Costs (Rev. 2)

Newman Unit 3 Condition Assessment
EPE
1898 & Co. Project No. 101995
Scenario 1

Cost Forecast
All costs are presented in 2020$, no inflation is included

EXPENDITURES (Presented in $000)

DESCRIPTION	LAST	FREQUENCY	SPEND	NEXT	TYPE	JUSTIFICATION	TOTAL	2021	2022	2023	2024	2025	2026
CAPITAL PROJECTS													
BOILER													
STEAM TURBINE / GENERATOR													
HIGH ENERGY PIPING													
BALANCE OF PLANT													
Circulating Water Piping replacement	Original	Once	CAPX	2021	RELIABILITY		**$2,000**	$2,000					
Crane Upgrades	Unknown	Once	CAPX	2023	RELIABILITY		**$500**			$500			
Elevator Repair/Upgrade	Unknown	Once	CAPX	2021	RELIABILITY	Repair house elevator shared with Units 1 and 2	**$40**	$40					
ELECTRICAL & CONTROLS													
CAPITAL EXPENDITURES TOTAL							**$2,540**	**$2,040**	**$0**	**$500**	**$0**	**$0**	**$0**
MAINTENANCE PROJECTS													
BOILER													
Boiler Inspection	2020	Annual	O&M	2021	RELIABILITY	Inspect and repair/replace boiler tubes and components identified during inspection.	**$525**	$100	$100	$100	$100	$100	$25
FD Fan Inspection	2020	Annual	O&M	2021	RELIABILITY	Inspect and repair/replace components identified during inspection.	**$100**	$20	$20	$20	$20	$20	
Boiler Contingency		Annual	O&M	2021	RELIABILITY		**$141**	$28	$28	$28	$28	$28	
STEAM TURBINE / GENERATOR													
Generator Major Inspection	2017	5 - 7 years	O&M	2024	RELIABILITY	Perform generator inspection testing. Replace/repair components identified during inspection.	**$400**				$400		
Valve Inspection	2016	30000 hrs	O&M	2021	RELIABILITY	Perform valve inspection for integrity and operability. Replace/repair components identified during inspection	**$1,500**	$1,500					
Steam Turbine / Generator Contingency		Annual	O&M	2021	RELIABILITY		**$384**	$77	$77	$77	$77	$77	
HIGH ENERGY PIPING													
Metallurgic replication	2018	5 years	O&M	2023	SAFETY		**$50**			$50			
Pipe Support System Inspection	2020	Annual	O&M	2021	RELIABILITY		**$100**	$20	$20	$20	$20	$20	
Creep Inspection	Unknown	5 years	O&M	2021	SAFETY		**$1,000**	$1,000					
BALANCE OF PLANT													
Deaerator Inspection	2018	2 years	O&M	2021	SAFETY	Perform deaerator inspection. Repair/replace components identified during inspection	**$450**	$150		$150		$150	
Condenser Inspection	Unknown	Once	O&M	2021	RELIABILITY	Inspect expansion joint	**$100**	$100					
Circ Water Pump rebuild	2018	5 years	O&M	2023	RELIABILITY	Rebuild of wear components	**$50**			$50			
Cooling Tower Inspection	2020	Annual	O&M	2021	RELIABILITY	Perform inspection. Replace/repair components identified during inspection	**$500**	$125	$125	$125	$125		
Condensate Pump Rebuild	2018	5 years	O&M	2023	RELIABILITY	Rebuild of wear components	**$50**			$50			
Boiler Feed Pump Inspection/Rebuild	2018	5 years	O&M	2023	RELIABILITY	Perform inspection. Replace/repair components identified during inspection (only about 10 years life left)	**$300**			$300			
LP FWH Inspection	Unknown	7 years	O&M	2024	RELIABILITY	Perform inspection. Replace/repair components identified during inspection	**$150**				$150		
HP FWH Inspection	Unknown	7 years	O&M	2024	RELIABILITY	Perform inspection. Replace/repair components identified during inspection	**$200**				$200		
BOP Contingency		Annual	O&M	2021	RELIABILITY		**$287**	$57	$57	$57	$57	$57	
ELECTRICAL & CONTROLS													
Electrical Maintenance	2020	Annual	O&M	2021	RELIABILITY	This is based on an average of O&M spending on electrical maintenance from 2014-2019	**$726**	$121	$121	$121	$121	$121	$121
Controls Maintenance	2020	Annual	O&M	2021	RELIABILITY	This is based on an average of O&M spending on instrumentation and controls maintenance from 2014-2019	**$570**	$95	$95	$95	$95	$95	$95
Emerson SureService (Approved in Newman Plan)	NEW	Annual	O&M	2021	RELIABILITY	Ongoing maintenance contract with DCS vendor.	**$210**	$35	$35	$35	$35	$35	$35
MAINTENANCE PROJECTS TOTAL							**$7,793**	**$3,428**	**$678**	**$1,278**	**$1,428**	**$703**	**$276**
O&M TOTAL													
Total Fixed O&M Costs							**$9,344**	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557

DESCRIPTION	LAST	FREQUENCY	SPEND	NEXT	TYPE	JUSTIFICATION	TOTAL	2021	2022	2023	2024	2025	2026
Total Variable O&M Costs							**$7,793**	$3,428	$678	$1,278	$1,428	$703	$276
Total O&M							**$17,137**	**$4,986**	**$2,236**	**$2,836**	**$2,986**	**$2,261**	**$1,833**
GRAND TOTAL													
Total Capital Expenditures							**$2,540**	$2,040	$0	$500	$0	$0	$0
Total O&M Expenditures							**$17,137**	$4,986	$2,236	$2,836	$2,986	$2,261	$1,833
TOTAL COST							**$19,677**	**$7,026**	**$2,236**	**$3,336**	**$2,986**	**$2,261**	**$1,833**

Appendix A - Newman Unit 3 Projected Costs (Rev. 2)

Newman Unit 3 Condition Assessment
EPE
1898 & Co. Project No. 101995
Scenario 2

Cost Forecast
All costs are presented in 2020$, no inflation is included

EXPENDITURES (Presented in $000)

DESCRIPTION	LAST	FREQUENCY	SPEND	NEXT	TYPE	Life Extension? (Y/N)	JUSTIFICATION	TOTAL	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
CAPITAL PROJECTS																			
BOILER																			
Boiler Chemical Clean	Unknown	20 years	CAPX	2025	PERFORMANCE	Y	Within the next 10 years	$800					$800						
STEAM TURBINE / GENERATOR																			
Generator Stator Rewind	1993	30+ years	CAPX	2022	RELIABILITY	Y	Significant greasing and evidence of stator bar movement.	$2,000		$2,000									
Generator Field Rewind	1993	30+ years	CAPX	2022	RELIABILITY	Y	Wedges are starting to migrate and uneven field impedance graph.	$700		$700									
HIGH ENERGY PIPING																			
BALANCE OF PLANT																			
Circulating Water Piping replacement	Original	Once	CAPX	2021	RELIABILITY	Y		$2,000			$2,000								
Crane Upgrades	Unknown	Once	CAPX	2023	RELIABILITY	Y		$500			$500								
Elevator Repair/Upgrade	Unknown	Once	CAPX	2021	RELIABILITY	Y	Repair house elevator shared with Units 1 and 2	$100		$100									
LP FWH replacement	Unknown	Once	CAPX	2025	RELIABILITY	Y		$700					$700						
HP FWH replacement	Unknown	Once	CAPX	2025	RELIABILITY	Y		$700					$700						
ELECTRICAL & CONTROLS																			
DCS Evergreen Upgrade	2018	4 - 5 years	CAPX	2022	RELIABILITY	Y	Upgrade software and hardware as required.	$250		$150		$100							
CEMS Analyzer Upgrade	Unknown	10 - 15 years	CAPX	2023	ENVIRONMENTAL	Y	Analyzer and sensor at end of design life, analyzer drift and inaccurate reading.	$60			$60								
2400V Switchgear	Original	30 years	CAPX	2022	RELIABILITY	Y	Plant reports no parts availability, O&M costs increasing as parts fail	$800		$800									
480V Station Service Unit Substation 3 with F	Original	30 years	CAPX	2023	RELIABILITY	Y	Plant reports no parts availability, O&M costs increasing as parts fail	$250			$250								
480V MCC 3A	Original	30 years	CAPX	2021	RELIABILITY	Y	Plant reports no parts availability, O&M costs increasing as parts fail	$100	$100										
480V MCC 3B	Original	30 years	CAPX	2024	RELIABILITY	Y	Plant reports no parts availability, O&M costs increasing as parts fail	$100				$100							
480V Cooling Tower MCC with Feeder Transf	Original	30 years	CAPX	2025	RELIABILITY	Y	Plant reports no parts availability, O&M costs increasing as parts fail	$400					$400						
CAPITAL EXPENDITURES TOTAL (Base)								**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
CAPITAL EXPENDITURES TOTAL (Incremental)								**$9,460**	**$100**	**$3,750**	**$2,810**	**$200**	**$2,600**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
MAINTENANCE PROJECTS																			
BOILER																			
Boiler Inspection	2020	Annual	O&M	2021	RELIABILITY	N	Inspect and repair/replace boiler tubes and components identified during inspection.	$500	$100	$100	$100	$100	$100						
Boiler Inspection	2020	Annual	O&M	2021	RELIABILITY	Y	Inspect and repair/replace boiler tubes and components identified during inspection.	$525						$100	$100	$100	$100	$100	$25
FD Fan Inspection	2020	Annual	O&M	2021	RELIABILITY	N	Inspect and repair/replace components identified during inspection.	$100	$20	$20	$20	$20	$20						
FD Fan Inspection	2020	Annual	O&M	2021	RELIABILITY	Y	Inspect and repair/replace components identified during inspection.	$100						$20	$20	$20	$20	$20	
Boiler Contingency		Annual	O&M	2021	RELIABILITY	N		$141	$28	$28	$28	$28	$28						
Boiler Contingency		Annual	O&M	2021	RELIABILITY	Y		$141						$28	$28	$28	$28	$28	
STEAM TURBINE / GENERATOR																			
Generator Major Inspection	2017	5 - 7 years	O&M	2024	RELIABILITY	Y	Perform generator inspection testing. Replace/repair components identified during inspection.	$150				$150							
Turbine Valve Inspection	2016	30000 hrs	O&M	2021	RELIABILITY	Y	Perform valve inspection for integrity and operability. Replace/repair components identified during inspection	$3,000	$1,500						$1,500				
Turbine Major Inspection	2017	60000 hrs	O&M	2027	RELIABILITY	Y	Perform turbine inspection. Replace/repair components identified during inspection.	$3,200							$3,200				
Steam Turbine / Generator Contingency		Annual	O&M	2021	RELIABILITY	N		$384	$77	$77	$77	$77	$77						
Steam Turbine / Generator Contingency		Annual	O&M	2021	RELIABILITY	Y		$384						$77	$77	$77	$77	$77	
HIGH ENERGY PIPING																			
Metallurgic replication	2018	5 years	O&M	2023	SAFETY	N		$50			$50								
Metallurgic replication	2018	5 years	O&M	2023	SAFETY	Y		$50								$50			
Pipe Support System Inspection	2020	Annual	O&M	2021	RELIABILITY	N		$100	$20	$20	$20	$20	$20						
Pipe Support System Inspection	2020	Annual	O&M	2021	RELIABILITY	Y		$100						$20	$20	$20	$20	$20	
Creep Inspection	Unknown	5 years	O&M	2021	SAFETY	N		$1,000	$1,000										
Creep Inspection	Unknown	5 years	O&M	2021	SAFETY	Y		$1,000						$1,000					
BALANCE OF PLANT																			
Deaerator Inspection	2018	2 years	O&M	2021	SAFETY	N	Perform deaerator inspection. Repair/replace components identified during inspection	$300	$150		$150								
Deaerator Inspection	2018	2 years	O&M	2021	SAFETY	Y	Perform deaerator inspection. Repair/replace components identified during inspection	$450					$150		$150		$150		
Condenser Inspection	Unknown	once	O&M	2021	RELIABILITY	N	Inspect expansion joint	$100	$100										
Circ Water Pump rebuild	2018	5 years	O&M	2023	RELIABILITY	N	Rebuild of wear components	$100			$100								
Circ Water Pump rebuild	2018	5 years	O&M	2023	RELIABILITY	Y	Rebuild of wear components	$100								$100			
Cooling Tower Inspection	2020	Annual	O&M	2021	RELIABILITY	N	Perform inspection. Replace/repair components identified during inspection	$625	$125	$125	$125	$125	$125						

Appendix A - Newman Unit 3 Projected Costs (Rev. 2)

DESCRIPTION	LAST	FREQUENCY	SPEND	NEXT	TYPE	Life Extension? (Y/N)	JUSTIFICATION	TOTAL	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Cooling Tower Inspection	2020	Annual	O&M	2021	RELIABILITY	Y	Perform inspection. Replace/repair components identified during inspection	$500						$125	$125	$125	$125		
Condensate Pump Rebuild	2018	5 years	O&M	2023	RELIABILITY	N	Rebuild of wear components (both pumps)	$100			$100								
Condensate Pump Rebuild	2018	5 years	O&M	2023	RELIABILITY	Y	Rebuild of wear components (both pumps)	$100								$100			
Boiler Feed Pump Inspection/Rebuild	2018	5 years	O&M	2023	RELIABILITY	N	Perform inspection. Replace/repair components identified during inspection (only about 10 years life left)	$300			$300								
Boiler Feed Pump Inspection/Rebuild	2018	5 years	O&M	2023	RELIABILITY	Y	Perform inspection. Replace/repair components identified during inspection (only about 10 years life left)	$300								$300			
LP FWH Inspection	Unknown	7 years	O&M	2024	RELIABILITY	N	Perform inspection. Replace/repair components identified during inspection	$150				$150							
LP FWH Inspection	Unknown	7 years	O&M	2024	RELIABILITY	Y	Perform inspection. Replace/repair components identified during inspection	$150								$150			
HP FWH Inspection	Unknown	7 years	O&M	2024	RELIABILITY	N	Perform inspection. Replace/repair components identified during inspection	$200				$200							
HP FWH Inspection	Unknown	7 years	O&M	2024	RELIABILITY	Y	Perform inspection. Replace/repair components identified during inspection	$200								$200			
Stack Inspection	2019	10 years	O&M	2029	SAFETY	Y	Perform inspection. Replace/repair components identified during inspection	$100									$100		
Air Heater Inspection/Repair	2018	10 years	O&M	2028	RELIABILITY	Y	Perform inspection. Replace/repair components identified during inspection	$250								$250			
BOP Contingency		Annual	O&M	2021	RELIABILITY	N		$287	$57	$57	$57	$57	$57						
BOP Contingency		Annual	O&M	2021	RELIABILITY	Y		$287						$57	$57	$57	$57	$57	
ELECTRICAL & CONTROLS																			
Electrical Maintenance	2020	Annual	O&M	2021	RELIABILITY	N	This is based on an average of O&M spending on electrical maintenance from 2014-2019	$726	$121	$121	$121	$121	$121	$121					
Electrical Maintenance	2020	Annual	O&M	2021	RELIABILITY	Y	This is based on an average of O&M spending on electrical maintenance from 2014-2019	$605							$121	$121	$121	$121	$121
Controls Maintenance	2020	Annual	O&M	2021	RELIABILITY	N	This is based on an average of O&M spending on instrumentation and controls maintenance from 2014-2019	$570	$95	$95	$95	$95	$95	$95					
Controls Maintenance	2020	Annual	O&M	2021	RELIABILITY	Y	This is based on an average of O&M spending on instrumentation and controls maintenance from 2014-2019	$475							$95	$95	$95	$95	$95
Emerson SureService (Approved in Newman	NEW	Annual	O&M	2021	RELIABILITY	N	Maintenance agreement with DCS OEM - request dollar amount from Newman Station for accuracy.	$210	$35	$35	$35	$35	$35	$35					
Emerson SureService (Approved in Newman	NEW	Annual	O&M	2021	RELIABILITY	Y	Maintenance agreement with DCS OEM - request dollar amount from Newman Station for accuracy.	$175							$35	$35	$35	$35	$35
MAINTENANCE PROJECTS TOTAL (Base)								**$5,943**	**$1,928**	**$678**	**$1,378**	**$1,028**	**$678**	**$251**	**$0**	**$0**	**$0**	**$0**	**$0**
MAINTENANCE PROJECTS TOTAL (Incremental)								**$12,342**	**$1,500**	**$0**	**$0**	**$150**	**$150**	**$1,427**	**$5,528**	**$1,828**	**$928**	**$553**	**$276**
O&M TOTAL																			
Total Fixed O&M Costs (Base)								**$9,344**	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557					
Total Fixed O&M Costs (Incremental)								**$7,787**							$1,557	$1,557	$1,557	$1,557	$1,557
Total Variable O&M Costs (Base)								**$5,943**	$1,928	$678	$1,378	$1,028	$678	$251	$0	$0	$0	$0	$0
Total Variable O&M Costs(Incremental)								**$12,342**	$1,500	$0	$0	$150	$150	$1,427	$5,528	$1,828	$928	$553	$276
Total O&M (Base)								**$15,287**	**$3,486**	**$2,236**	**$2,936**	**$2,586**	**$2,236**	**$1,808**	**$0**	**$0**	**$0**	**$0**	**$0**
Total O&M (Incremental)								**$20,129**	**$1,500**	**$0**	**$0**	**$150**	**$150**	**$1,427**	**$7,086**	**$3,386**	**$2,486**	**$2,111**	**$1,833**
GRAND TOTAL																			
Total Capital Expenditures (Base)								**$0**	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Capital Expenditures (Incremental)								**$9,460**	$100	$3,750	$2,810	$200	$2,600	$0	$0	$0	$0	$0	$0
Total O&M Expenditures (Base)								**$15,287**	$3,486	$2,236	$2,936	$2,586	$2,236	$1,808	$0	$0	$0	$0	$0
Total O&M Expenditures (Incremental)								**$20,129**	$1,500	$0	$0	$150	$150	$1,427	$7,086	$3,386	$2,486	$2,111	$1,833
TOTAL COST (Base)								**$15,287**	**$3,486**	**$2,236**	**$2,936**	**$2,586**	**$2,236**	**$1,808**	**$0**	**$0**	**$0**	**$0**	**$0**

Newman Unit 3 Condition Assessment
EPE
1898 & Co. Project No. 101995
Scenario 3

Cost Forecast
All costs are presented in 2020$, no inflation is included

EXPENDITURES (Presented in $000)

DESCRIPTION	LAST	FREQUENCY	SPEND	NEXT	TYPE	Life Extension? (Y/N)	JUSTIFICATION	TOTAL	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
CAPITAL PROJECTS																								
BOILER																								
Boiler Clean	Unknown	20 years	CAPX	2025	PERFORMANCE	Y	Within the next 10 years	$800					$800											
STEAM TURBINE / GENERATOR																								
Generator Stator Rewind	1993	30+ years	CAPX	2022	RELIABILITY	Y	Significant greasing and evidence of stator bar movement.	$2,000		$2,000														
Generator Field Rewind	1993	30+ years	CAPX	2022	RELIABILITY	Y	Wedges are starting to migrate and uneven field impedance graph.	$700		$700														
HIGH ENERGY PIPING																								
BALANCE OF PLANT																								
Circulating Water Piping replacement	Original	Once	CAPX	2021	RELIABILITY	Y		$2,000	$2,000															
BFP Replacement	Unknown	Once	CAPX	2030	RELIABILITY	Y	Existing pumps have ~10 years life left in them.	$3,000										$3,000						
Crane Upgrades	Unknown	Once	CAPX	2023	RELIABILITY	Y		$500			$500													
Elevator Repair/Upgrade	Unknown	Once	CAPX	2021	RELIABILITY	Y	Repair house elevator shared with Units 1 and 2	$40	$40															
LP FWH replacement	Unknown	Once	CAPX	2025	RELIABILITY	Y		$700					$700											
HP FWH replacement	Unknown	Once	CAPX	2025	RELIABILITY	Y		$700					$700											
ELECTRICAL & CONTROLS																								
DCS Evergreen Upgrade	2018	4 - 5 years	CAPX	2022	RELIABILITY	Y	Upgrade software and hardware as required.	$450		$150				$100					$100					$100
CEMS Analyzer Upgrade	Unknown	10 - 15 years	CAPX	2023	ENVIRONMENTAL	Y	Analyzer and sensor at end of design life, analyzer drift and inaccurate reading.	$60			$60													
2400V Switchgear	Original	30 years	CAPX	2022	RELIABILITY	Y	Plant reports no parts availability, O&M costs increasing as parts fail	$800		$800														
480V Station Service Unit Substation 3 with Feeder Transformer	Original	30 years	CAPX	2023	RELIABILITY	Y	Plant reports no parts availability, O&M costs increasing as parts fail	$250			$250													
480V MCC 3A	Original	30 years	CAPX	2021	RELIABILITY	Y	Plant reports no parts availability, O&M costs increasing as parts fail	$100	$100															
480V MCC 3B	Original	30 years	CAPX	2024	RELIABILITY	Y	Plant reports no parts availability, O&M costs increasing as parts fail	$100				$100												
480V Cooling Tower MCC with Feeder Transformer	Original	30 years	CAPX	2025	RELIABILITY	Y	Plant reports no parts availability, O&M costs increasing as parts fail	$400					$400											
Emerson AVR Digital Front End Upgrade	2015	15 - 20 years	CAPX	2030	RELIABILITY	Y	AVR will be approaching end of design life and an upgrade will help ensure reliable operation.	$75										$75						
Turbine Switchgear Battery and Charger	2013	20 years	CAPX	2033	RELIABILITY	Y	Battery and charger will be at end of design life.	$250													$250			
CAPITAL EXPENDITURES TOTAL (Base)								$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
CAPITAL EXPENDITURES TOTAL (Incremental)								$12,925	$2,140	$3,650	$810	$100	$2,600	$100	$0	$0	$0	$3,075	$100	$0	$250	$0	$0	$100
MAINTENANCE PROJECTS																								
BOILER																								
Boiler Inspection	2020	Annual	O&M	2021	RELIABILITY	N	Inspect and repair/replace boiler tubes and components identified during inspection.	$500	$100	$100	$100	$100	$100											
Boiler Inspection		Annual	O&M	2021	RELIABILITY	Y	Inspect and repair/replace boiler tubes and components identified during inspection.	$1,525						$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100
FD Fan Inspection	2020	Annual	O&M	2021	RELIABILITY	N	Inspect and repair/replace components identified during inspection.	$100	$20	$20	$20	$20	$20											
FD Fan Inspection		Annual	O&M	2021	RELIABILITY	Y	Inspect and repair/replace components identified during inspection.	$300						$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Boiler Contingency		Annual	O&M	2021	RELIABILITY	N		$141	$28	$28	$28	$28	$28											
Boiler Contingency		Annual	O&M	2021	RELIABILITY	Y		$422						$28	$28	$28	$28	$28	$28	$28	$28	$28	$28	$28
STEAM TURBINE / GENERATOR																								
Generator Major Inspection	2017	5 - 7 years	O&M	2024	RELIABILITY	Y	Perform generator inspection testing. Replace/repair components identified during inspection.	$950				$150					$400					$400		
Valve Inspection	2016	30000 hrs	O&M	2021	RELIABILITY	Y	Perform valve inspection for integrity and operability. Replace/repair components identified during inspection	$6,000	$1,500						$1,500					$1,500				
Turbine Major Inspection	2017	60000 hrs	O&M	2027	RELIABILITY	Y	Perform turbine inspection. Replace/repair components identified during inspection.	$6,400							$3,200									
Steam Turbine / Generator Contingency		Annual	O&M	2021	RELIABILITY	N		$384	$77	$77	$77	$77	$77											
Steam Turbine / Generator Contingency		Annual	O&M	2021	RELIABILITY	Y		$1,153						$77	$77	$77	$77	$77	$77	$77	$77	$77	$77	$77
HIGH ENERGY PIPING																								
Metallurgic replication	2018	5 years	O&M	2023	SAFETY	N		$50			$50													
Metallurgic replication	2018	5 years	O&M	2023	SAFETY	Y		$150								$50					$50			
Pipe Support System Inspection	2020	Annual	O&M	2021	RELIABILITY	N		$100	$20	$20	$20	$20	$20											
Pipe Support System Inspection	2020	Annual	O&M	2021	RELIABILITY	Y		$320						$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Creep Inspection	Unknown	5 years	O&M	2021	SAFETY	N		$1,000	$1,000															
Creep Inspection	Unknown	5 years	O&M	2021	SAFETY	Y		$3,000						$1,000					$1,000					$1,000
BALANCE OF PLANT																								
Deaerator Inspection	2018	2 years	O&M	2021	SAFETY	N	Perform deaerator inspection. Repair/replace components identified during inspection	$300	$150		$150													
Deaerator Inspection	2018	2 years	O&M	2021	SAFETY	Y	Perform deaerator inspection. Repair/replace components identified during inspection	$1,200					$150		$150		$150		$150		$150		$150	
Condenser Inspection	Unknown	once	O&M	2021	RELIABILITY	N	Inspect expansion joint	$100	$100															
Circ Water Pump rebuild	2018	5 years	O&M	2023	RELIABILITY	N	Rebuild of wear components	$50			$50													
Circ Water Pump rebuild	2018	5 years	O&M	2023	RELIABILITY	Y	Rebuild of wear components	$150								$50					$50			
Cooling Tower Inspection	2020	Annual	O&M	2021	RELIABILITY	N	Perform inspection. Replace/repair components identified during inspection	$625	$125	$125	$125	$125	$125											
Cooling Tower Inspection	2020	Annual	O&M	2021	RELIABILITY	Y	Perform inspection. Replace/repair components identified during inspection	$1,875						$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125
Condensate Pump Rebuild	2018	5 years	O&M	2023	RELIABILITY	N	Rebuild of wear components	$50			$50													
Condensate Pump Rebuild	2018	5 years	O&M	2023	RELIABILITY	Y	Rebuild of wear components	$150								$50					$50			
Boiler Feed Pump Inspection/Rebuild	2018	5 years	O&M	2023	RELIABILITY	N	Perform inspection. Replace/repair components identified during inspection (only about 10 years life left)	$300			$300													
Boiler Feed Pump Inspection/Rebuild	2018	5 years	O&M	2023	RELIABILITY	Y	Perform inspection. Replace/repair components identified during inspection (only about 10 years life left)	$900								$300					$300			
LP FWH Inspection	Unknown	7 years	O&M	2024	RELIABILITY	N	Perform inspection. Replace/repair components identified during inspection	$150				$150												
LP FWH Inspection	Unknown	7 years	O&M	2024	RELIABILITY	Y	Perform inspection. Replace/repair components identified during inspection	$300											$150					
HP FWH Inspection	Unknown	7 years	O&M	2024	RELIABILITY	N	Perform inspection. Replace/repair components identified during inspection	$200				$200												
HP FWH Inspection	Unknown	7 years	O&M	2024	RELIABILITY	Y	Perform inspection. Replace/repair components identified during inspection	$400											$200					

Appendix A - Newman Unit 3 Projected Costs (Rev. 2)

DESCRIPTION	LAST	FREQUENCY	SPEND	NEXT	TYPE	Life Extension? (Y/N)	JUSTIFICATION	TOTAL	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Stack Inspection	2019	10 years	O&M	2029	SAFETY	Y	Perform inspection. Replace/repair components identified during inspection	**$200**									$100							
Air Heater Inspection/Repair	2018	10 years	O&M	2028	RELIABILITY	Y	Perform inspection. Replace/repair components identified during inspection	**$500**								$250								
BOP Contingency		Annual	O&M	2021	RELIABILITY	N		**$287**	$57	$57	$57	$57	$57											
BOP Contingency		Annual	O&M	2021	RELIABILITY	Y		**$861**						$57	$57	$57	$57	$57	$57	$57	$57	$57	$57	$57
ELECTRICAL & CONTROLS																								
Electrical Maintenance	2020	Annual	O&M	2021	RELIABILITY	N	This is based on an average of O&M spending on electrical maintenance from 2014-2019	**$726**	$121	$121	$121	$121	$121	$121										
Electrical Maintenance	2020	Annual	O&M	2021	RELIABILITY	Y	This is based on an average of O&M spending on electrical maintenance from 2014-2019	**$1,815**							$121	$121	$121	$121	$121	$121	$121	$121	$121	$121
Controls Maintenance	2020	Annual	O&M	2021	RELIABILITY	N	This is based on an average of O&M spending on instrumentation and controls maintenance from 2014-2019	**$570**	$95	$95	$95	$95	$95	$95										
Controls Maintenance	2020	Annual	O&M	2021	RELIABILITY	Y	This is based on an average of O&M spending on instrumentation and controls maintenance from 2014-2019	**$1,425**							$95	$95	$95	$95	$95	$95	$95	$95	$95	$95
Emerson SureService (Approved in Newman Plan)	NEW	Annual	O&M	2021	RELIABILITY	N	Maintenance agreement with DCS OEM - request dollar amount from Newman Station for accuracy.	**$210**	$35	$35	$35	$35	$35	$35										
Emerson SureService (Approved in Newman Plan)	NEW	Annual	O&M	2021	RELIABILITY	Y	Maintenance agreement with DCS OEM - request dollar amount from Newman Station for accuracy.	**$525**							$35	$35	$35	$35	$35	$35	$35	$35	$35	$35
MAINTENANCE PROJECTS TOTAL (Base)								**$5,843**	**$1,928**	**$678**	**$1,278**	**$1,028**	**$678**	**$251**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
MAINTENANCE PROJECTS TOTAL (Incremental)								**$30,520**	**$1,500**	**$0**	**$0**	**$150**	**$150**	**$1,427**	**$5,528**	**$1,378**	**$1,328**	**$678**	**$2,178**	**$2,178**	**$1,278**	**$1,078**	**$828**	**$1,678**
O&M TOTAL																								
Total Fixed O&M Costs (Base)								**$7,787**	$1,557	$1,557	$1,557	$1,557	$1,557	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Fixed O&M Costs (Incremental)								**$24,919**	$0	$0	$0	$0	$0	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557	$1,557
Total Variable O&M Costs (Base)								**$5,843**	$1,928	$678	$1,278	$1,028	$678	$251	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Variable O&M Costs(Incremental)								**$30,520**	$1,500	$0	$0	$150	$150	$1,427	$5,528	$1,378	$1,328	$678	$2,178	$2,178	$1,278	$1,078	$828	$1,678
Total O&M (Base)								**$13,630**	**$3,486**	**$2,236**	**$2,836**	**$2,586**	**$2,236**	**$251**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total O&M (Incremental)								**$55,439**	**$1,500**	**$0**	**$0**	**$150**	**$150**	**$2,985**	**$7,086**	**$2,936**	**$2,886**	**$2,236**	**$3,736**	**$3,736**	**$2,836**	**$2,636**	**$2,386**	**$3,236**
GRAND TOTAL																								
Total Capital Expenditures (Base)								**$0**	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Capital Expenditures (Incremental)								**$12,925**	$2,140	$3,650	$810	$100	$2,600	$100	$0	$0	$0	$3,075	$100	$0	$250	$0	$0	$100
Total O&M Expenditures (Base)								**$13,630**	$3,486	$2,236	$2,836	$2,586	$2,236	$251	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenditures (Incremental)								**$55,439**	$1,500	$0	$0	$150	$150	$2,985	$7,086	$2,936	$2,886	$2,236	$3,736	$3,736	$2,836	$2,636	$2,386	$3,236
TOTAL COST (Base)								**$13,630**	**$3,486**	**$2,236**	**$2,836**	**$2,586**	**$2,236**	**$251**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

APPENDIX B – NEWMAN UNIT 4 PROJECTED COST

Newman Unit 4 Condition Assessment
EPE
1898 & Co. Project No. 101995
Scenario 1

Cost Forecast
All costs are presented in 2020$, no inflation is included

EXPENDITURES (Presented in $000)

DESCRIPTION	LAST	FREQUENCY	SPEND	NEXT	TYPE	JUSTIFICATION	TOTAL	2021	2022	2023	2024	2025	2026
CAPITAL PROJECTS													
COMBUSTION TURBINE / GENERATOR #1													
Generator Stator Rewind	Unknown	Once	CAPX	2022	RELIABILITY		$2,000		$2,000				
Hot Gas Path Inspection	Unknown	16000 hrs	CAPX	2022	RELIABILITY		$750		$750				
Major Overhaul	2019	32000 hrs	CAPX	2024	RELIABILITY		$1,000				$1,000		
COMBUSTION TURBINE / GENERATOR #2													
Hot Gas Path Inspection	Unknown	16000 hrs	CAPX	2023	RELIABILITY		$750			$750			
Major Overhaul	2020	32000 hrs	CAPX	2025	RELIABILITY		$1,000					$1,000	
HEAT RECOVERY STEAM GENERATOR #1													
Valve Replacement	Unknown	Once	CAPX	2022	RELIABILITY	Main Steam check valves and power check valves	$300		$300				
HEAT RECOVERY STEAM GENERATOR #2													
Valve Replacement	Unknown	Once	CAPX	2022	RELIABILITY	Main Steam check valves and power check valves	$300		$300				
STEAM TURBINE / GENERATOR													
Generator Stator Rewind	Unknown	Once	CAPX	2024	RELIABILITY	One GT & one STMR	$2,000				$2,000		
Major Overhaul	2016	60000 hrs	CAPX	2024	RELIABILITY		$1,500				$1,500		
HIGH ENERGY PIPING													
BALANCE OF PLANT													
Crane Upgrade	Unknown	Once	CAPX	2023	RELIABILITY	Upgrade and addition of remote operation	$500			$500			
ELECTRICAL & CONTROLS													
4160V Outdoor Switchgear Replacement (Currently in Newman Capital Plan)	Original	30 years	CAPX	2021	RELIABILITY	Gear past design end-of-life and limited parts availability and increasing O&M costs as components fail.	$700	$700					
CAPITAL EXPENDITURES TOTAL							**$10,800**	**$700**	**$3,350**	**$1,250**	**$4,500**	**$1,000**	**$0**
MAINTENANCE PROJECTS													
COMBUSTION TURBINE / GENERATOR #1													
Combustor Inspection	Unknown	8000 hrs	O&M	2021	RELIABILITY		$900	$300		$300		$300	
Hot Gas Path Inspection	Unknown	16000 hrs	O&M	2022	RELIABILITY		$750		$750				
Major Overhaul	2019	32000 hrs	O&M	2024	RELIABILITY		$1,000				$1,000		
Parts Refurbishment	2020	Annual	O&M	2021	RELIABILITY		$3,000	$400	$900	$400	$900	$400	
Generator Inspection and Bump Test	2022	5 - 7 years	O&M	2022	RELIABILITY	2019 Generator inspection showed resonant frequency at 122 Hz at CE.	$400		$400				
COMBUSTION TURBINE / GENERATOR #2													
Combustor Inspection	Unknown	8000 hrs	O&M	2022	RELIABILITY		$900	$300	$300		$300		
Hot Gas Path Inspection	Unknown	16000 hrs	O&M	2023	RELIABILITY		$750			$750			
Major Overhaul	2020	32000 hrs	O&M	2025	RELIABILITY		$1,000					$1,000	
Parts Refurbishment	2020	Annual	O&M	2021	RELIABILITY		$3,500	$900	$400	$900	$400	$900	
Generator Major Inspection with Bump Test	2019/2020	5 years	O&M	2024	RELIABILITY	OEM recommendation is to perform overhaul/inspection every 5 years. 2020 inspection showed resonant frequencies at 126 Hz and 132 Hz.	$400				$400		
HEAT RECOVERY STEAM GENERATOR #1													
Boiler Inspection	Unknown	Annual	O&M	2021	RELIABILITY	Inspect and repair/replace boiler tubes and components identified during inspection.	$600	$120	$120	$120	$120	$120	
Boiler Contingency		Annual	O&M	2021	RELIABILITY		$217	$43	$43	$43	$43	$43	
HEAT RECOVERY STEAM GENERATOR #2													
Boiler Inspection	Unknown	Annual	O&M	2021	RELIABILITY	Inspect and repair/replace boiler tubes and components identified during inspection.	$600	$120	$120	$120	$120	$120	
Boiler Contingency		Annual	O&M	2021	RELIABILITY		$217	$43	$43	$43	$43	$43	
STEAM TURBINE / GENERATOR													
Valve Inspection	Unknown	30000 hrs	O&M	2024	RELIABILITY		$800				$800		
Major Overhaul	2016	60000 hrs	O&M	2024	RELIABILITY		$1,500				$1,500		
Generator Minor Inspection	2019	5 years	O&M	2021	RELIABILITY	OEM recommendation is to perform overhaul/inspection every 5 years.	$250	$250					
Steam Turbine / Generator Contingency		Annual	O&M	2021	RELIABILITY		$389	$78	$78	$78	$78	$78	
HIGH ENERGY PIPING													

Appendix B - Newman Unit 4 Projected Costs (Rev. 2)

DESCRIPTION		LAST	FREQUENCY	SPEND	NEXT	TYPE	JUSTIFICATION	TOTAL	2021	2022	2023	2024	2025	2026
	Metallurgic replication	Never	5 years	O&M	2021	SAFETY		**$50**	$50					
	Pipe Support System Inspection	2020	Annual	O&M	2021	RELIABILITY		**$100**	$20	$20	$20	$20	$20	
	Creep Inspection	Unknown	5 years	O&M	2022	SAFETY				$500				
BALANCE OF PLANT														
	Condenser Inspection	Unknown	Once	O&M	2022	RELIABILITY	Perform condenser inspection. Repair/replace components identified during inspection	**$200**		$200				
	Cooling Tower Inspection	Unknown	2 yrs	O&M	2022	RELIABILITY	Perform cooling tower inspection. Repair/replace components identified during inspection	**$120**		$60		$60		
	Circ Water Pump Rebuild	2020	5 yrs	O&M	2024	RELIABILITY	Rebuild of wear components	**$150**				$150		
	Aux Cooling Water Pump Rebuild	2020	5 yrs	O&M	2024	RELIABILITY	Rebuild of wear components	**$100**				$100		
	Condensate Pump Rebuild	Unknown	5 yrs	O&M	2022	RELIABILITY	Rebuild of wear components	**$100**		$100				
	Boiler Feed Pump Rebuild	Unknown	5 yrs	O&M	2022	RELIABILITY	Rebuild of wear components	**$300**		$300				
	BOP Contingency		Annual	O&M	2021	RELIABILITY		**$143**	$29	$29	$29	$29	$29	
ELECTRICAL & CONTROLS														
	Electrical Maintenance	2020	Annual	O&M	2021	RELIABILITY	This is based on an average of O&M spending on electrical maintenance from 2014-2019	**$2,454**	$409	$409	$409	$409	$409	$409
	Controls Maintenance	2020	Annual	O&M	2021	RELIABILITY	This is based on an average of O&M spending on instrumentation and controls maintenance from 2014-2019	**$1,446**	$241	$241	$241	$241	$241	$241
	Emerson SureService Agreement	NEW	Annual	O&M	2021	RELIABILITY	Service contract with Emerson to maintain Ovation DCS. Newman stations expects to finalize in 2020.	**$210**	$35	$35	$35	$35	$35	$35
MAINTENANCE PROJECTS TOTAL								**$23,046**	**$3,338**	**$5,048**	**$3,488**	**$6,748**	**$3,738**	**$685**
O&M TOTAL														
	Total Fixed O&M Costs							**$21,721**	$3,620	$3,620	$3,620	$3,620	$3,620	$3,620
	Total Variable O&M Costs							**$23,046**	$3,338	$5,048	$3,488	$6,748	$3,738	$685
	Total O&M							**$44,767**	**$6,958**	**$8,668**	**$7,108**	**$10,368**	**$7,358**	**$4,305**
GRAND TOTAL														
	Total Capital Expenditures							**$10,800**	$700	$3,350	$1,250	$4,500	$1,000	$0
	Total O&M Expenditures							**$44,767**	$6,958	$8,668	$7,108	$10,368	$7,358	$4,305
TOTAL COST								**$55,567**	**$7,658**	**$12,018**	**$8,358**	**$14,868**	**$8,358**	**$4,305**

Newman Unit 4 Condition Assessment
EPE
1898 & Co. Project No. 101995
Scenario 2

Cost Forecast
All costs are presented in 2020$, no inflation is included

EXPENDITURES (Presented in $000)

DESCRIPTION	LAST	FREQUENCY	SPEND	NEXT	TYPE	Life Extension? (Y/N)	JUSTIFICATION	TOTAL	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
CAPITAL PROJECTS																			
COMBUSTION TURBINE / GENERATOR #1																			
Generator Stator Rewind	Unknown	Once	CAPX	2022	RELIABILITY	N		$2,000		$2,000									
Hot Gas Path Inspection	Unknown	16000 hrs	CAPX	2022	RELIABILITY	N		$750		$750									
Hot Gas Path Inspection	Unknown	16000 hrs	CAPX	2022	RELIABILITY	Y		$750						$750					
Major Overhaul	2019	32000 hrs	CAPX	2024	RELIABILITY	N	OEM recommendation	$1,400				$1,400							
Major Overhaul	2019	32000 hrs	CAPX	2024	RELIABILITY	Y	OEM recommendation	$1,400								$1,400			
Inlet Cooling System Upgrade	Unknown	Once	CAPX	2024	PERFORMANCE	Y		$1,200				$1,200							
Inlet Cooling System Structure Repairs	Unknown	Once	CAPX	2024	PERFORMANCE	Y		$120				$120							
COMBUSTION TURBINE / GENERATOR #2																			
Generator Stator Rewind	Unknown	Once	CAPX	2022	RELIABILITY	N		$2,000		$2,000									
Hot Gas Path Inspection	Unknown	16000 hrs	CAPX	2023	RELIABILITY	N		$750		$750									
Hot Gas Path Inspection	Unknown	16000 hrs	CAPX	2023	RELIABILITY	Y		$750							$750				
Major Overhaul	2020	32000 hrs	CAPX	2025	RELIABILITY	N	OEM recommendation	$1,400					$1,400						
Major Overhaul	2020	32000 hrs	CAPX	2025	RELIABILITY	Y	OEM recommendation	$1,400									$1,400		
Inlet Cooling System Upgrade	Unknown	Once	CAPX	2025	PERFORMANCE	Y		$1,200					$1,200						
Inlet Cooling System Structure Repairs	Unknown	Once	CAPX	2025	PERFORMANCE	Y		$120					$120						
HEAT RECOVERY STEAM GENERATOR #1																			
Valve Replacement	Unknown	Once	CAPX	2022	RELIABILITY	N	Main Steam check valves and power check valves	$400		$400									
High Pressure Circulating Pump Replacement	Unknown	Once	CAPX	2023	RELIABILITY	Y		$13			$13								
HEAT RECOVERY STEAM GENERATOR #2																			
Valve Replacement	Unknown	Once	CAPX	2022	RELIABILITY	N	Main Steam check valves and power check valves	$400		$400									
High Pressure Circulating Pump Replacement	Unknown	Once	CAPX	2023	RELIABILITY	Y		$13			$13								
STEAM TURBINE / GENERATOR																			
Generator Stator Rewind	Unknown	Once	CAPX	2024	RELIABILITY	Y	Rewind one GT and one STMR	$2,000				$2,000							
Major Overhaul	2016	60000 hrs	CAPX	2024	RELIABILITY	Y		$1,500				$1,500							
HIGH ENERGY PIPING																			
BALANCE OF PLANT																			
Crane Upgrade	Unknown	Once	CAPX	2023	RELIABILITY	N	Upgrade and addition of remote operation	$250			$250								
Crane Upgrade	Unknown	Once	CAPX	2023	RELIABILITY	Y	Upgrade and addition of remote operation	$250						$250					
Condenser Retube	Unknown	Once	CAPX	2024	RELIABILITY	Y		$800				$800							
Cooling Tower Structure Replacement	Unknown	Once	CAPX	2022	RELIABILITY	Y		$1,250		$1,250									
Cooling Tower Fan Replacement	Unknown	Once	CAPX	2025	RELIABILITY	Y		$110					$110						
Nox Control Water Injection Pump Replacements	Unknown	Once	CAPX	2025	ENVIRONMENTAL	Y		$13					$13						
ELECTRICAL & CONTROLS																			
CTG-1 Generator Circuit Breaker	Original	Once	CAPX	2022	RELIABILITY	Y	Circuit breakers designed life is primarily based on number of operations and breaker is approaching 50 years.	$400		$400									
CTG-2 Generator Circuit Breaker	Original	Once	CAPX	2024	RELIABILITY	Y	Circuit breakers designed life is primarily based on number of operations and breaker is approaching 50 years.	$400				$400							
Main Auxiliary Transformer (T-10) Replacement	Original	30 years	CAPX	2023	RELIABILITY	Y	Transformer past design end-of-life. All other transformers replaced.	$350			$350								
CEMS Analyzer Upgrade	Unknown	10 - 15 years	CAPX	2023	ENVIRONMENTAL	Y	Analyzer and sensor at end of design life, analyzer drift and inaccurate readings.	$60			$60								
4160V Switchgear 1A	Original	30 years	CAPX	2022	RELIABILITY	Y	Electrical gear past design end-of-life and limited parts availability and increasing O&M costs as components fail.	$600		$600									
4160V Switchgear 1B	Original	30 years	CAPX	2023	RELIABILITY	Y	Electrical gear past design end-of-life and limited parts availability and increasing O&M costs as components fail.	$400			$400								
4160V Outdoor Switchgear Replacement (Currently in Newman (	Original	30 years	CAPX	2021	RELIABILITY	N	Electrical gear past design end-of-life and limited parts availability and increasing O&M costs as components fail.	$700	$700										
480V CT Switchgear	Original	30 years	CAPX	2024	RELIABILITY	Y	Electrical gear past design end-of-life and limited parts availability and increasing O&M costs as components fail.	$400				$400							
480V Water Treatment Switchgear Replacement including Trans	Original	30 years	CAPX	2025	RELIABILITY	Y	Electrical gear past design end-of-life and limited parts availability and increasing O&M costs as components fail.	$450					$450						
480V MCC Water Treatment Replacement	Original	30 years	CAPX	2022	RELIABILITY	Y	Electrical gear past design end-of-life and limited parts availability and increasing O&M costs as components fail.	$425		$425									
480V MCC Cooling Tower Replacement	Original	30 years	CAPX	2025	RELIABILITY	Y	Electrical gear past design end-of-life and limited parts availability and increasing O&M costs as components fail.	$325					$325						
480V MCC Fuel Oil Replacement	Original	30 years	CAPX	2021	RELIABILITY	Y	Electrical gear past design end-of-life and limited parts availability and increasing O&M costs as components fail.	$325	$325										
Battery Replacements	Unknown	Once	CAPX	2023	RELIABILITY	Y		$120			$120								
UPS Replacements	Unknown	Once	CAPX	2021	RELIABILITY	Y		$200	$200										
High, Medium and Low Voltage Cable Replacements	Unknown	Once	CAPX	2023	RELIABILITY	Y		$2,473			$2,473								
Atomizing Air Compressor Motor Replacements	Unknown	Once	CAPX	2025	RELIABILITY	Y		$10					$10						
CAPITAL EXPENDITURES TOTAL (Base)								$10,050	$700	$6,300	$250	$1,400	$1,400	$0	$0	$0	$0	$0	$0
CAPITAL EXPENDITURES TOTAL (Incremental)								$19,825	$525	$2,675	$3,428	$6,420	$2,228	$1,000	$750	$1,400	$1,400	$0	$0
MAINTENANCE PROJECTS																			
COMBUSTION TURBINE / GENERATOR #1																			
Exciter Overhaul	2019	5 years	O&M	2024	RELIABILITY	Y	OEM recommendation is to perform overhaul/inspection every 5 years.	$100				$100							
Generator Major Inspection with Bump Test	2019	5 years	O&M	2022	RELIABILITY	N	OEM recommendation is to perform overhaul/inspection every 5 years. 2019 Generator inspection showed resonant frequency at 122 Hz at CE	$400		$400									
Generator Major Inspection with Bump Test	2019	5 years	O&M	2022	RELIABILITY	Y	OEM recommendation is to perform overhaul/inspection every 5 years. 2019 Generator inspection showed resonant frequency at 122 Hz at CE	$300						$300					
Combustor Inspection	Unknown	8000 hrs	O&M	2021	RELIABILITY	N	OEM recommendation	$1,950	$650		$650		$650						
Combustor Inspection	Unknown	8000 hrs	O&M	2021	RELIABILITY	Y	OEM recommendation	$1,300							$650		$650		
Hot Gas Path Inspection	Unknown	16000 hrs	O&M	2022	RELIABILITY	N	OEM recommendation	$750		$750									
Hot Gas Path Inspection	Unknown	16000 hrs	O&M	2022	RELIABILITY	Y	OEM recommendation	$750						$750					
Major Overhaul	2019	32000 hrs	O&M	2024	RELIABILITY	N	OEM recommendation	$1,000				$1,000							
Major Overhaul	2019	32000 hrs	O&M	2024	RELIABILITY	Y	OEM recommendation	$1,000								$1,000			
Parts Refurbishment	2020	Annual	O&M	2021	RELIABILITY	N	OEM recommendation	$3,000	$400	$900	$400	$900	$400						
Parts Refurbishment	2020	Annual	O&M	2021	RELIABILITY	Y	OEM recommendation	$3,500						$900	$400	$900	$400	$900	
COMBUSTION TURBINE / GENERATOR #2																			
Exciter Overhaul	2019	5 years	O&M	2024	RELIABILITY	Y	OEM recommendation is to perform overhaul/inspection every 5 years.	$100				$100							

Appendix B - Newman Unit 4 Projected Costs (Rev. 2)

DESCRIPTION	LAST	FREQUENCY	SPEND	NEXT	TYPE	Life Extension? (Y/N)	JUSTIFICATION	TOTAL	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Generator Major Inspection with Bump Test	2019/2020	5 years	O&M	2024	RELIABILITY	N	OEM recommendation is to perform overhaul/inspection every 5 years. 2020 inspection showed resonant frequencies at 126 Hz and 132 Hz.	$400				$400							
Generator Major Inspection with Bump Test	2019/2020	5 years	O&M	2024	RELIABILITY	Y	OEM recommendation is to perform overhaul/inspection every 5 years. 2020 inspection showed resonant frequencies at 126 Hz and 132 Hz.	$300									$300		
Combustor Inspection	Unknown	8000 hrs	O&M	2022	RELIABILITY	N	OEM recommendation	$1,300		$650		$650							
Combustor Inspection	Unknown	8000 hrs	O&M	2022	RELIABILITY	Y	OEM recommendation	$1,950						$650		$650		$650	
Hot Gas Path Inspection	Unknown	16000 hrs	O&M	2023	RELIABILITY	N	OEM recommendation	$750			$750								
Hot Gas Path Inspection	Unknown	16000 hrs	O&M	2023	RELIABILITY	Y	OEM recommendation	$750							$750				
Major Overhaul	2020	32000 hrs	O&M	2025	RELIABILITY	N	OEM recommendation	$1,000					$1,000						
Major Overhaul	2020	32000 hrs	O&M	2025	RELIABILITY	Y	OEM recommendation	$1,000									$1,000		
Parts Refurbishment	2020	Annual	O&M	2021	RELIABILITY	N	OEM recommendation	$3,500	$900	$400	$900	$400	$900						
Parts Refurbishment	2020	Annual	O&M	2021	RELIABILITY	Y	OEM recommendation	$3,000						$400	$900	$400	$900	$400	
HEAT RECOVERY STEAM GENERATOR #1																			
Boiler Inspection	Unknown	Annual	O&M	2021	RELIABILITY	N	Inspect and repair/replace boiler tubes and components identified during inspection.	$750	$150	$150	$150	$150	$150						
Boiler Inspection	Unknown	Annual	O&M	2021	RELIABILITY	Y	Inspect and repair/replace boiler tubes and components identified during inspection.	$750						$150	$150	$150	$150	$150	
Boiler Contingency	Unknown	Annual	O&M	2021	RELIABILITY	N		$217	$43	$43	$43	$43	$43						
Boiler Contingency	Unknown	Annual	O&M	2021	RELIABILITY	Y		$217						$43	$43	$43	$43	$43	
HEAT RECOVERY STEAM GENERATOR #2																			
Boiler Inspection	Unknown	Annual	O&M	2021	RELIABILITY	N	Inspect and repair/replace boiler tubes and components identified during inspection.	$750	$150	$150	$150	$150	$150						
Boiler Inspection	Unknown	Annual	O&M	2021	RELIABILITY	Y	Inspect and repair/replace boiler tubes and components identified during inspection.	$750						$150	$150	$150	$150	$150	
Boiler Contingency	Unknown	Annual	O&M	2021	RELIABILITY	N		$217	$43	$43	$43	$43	$43						
Boiler Contingency	Unknown	Annual	O&M	2021	RELIABILITY	Y		$217						$43	$43	$43	$43	$43	
STEAM TURBINE / GENERATOR																			
Exciter Overhaul	2019	5 years	O&M	2024	RELIABILITY	Y	OEM recommendation is to perform overhaul/inspection every 5 years.	$40				$40							
Generator Major Inspection	2019	5 years	O&M	2024	RELIABILITY	Y	OEM recommendation is to perform overhaul/inspection every 5 years.	$300									$300		
Generator Minor Inspection	2019	5 years	O&M	2021	RELIABILITY	N		$250	$250										
Valve Inspection	Unknown	30000 hrs	O&M	2021	RELIABILITY	N		$800				$800							
Valve Inspection	Unknown	30000 hrs	O&M	2021	RELIABILITY	Y		$800								$800			
Major Overhaul	2016	60000 hrs	O&M	2025	RELIABILITY	Y		$1,500					$1,500						
Turning Gear Inspection & Repair	Unknown	Once	O&M	2025	RELIABILITY	Y		$60				$60							
Lube Oil System Inspection & Repair	Unknown	Once	O&M	2024	RELIABILITY	Y		$80				$80							
Electro-Hydraulic Control System Inspection & Repair	Unknown	Once	O&M	2024	RELIABILITY	Y		$220				$220							
Steam Turbine Contingency	Unknown	Annual	O&M	2021	RELIABILITY	N		$389	$78	$78	$78	$78	$78						
Steam Turbine Contingency	Unknown	Annual	O&M	2021	RELIABILITY	Y		$389						$78	$78	$78	$78	$78	
HIGH ENERGY PIPING																			
Metallurgic replication	Never	5 years	O&M	2021	SAFETY	N		$50	$50										
Metallurgic replication	Never	5 years	O&M	2021	SAFETY	Y		$50						$50					
Pipe Support System Inspection	2020	Annual	O&M	2021	RELIABILITY	N		$100	$20	$20	$20	$20	$20						
Pipe Support System Inspection	2020	Annual	O&M	2021	RELIABILITY	Y		$100						$20	$20	$20	$20	$20	
Creep Inspection	Unknown	5 years	O&M	2023	SAFETY	N		$500			$500								
Creep Inspection	Unknown	5 years	O&M	2023	SAFETY	Y		$500								$500			
BALANCE OF PLANT																			
Condenser Inspection	Unknown	once	O&M	2022	RELIABILITY	N	Perform condenser inspection. Repair/replace components identified during inspection	$200		$200									
Condenser Inspection	Unknown	once	O&M	2022	RELIABILITY	Y	Perform condenser inspection. Repair/replace components identified during inspection	$200						$200					
Cooling Tower Inspection		Annual	O&M	2021	RELIABILITY	N	Perform cooling tower inspection. Repair/replace components identified during inspection	$120		$60		$60							
Cooling Tower Inspection		Annual	O&M	2021	RELIABILITY	Y	Perform cooling tower inspection. Repair/replace components identified during inspection	$270						$150		$60		$60	
Circ Water Pump Rebuild	2020	5 yrs	O&M	2025	RELIABILITY	N	Rebuild of wear components	$150				$150							
Circ Water Pump Rebuild	2020	5 yrs	O&M	2025	RELIABILITY	Y	Rebuild of wear components	$150									$150		
Aux Cooling Water Pump Rebuild	2020	5 yrs	O&M	2025	RELIABILITY	N	Rebuild of wear components	$100			$100								
Aux Cooling Water Pump Rebuild	2020	5 yrs	O&M	2025	RELIABILITY	Y	Rebuild of wear components	$200						$100			$100		
Condensate Pump Rebuild	Unknown	5 yrs	O&M	2022	RELIABILITY	N	Rebuild of wear components	$100		$100									
Condensate Pump Rebuild	Unknown	5 yrs	O&M	2022	RELIABILITY	Y	Rebuild of wear components	$100							$100				
Boiler Feed Pump Rebuild	Unknown	5 yrs	O&M	2022	RELIABILITY	N	Rebuild of wear components	$300		$300									
Boiler Feed Pump Rebuild	Unknown	5 yrs	O&M	2022	RELIABILITY	Y	Rebuild of wear components	$300							$300				
Deaerator Inspection & Repair	Unknown	Once	O&M	2022	RELIABILITY	Y		$20		$20									
Voith Variable Speed Transmission Inspection & Repair	Unknown	Once	O&M	2027	RELIABILITY	Y		$500							$500				
Standby Boiler Feed Pump Inspection & Repair	Unknown	Once	O&M	2027	RELIABILITY	Y		$500							$500				
Low Pressure Standby Heater Inspection & Repair	Unknown	Once	O&M	2024	RELIABILITY	Y		$100				$100							
BOP Contingency	Unknown	Annual	O&M	2021	RELIABILITY	N		$143	$29	$29	$29	$29	$29						
BOP Contingency	Unknown	Annual	O&M	2021	RELIABILITY	Y		$143						$29	$29	$29	$29	$29	
ELECTRICAL & CONTROLS																			
Electrical Maintenance	2020	Annual	O&M	2021	RELIABILITY	N	This is based on an average of O&M spending on electrical maintenance from 2014-2019	$2,454	$409	$409	$409	$409	$409	$409					
Electrical Maintenance	2020	Annual	O&M	2021	RELIABILITY	Y	This is based on an average of O&M spending on electrical maintenance from 2014-2019	$2,045							$409	$409	$409	$409	$409
Controls Maintenance	2020	Annual	O&M	2021	RELIABILITY	N	This is based on an average of O&M spending on instrumentation and controls maintenance from 2014-2019	$1,446	$241	$241	$241	$241	$241	$241					
Controls Maintenance	2020	Annual	O&M	2021	RELIABILITY	Y	This is based on an average of O&M spending on instrumentation and controls maintenance from 2014-2019	$1,205							$241	$241	$241	$241	$241
Emerson SureService Agreement	NEW	Annual	O&M	2021	RELIABILITY	N	Service contract with Emerson to maintain Ovation DCS. Newman stations expects to finalize in 2020.	$210	$35	$35	$35	$35	$35	$35					
Emerson SureService Agreement	NEW	Annual	O&M	2021	RELIABILITY	Y	Service contract with Emerson to maintain Ovation DCS. Newman stations expects to finalize in 2020.	$175							$35	$35	$35	$35	$35
MAINTENANCE PROJECTS TOTAL (Base)								**$23,296**	**$3,448**	**$4,958**	**$4,498**	**$5,558**	**$4,148**	**$685**	**$0**	**$0**	**$0**	**$0**	**$0**
MAINTENANCE PROJECTS TOTAL (Incremental)								**$25,931**	**$0**	**$20**	**$0**	**$700**	**$1,500**	**$4,013**	**$5,298**	**$5,508**	**$4,998**	**$3,208**	**$685**
O&M TOTAL																			
Total Fixed O&M Costs (Base)								**$21,721**	$3,620	$3,620	$3,620	$3,620	$3,620	$3,620					
Total Fixed O&M Costs (Incremental)								**$18,101**							$3,620	$3,620	$3,620	$3,620	$3,620
Total Variable O&M Costs (Base)								**$23,296**	$3,448	$4,958	$4,498	$5,558	$4,148	$685	$0	$0	$0	$0	$0
Total Variable O&M Costs(Incremental)								**$25,931**	$0	$20	$0	$700	$1,500	$4,013	$5,298	$5,508	$4,998	$3,208	$685
Total O&M (Base)								**$45,017**	**$7,068**	**$8,578**	**$8,118**	**$9,178**	**$7,768**	**$4,305**	**$0**	**$0**	**$0**	**$0**	**$0**
Total O&M (Incremental)								**$44,032**	**$0**	**$20**	**$0**	**$700**	**$1,500**	**$4,013**	**$8,918**	**$9,128**	**$8,618**	**$6,828**	**$4,305**
GRAND TOTAL																			
Total Capital Expenditures (Base)								**$10,050**	$700	$6,300	$250	$1,400	$1,400	$0	$0	$0	$0	$0	$0
Total Capital Expenditures (Incremental)								**$19,825**	$525	$2,675	$3,428	$6,420	$2,228	$1,000	$750	$1,400	$1,400	$0	$0
Total O&M Expenditures (Base)								**$45,017**	$7,068	$8,578	$8,118	$9,178	$7,768	$4,305	$0	$0	$0	$0	$0
Total O&M Expenditures (Incremental)								**$44,032**	$0	$20	$0	$700	$1,500	$4,013	$8,918	$9,128	$8,618	$6,828	$4,305
TOTAL COST (Base)								**$55,067**	**$7,768**	**$14,878**	**$8,368**	**$10,578**	**$9,168**	**$4,305**	**$0**	**$0**	**$0**	**$0**	**$0**

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