BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

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EXH. JRT-5

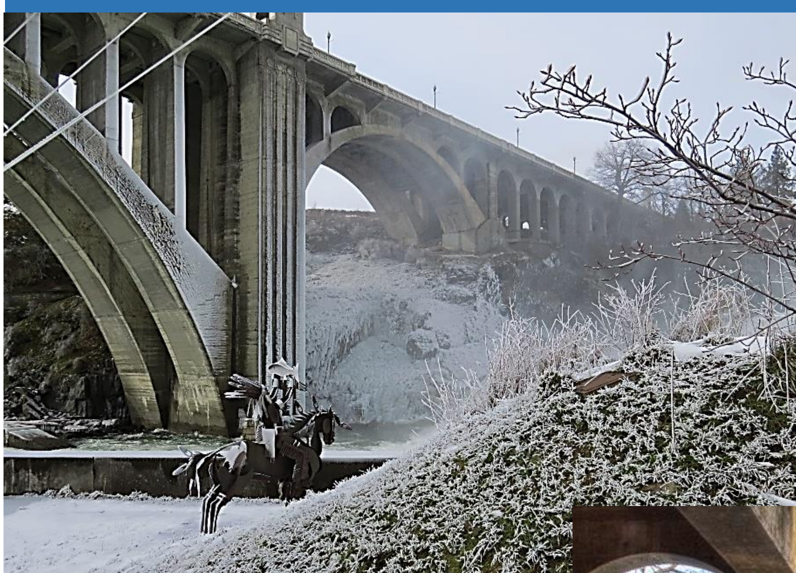
JASON R. THACKSTON

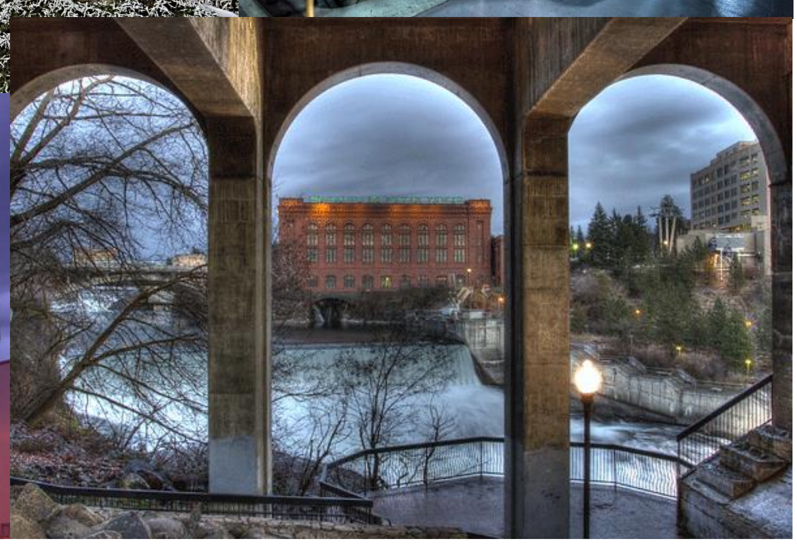
REPRESENTING AVISTA CORPORATION

Avista Utilities

Generation Infrastructure Plan

2020





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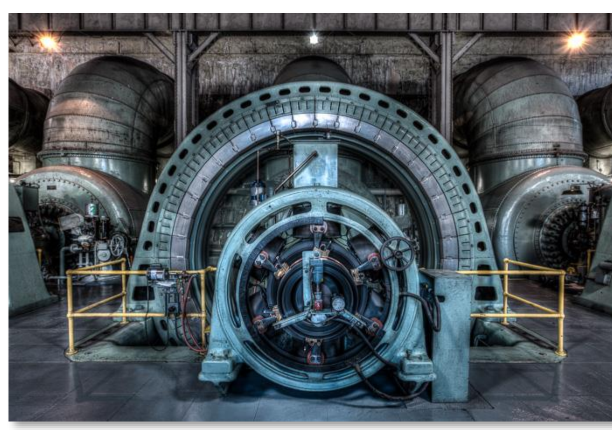


EXECUTIVE SUMMARY

Throughout its history, Avista has invested in a broad portfolio of generating assets with the primary focus of providing low cost and reliable energy to benefit Avista's customers. While that purpose has not changed, the utility world is experiencing significant changes that impact the demands placed upon these historical assets and which are well beyond the scope of their original design.

Generating assets have been historically utilized to support the interconnected transmission grid and provide energy to customers, but are now being increasingly called upon, via federal regulations, to provide frequency response, voltage support and system reserves. Another factor coming into play is society's desire to move to a "green" energy system. This interest has led to public policy in the form of federal and state tax incentives, grants, and renewable portfolio standards (RPS) which establish targets to reduce or even eliminate carbon emissions. These policy changes have encouraged the installation of significant amounts of intermittent wind and solar-based energy resources which have created new demands on the grid and on existing generation resources. For example, a wind farm can be producing maximum output for a brief time due to high winds, and the next moment be producing no energy as the winds die down, requiring a controllable resource such as a conventional hydro or natural gas plant to make up the difference instantaneously. With all of these changes, traditional generating stations are being called upon to operate in ways they were not originally designed for by ramping output up or down more frequently and with larger variations, resulting in increasing wear and tear on the units and the accompanying higher O&M costs and capital investments required to repair or replace components to keep these existing assets functioning.

The Company is also committed to mitigating environmental impacts and improving the areas in which it operates, including direct customer benefits such as parks and boat ramps, issues such as fish and wildlife habitat protection and enhancement, erosion control, water quality, and a variety of license requirements. Maintaining compliance with all related regulatory, environmental, societal, legal, safety, and health-related requirements also results in increasing costs over time as these demands continue to change with better science and societal values.

Operating a utility is a highly complex business requiring a balancing act between many significant factors including customer service and reliability, the integrity of the interconnected grid, keeping costs low by utilizing Company resources and those of the energy marketplace, and protecting and enhancing the areas impacted by Company operations. Avista's diverse portfolio provides a strong platform for meeting these requirements, but as briefly described above, times are changing in the utility world. Investment strategies and decisions will need to continue to evolve to match the demands placed upon these traditional assets in the future energy space. This report attempts to describe the ways in which Avista's Generation group is addressing all of the requirements being placed on them and on their equipment, from upgrades and new technology to repairing and replacing assets to keep them in service. For specific details about Avista's generating resources, equipment, issues, and a glossary of terms, please see the Company's 2019 Generation Infrastructure Plan.[1]

[1] Available on the Avenue under "Tools & Resources" then "Avista Infrastructure Plans" as "Generation Infrastructure Plan" or in hardcopy by request.

Introduction

Avista's electric generating portfolio is a blend of hydro, natural gas, coal, wood-waste biomass, wind and solar-powered generation. Many of Avista's generating assets are more than 50 years old; some are more than 100 years old. While these assets have been managed and maintained over the years, Avista must continually make investments in its generating fleet in order to continue providing customers with safe and reliable electric service at a reasonable cost, and with service levels that meet or exceed customer's expectations for quality and satisfaction, all while fulfilling safety and regulatory requirements.

Plant	In Service Date	Age	Type
Post Falls	1906	114	Hydro
Nine Mile	1908	112	Hydro
Little Falls	1910	110	Hydro
Long Lake	1915	105	Hydro
Upper Falls	1922	98	Hydro
Cabinet Gorge	1952	68	Hydro
Noxon Rapids	1959	61	Hydro
Monroe Street	1992	28	Hydro
Kettle Falls	1983	37	Biomass
Colstrip 3	1984	36	Coal
Colstrip 4	1986	34	Coal
Northeast	1978	42	Gas CT
Rathdrum	1995	25	Gas CT
Boulder Park	2002	18	Gas CT
Kettle Falls CT	2003	17	Gas CT
Coyote Springs 2	2003	17	Gas CC
Buck-A-Block	2002	18	Solar
Community Solar	2015	5	Solar
Lind Solar	2018	2	Solar
Palouse Wind	2011	9	Wind

In addition to serving customers by providing low cost energy, generating resources are a critical element in maintaining overall system reliability. Avista's generating resources are called upon to support system voltage, grid frequency, provide reserves, and deliver other required operating services needed to maintain a stable and reliable grid for Avista and across the Western Interconnection.[2] Additionally, Avista is planning to enter the Western Energy Imbalance Market (EIM) starting in 2022 to take advantage of the flexibility of these resources in an organized market to the benefit of its customers.

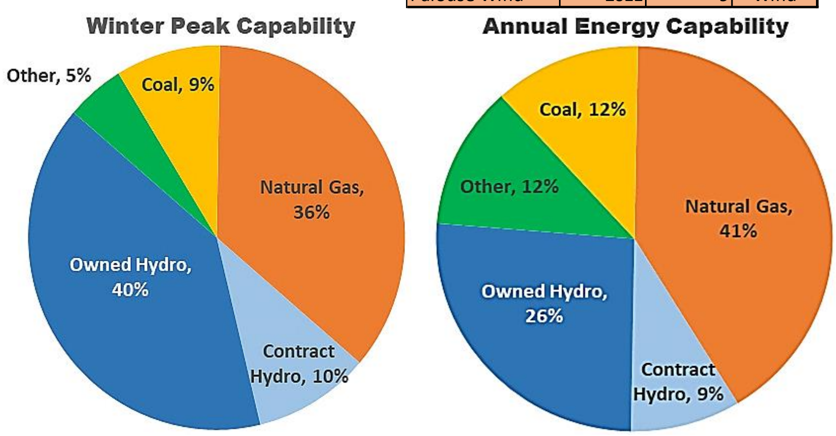


Figure 1. Avista's Typical Generation Mix

The Company's typical fuel mix for generation is shown in Figure 1.[3] The Company owns and operates six hydroelectric generating stations on the Spokane River and two more on the Clark Fork River. In addition, the Company purchases output from the City of Spokane's hydroelectric projects and from some small customer-owned hydro projects. Altogether, hydroelectricity provides up to about half of Avista's capacity to meet customer needs.
Avista is also part-owner of two coal-fired units at the Colstrip Power Generation Station in Montana, capable of providing up to 12% of the Company's resource requirements. The Company's thermal resources also include five natural gas projects, one of which is a combined cycle plant, four of which

[2] Voltage is the pressure from the generator that pushes charged electrons (current) across a power line to the load source. Frequency on the grid is the change in direction in current flow on an alternating current system. Reserves are energy resources set aside in case a generator goes out of service, a transmission line fails, or other disruptions to supply occur. Generating governors control the speed of individual generators to help them stay at 60 Hertz and keep the voltage and frequency of the grid in balance.
[3] From Avista's 2020 Electric IRP, page 4-1, https://www.myavista.com/about-us/our-company/integrated-resource-planning

Avista's "Green" Generating Resources in Megawatts	
Hydro Generation	1,029
Kettle Falls Biomass	54
Wind	40
Total Gen. Capability	**1,122**
% of Total Gen. Capacity	***60%***

are designed to provide peaking capability. In addition, Avista owns a wood biomass plant in Kettle Falls and purchases natural gas-fired energy from Rathdrum Power, an independent power producer.

The Company has pursued an expanding portfolio of renewable wind energy including purchasing from independent power producer Palouse Wind in Oakesdale, Washington, with a peak generating capacity of 105 megawatts, as well as purchasing 50 average megawatts of wind energy from the Rattlesnake Flat Wind Project near Lind, Washington beginning in 2020.[4] The Company is also actively pursuing solar technology. Since 2002, the Company has offered customers the opportunity to purchase solar energy using both a Renewable Energy Credit Program and a Community Solar Program. The Company contracted for the output of a 20 megawatt solar generation facility in Lind, Washington in 2018.[5] Avista also purchases energy from customer-owned renewable power projects including the Spokane Waste-to-Energy plant and the Spokane County Digester.[6] A notable strength of Avista's generation portfolio is the ability to fairly easily integrate intermittent renewable resources such as wind and solar, primarily due to the flexibility of the Company's hydro resources. Compared to the national average, Avista's "green energy"[7] production percentage is one of the highest in the nation, at nearly 61% compared to the national average of 17%,[8] and Avista's hydro generation is a dominant factor in that success.

The Company has a strong focus on producing sustainable, responsible, and environmentally friendly energy with its diverse range of resources, creating a portfolio flexible enough to meet baseload requirements, peaking capacity needs and system stability requirements. The Company has added new generating capacity to meet growing customer loads since the Company was founded and has worked to cost-effectively maintain and/or increase the capacity of their generating resources to maximize their efficiency and output. Avista believes that a diversified portfolio is the most cost-effective tool available to supply reliable energy to customers under a variety of conditions.[9] All of this requires a balancing act: managing consumer needs and preferences, the ability to meet varying load conditions, complying with system and regulatory requirements, and optimizing cost to customers are among the many requirements placed on the Company's generating resources and staff. Avista's diverse generation resource portfolio provides the means of achieving this balance while providing significant benefits: energy for customers, the flexibility required to maintain the integrity of the grid, the ability to integrate non-traditional, non-baseload resources such as solar or wind, and to provide opportunity to participate in the wholesale market on behalf of customers.

[4] "Rattlesnake Flat Wind Project to provide Renewable Energy to Avista Customers," Inland Northwest Partners, March 19, 2019, http://inwp.org/2019/03/20/rattlesnake-flat-wind-project-to-provide-renewable-energy-to-avista-customers/. This project offers up to 144 megawatts of peak capacity.
[5] Becky Kramer, "81,000 solar panels: Washington's largest solar farm planned near Lind," The Spokesman Review, April 8, 2018. http://www.spokesman.com/stories/2018/apr/08/81000-solar-panels-washingtons-largest-solar-farm-/
[6] For details about each of Avista's generating facilities, please see the Company's 2019 Generation Infrastructure Plan available on the Avenue under "Tools & Resources" then "Avista Infrastructure Plans" or in hardcopy by request.
[7] "Green Energy" does not include coal, nuclear, natural gas, petroleum, or other non-renewable generation sources.
[8] U.S. Energy Information Administration, 2019, https://www.eia.gov/tools/faqs/faq.php?id=92&t=4
[9] For a really interesting article about the value of generation diversity, please see: "The Value of US Power Supply Diversity," Global Energy Institute, July 2014, https://www.globalenergyinstitute.org/sites/default/files/USPowerSupplyDiversityStudy.pdf

Generation Capital Expenditures

Many factors go into determining which generating assets to add, upgrade, maintain, and utilize in a utility's generation portfolio. For example, when natural gas prices are low, new natural gas-fired plants may be more competitive than other projects, such as upgrading existing hydroelectric units. On the flip side, depending upon market conditions, the cost of building new generation may be more expensive than acquiring energy and services in the wholesale energy marketplace. However, this decision must be balanced with the risk associated with being dependent upon market prices versus have the "known" costs associated with a utility-owned resource. This dynamic heavily influences the Company's decisions related to investing in new generating resources or adding capacity to existing resources, as well as how to manage and maintain these key assets.

The changing demands on these units as they have migrated from simply producing energy to being needed for wholesale electric markets, grid support, integration of intermittent renewable resources, and operations that address stewardship activities have placed additional performance demands on power plants, resulting in maintenance requirements beyond traditional spending patterns and expectations and impacting investment decisions for power companies around the world, Avista included. The new requirements are demanding that these historical assets be used in ways beyond their original design, creating the need for additional maintenance and capital investments to allow them to remain operational, especially for the hydro system.[10] These needs are reflected in the upcoming five-year budget. Collectively these investments help Avista to effectively support grid reliability needs, meet regulatory and other mandatory obligations, replace equipment that is damaged, provide opportunities in the wholesale markets, address system performance and capacity issues, replace equipment that has failed, and renew infrastructure at the end of its useful life based on asset condition.

Avista's generation capital and maintenance programs are experiencing increasing pressures:

- Aged equipment requires increasing investment in maintenance to maintain reliability.
- Increasing competition for dollars within the Company.
- Pressure to do more with less. Reduced funding which decreases the depth and frequency of routine maintenance and can provoke postponing major maintenance, putting units at risk of failure.
- Decreases in manpower which shrinks the number of people available to perform work and requires more capability for automated operation (and associated infrastructure).
- Increasing regulatory requirements (primarily federal) prompting increasing costs.
- Constantly changing technology. Equipment must be upgraded or replaced when old technology becomes ineffective and/or is no longer supported. "Old-time" businesses like utilities can be slow to accept automation and technology.
- Changing requirements due to market pressures, requiring updates in controls and technologies to allow participation in these markets (per regulatory requirements).
- Aging workforce threatening the loss of decades of accumulated knowledge and experience.

[10] As mentioned, generation units provide critical support to grid stability. Hydropower is considered "the Guardian of the Grid," as this resource readily provides energy, capacity, and ancillary services such as voltage and reactive support. It is highly flexible and complimentary to other types of generation and its quick response to changing conditions makes it invaluable in meeting the ever-changing needs of the interconnected system. For more information, please see Electric Research Power Institute, "Quantifying the Value of Hydropower in the Electric Grid: Final Report," https://www1.eere.energy.gov/wind/pdfs/epri_value_hydropower_electric_grid.pdf. Also: N. Kumar, P. Besuner, Et al., National Renewable Energy Laboratory, "Power Plant Cycling Costs," April 2012, https://www.nrel.gov/docs/fy12osti/55433.pdf

Each year Avista makes investment decisions for its generating facilities with the goals of maximizing the value of limited funding and other resources while managing competing requirements and aligning with Company goals and objectives. A variety of projects are proposed for each budget cycle with varying characteristics. The Generation group utilizes a formalized process known as the Scheduling, Cost, and Resource Utilization Meeting or "SCRUM" to develop capital project requests. In these quarterly meetings, generation leaders and stakeholders discuss criticality, risks, costs, mandatory requirements, resource requirements, alternatives, and options in order to select and prioritize projects that are within Generation's allocated budget and that make best use of the funds they are given. If a project is approved, a more accurate cost and time estimate is developed, and once a proposed project is finalized, it is sent to the Capital Planning Group for further consideration.

SCRUM Meeting Participants

- Thermal Operations
- Hydro Operations
- Hydro Operations & Management
- Project Maintenance & Construction
- Project Delivery
- Electrical Engineering
- Controls Engineering
- Civil Engineering
- Mechanical Engineering
- Maximo Team

The Capital Planning Group (CPG) is a group of Avista Directors that represent capital intensive areas of the Company. Committee members are directors from a variety of business units to add a depth of perspective, though their role is to consider capital decisions from the perspective of overall Company operations and strategic goals as well as spending guidance set by senior management and approved by the Finance Committee of the Board of Directors. They develop a final budget that represents a reasonable balance among competing needs and business units in order to maintain the performance of Avista's systems, as well as provide prudent management of the overall enterprise in the best interest of shareowners and customers.

Investment strategies and decisions will need to continue to evolve in order to match the demands placed upon these traditional assets in the future energy space. Challenges that the generation business will face in the next ten years will likely be quite different than what we can imagine today as different energy storage technologies evolve and new energy producing technologies are added. Thus investment decisions for these existing assets must not only address the issues we face today, but anticipate the needs of the future in order for Avista to continue to provide its customers with competitive energy resources. Approved projects for Generation during the current budget cycle are discussed below.

Classification of Infrastructure Need by Investment Drivers

As a way to create more clarity around the particular needs being addressed with each capital investment as well as simplifying the organization and understanding of Avista's overall project plans, the Company has organized all capital infrastructure investments by the classification of need or

"Investment Driver." The investments associated with each investment driver are briefly defined below.

- ***Customer Requested*** – This category is primarily related to connecting new distribution customers or large transmission-direct customers and is generally not applicable to Generation, as the Company is responsible for determining the contents of its resource portfolio; this is not driven by customer requests. If a project is budgeted in this category for Generation, it may include requests by customer groups for resource enhancements such as improved fisheries, new recreational opportunities, etc. In the current budget cycle, there are no Generation projects planned in this category.

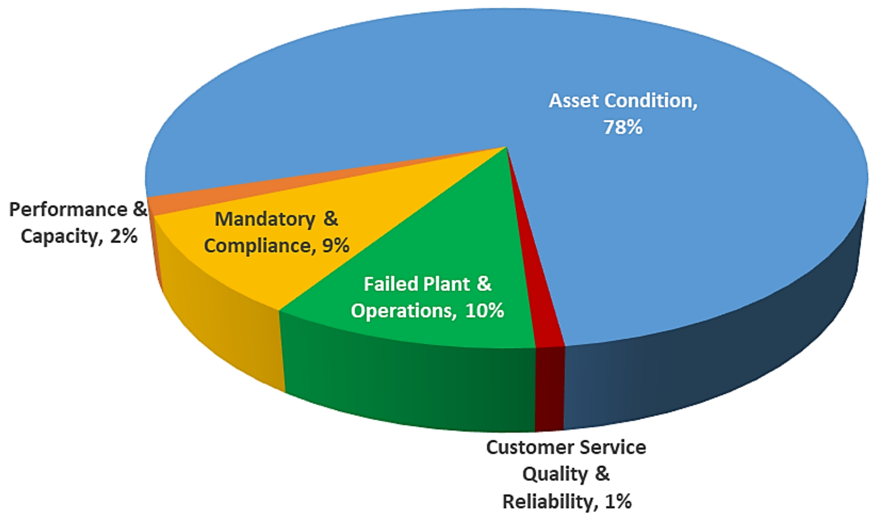


Figure 2. Total Planned Capital Expenditures by Investment Driver 2020 – 2024

- ***Mandatory & Compliance*** – The Company makes many of its business decisions as a direct result of compliance with laws, regulations and agreements, including projects related to dam safety upgrades, public safety, air and water quality, equipment essential to legally operating within the interconnected grid, etc. These expenditures are compelled by regulation or contract and are largely beyond the control of the Company. During this budget cycle this category includes FERC required work to stabilize the Long Lake Power Plant and reinforcing or removing the old penstock at Monroe Street.

- ***Failed Plant & Operations*** – At times assets will fail unexpectedly due to damage or an accident or will wear out earlier than expected, but this category also accounts for equipment that requires periodic replacement. Generating assets comprise large, massive rotating equipment and support machinery with different life expectancies and different maintenance needs than traditional transmission and distribution utility assets. Sudden mechanical failures or electrical insulation breakdowns are typical expenditures in this category. During this budget cycle a large expenditure is required to replace a failed transformer at Coyote Springs, described in more detail below.

- ***Asset Condition*** – All assets have a functional service life defined by age, obsolescence, and degradation of the asset. This category provides funding to replace assets or portions of assets as needed. This may include replacing parts as they wear out or when items can no longer meet their required purpose, as systems become obsolete and replacement parts are no longer available, if safety or environmental issues are identified, if equipment must be upgraded to continue to provide service, or if the condition of an asset is such that it is no longer optimizing its own performance or customer value. Some parts are so critical to the operation of a plant that they cannot be allowed to fail. When these items reach an age when they are close to or at the end of their useful life, the Company preventively replaces them to maintain reliability and acceptable levels of service. Asset Condition is a major spending category for Generation (as shown in Figure 2), as they are managing many assets that are over 100 years old. It is a continuous process to replace or overhaul old equipment, bring assets up to current codes and standards, and upgrade items that are no longer performing to necessary levels. The Generation team has 34 asset condition related projects in the upcoming budget cycle.

- ***Customer Service Quality & Reliability*** – This category is set aside for expenses relating to meeting customer expectations for quality of service as well as increasing the reliability of operating assets. Typical expenses the Company would see in this category include distribution feeder automation which allows isolating the sections of a line so customers not directly impacted by a faulted section can maintain their service. For Generation, investments in this category are considered with a different filter and primarily include expenditures such as deployment of automation equipment or monitoring and control systems that allow generating units to respond to changing system conditions and to help maintain the reliability of the grid and uninterrupted service to customers.

- ***Performance & Capacity*** – Programs in this category help ensure that the Company's assets satisfy business needs and meet performance standards. This may include upgrading systems and controls to improve accuracy, enhancing equipment to increase or ensure production levels, and contractual work on plants co-owned with others that require routine replacement of parts to maintain service levels. Avista has traditionally invested in cost effective capacity increases within its existing fleet of generating assets over time. In the past 25 years, more than 100 megawatts of new and cost-effective capacity and energy has been created through upgrade programs on these facilities. This category is also heavily impacted by the way generating resources support the interconnected grid and by Avista's participation in the regional wholesale energy market. For example, in order to participate in regional energy markets, utilities must have software and controls in place to ensure that every transaction is closely monitored and tracked. These types of expenditures fall under this category.

Business Driver	2020	2021	2022	2023	2024	5-Year Total	5-Year Average
Mandatory & Compliance	$880,000	$1,605,000	$13,010,000	$11,300,000	$0	$26,795,000	$5,359,000
Failed Plant & Operations	$9,371,680	$7,240,000	$4,840,000	$3,600,000	$3,600,000	$28,651,680	$5,730,336
Asset Condition	$38,455,125	$43,423,675	$35,803,738	$45,651,000	$55,649,000	$218,982,538	$43,796,508
Customer Service Quality & Reliability	$585,000	$585,000	$585,000	$650,000	$650,000	$3,055,000	$611,000
Performance & Capacity	$2,160,000	$1,080,000	$250,000	$0	$1,300,000	$4,790,000	$958,000
Total	*$51,451,805*	*$53,933,675*	*$54,488,738*	*$61,201,000*	*$61,199,000*	*$282,274,218*	*$56,454,844*

Table 1. Avista's Planned Generation Capital Expenditures 2020-2024

All Avista's capital expenditures can be characterized by one of these drivers, though not all the investment driver categories are represented for each asset class. For example, electric distribution investments utilize all six categories; however, investments planned for Generation during the upcoming five-year planning cycle do not include any projects in the category of Customer Requested. This is not unexpected, as customers do not request that Avista build power plants. Also note that not all the investment drivers will be used in all Avista's primary asset categories in every budgeting cycle, yet they remain an efficient and effective way of categorizing expenditures in a clear and transparent fashion that promotes better understanding of how the Company makes business decisions.

Also, due to the time horizon over which the Company must budget its infrastructure investments, there may be changes in the actual projects funded, program budgets, and implementation timing. Such changes may be due to changes in project scope, changing material or resource costs, or a more refined estimate based on where the project is in its development planning. External factors such as new regulatory or legislative requirements also drive changes in the plan and budget. Budgets are continually evaluated and reevaluated to take these factors into consideration.

Overview of Planned Capital Investments 2020 – 2024

Over the next five-year planning horizon, Avista expects to spend about $282 million in capital investments for its generating facilities, allocated across the capital budget investment drivers described earlier. Major projects include upgrading the Long Lake dam to allow it to meet minimum safety requirements for stability during maximum flood conditions, replacing the generators, turbines and governors at the 1906 Post Falls plant, and changing out all of the intake gates, station service, and control systems at Cabinet Gorge. A general description of the capital projects under each business driver is provided below.

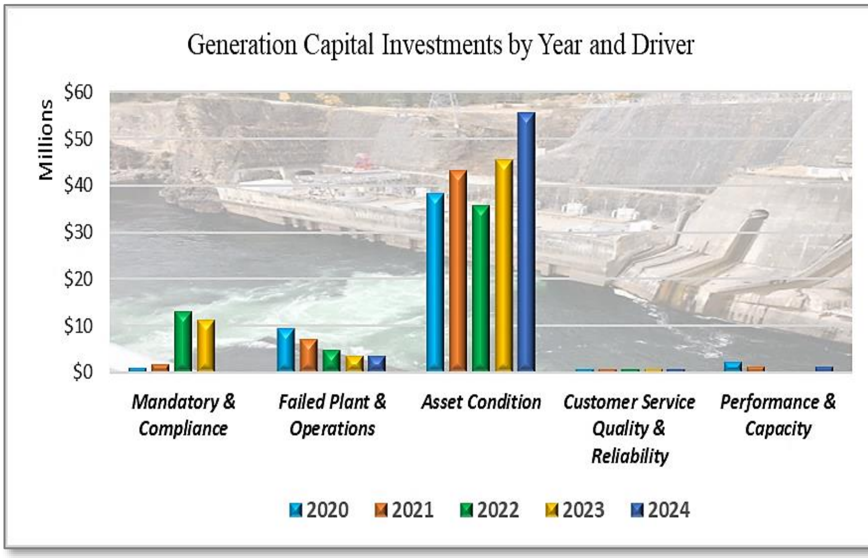


Figure 3. Avista Total Capital Expenditures by Investment Driver

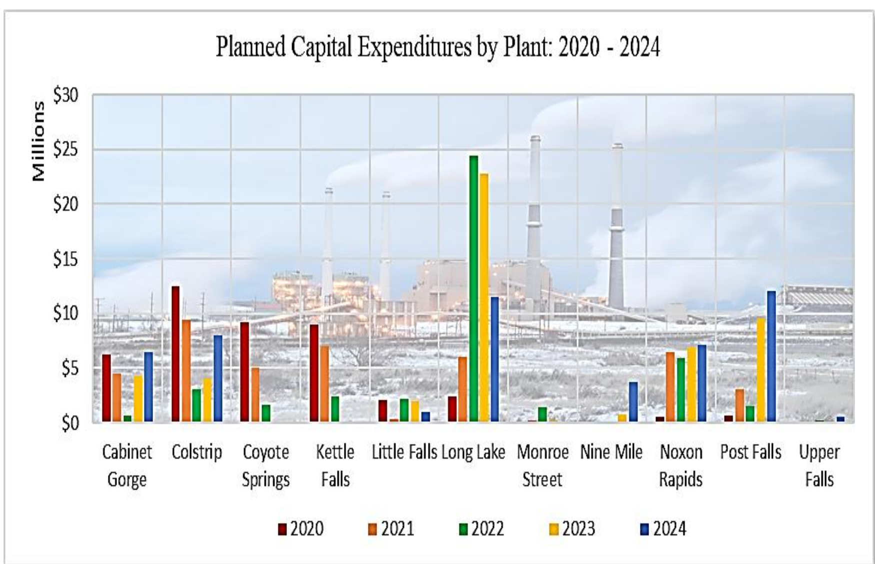


Figure 4. Avista Total Capital Expenditures by Plant

Mandatory & Compliance

Long Lake Dam erosion

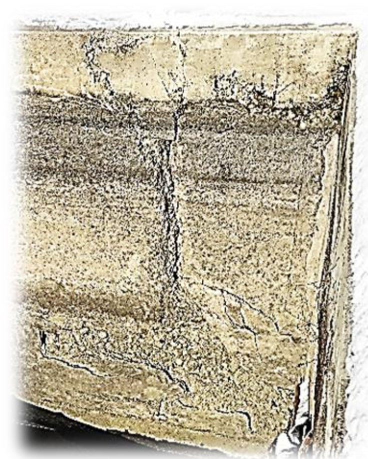
Avista's Generation fleet is impacted by a variety of federal, regional, state, and local regulations and requirements. Environmental and safety requirements also play a major role in this spending category, which includes investments driven typically by compliance with laws, rules, and contract requirements that are external to the Company. In 1977, the Federal Government, through the Federal Energy Regulatory Commission (FERC), became the main regulatory body related to hydro generation. FERC is responsible for licensing new projects, relicensing existing projects when their licenses expire, overseeing existing projects, ensuring dam safety, and administering environmental compliance.[11] Avista has six projects on the Spokane River. Five of these projects[12] operate under a single 50-year FERC license, which plays a major role in any mitigation activities at the plants. Cabinet Gorge and Noxon Rapids on the Clark Fork River are also regulated by FERC. In addition, Avista is regulated by state, local, and tribal authorities in some instances. Over the next five-year budget cycle, Avista has two projects in this investment driver. One requires adding stability to Long Lake dam. The other stabilizes the old penstock at the Monroe Street project.

Mandatory & Compliance	2020	2021	2022	2023	2024	5-Year Total	5-Year Average
Long Lake Stability Enhancement	$880,000	$1,455,000	$12,260,000	$11,300,000	$0	$25,895,000	$5,179,000
Monroe Street Abandoned Penstock Stabilization	$0	$150,000	$750,000	$0	$0	$900,000	$180,000
Total	*$880,000*	*$1,605,000*	*$13,010,000*	*$11,300,000*	*$0*	*$26,795,000*	*$5,359,000*

Table 2. Mandatory & Compliance Capital Expenditures 2020-2024

Long Lake Stability Enhancement

During a FERC annual inspection, the inspector noticed a seeping joint in an airshaft and requested that Avista evaluate the stability of the intake and spillway dams including evaluating all loading conditions the dams may experience including full-pool (normal) operations, probable maximum flood, and seismic conditions. The analysis revealed that Long Lake dam does not meet meet minimum safety requirements for stability during probable maximum flood, full pool, or post-earthquake loading conditions. FERC requires mitigation to address these issues. In response, the Company will add additional anchoring to the bedrock of the dam as well as concrete mass to the dam structure itself for stabilization.

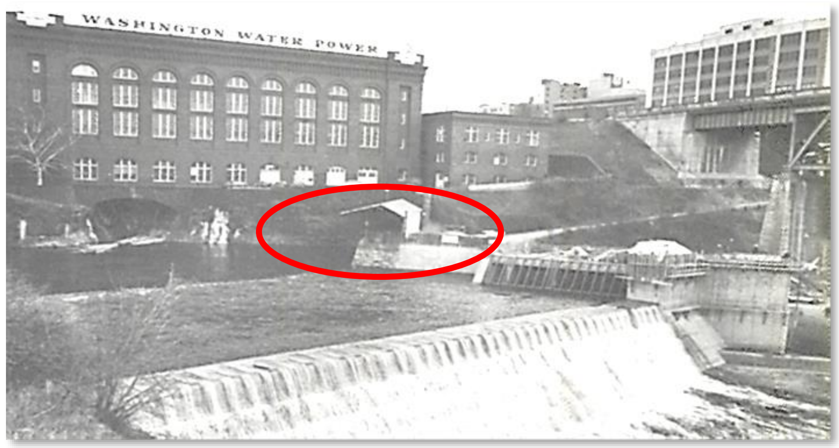


Long Lake Dam cracks

[11] This includes wildlife management programs, fishery management programs, recreational facilities, and water quality.
[12] Five of the Spokane River Projects: Long Lake, Nine Mile, Monroe Street, Upper Falls, and Post Falls, operate under a single license; Little Falls is operated under separate authority from the U.S. Congress and an agreement with the Spokane Tribe (due to the year it was built).

Construction began in 2019 and should take approximately two years to complete. This project will also include changes in spillway configurations to reduce dissolved gasses downstream, improving water quality for fish habitat.

Monroe Street Abandoned Penstock Stabilization



Monroe Street intake when built in 1972

The Monroe Street Powerhouse was built in 1890 and has undergone several modernizations over the last 130 years. During the 1972 project, a new turbine intake and penstock arrangement was installed. Though no clear records exist from that time period regarding this project, it is believed that the three original penstock intakes were plugged with concrete and sealed. These old penstocks have deteriorated to the point that they are leaking groundwater into the powerhouse and underground electrical cable vaults as well as causing flooding in Huntington Park. A thorough assessment identified these old penstocks as high risk due to their location below a public park, unknown physical condition, and the increased amount of flooding that has been observed. There is fear that these old penstocks could collapse due to deterioration and/or the weight of the heavy equipment that traverses them due to renovations at the park and on the Monroe Street generating station. The Company will address this safety situation by locating the old penstocks and stabilizing or removing them. At the same time, a thorough examination of the condition of the original intake dam will take place to validate that it is also stable and safe, as there is a concern that the river could be undercutting the original rock and mortar foundation. All issues found for both the penstocks and the intake will be remedied under this business case.

Failed Plant & Operations

This ongoing category provides for the timely restoration of the Company's facilities and equipment due to unexpected damage or failure. Assets fail over time, especially when they are assets of the age of some of Avista's generating equipment. This high-value equipment requires maintenance, replacement of parts that fail or wear out, and installing or replacing critical components in order to allow for continued functional and reliable operation. Funds in this category ensure that equipment can be repaired and back online as quickly as possible to continue providing reliable service. In the upcoming budget period, Generation has three primary projects in this category, described below.

Failed Plant & Operations	2020	2021	2022	2023	2024	5-Year Total	5-Year Average
Base Load Thermal Program	$2,042,280	$2,790,000	$2,790,000	$3,100,000	$3,100,000	$13,822,280	$2,764,456
Coyote Springs 2 Single Phase Transformer	$7,000,000	$4,000,000	$1,600,000	$0	$0	$12,600,000	$2,520,000
Peaking Generation Business Case	$329,400	$450,000	$450,000	$500,000	$500,000	$2,229,400	$445,880
Total	*$9,371,680*	*$7,240,000*	*$4,840,000*	*$3,600,000*	*$3,600,000*	*$28,651,680*	*$5,730,336*

Table 3. Failed Plant & Operations Capital Expenditures 2020-2024

Base Load Thermal Program

Baseload resources provide a constant level of generation, usually at a lower cost compared to units used for peaking. These plants are designed to run at the same output level for long periods of time year-round except when undergoing maintenance or experiencing a forced outage. They are typically less expensive to operate than other generators once they are running, but some require expensive or long startup and ramp down times, which makes them best suited to meet the constant baseload of electricity need. Because of the changing system demands, these baseload assets are increasingly being required to operate at more variable outputs. Operating them at variable levels in order to meet changing load conditions increases the wear on the equipment and can cause challenges in meeting emission requirements or in maintaining operational limits. The Company's baseload thermal plants are the wood biomass facility at Kettle Falls and natural gas-fired Coyote Springs 2 generating station.

In the next budget cycle work in the Baseload Thermal Program includes:

- *Kettle Falls*: Replace the furnace grate drive system that moves the burned fuel from the boiler to the ash disposal system. Exchange the forced draft fan motor that blows the wood waste into the boiler where it is burned. The diesel fueling system will be improved to provide additional containment and better onsite fuel handling. The turbine/generator fire system will also be replaced.
- *Coyote Springs 2*: Replace the system that controls the steam temperature in the boiler, upgrade the medium pressure steam control valves, upgrade the NOx emissions monitoring system, and improve site security.

Coyote Springs 2 Single Phase Transformer

Coyote Springs 2 spare transformer being moved into place

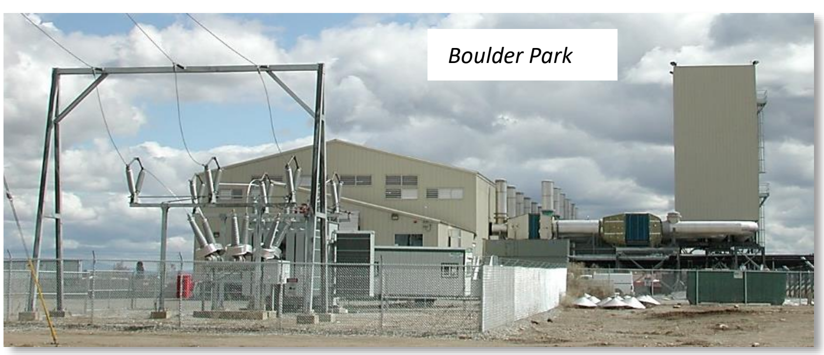
Coyote Springs 2 currently uses a three-phase transformer (GSU) to connect the generator to the grid. The original transformer and subsequent three phase replacements have experienced seven failures between the installation of the first GSU in 2002 and when it suffered a final, catastrophic failure in 2018. The site spare transformer was placed in service at that time, but it is experiencing increasing levels of combustible gases and has been subsequently limited to 90% capacity. There is no other spare available if this unit fails. Because of the unique voltage connections and capacity requirements, these types of transformers must be custom ordered, built to individual specifications, and can take up to 18 months to receive. Should a GSU failure occur, the plant will be out of service for that time. The average daily cost in lost power for an outage at Coyote Springs is $18,774, meaning an 18-month outage would cost the Company in the range of $10.2 million in lost generation. After analyzing this cost and the current risk of failure, it was determined that the Company would purchase four single-phase transformers that are smaller, easier to transport, and have additional electrical clearances (which is believed to be one of the issues causing the failures). Three of these four new units will be connected, with the fourth to provide redundancy in case one of them fails. These new units will also provide higher capacity, increased safety, and be built with new high efficiency technology. Though this project will cost approximately $15 million, it should more than pay for itself in increased reliability and certainty of plant availability, decreased maintenance costs, and a significant reduction in the risk of losing generation and associated revenues.

Peaking Generation Business Case

As mentioned earlier, the Company has three primary natural gas peaking facilities.[13] These plants must provide rapid start capability to meet changing load conditions. Their reliability allows the Company to meet these changes, especially during critical load periods. As would be expected, these plants require regular maintenance and replacement of parts as they wear out and, in addition, are subject to stringent environmental and regulatory compliance. In order to meet all these obligations, the Company is embarking on a several projects related to these peaking units:

Rathdrum turbine inspection

- *Boulder Park*: The air emissions system controller must be replaced. In addition, the air compressors used to start the engines have worn out and need to be exchanged.
- *Northeast Combustion Turbine*: The plant's current antiquated sewage management system has environmental and regulatory issues and will be replaced, and a new sewage holding tank will be built. The air compressors used to start the turbine must also be replaced.



Boulder Park

- *Rathdrum*: The current fire extinguishing system needs to be modernized and the emissions control and monitoring system must be updated.

[13] The Kettle Falls CT is used for peaking, but it provides only 7.5 megawatts, so is not a primary peaking plant.

Asset Condition

Above: Cabinet Gorge Unit #1 headgate issues

Left: Post Falls Powerhouse wall deterioration

Bottom: Nine Mile

This is by far the primary investment driver in Generation, and that is true across the utility industry in general. According to an Ernst & Young study, "The utilities sector is at a precipice. By some estimates, 60% of the electric grid assets will need replacement in this decade. The timing of these requirements could not be worse: demand and use are flat, and regulators are more strongly scrutinizing, or flat out denying, rate case increases. Critical utility assets are reaching or have already exceeded their useful lives. A robust reliability-centered maintenance program can delay or slow corrosion, but at some point, these assets will fail…basic logistics means it may take anywhere from 10 to 20 years to replace these aging assets."[14] Avista's Generation group is facing these very real issues. Most of Avista's generation assets are decades old and provide nearly continuous service, so are subjected to a great deal of wear and tear. Generation's Asset Condition budget includes programs to address these issues head-on: rebuilds related to aging or end-of-life assets, remedying ancillary equipment failure, and upgrades related to design, safety, reliability or other regulatory standards. While still functional, some systems at Avista's power plants are so outdated that they are no longer supported, and replacement parts are no longer available.

In addition, increasing amounts of technological equipment is being required by NERC Standards related to the reliability of the electric grid, making even functioning older equipment unable to meet the requirements needed today. Additionally, FERC dam inspection safety requirements continue to evolve posing challenges to assure safety of the structures and safety for the public. These additional issues put even more pressure on an already constrained budget. Funding categories in the Asset Condition driver are shown in Table 4 and briefly described in the text below.

[14] Ernst & Young, "Power & Utilities: 5 Insights for Executives," 2013, https://www.ey.com/Publication/vwLUAssets/EY-Living_on_borrowed_time/$FILE/EY-5-Insights_protect_PU_Utilities-Risk.pdf

Asset Condition	2020	2021	2022	2023	2024	5-Year Total	5-Year Average
Base Load Hydro	$756,960	$1,034,100	$1,034,100	$1,149,000	$1,149,000	$5,123,160	$1,024,632
Cabinet Gorge Automation	$500,000	$0	$0	$0	$0	$500,000	$100,000
Cabinet Gorge Control Room Replacement	$0	$0	$0	$160,000	$1,235,000	$1,395,000	$279,000
Cabinet Gorge Gantry Crane Runway Modernization	$500,000	$0	$0	$0	$0	$500,000	$100,000
Cabinet Gorge HVAC Replacement	$0	$0	$0	$550,000	$0	$550,000	$110,000
Cabinet Gorge Spillgate Replacement	$0	$0	$0	$1,000,000	$2,500,000	$3,500,000	$700,000
Cabinet Gorge Station Service	$2,800,000	$750,000	$500,000	$0	$0	$4,050,000	$810,000
Cabinet Gorge Stop Log Replacement	$0	$1,000,000	$0	$0	$0	$1,000,000	$200,000
Cabinet Gorge Unit 1 Governor Upgrade	$0	$0	$0	$560,000	$0	$560,000	$112,000
Cabinet Gorge Unit 2 Field Pole Refurbishment	$0	$0	$0	$0	$1,500,000	$1,500,000	$300,000
Cabinet Gorge Unit 3 Protection & Control Upgrade	$1,800,000	$750,000	$0	$0	$0	$2,550,000	$510,000
Cabinet Gorge Unit 4 Protection & Control Upgrade	$600,000	$2,000,000	$0	$0	$0	$2,600,000	$520,000
Cabinet Gorge Warehouse Replacement	$0	$0	$130,000	$2,025,000	$0	$2,155,000	$431,000
Colstrip 3&4 Capital Projects	$12,500,000	$9,400,000	$3,034,000	$4,000,000	$8,000,000	$36,934,000	$7,386,800
Generation DC Supplied System Update	$840,000	$840,000	$900,000	$840,000	$900,000	$4,320,000	$864,000
Generation Masonry Building Rehabilitation	$0	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$4,000,000	$800,000
HMI Control Software	$2,230,625	$1,961,875	$1,195,938	$0	$0	$5,388,438	$1,077,688
Kettle Falls Fuel Yard Equipment Replacement	$9,000,000	$7,000,000	$2,400,000	$0	$0	$18,400,000	$3,680,000
Little Falls Intake Gate Replacement	$0	$300,000	$2,200,000	$2,000,000	$0	$4,500,000	$900,000
Little Falls Plant Upgrade	$2,100,000	$0	$0	$0	$0	$2,100,000	$420,000
Little Falls Spillway Flashboard Replacement	$0	$0	$0	$0	$1,000,000	$1,000,000	$200,000
Long Lake Plant Upgrade	$1,500,000	$4,500,000	$11,500,000	$11,500,000	$11,500,000	$40,500,000	$8,100,000
Long Lake Replace Plant Emergency Generator	$0	$75,000	$650,000	$0	$0	$725,000	$145,000
Monroe Street Generator Excitation Replacement	$0	$93,000	$650,000	$182,000	$0	$925,000	$185,000
Nine Mile Powerhouse Crane Rehab	$0	$0	$0	$750,000	$750,000	$1,500,000	$300,000
Nine Mile Unit 3 Mechanical Overhaul	$0	$0	$0	$0	$2,000,000	$2,000,000	$400,000
Nine Mile Units 3 & 4 Control Upgrade	$0	$0	$0	$0	$1,000,000	$1,000,000	$200,000
Noxon Rapids Generator Step-Up Bank C Replacement	$0	$0	$0	$1,005,000	$2,406,000	$3,411,000	$682,200
Noxon Rapids Spillgate Refurbishment	$500,000	$6,430,000	$5,930,000	$5,930,000	$4,759,000	$23,549,000	$4,709,800
Post Falls Redevelopment Program	$0	$0	$0	$0	$2,000,000	$2,000,000	$400,000
Post Falls Landing and Crane Pad Development	$190,000	$3,110,000	$0	$0	$0	$3,300,000	$660,000
Post Falls North Channel Spillway Rehabilitation	$500,000	$0	$1,500,000	$9,500,000	$10,000,000	$21,500,000	$4,300,000
Regulating Hydro	$2,137,540	$3,179,700	$3,179,700	$3,500,000	$3,500,000	$15,496,940	$3,099,388
Upper Falls Trash Rake Replacement	$0	$0	$0	$0	$450,000	$450,000	$90,000
Total	*$38,455,125*	*$43,423,675*	*$35,803,738*	*$45,651,000*	*$55,649,000*	*$218,982,538*	*$43,796,508*

Table 4. Asset Condition Capital Expenditures 2020-2024

Baseload Hydro

Avista's baseload hydro projects are run-of-river plants without the ability to ramp up or down to meet changing load conditions due to FERC license and state water permit regulations. While limited in their flexibility to changing loads, they are still required to meet NERC reliability requirements in terms of frequency response and voltage support. All four: Post Falls, Upper Falls, Monroe Street, and Nine Mile Falls, are located on the Spokane River. Projects in the Baseload Hydro category are typically small capital outlays, short in duration, and reactionary to plant operations issues. These are four of Avista's oldest power plants, so existing machinery and systems periodically fail and must be replaced to keep the plants in service. The amount budgeted in this category is based on historical actuals and designed to be conservative while providing the flexibility in covering these expenses as they come up. Examples of Baseload Hydro expenditures in the past have included expenses related to replacing failed spillway gate controls, projects to drain or divert water away from critical structures, installing security cameras, and safety features such as handrails and boater warning systems.

Cabinet Gorge Automation

Cabinet Gorge was designed to be a baseload plant. Today it is called upon as a primary baseload generating resource when stream flows are high but also to quickly change output levels in response to the variability of wind and solar generation, to adjust instantaneously to changing customer loads, and to provide grid regulating and stability services such as frequency and voltage fluctuation response. The existing equipment at the plant was not designed for these additional responsibilities, leading to times when the plant has not responded to system frequency events as needed due to the older equipment. In addition, the age of the equipment and the extra burdens placed upon it due to the changing operations has caused an increasing number of outages and failures. This equipment must be replaced and upgraded to the technology needed to provide the service now required of this plant. In order to deliver adequate unit response, operating flexibility and system/grid reliability, the Company will install new speed controllers (governors), automatic voltage control equipment, primary unit controls, and protective relay systems. This will require an extended outage, which provides time to address other issues without further impacting plant output, such as insulating the generator housing roof, upgrading the cooling water system, and adding ancillary equipment such as unit flow meters.

Cabinet Unit #1 governor

Cabinet Gorge Station Service

Cabinet Gorge Control Room Replacement

The existing control room at Cabinet is in the center of the power plant. It has windows that look out to the old control panels (no longer used) and doubles as the plant's conference and break room. It was built over 60 years ago. The Company plans to reconfigure the existing space to allow for a modern control room with new controls, monitoring equipment, additional computers, and adequate security measures as well as addressing the human needs for training, meeting, and breakroom space.

Cabinet Gorge Gantry Crane Runway Modernization

A gantry crane is one of the most critical components in a power plant. It is built on a giant steel frame with a beam (or beams) across the top to support the load it carries on a runway (rails) underneath the main structure. Gantry cranes are especially useful for their mobility, lifting capacity, and versatility and can easily move extremely heavy equipment such as large transformers, turbines, or generators safely from place to place and at various heights. In 2019 the Cabinet Gorge gantry crane was rehabilitated to increase its lifting capacity from 275 to 340 tons in order to handle additional needs at the plant. Unfortunately, as shown in the photo above, the runway was already in desperate need of repair and cannot handle the additional weight. The concrete supporting the rails is cracking and failing and the rails themselves must be strengthened.

Above: Cabinet gantry crane runway degradation
Below: Gantry Crane and runway

Cabinet Gorge HVAC Replacement

The current Cabinet Gorge powerhouse ventilation system is original to the plant, built in 1952. It must be operated manually since the original controls failed. It has no cooling capacity, meaning that summer temperatures within the plant frequently exceed 90° F, which will be made worse when additional power plant unit upgrades take place over the next few years. During the upgrades, more transformers and rectifiers will be added, increasing the heat level within the powerhouse. This heat can lead to overheating of powerhouse equipment such as motors and pumps. Air quality is also a pressing concern, as there is no air filtration system in place. During fire seasons, smoke can be seen in the operator work areas. Generation’s approach to this issue is careful and measured, starting with a study to determine what existing equipment can be reconfigured rather than replaced, and where new HVAC equipment may be necessary based on the new heat source equipment locations. This approach allows them to maximize the value of a new system and ensure that it provides adequate heating and cooling into the future, protecting both valuable employees and critical equipment.

Cabinet Gorge Spillgate Replacement

Above: Corrosion on Cabinet Gorge Spillgate #8
Left: Spillgates are subjected to a lot of different damaging factors, including river debris (Spillgate #6)

Spillgates control the flow of water over the dam when the water in the river exceeds the capability of what can pass through the turbines. Spillgates protect the dam during high flows or if the plant (or units at the plant) trip offline. They allow a controlled release of the water versus overtopping the dam. The spillgates at Cabinet are original to the dam, over 60 years old. They are missing rivets, bent, have worn out seals (some do not seal at all), and heavy amounts of corrosion. Though they have been maintained, they have been exposed to significant water pressure and the resulting decomposition for decades and have degraded to the point that they must be replaced for the safety of the dam, employees, and the public. Avista plans to replace each of the eight spillgates with a new welded design that should provide superior fit and operation. The new gates will allow for the more continuous operation of the gates as required by Cabinet's role in ramping to meet load and to integrate renewable resources, and in meeting grid stability and voltage control requirements.

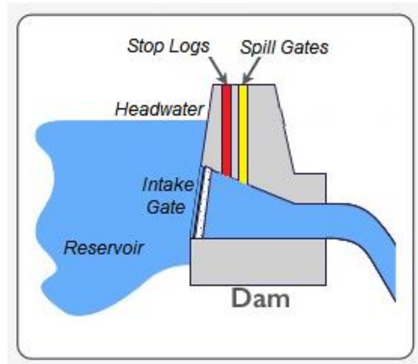
Cabinet Gorge Station Service

Cabinet's station service is located behind that spray

All generating plants require electricity in order to operate equipment at the plant such as the lights, computers, monitoring equipment, pumps, compressors and other motors, as well battery chargers for DC systems. This electricity is provided by a power distribution system called station service, which can draw power from a generating unit at the plant or from the grid if the entire plant goes offline (station service can then be used to restart the units). The Cabinet Gorge station service system was built in 1951 and has been well used as well as being subjected to extremely wet conditions since that time. As shown in the photo above, when water flows are high and especially when the plant is spilling, these components are drenched. Plant electricity needs have greatly increased since the plant was built and the station service designed and installed, and the accompanying 26-year-old emergency generator has the same issue. The current station service transformers no longer have the capacity to provide the needed redundancy of the load currently demanded of Cabinet and are subject to overloading. The current Motor Control Center[15] lacks monitoring and does not provide adequate visibility into how the station service is performing.

These aged components have the potential to trigger load shedding, generator unit trips, and/or plant-wide forced outages. At the same time, this equipment has a very long manufacturing lead time, sometimes several months. This means that a simple switchgear or power cable failure could, for example, create a lengthy and expensive outage at the plant.[16] This risk will be mitigated when the Company updates, upgrades and/or replaces station service components to bring Cabinet's station service up to adequate functionality.

Cabinet Gorge Stop Log Replacement



This project is related to the Cabinet Gorge Spillgate Replacement Program. Stop logs are welded steel beams with a rubber seal at the bottom, placed on top of each other into premade slots or guides on the top of the dam to form a wall. These sections are manually placed with cranes rather than by automated hoist systems. The primary purpose of stoplogs is to provide a barrier in front of spillgates so the spillgates can be maintained or replaced. Stop logs are required to control the reservoir while the old spillgates at Cabinet are removed and the new ones put in place. Without them, it is not possible to replace the old spillgates. After the spillgates are replaced, the stoplogs will continue to perform service as a barrier to the reservoir when the spillgates undergo inspection or maintenance.

Cabinet Gorge Unit 1 Governor Upgrade

All the governors at Avista are being or have been upgraded to programmable logic controller (PLC) that uses an open architecture platform which can be modified in the future as operations require. The governor is the main controller of the turbine, ensuring that the generator spins at the correct speed. The governor is constantly monitoring the frequency on the interconnected grid, automatically sensing increased, decreased, or no load, and adjusting the speed of the unit to compensate for human usage and other variabilities. The PLC is a computer-based system that controls the automated functions of the governor, making it easier to manage, control and react quickly to

Cabinet Gorge Unit 1 governor

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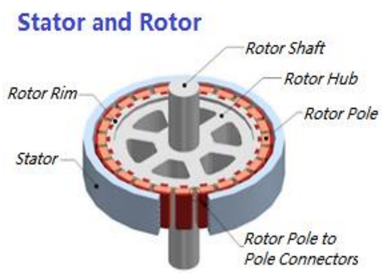
15 All motors must be controlled, and in a situation that uses many motors like a generating station, it is highly beneficial to monitor and control all of these motors from one location. That central location is called the Motor Control Center.

16 An outage at Cabinet is estimated to cost between $5,000 and $9,000 per day, depending on which unit is out of service. This is based on historic market prices.

changing system conditions and operating scenarios. Cabinet Gorge Unit 1 is the last of Avista's hydro units to be upgraded to this technology.

Cabinet Gorge Unit 2 Field Pole Refurbishment

A generator is comprised of a stator (the stationary part) and a rotor that spins inside the stator to create electricity. The poles are a part of creating the magnetic field that allows this to happen. The field poles at Cabinet are original equipment from 1952. The generators were upgraded in the early 2000s, but the field poles were not changed, so the current insulating rating of the poles no longer matches the insulating rating of the generator stator. This results in the poles experiencing higher operating temperatures than their insulating rating, decreasing the expected life of the generator and putting its reliability at risk. The Company plans to refurbish the poles, rewind[17] the generator, and install new monitoring equipment to protect these valuable assets. Interestingly, this work was delayed waiting until the plant's gantry crane lifting capacity was increased to allow it to pull the unit, as mentioned in the Cabinet Gorge Gantry Crane Runway Modernization business case above.



Cabinet Gorge rotor being pulled for maintenance

Cabinet Gorge Unit 3 & 4 Protection & Control Upgrade

Two distinct business cases (for units 3 and 4) are combined in this description because they are intended to accomplish the same thing. As mentioned earlier, Cabinet Gorge was designed for baseload operation, but is now required to quickly change output levels to accommodate changing customer loads, variable output of renewable resources, and to provide frequency, voltage support and other regulating services for the grid. Controls to adjust output and voltage levels are required to allow the plant to automatically and instantly react as needed. Protective relay systems will also be added to detect a fault or system disturbance and trip a circuit breaker to protect the generating units.

[17] The rotor's outer surface is covered with electromagnets. The stator's inner surface is made up of copper windings. When the rotor turns inside the stator, the magnetic field created by the electromagnets causes the electrons in the copper windings to move. Their movement generates the electric current. Thus, the winding is a critical component in producing electricity. These windings are coated with insulation which, over time, degrades and must be replaced. This replacement work is called performing a "rewind."

Cabinet Gorge Warehouse Replacement

Existing Cabinet Gorge warehouse

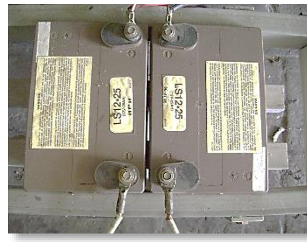
Cabinet Gorge has one small warehouse, a non-insulated steel building that was built about 70 years ago and is a legacy of the original construction project. There is not adequate space to store equipment, no restroom, no heating or cooling systems, and the building does not meet current fire, electrical and hazardous material codes, among many issues. This is especially problematic due to the difficult winters at Cabinet Gorge. The Company sees safety and weather risks with continuing to store expensive vehicles, key spare parts, and equipment outside or inside the powerhouse. There simply is not adequate space to serve the needs of the plant personnel today. Avista plans to replace the old warehouse with a larger building adequate to the plant's needs and which meets code specifications, and includes restrooms, a covered vehicle parking area, and a new fueling station which complies with environmental requirements.

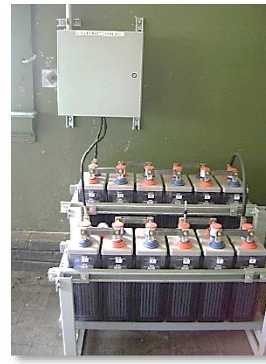
Colstrip 3 & 4 Capital Projects

Avista does not operate the Colstrip facility nor does it prepare the annual capital budget plan. The plant operator, Talen Energy, provides the annual business plan and capital budgets to the owner group every September for approval. Avista owns a 15% share in Colstrip Units 3 & 4. The expenditures Talen presents for the Colstrip plant are in accordance with the Ownership and Operation Agreement among all six parties (the five owners and Talen).[18] Typical expenses are related to environmental, state and federal regulations, reliability requirements, and general sustenance of the facility. Avista's capital portion of these expenditures vary depending on if it is an overhaul year or not but overall average about $7.5 million a year.

[18] The other owners are Puget Sound Energy, Northwestern Energy, Portland General Electric and PacifiCorp.

Generation DC Supplied System Update

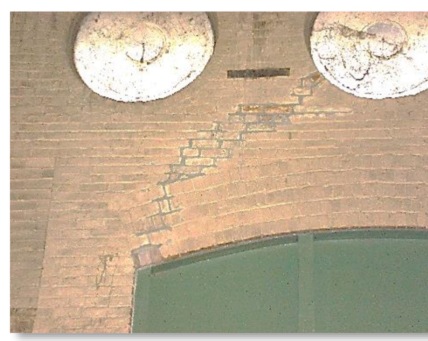




Four of the many battery systems at the Little Falls Power Plant

The direct current (DC) system or battery system at each generation plant is used for the protection, control, and monitoring equipment at the plant. All of the protection relays, breaker control circuits and monitoring circuits are fed from this source, which must always be on-line and providing service. Over time, several additional battery systems have come into existence for things like station service, uninterruptible power supply requirements, governors, communications, and various controls systems, leading to a great deal of complexity in managing and maintaining all the different setups. There are mandatory NERC requirements related to inspections, maintenance, and testing of all these battery banks, adding further complexity and risk of non-compliance due to lack of standardization. In response, the Company developed a new standardized generation plant battery scheme that utilizes a single battery system for each plant, designed to meet all NERC specifications, as well as provide redundancy and the capability of managing all the different activities required of the batteries. The new system also provides technology that allows continuously monitoring the systems for operations and maintenance purposes. Upkeep and support will be streamlined by having the same system at each plant with the capability of growing as needed while maintaining standardized specifications.

Generation Masonry Building Rehabilitation



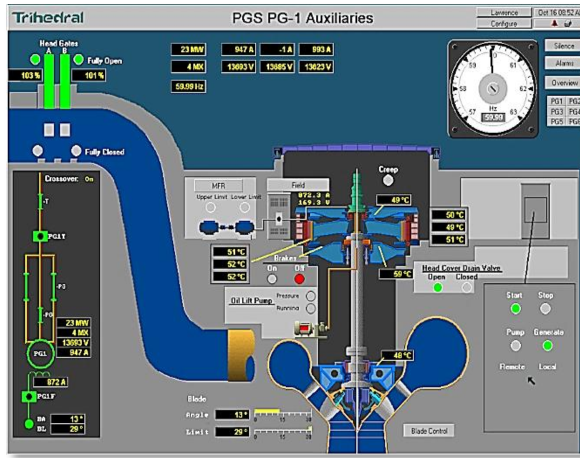
Repairs to a brick wall at Nine Mile

Many of Avista's powerhouses were constructed with brick and grout one hundred years ago or more.[19] The brick and mortar are failing; some buildings have rained bricks onto the ground in windstorms or during the freeze and thaw each spring, creating a safety hazard. Most of this risk is faced by employees and vehicles, but at Post Street, members of the public are also exposed to the danger. The Company must address this from both a safety and a building integrity perspective, and, in response, developed a refurbishment plan to manage this issue long term. Projects are prioritized based on those with the most potential danger to employees and the public as well as those in the worst physical

[19] These include Little Falls powerhouse and gate building, Long Lake Powerhouse, Nine Mile Falls Powerhouse, Post Street, Post Falls Powerhouse and substation.

condition. All of these buildings will be repaired over time to keep them functioning and safe well into the future.

Human Machine Interface (HMI) Software



Example of an HMI screen

Human Machine Interface (HMI) software creates screens that are used by Avista's power plant operators to monitor and control hydroelectric and thermal generating facility systems. These screens allow an operator to run the station from a computer in a control room rather than having to use equipment on the generating floor. The existing version of HMI software Avista utilizes, Wonderware,[20] reached the end of its useful life in 2014 when the platform the Company is using for it, Windows 7, stopped being sold by Microsoft, who will no longer support it at all after 2020. In fact, Microsoft has advised users that this version of Windows is at risk for "critical" system compromise and cyber security issues . Avista plans to replace this system with new control screens that will be developed using a new software platform. These screens will be customized to each generating facility and will have user-friendly interfaces. The Company plans to begin this process immediately to ensure a smooth transition to the required new systems and to prevent potential cyber security risks. This project aligns with Avista's Safe & Reliable Infrastructure Technology goals and objectives.

Kettle Falls Fuel Yard Equipment Replacement

The Kettle Falls fuel yard was designed and built 35 years ago and has reached the end of its useful life according to industry standards. It consists primarily of a truck scale, dumpers that receive the delivered fuel, conveyors to move the fuel from the dumpers to the fuel yard, and equipment that chops the wood into the right size for combustion. Trucking lengths and weights have significantly changed since the yard was built. It was designed for 48-foot trailers. Current trucks typically utilize trailers of up to 53 feet in length, making maneuvering in the yard very difficult and creating issues with trucking safety regulations. In fact, the trucks do not fit adequately into the dumper area and must unhitch their trailers to deliver their loads, creating very real safety hazards.[21]


Dust created from dumping loads into undersized equipment, an environmental and air quality concern

[20] The existing HMI software Avista uses is Wonderware, sold by Schneider Electric and used by utilities with generating assets nationwide. For more information, see: https://www.wonderware.com/hmi-scada/intouch/?hsCtaTracking=c2282633-e9e0-46ec-bff6-f974859d18c7%7Cfd4e6403-b324-49df-b431-89ce894b9dbc

[21] In 2013 a fatality occurred when a driver was attempting to unhitch his trailer in order to fit into the dumper area.

In addition, these new larger trucks do not fit on the current scale. The plant has also outgrown its conveyor, with fuel constantly spilling over the edges, creating large amounts of dust and clogging the equipment. The dust that is created with the large trucks trying to tip their loads into the undersized dumper system creates environmental compliance issues. The constant presence of wet wood also creates a great deal of rusting in the support equipment and electrical systems, which have been patched but need to be replaced. With an average of 80 semi loads delivered each day and over 25 sawmills depending on the fuel yard at Kettle Falls to be in full operation, there is tremendous pressure to keep the system running. The redesigned fuel yard will help ensure the safety of the people involved in the operation, keep environmental consequences low, and help ensure continuous reliable operation of the plant.

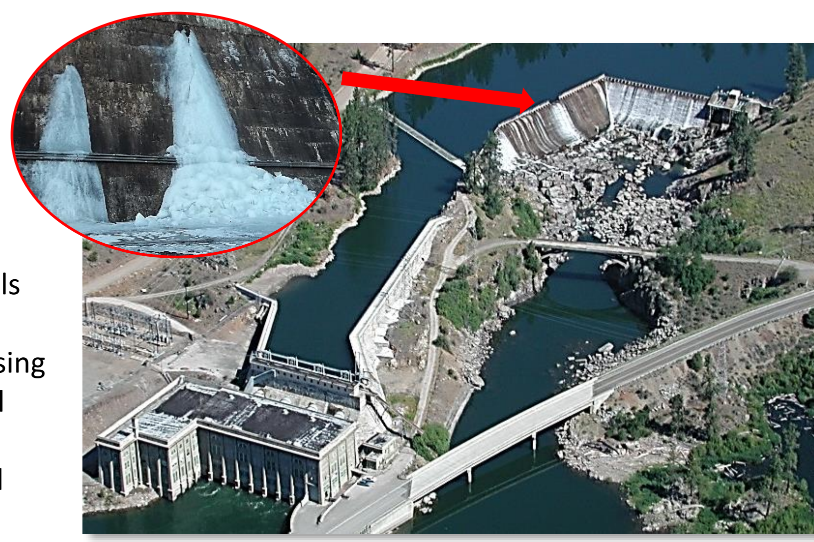
Wood chip delivery coming into Kettle Falls yard

Little Falls Intake Gate Replacement

The intake gate is where the river water enters the dam so gravity can pull the water through the penstock and to the turbine. At Little Falls, the intake gates are powered by an AC motor that is served by a single source. If power is lost, there is no way to close the gates in the event of a plant emergency. In addition, the concrete around the intake gates is in such disrepair that the gates cannot be completely sealed without using divers to manually seal them. Both conditions pose a significant safety and environmental risk, as they could lead to an uncontrolled release of the water from the reservoir. The Company plans to remedy this situation by updating the gates and their control components including repairing the concrete, gate slots, guides and sills to allow the gates to properly seal. This project will ensure safe and dependable gate operation.

Little Falls Plant Upgrade

The existing Little Falls equipment ranges in age from 60 to more than 100 years old and has reached the point of being beyond end-of-life and into the category of obsolete. Little Falls has experienced an increase in forced outages over the past six years, increasing from about 20 hours in 2004 to several hundred hours per year over the past several years due to failures on several different pieces of equipment. Plant availability is going steadily downhill. The Company is in the process of upgrading and modernizing all



Above: Little Falls Left: ice build-up at cracks the equipment in this plant, including the generating units, governors, intake gates, bearings, wicket gates, station service, control and protection systems to get the plant back to full, reliable operation. The intake gate project discussed above is part of this overall upgrade program.

Little Falls Spillway Flashboard Replacement

Flashboards are lengths of wood that are put at the top of a dam spillway to raise the operating water level, which increases the head (reservoir level) of the plant, increasing output. Flashboards have an advantage in that they are relatively inexpensive and can be quickly removed or may wash away, such as during a flood. Once the flashboards have been released, they are not recoverable and the wood floats downstream. The boards are placed by employees in barges out in the reservoir (the technique shown in the picture below). This task typically takes 10 to 14 days, as the three sections are 185, 262, and 150 feet long. When the boards must be pulled to prevent upstream flooding or when flows exceed the plant's capacity (an event which can occur in a very short time period), a long cable is strung around two sections of flashboards, tied to the winch of a pickup parked on the shore, and pulled by the winch until the force of the water causes them to collapse into the river, where they are washed downstream. The third section must be manually removed. Workers in barges must cut them out or beat on them to knock them out. Obviously, this creates a number of safety issues as well as being very slow and inefficient.

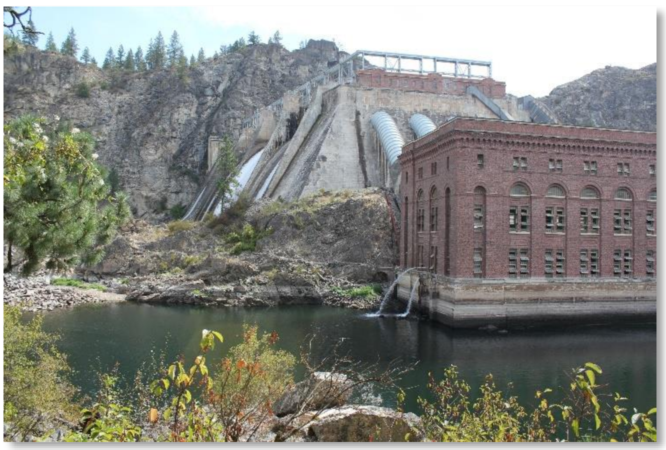
Above: Little Falls during spill with flashboards installed
Right: installing the flashboards

In addition, the existing flashboards cannot be installed in high water conditions due to safety concerns, reducing the plant's potential generating capacity during those times. New boards must be purchased each time the flashboards have to be removed. Besides the flashboard issues, the Company found a large crack and some other more minor structural issues in one of the piers of the dam that will be repaired during this same time period.

Long Lake Plant Upgrade

Long Lake

Long Lake is also a very old power plant; some of its equipment is over 100 years old. Like Little Falls, the outage rate has continued to increase over the past six years as aged equipment has begun to fail. One of the turbines failed in 2015, and currently the other turbines are thrusting too much, which is a sign of significant wear. The 1990-vintage control system is also rapidly deteriorating. The original generators, rated at 12 megawatts, are now operating at a maximum output of 22 to 24 megawatts, well above their nameplate rating.



Though modifications were made to help accommodate this increased generation, the units were not designed for this output. They are also operating at their maximum temperature, which stresses the life cycle of the already over fifty-year-old windings. Inspections of the generator show the stator core is "wavy" where the core lamination steel should be straight, indicating higher than expected losses occurring in the generator. Finally, maintenance reports have identified that the field poles on the rotor have shifted from their designed position very slightly over the years. While there can be several causes of this movement, it is speculated that it is due to the high operating temperatures of the generator, again indicating stress on the equipment.

To make matters worse, the old generator step-up transformers are also continually running at high temperature. But that is not all. When the Company needs to disconnect station service, the ancient equipment presents the greatest arc-flash potential in the Company and has directly caused injuries. The safety and reliability issues presented by all of these issues must be addressed. The Company plans to completely overhaul or replace this old equipment, modernizing the plant and bringing it up to acceptable safety and reliability standards.

Long Lake Emergency Generator Replacement

Station service provides the electrical service for the power plant. At Long Lake, this service includes an emergency generator that provides power to systems to protect machinery and personnel in the event of a complete loss of power at the plant. Installed in the 1980s, this emergency generator serves as a back-up power source for critical plant systems including providing electricity to governor oil pumps to

Current Long Lake emergency generator

maintain control of the turbines, sump pumps to protect the plant from flooding, battery chargers to keep the critical DC system available, and some egress lighting for personnel to safely navigate the area. The emergency generator must be fully synchronized to the station service so it can seamlessly transfer via a switch. The current switch is so old that parts are no longer available for it, and it has begun to fail in testing. In addition, the emergency generator controls are now well over 30 years old and parts are no longer available. This equipment is well past useful life and will be replaced.

Monroe Street Generator Excitation Replacement

In order to create the magnetic field required to generate electricity, an exciter is used. The exciter controls the magnetic field of the rotor producing a steady voltage, the amount of which is determined by the speed and amount of excitation applied to the rotor. When the turbine spins the rotor through this field, the generator creates electricity. The exciter also regulates the control and protective parts of the generator. The Monroe Street exciter was installed in 1990 and has passed the end of its expected life of 20 years. Spare parts are no longer available, presenting the risk that a failure of this system would create an outage that could last several months, with resulting financial impact in lost generation. This issue will be addressed with the installation of a new excitation system.

Nine Mile Powerhouse Crane Rehabilitation

Cranes are an essential part of maintaining a powerplant. They can lift heavy equipment for access to plant apparatus or to move heavy loads as needed. Nine Mile has two such cranes, installed in 1993.

One of Nine Mile's two powerhouse cranes

These cranes were designed for light duty with 35 tons of lifting capability and low duty motors rated at a cycle of five minutes per hour. This rating was acceptable at the time. However, in recent years, the cranes, which have already reached end-of-life, have experienced several instances of thermal overloading due to a high level of use that has developed over time. They have had to be shut down several times, stopping work and delaying projects. These cranes, as mentioned earlier, lift and move heavy equipment in the powerhouse. A failure could be catastrophic in both damages done to the plant and the potential loss of life should a crane fail. The Company determined that the most cost-effective solution is to replace the hoists, trolley system, and archaic control systems with modern reliable systems to keep the cranes functional for meeting operational needs and for the safety of employees and power plant equipment.

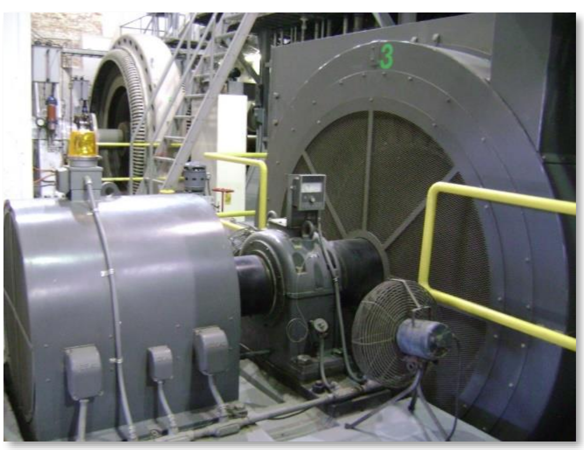
Nine Mile Unit 3 Mechanical Overhaul

Nine Mile Unit 3 was replaced with a new American Hydro unit in 1995. Unfortunately Nine Mile suffers from serious issues with sediment from Latah Creek[22] which have caused the buckets on this unit to wear and crack. In addition, the downstream bearings do not support the thrust of the generator adequately and put all the pressure on the upstream generator guides, creating incredible stress, rapid wear and overheating. Eventually this will cause the unit to fail. To avoid this extreme, the Company is going to replace the damaged equipment with new Francis runners and new downstream bearings, refurbish the wicket gates, and replace the operating components with modern equipment.

Nine Mile unit replacement in 1995

Nine Mile Units 3 & 4 Control Upgrade

These units were installed in the 1990s as mentioned in the business case above and have reached the end of their projected lives. In order to continue to ensure that these units operate correctly, the existing controls must be updated to prevent failures and unplanned outages. The controls include governors, voltage and primary unit controls, and the protective relay system. The governor controls are especially problematic, as the existing controls are not sized appropriately to handle the load placed upon them, causing issues when starting up the units or in adequately controlling voltage, frequency, speed and plant output. These controls are a key component in allowing Avista's hydro generation resources to provide operating reserves, instantaneous frequency and



[22] Latah Creek (also known as Hangman Creek) has been identified by many sources as having extreme amounts of sediment and erosion issues, all of which pass through the turbines at Nine Mile Falls. https://celp.org/2017/04/20/watersheds-to-watch-wria-56-hangman-latah/

voltage response, and other requirements in serving Avista customers and being part of the interconnected Western grid.

Noxon Rapids Generator Step-Up Bank C Replacement

In the mid-1970s Washington Water Power installed Noxon Rapids Unit #5 along with a bank of transformers to support this new unit. This bank is made up of three 45 MVA transformers which transform the voltage of Unit #5 from 14,400 volts to a transmission voltage level of 230,000 volts. This transformer bank is a critical component in moving the energy from the generator to the customer. The bank is nearly 50 years old. The U.S. Department of Energy states that the standard useful life of a large step-up transformer is 40 years.[23] These transformers are custom made and take about a year to acquire, so it is not in the Company's best interest to let this unit run to fail and take a generating unit offline for that time period, as that would entail a loss of approximately $2 million.[24] Also of prime consideration is that Unit 5 is the largest hydro unit in Avista's portfolio and is used to meet load demand variability, system reserves, and to meet the Company's obligations to the interconnected Western grid. It is a critical resource; therefore, the Company will be replacing this end-of-life transformer bank to ensure continued service from this important unit.

Noxon Rapids transformer bank

Noxon Rapids Spillgate Refurbishment

Spillgates control the water flow over the dam during times when the amount of water in the river exceeds what can go through the turbines, which typically happens during high flow conditions or if a unit trips offline. The eight spillgates at Noxon are over 60 years old, and corrosion has caused the gates to deteriorate. The old gates are a rivet design that is no longer capable of meeting the current loading requirements or potential seismic conditions required by FERC specifications. The new gates will feature an updated structural design including much more durable welded steel gates, new controls, seals, and operating

Noxon spillgates in action

[23] "Large Transformers and the U.S. Electric Grid," U.S. Department of Energy, page v, https://www.energy.gov/sites/prod/files/Large%20Power%20Transformer%20Study%20-%20June%202012_0.pdf

[24] The average power value of Noxon Unit 5 is $8,298 per day or $3 million per year, so this figure is conservative.

mechanisms, all of which will help handle the increased operation of the gates in response to fluctuating power and market conditions and will meet FERC requirements.

Post Falls wall erosion

Post Falls Redevelopment Program

The Post Falls plant has been operating with the original generators, turbines and governors since 1906. Its brick powerhouse with riveted steel superstructure has not changed since 1906 either. While the plant is still producing electricity, the generating equipment, protective relaying, unit controls, and many other components of the operating equipment are mechanically and functionally failing. The turbines are estimated to be 50% efficient contrasted to modern turbines, which can exceed 90% efficiency. The existing governors have had patchwork repairs due to lack of replacement parts, and while they do allow for some unit control, they are ineffective in their response to system disturbances. Generator voltage controllers, protective relays, and unit monitoring systems all have a similar story of marginal functionality. The generating units are exhibiting signs of failure as well; units 4 and 6 have had to be de-rated due to their deteriorated condition.

Top of the dam

In addition, safety issues have evolved over time. For example, workers access the runner for maintenance via an access port that is so small that one person can barely squeeze through (as shown in the photo on the left). Should a worker get injured inside the turbine, it is nearly impossible to extract them. The safety concerns related to this have become so grave that the runners have not been maintained in over ten years. In addition, the 1940s era generator breakers are located right in the operator control room, creating a significant arc flash hazard. One of the primary issues is related to operational constraints. The old controls simply do not allow the accurate and precise operational changes that are mandatory in supporting recreation, fishery, and other FERC license requirements for this plant, including total dissolved gas concentrations, fish habitat minimum flow requirements, and operational safety for the public during spillgate operation.[25] To remedy these issues, the Company is embarking on a full replacement of the existing Post Falls units with six

[25] For more details about these requirements, please see the internal Company website, the Avenue, under "Tools & Resources" then "Avista Infrastructure Plans" in "Generation Infrastructure Plan." Available in hardcopy form if requested.

new variable blade turbines, increasing the generating capacity of the facility by 40% capacity, 15% energy. All other archaic powerhouse equipment will be replaced at the same time, bringing the plant up to current safety and operational standards.

Post Falls Landing and Crane Pad Development

The property located adjacent to the Post Falls powerplant is being developed by the City of Post Falls as a recreation area. Avista took this opportunity to work with the City to develop an additional area of this property to be used for equipment needed for the current construction project at Post Falls as well as maintenance activities in the future. When Avista is not using their part of the property, it can be utilized by the public. This solves a couple of problems quite effectively. First, there is not enough room at Avista's current plant property for the equipment needed for the major renovation taking place at the plant. Second, construction currently blocks access to the reservoir for recreational activities. Finally, the City's initial park plan was not planned to provide the access Avista needs for vehicles, construction equipment, barges, and cranes. Avista worked closely with the City of Post Falls to create a project that benefits both parties. The City purchased the property with an agreement to allow Avista the access needed, and Avista agreed to help create and build the associated park for public use.

Post Falls North Channel Spillway Rehabilitation

The North Channel spillway at Post Falls is made up of nine spillgates – one large gate and eight smaller tainter-style radial gates. The North Channel spillway is the main spillway utilized[26] when the plant reaches flow capacity through the generators, thus is critical to plant operations. During the Post Falls construction discussed above, all river flows will be diverted through this spillway for up to two years. Unfortunately, it is in no condition to safely manage the expected flows due to significant overall concrete deterioration, leaking joints and lift lines, and a large crack in the supporting concrete for the eight tainter gates, to name a few of the known issues. The gate lift mechanisms are mechanically failing, and one has already failed. The Company plans to replace the old gates and repair the concrete structures which support them, swap out the gate controls and lifts with new safer components, perform extensive concrete work (including replacing the spillway piers) and replace all of the original embedded components such as gate slots, guides and sills. This work will ensure that the spillway is robust enough to handle the extra usage expected during construction and perform safely well into the future.

North Channel Spillway at Post Falls with the large gate above and the radial tainter gates shown on the left

[26] The South Channel spillway is typically only utilized during extremely high flow conditions, such as during spring runoff.

Regulating Hydro

Avista's regulating plants include Cabinet Gorge, Noxon Rapids, Long Lake and Little Falls, totaling about 950 megawatts of power generation. Regulating hydro plants have reservoir storage capacity, enabling them to ramp up and down for load following, provide peaking power, integrate variable resources such as wind and solar, and provide a wide variety of grid services such as spinning reserves,

Hydro Project	Type	Nameplate Capacity (MW)	Maximum Capability (MW)	Expected Energy (aMW)
Cabinet Gorge	Regulating	265.2	270.5	123.6
Little Falls	Regulating	32	35.2	22.6
Long Lake	Regulating	81.6	89	56
Monroe Street	Baseload	14.8	15	11.2
Nine Mile	Baseload	36	32	15.7
Noxon Rapids	Regulating	518	610	196.5
Post Falls	Baseload	14.8	18	9.4
Upper Falls	Baseload	10	10.2	7.3
Total Avista Owned		972.4	1079.9	442.3
PURPA Contracts	Hydro	24.06	24.06	9.6
Total Hydro		996.46	1103.96	451.9

reserves, load following, energy imbalance resolution, frequency response, reactive power, and voltage control. Funding in this category covers smaller capital expenditures and upgrades needed to keep these plants operating safely and reliably. Most of these projects are short term in duration and don't rise to the level of a capital project on their own. They are usually reactionary to operations issues that arise, such as replacing a failed monitoring system, repairing decayed concrete, or exchanging an end-of-life trash rake. Responding to FERC directives can also fall into this category. During this budget cycle, this spending category includes a FERC requirement for the Company to add a redundant spill gate hoist system at Long Lake. Since the expenditures that will be covered in this case are very difficult to predict and it is primarily responsive in nature, the Company bases this five-year budget on historical spending patterns.

Upper Falls Trash Rake Replacement

Above: Upper Falls trash rake

Below: trash rake conveyor system removing the debris

Trash racks are located on the face of the dam immediately before the water enters the powerhouse intake. They are designed to prevent any debris which could damage the equipment from entering the dam. Trash racks can become so clogged that the water flow through the turbine is restricted and generation is reduced. One means of cleaning them is the use of trash rakes, which are very heavy- duty scrapers. These rakes scrape debris off the trash racks and remove it so the water can enter the dam freely. At Upper Falls, the existing trash rake is undersized for the amount of debris that flows down the river and up against the dam. This causes it to occasionally stall in mid-operation, requiring manual intervention. It is also too small to lift the logs that wash up, meaning the plant operators must cut up the logs by hand

Original Upper Falls trash racks (across the front) and trash rake (above the trash racks)

to remove them, defeating the very purpose of the trash rake. It's location above the reservoir means the possibility of hydraulic fluid from the rake leaking into the water, posing a potential environmental hazard. The Company plans to replace this existing rake system with a larger rake able to reach the full length of the dam's trash racks and able to remove large logs as needed. The new system includes a replacement conveyor system with improved safety features, modern controls, and a containment system for potential fluid leaks.

Performance & Capacity

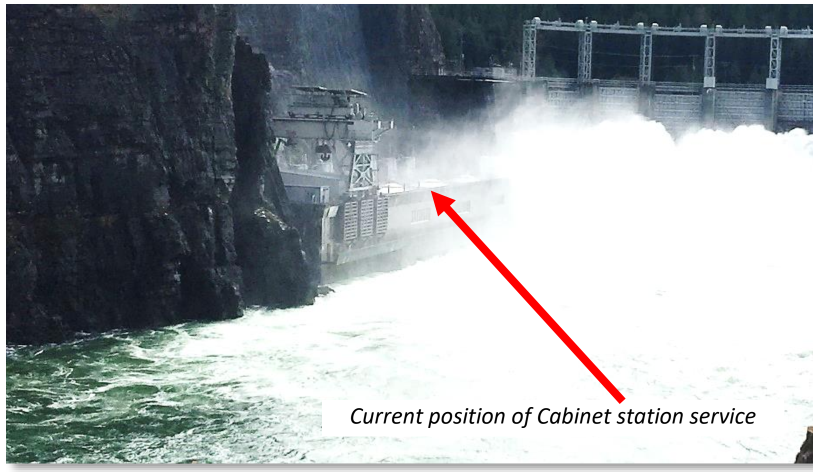
Avista's Performance & Capacity investments target the maintenance or improvement of Company infrastructure based on verified need or analysis, by industry accepted practices, by contractual obligations, and/or as prescribed by Company policies, procedures, and standards. The goal of Performance and Capacity programs is to ensure the safe, efficient, reliable and prudent management of utility assets and operations. A common example is the objective to operate within established thermal limits for electrical equipment. Other examples include technology projects designed to increase system reliability and operational flexibility such as metering, communications, control and technology upgrades or enhancements made to modernize facilities. Four programs are planned in this category during the upcoming budget cycle, described below.

Performance & Capacity	2020	2021	2022	2023	2024	5-Year Total	5-Year Average
Cabinet Gorge 15 kV Bus Replacement	$0	$0	$0	$0	$1,200,000	$1,200,000	$240,000
Coyote Springs Long Term Service Agreement	$2,160,000	$1,080,000	$0	$0	$0	$3,240,000	$648,000
Upper Falls & Monroe Street Permanent Backup Generator	$0	$0	$0	$0	$100,000	$100,000	$20,000
Upper Falls Unit Upgrade	$0	$0	$250,000	$0	$0	$4,540,000	$908,000
Total	*$2,160,000*	*$1,080,000*	*$250,000*	*$0*	*$1,300,000*	*$9,080,000*	*$1,816,000*

Table 5. Performance & Capacity Capital Expenditures 2020-2024

Cabinet Gorge 15 kV Bus Replacement

The station service equipment at Cabinet is currently located on the deck of the dam. It is going to be moved inside the powerhouse to protect it from getting soaked during spill (as shown in the photo) which has resulted in corrosion of the equipment. (This is part of the Cabinet Gorge Station Service



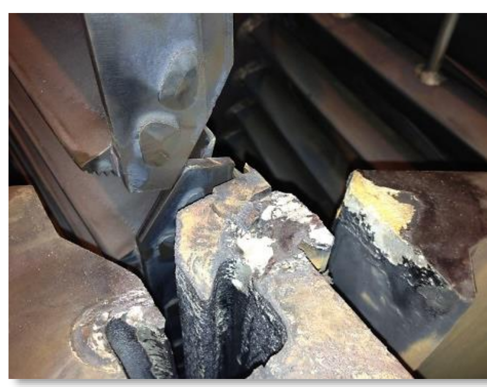
Current position of Cabinet station service

business case described previously.) In order to make room for the station service equipment, the existing 15 kV bus must be moved out of the way. It must be raised five feet to allow the new station service equipment to be installed. Over time the existing main bus has not kept up with the ratings of the generators and associated transformers; it is now about 10% under what it should be. Generation developed a creative approach to this situation which minimized the cost and the outage time while at the same time it addresses the need for more robust equipment. They will build scaffolding over the existing bus and install most of the new bus using ceiling hangers rather than moving it completely. This shortens the outage from eight weeks to six days. At the same time, they will upgrade the bus work to match the needs of the plant. This work will be planned to dovetail with the Station Service business case to ensure that the work is as smooth and efficient as possible and does not require an additional outage.

Coyote Springs Long Term Service Agreement

Overhauling Coyote Springs

The gas turbine and associated components at Coyote Springs are subjected to extremely high temperatures and the associated stress on the equipment. This equipment must be serviced, repaired, or replaced regularly, requiring major overhauls every 32,000 operating hours in order to remain operable. Avista has an operating agreement with Portland General Electric, who operates the plant, and a Long-Term Service Agreement (LTSA) with General Electric, who provides the maintenance for the gas turbine. Annual costs fluctuate based on the number of sustained operating hours of the plant. Budgeted values are based upon contractual agreement. The contract was implemented in 2003, then renegotiated in 2012 and in 2015. Most of the work done under this category is related to maintenance and upkeep, upgrading or enhancing controls, and small improvements that increase efficiency and plant output.



Coyote Springs damage

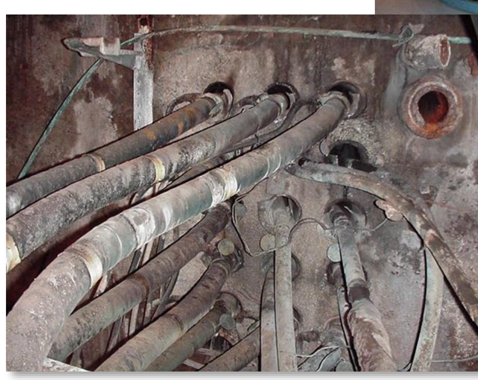
Upper Falls & Monroe Street Permanent Backup Generator

Upper Falls and Monroe Street Generating Stations provide a large part of downtown Spokane's power needs. In order to improve the reliability of this system, a backup generator is needed to ensure that in the event of an unexpected plant shutdown, critical elements needed to manage the Spokane River in the downtown Spokane area can be supplied. Currently this backup is provided by a shared generator that is on a trailer and must be towed by a certified towing operator to one of five possible connection points, requiring lost time as the trailer is pulled into place, tested, and connected to the system. The Company plans to install a permanent onsite backup generator available to both plants that will be automatically triggered by the loss of primary power. The generator will be located close to a fuel source and will be tested regularly to ensure proper operation when called upon.


Upper Falls Power Station

Upper Falls Unit Upgrade

Upper Falls, built in 1922, is still utilizing all-original equipment from that time. It has one of the oldest turbines in Avista's fleet and is due for some major overhauls. The runner is extremely difficult to access, so has experienced very little maintenance or inspection over the last nearly 100 years. The runner will be replaced with a new design that should increase capacity to the unit by using available water more efficiently. The generator is still functional but requires replacement of the core, a rewind to replace the ancient insulation of the generator and associated field pole, and replacement of wooden bearings, the current wearing of which is causing excessive vibrations. The wooden turbine guide will also be replaced, which should also help reduce vibrations. During the course of this work, the oil lubrication system, operating components, and other controls for the unit will be modernized. This work should increase the safe, reliable and efficient operation of the plant and reduce O&M expenditures currently required to keep the antiquated systems functioning.



Upper Falls components

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Overview of Generation Planned Maintenance Investments 2020 – 2024

All power plants require various levels of continuous maintenance to ensure their safe, reliable, and effective operations. This starts with the concept of anticipating system and equipment failures or breakdowns by servicing these systems and equipment at regular intervals and replacing parts (hopefully before they fail). The ideal maintenance strategy is about applying the right measures at the right times. As a general rule, the judicious identification and correct assessment of existing weaknesses in equipment can prevent many failures; however, an effective maintenance strategy also involves a careful balance of risk and expense – providing adequate maintenance while not spending an excessive amount of money in doing so. There are ongoing efforts in the Generation group to better document equipment condition and to develop a balance of risks, costs, and performance needs of this equipment as it impacts the generating assets.

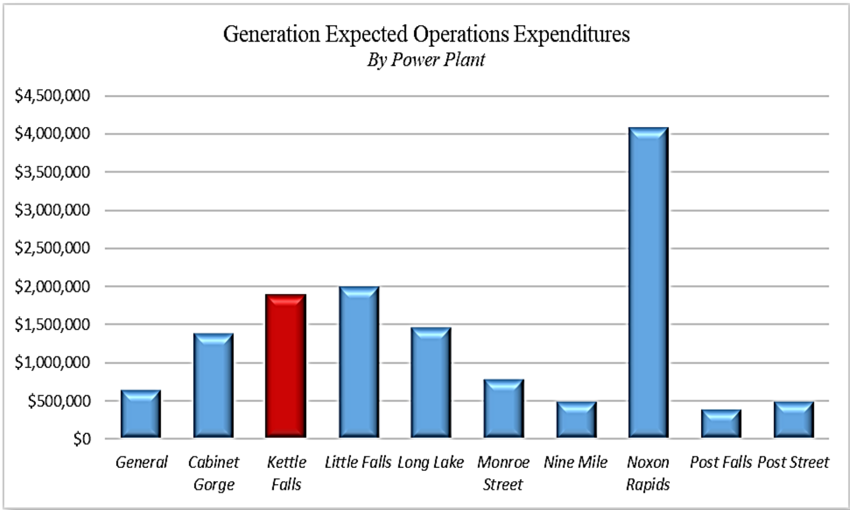

Figure 5. Avista Planned Operational Expenditures for Generation During the Next Budget Cycle

Avista's maintenance practices include combinations of preventive and corrective measures so that structures, systems and components perform as intended now and into the future. Some critical maintenance elements include items that utilities are compelled to complete due to regulatory requirements. These can include dam safety issues, containment and management of oil or other releases, air emission controls and monitoring, water quality measures, and FERC license compliance.

Increasing federal regulation to maintain transmission grid stability and reliability related to required reserves and the penetration of renewable generation have begun to impact plant operations and O&M costs. According to the National Renewable Energy Laboratory (NREL), the constant cycling to keep units available in order to follow changes in customer load and to make up for the intermittent generation of wind and solar is causing damage to equipment and increasing utility operating costs. Every time a power plant is turned on and off, its components go through large thermal and/or pressure stresses, resulting in what the Lab calls "creep-fatigue." [27] Without appropriate maintenance, this can result in shorter life expectancies of critical components, higher forced outage rates, and reduced overall plant life. This is true even for power plants that are flexible, such as Avista's reservoir-based hydro projects or the Company's natural gas peaking units. This wear and tear on equipment

[27] N. Kumar, P. Besuner, Et al., National Renewable Energy Laboratory, "Power Plant Cycling Costs," April 2012, https://www.nrel.gov/docs/fy12osti/55433.pdf

ultimately leads to higher maintenance costs, and this can show up even years later in lower capacity factors, less generation, and higher production costs.[28] Lack of investment in maintenance can have costly consequences. Besides safety risks, defects in power stations can result in loss of production and can lead to higher cost remediation measures.

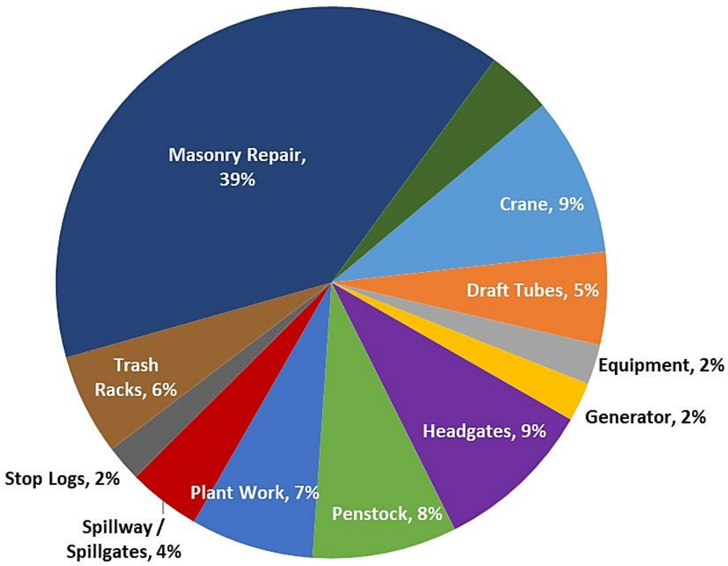

Figure 6. Avista Projected Generation Operational Expenditures: Hydro

Avista, like many utilities across America, is dealing with increasing and continually changing performance requirements and the resulting maintenance demands and costs related to these changes. In addition, aging equipment and shrinking O&M budgets are creating new challenges to overcome. The Company's maintenance strategy is a balancing act that includes many facets: risk of failure, cost, manpower availability, equipment availability, customer load levels, stream flows, market prices, natural gas prices, regulatory requirements, asset management strategies, environmental impacts, and other factors.

Over the next five years the Company plans to spend an average of about one million per year maintaining hydro facilities and about half a million per year on our thermal plant at Kettle Falls. As shown in Figure 6, a lot of work is needed on the structures related to the generating station, including repairing damaged or broken concrete and cracks, grouting, and rectifying erosion issues (shown in the pie chart as "Masonry Repair"). Other significant expenditures include repairing the cranes at Noxon and Cabinet, headgate and draft tube work at Noxon and penstock work at Little Falls. All of the plants will undergo routine maintenance and inspections, and most will receive new performance monitoring equipment. A brief description of the more specific operations work planned is described below.

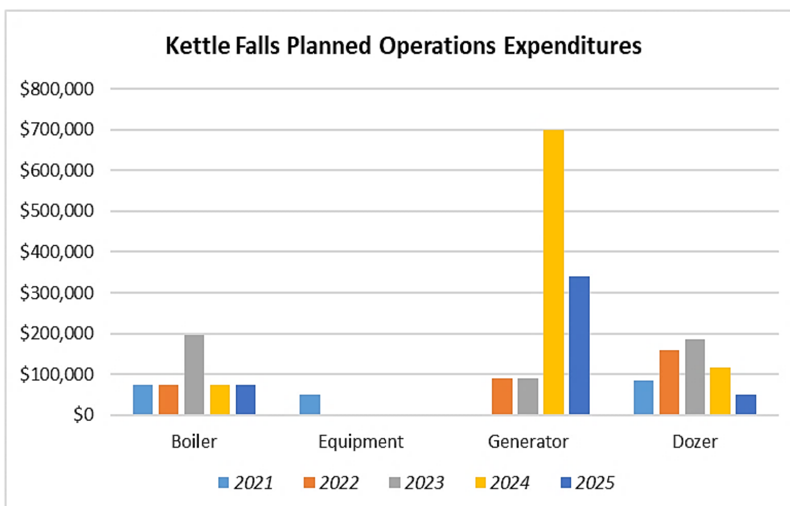

Figure 7. Avista Projected Generation Operational Expenditures at Kettle Falls

[28] In fact, studies have shown that 60% to 80% of all power plant failures are related to cycling operations. Study by Intertek-Aptech, Steven A. Lefton and Douglas Hilleman, "Make Your Plant Ready for Cycling Operations," Power Magazine, August 2011, http://www.powermag.com/make-your-plant-ready-for-cycling-operations/?pagenum=1

- Kettle Falls: Over the next five years the boiler grate will be rebuilt along with the boiler feed pump. Unit 2 will undergo major maintenance, and the plant turbine trip and throttle will be renovated. The big caterpillar that pushes the wood waste into place and organizes it needs to be regularly maintained, which includes replacing the tracks and rollers periodically. During this budget cycle a major overhaul will also take place.

- Cabinet Gorge: Cabinet will be receiving draft tube gate repairs. In addition, the penstock will be painted and coated with epoxy, not only to protect the metal from corrosion, but because this creates a "slicker" surface, increasing the hydrodynamic performance of the plant. The draft tube gates will be repainted, and the seals will be refurbished, the gantry crane runway concrete will be repaired, and the stop logs refurbished.
- Noxon Rapids: Noxon will undergo painting and maintenance on the headgates, repair of the draft tube gate seals, and overhaul of its Gantry crane. It requires a lot of masonry work including repairing an air shaft crack and the face of the dam itself as well as resealing the powerhouse deck. Work on the gallery drain and sump pump will also take place.
- Little Falls: This plant requires some concrete repair on the face of the spillway section of the dam, on the fish chute, on the barge landing, and on the power plant building. The conduit at the plant will be moved and repaired and the penstocks will be repainted to protect them from corrosion and increase their performance.
- Long Lake: Long Lake also requires significant repairs to the building masonry as well as grouting on the spillway piers and the spillway face. Other plans include spillgate, headgate, and scroll case refurbishment.
- Monroe Street: This plant will also undergo work on the trash racks to remove rocks and maintenance on the headgate.
- Nine Mile: Powerhouse repair work is needed at this plant including repairing the masonry of building itself and the splitter wall erosion.
- Post Falls: This plant also needs masonry repair and will also undergo a repair of unit #1.
- Post Street: Another plant needing some significant masonry repair and new windows.

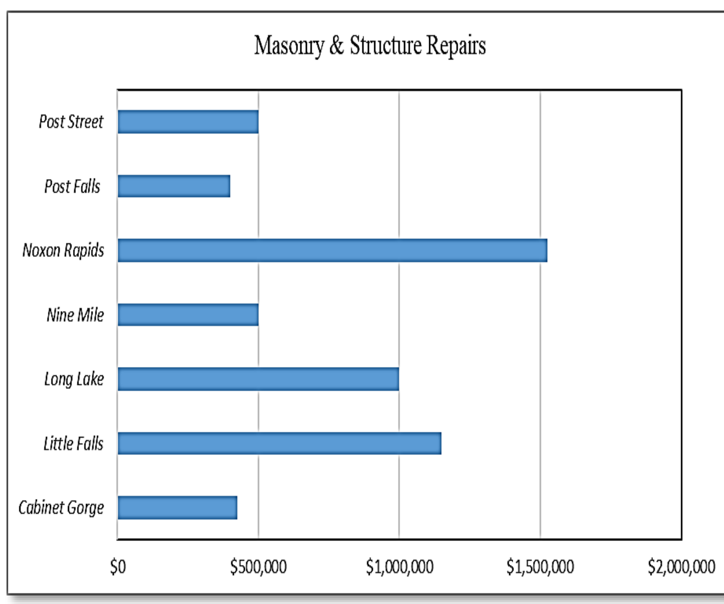

Figure 8. Avista Projected Masonry/Structural Repairs

Summary & Wrap-Up

Since the early days of the utility business in the late 19th century and throughout the 20th century, generating plants were constructed to supply utility customers with low cost and reliable energy. During that time, investment decisions were consistently driven by the need to either maintain or add enhancements to Company assets in order to continue to provide this low-cost energy. Decisions on what maintenance was done and what new investments were needed were screened against this low-cost criterion.

Just as importantly, addressing environmental concerns along with stewardship of the resources impacted by these generating assets has always been a major consideration and cost driver for the generation fleet. Hydro generating stations are governed by regulations dictated by the Federal Energy Regulatory Commission (FERC) which not only determine the way these plants are operated but also drive significant investments in wildlife, fishery, and recreational programs that benefit the public. Avista's plants must also satisfy site permits, water quality monitoring, and disposal permits where applicable. In addition, historical and cultural resources are actively managed.[29] These important stewardship elements do contribute to the expenses associated with ownership of these assets, but also help assure that projects are being operated responsibly and that they create public resources which provide significant benefits to the communities and regions that surround these generating stations.

Today, the use of Avista's generating assets is complex and strives to meet multiple demands – those of grid reliability, low cost energy, wholesale markets, and stewardship as well as manage outside influences such as costs of natural gas, market effects, commodity pricing, and other factors. All are key considerations in managing these assets. Consequently, many factors must be balanced with available funds and resources to achieve acceptable results. Because of this, the process of determining what work will be done and when it is planned is continually shifting to accommodate any change in need, purpose, or opportunity that can benefit Avista and its customers. Avista's generation infrastructure programs are thoughtfully developed, analyzed, optimized, adjusted, and re-analyzed as appropriate to ensure that the Company meets all of these requirements.

Over the last 129 years, Avista has built a diverse portfolio of generating assets required to continually serve the changing needs of customers. Investment strategies and decisions will need to continue to evolve in order to match the demands placed upon these traditional assets in the future energy space. Going forward the Generation group will continue to actively manage these resources to provide reliable and cost-effective service, meet stewardship responsibilities, and provide a stable foundation as the utility industry transitions to the future.

[29] For a great description of FERC's regulation of hydroelectric power plants, please see "Hydropower Primer: A Handbook of Hydropower Basics," Federal Energy Regulatory Commission, https://www.ferc.gov/legal/staff-reports/2017/hydropower-primer.pdf