

CUSTOMER

WINTER 2019

Circuit

WESTERN AREA POWER ADMINISTRATION



2019 State of WAPA's Assets

inside

2 Administrator's letter

4 State of Operations

16 Hydrology conditions

18 Grid resilience

20 Transformer acquisition

22 Reserve Balance Strategy



A LETTER FROM THE ADMINISTRATOR AND CEO

February 2019

The pace of change in the electricity industry will continue to accelerate in 2019, bringing advances in technology that will lead to a grid that is smarter, more connected and more integrated than ever before. We at WAPA are meeting these developments head-on by investing in our connected future to preserve and strengthen our value to customers, our neighbors and the nation.

We are investing in a connected energy future by being agile, integrated, responsive, engaged and resilient. And we are making those investments while staying true to our core values and mission to keep rates as low as possible consistent with sound business principles.

Laying groundwork

Our accomplishments in 2018 demonstrated this commitment and provided a solid foundation upon which to build. WAPA hydropower continues to be among the most affordable generation sources in the nation, supporting low electric rates across our service territory. Nearly 80 percent of our customers experienced stable or decreased rates in 2018.

Hydropower from Hoover Dam reached 58 new allottees last year, 23 of which are Native American tribes. This nine-year remarketing effort, achieved thanks to the diligent efforts of several employees in Desert Southwest and across WAPA, will extend the benefits of affordable federal power to more people, improving their lives and supporting their economies.

Other successes in 2018 include advances in physical security and collaborations with other organizations on security information and mitigation efforts. We created the new real-time engineer position in our 24-hour operations centers to comply with regulatory drivers and partnered with customers to build new critical energy infrastructure. Both our Asset Planning and Management and Maintenance teams collected and analyzed data on the health of our transmission lines and transformers. This information will guide the grid investments we will need to make now and in the future.

Although the efforts of the Mountain West Transmission Group to join the Southwest Power Pool were put on hold, the likelihood of markets coming to the West remains. The strong partnerships we formed with the members of the group will help us to adapt to the evolving electricity industry. This year, we will focus on securing new reliability coordinator arrangements.

Planning follow-through

Investing in a connected future requires a plan as well as a foundation, and *Strategic Roadmap 2024* and WAPA's Tactical Action Plan provide vision and practical action.

The Tactical Action Plan, which was refreshed in January, shares our activities and priorities for the next two to three years under *Strategic Roadmap 2024*. The Roadmap outlines goals and objectives at the 20,000-foot level, and the TAP is the list of ground-level activities that will put us on the path to success.

This third iteration of the TAP has been updated to reflect changes—in the industry and at WAPA—over the past few years, but the priorities will be familiar. The four Strategic Target Areas are:

- Mission Critical Customer Services in an Evolving Industry.
- Grid Resilience.
- Asset Management 2.0.
- People and Organization.

Coming issues of the *Customer Circuit* will explore each of these in depth, sharing our efforts and looking at what they mean to you and your operations.

Investing in assets, stability

The WAPA 10-Year Capital Plan calls for investing \$1.6 billion in our transmission system during fiscal years 2019-2028, or about \$160 million annually. The bulk of that funding will be dedicated to maintaining and upgrading transmission lines and substations. These projects are necessary to ensure the safety, security and reliability of our system.

In addition to that investment, we plan another \$961 million in reimbursable work for nonfederal partners. Those projects include ongoing work on the San Luis Transmission Project in California and the Southline Transmission Project across southern New Mexico and southern Arizona. These projects will help improve reliability, ease congestion and protect the environment in WAPA's service territory.

My direction to staff in the fiscal year 2021 budget guidance is to remain budget- and staff-neutral as we mature our programs, prepare for the future and improve our performance. Adapting requires us to continue to seek efficiencies, streamline processes and implement innovations that improve the way we do business for a lower cost than we do now.

Investing in people, culture

When we talk about investing in a connected future, we are not only speaking from an economic standpoint; investments are also made in relationships, training, people and being innovative and inclusive.

We are investing in this connected future by being:

- **Agile**—responding to changes in the industry, including from regulatory bodies; evolving our Open Access Transmission Tariff to be more in line with the pro forma OATT; and preparing for markets and market-like entities in the West.
- **Integrated**—accommodating battery storage and new technologies; partnering on fiber and other similar opportunities; and developing a workforce of the future.
- **Responsive**—proactively addressing our customers' needs and their requests for transparency; and seeking occasions to partner on common issues.

- **Engaged**—listening to our customers and employees to determine how we can support them now and in the future; connecting them with subject matter experts on today's big topics in open and safe discussions; and participating in the big conversations.
- **Resilient**—defending and combating against physical and cyber threats; adapting to potential new long-term water conditions; and advancing financial security that looks different from today for appropriations and purchase power and wheeling.

Envisioning future

No matter which way you turn, you see transition in the ways the utility industry has traditionally done business. What is happening to the grid now is not related to the physics we have known for more than 100 years. It is related to information technology, financial change and new ways consumers think about energy and the increasing range of market choices available to them. We must continue to keep pace with technology to adapt and thrive in this new electronic world.

Let me be clear that we are not looking to be on the leading edge of this future or to lead this future, but we must invest in this future to remain relevant. It is only by remaining relevant that we will preserve and strengthen the value of our hydropower and transmission services for our customers.

The choice is ours, together: with your support we can advance—move forward in a purposeful way. We are positioning WAPA in a way that will optimize your ability to respond to and accommodate the continuously evolving future.



Mark A. Gabriel



State of Operations

WAPA operates a distributed business model with various functions spread throughout its 15-state, 1.4-million-square-mile territory. Located in Lakewood, Colorado, WAPA's Headquarters serves many diverse customers, including Congress, Native American power customers, public power utilities, other government agencies and WAPA's regional and field offices. HQ is home base for WAPA's Administrator and CEO, the General Counsel and the organization's Economic Impact and Diversity, Public Affairs, Engineering, Operating, Financial and Information Technology offices.

Within these functions, WAPA accomplishes the "behind-the-scenes" work to fulfill the needs of the organization's more than 700 firm electric service utility customers, who then provide electricity to more than 40 million people in the West. This work includes:

- Representing WAPA in Washington, D.C.
- Conducting public meetings.
- Developing publications such as the annual report.
- Managing finances and WAPA's annual budget.
- Focusing support on WAPA-wide employee safety and system security.
- Designing and maintaining power systems facilities.
- Overseeing and continuously improving North American Electric Reliability Corporation compliance activities.
- Supporting renewable resources and environmental protection.
- Supporting the power marketing community.

WAPA continues to make improvements that follow industry-leading practices. In late 2018, the Office of the Chief Administrative Officer took over many internal administrative operations and management of programs that were formerly under the Office of the Chief Operating Officer. The move created a more efficient, effective organization.

WAPA expanded The Source to give customers a decade's worth of financial and operational information related to organizational activities. The new information consists of data from Oct. 1, 2007, through Jan. 31, 2019, and WAPA's unobligated reserve balance strategy for fiscal years 2016

through 2020. Customers were also invited to attend WAPA's 10-Year Capital Plan review meeting in December to ask questions about the proposed budget, offer feedback and participate in roundtable discussions with program experts.

Responding to growing concerns in the power industry about the security of the nation's transmission infrastructure, WAPA hosted the Technology and Security Symposium at HQ last August. The daylong event was attended by professionals from 23 utilities, national laboratories and other government organizations, industry associations and security technology companies. Attendees learned from industry leaders about issues surrounding cyber and physical threats to the grid.

The Office of Security and Emergency Management continues to improve WAPA's physical security posture, partnering with Asset Planning and Management to establish a tiered approach that streamlines and prioritizes projects aimed at protecting WAPA's physical infrastructure. Asset management data is being used to identify the most effective investments in physical security and the most strategic locations for those investments across WAPA's facilities. This process will create a framework for more informed and strategic investments in hardening critical facilities against attacks.

WAPA launched a search for a new reliability coordinator service provider when Peak RC announced that it was going to cease operations by the end of 2019. In September 2018, the Western Area Colorado – Missouri, Western Area Lower Colorado and Western Area Upper Great Plains – West balancing authorities entered into an agreement with Southwest Power Pool for RC services. The transition to SPP, planned for December 2019, will avoid the 30-percent cost increase that was expected if Peak RC continued providing these services. The California Independent System Operator will be providing RC services to the Sierra Nevada sub-balancing authority starting in July.

WAPA will continue to participate in activities to form two new reliability coordinators in the Western Interconnection in 2019. WAPA's leadership in committees and workgroups and regular communication with customers and other interconnected utilities are helping ensure a smooth transition of operations and continued viability of the Western Interconnection.

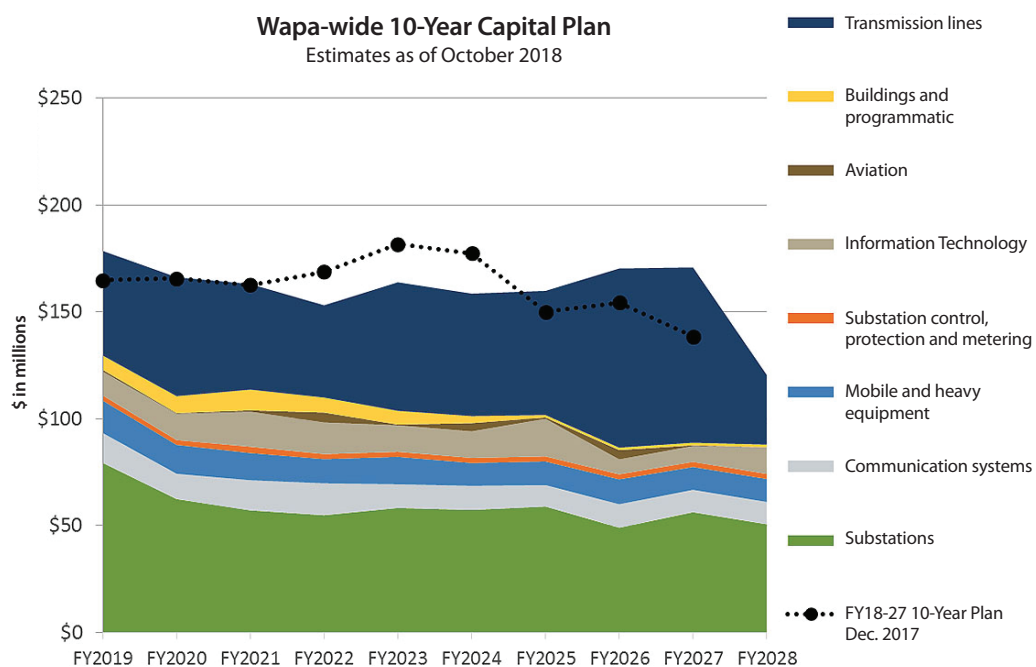
Following evaluation of its helicopter use, Sierra Nevada purchased an additional aircraft to support critical maintenance activities, including line patrol, long-line maintenance and emergency and disaster response. The acquisition is an investment in system reliability and efficient, cost-effective maintenance in an increasingly challenging environment.

This year's investments in a connected future will provide value to customers through a more transparent process. Staff will hone WAPA's 10-Year Capital Plan by focusing on capital investment drivers, such as lifecycle replacements, physical security and cybersecurity. Some upcoming projects include:

- Developing more efficient means to improve reliability and continuously document compliance with the North American Electric Reliability Corporation and other applicable standards.
- Using asset management data to better inform decision making and develop efficient and well-justified budgets throughout WAPA.

- Continuing implementation of organizational structure changes to prepare for the future of markets.
- Ensuring more accurate work planning, cost estimation and capital improvement project design through continuous process improvement.
- Advancing WAPA as an employer of choice through continued focus on human performance and just culture, including proactive training and leadership development opportunities.
- Improving physical security and emergency management programs through planning and collaboration with all stakeholders.

WAPA is committed to using effective business processes to make funding allocation decisions that support WAPA's customers and mission to deliver cost-effective and reliable power. System reliability and providing valuable energy and transmission services remain among the organization's top priorities.



State of the Regions

COLORADO RIVER STORAGE PROJECT MANAGEMENT CENTER

The Colorado River Storage Project Management Center markets clean, reliable hydropower from 14 powerplants known as the Salt Lake City Area/Integrated Projects under a single rate. These generating resources produced an average of 5,323 gigawatt-hours annually over the past 10 years for CRSP MC's 135 preference and project-use customers. Glen Canyon Dam is the largest powerplant, generating 74 percent of SLCA/IP energy. In 2018, WAPA began delivering power from the Olmsted Powerplant, CRSP MC's newest facility and WAPA's 57th powerplant. It will deliver about 27 million kilowatt-hours this year. Transmission facilities in Arizona, New Mexico, Colorado, Utah and Wyoming deliver SLCA/IP hydropower to its preference and project-use customers. CRSP MC owns 2,323 miles of transmission lines, 248 breakers and 41 transformers.

In the area of power marketing, staff members finalized the 2025 SLCA/IP power contracts for 62 customers in 2018. The contracts extend customers' services under the current marketing plan through 2057 and will provide long-term assurance and stability for customers receiving SLCA/IP hydropower.

CRSP MC has a total of 53 Native American tribal customers, 11 of which have signed contracts for 2025. In an ongoing effort to engage with WAPA's tribal customers, CRSP MC staff has met with many tribal leaders, utilities and regional associations. Since the SLCA/IP allocations were awarded, two tribal utilities have been established with two more to begin service soon. Several other tribes are considering establishing their own utilities. In 2019,



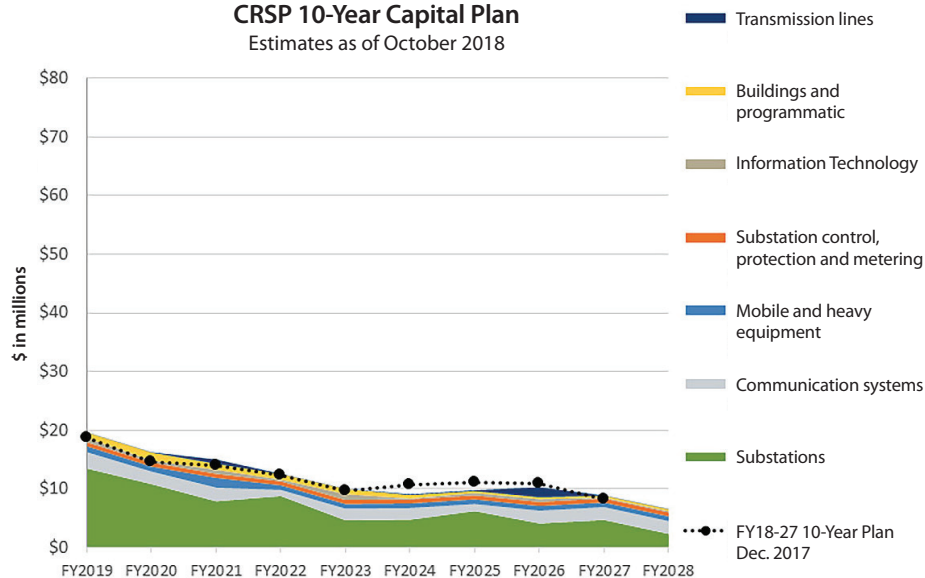
CRSP MC will continue to visit and meet with tribal leaders to strengthen its working relationships with the tribes.

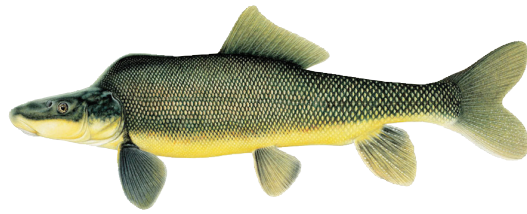
Maintaining infrastructure in partnership with other WAPA regions and the Bureau of Reclamation is a high priority for CRSP MC. Ongoing projects to upgrade protection and control equipment at Pinnacle Peak and Glen Canyon substations moved forward in 2018.

Construction will continue in 2019 on:

- Glen Canyon-to-Shiprock 60-megavolt-ampere-reactive, 230-kilovolt reactor project.
- Glen Canyon Warehouse workspace with WAPA and Reclamation staff.
- Ault 345/230-kV, KU1A 600-MVAR transformer and 230-kV breaker replacement.

CRSP 10-Year Capital Plan
Estimates as of October 2018





Protecting resources, environment

Environmental staff from CRSP MC is proud to be playing a role in the recovery of endangered fish species in the Colorado River through participation in the Upper Colorado River Endangered Fish Recovery Program and the Glen Canyon Dam Adaptive Management Program.

In 2018, the Fish and Wildlife Service proposed downlisting the federally protected humpback chub and razorback sucker from endangered to threatened status due to their increasingly stable populations. Downlistings are the result of successful conservation efforts between the FWS and other organizations, including WAPA, to protect these unique fish populations and their habitats. Changing the status of the fish from endangered to threatened should allow more flexibility in the hydropower facility operations in the Colorado River drainage basin. The FWS' efforts to downlist and revise their recovery plans will continue into 2019.

Environmental staff from CRSP MC is assisting the Grand Canyon Monitoring and Research Center with studies that evaluate the effects of dam operations on downstream resources. One such study, the "bug flow" experiment, evaluated how changes in water releases affect the insect population that supplies food for fish below Glen Canyon Dam. Researchers hypothesized that fluctuating river levels cause insect eggs to dry out and die, reducing the primary food source for native fish. The bug flow experiment tested to see if adjusting the daily release patterns at Glen Canyon Dam can increase the diversity and production of aquatic insects without significantly affecting the hydropower resource.

Water releases may also directly affect the reproduction and growth of rainbow trout, so CRSP MC has teamed up with Reclamation and the Grand Canyon Monitoring and Research Center to research trout management flows. The strategy is intended to enhance the trout fishery below Glen Canyon Dam while reducing conflicts between rainbow trout and native fish like the endangered humpback chub further downstream in Grand Canyon National Park. Using releases to control the trout population could potentially enhance hydropower value, a side benefit of trout management flows that particularly interests WAPA.

November 2018 saw the fifth high-flow experiment, or HFE, at Glen Canyon Dam since implementation of the 2012 HFE protocol. These experiments recreate seminatural flooding cycles in the spring and fall to determine if the events maintain or increase sandbar size in the Grand Canyon over a 10-year period. The 2018 HFE was only a 60-hour event compared to 90-hour releases in the past. The initial indication is that the shorter release was still successful in rebuilding and replenishing the sandbars and beaches in the Grand Canyon.

This HFE and other activities conducted by the Glen Canyon Dam Adaptive Management Program explore how to better protect and improve resources downstream of Glen Canyon Dam while still allowing for all the dam's benefits, including hydropower production. Data and analysis from this experiment will help determine future dam operations and guide subsequent HFE frequency and duration.



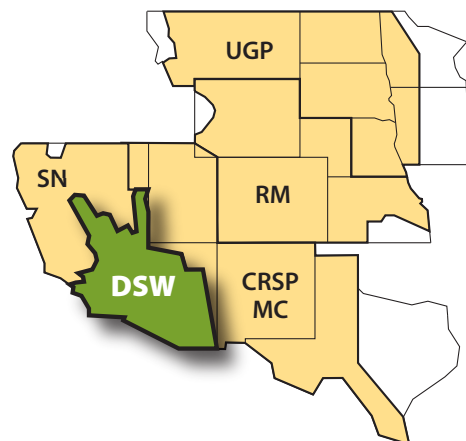
DESERT SOUTHWEST

Desert Southwest markets hydroelectric power to about 100 municipalities, cooperatives, Native American tribes, federal and state agencies and irrigation districts in California, Arizona and Nevada from powerplants operated at Hoover, Parker and Davis dams. Power is also marketed from the federal portion of power generated at Navajo Generating Station. DSW maintains 70 substations, 2,689 miles of transmission lines ranging from 34.5-kilovolt to 500-kV and 83 communication sites to provide safe, secure, reliable and affordable energy and transmission services to its customers.

When the Mountain West Transmission Group recently paused its activities, the Power Operations team took the opportunity to review the balancing authority services it provides for the Colorado River Storage Project Management Center, DSW and Rocky Mountain. Power Operations and Power Marketing staff from all three offices are developing a list of short- and long-term optimization strategies to provide the most efficient and cost-effective services to WAPA and its customers. The effort will result in a prioritized list of opportunities to be presented to regional leadership teams by April. The leadership team will create an implementation plan to enact the most beneficial items.

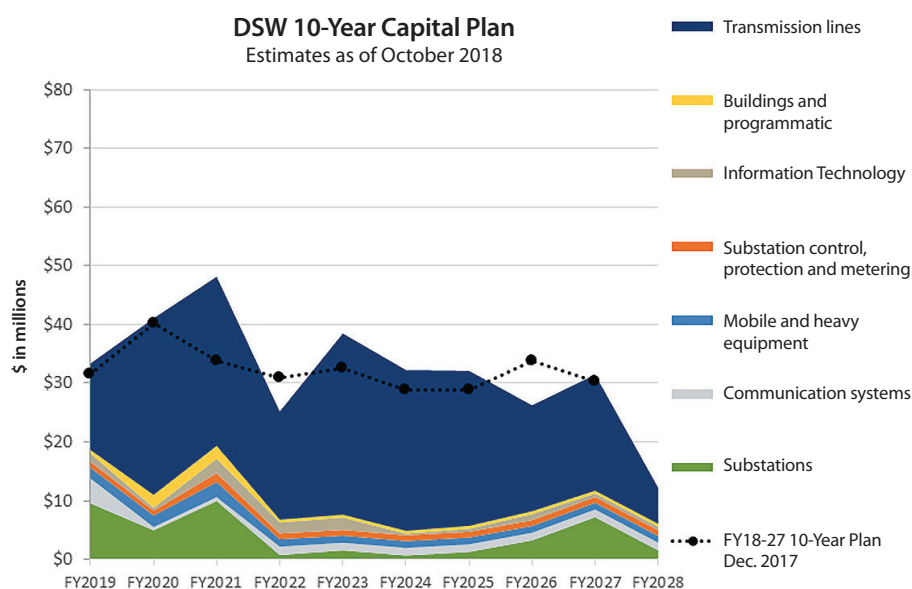
Last fall, DSW completed the installation of a new transformer and supporting equipment at the Senator Wash Pumping Plant for the Bureau of Reclamation. Not only did the replacement improve reliability for one of WAPA's federal partners, but the transformer's oil containment system was upgraded to an environmentally safer model.

DSW works closely with customers to find the most feasible and cost-effective routes and design to improve



its transmission systems. Customer input will be critical to helping WAPA determine the best course of action to replace the aging transmission lines connecting Parker Substation to Headgate Rock and Bouse substations. The existing structures are well past their estimated service lives and replacing them is necessary to ensure continued operational reliability in the long term. Discussions with customers about the Bouse upgrade will take place in 2019 to be followed by extensive collaboration throughout the project's multiple phases.

The Interstate-8 Crossing project near Yuma, Arizona, will be completed in 2019, significantly improving operational reliability for WAPA's project-use power customers. Some of the aging infrastructure being replaced is more than 60 years old. Notably, the project marks WAPA's first successful use of micropile foundations in mountainous areas that are inaccessible to wheeled or tracked vehicles.





The Hassayampa Switching Station Project for the Bureau of Reclamation and the Central Arizona Project is also scheduled for completion in 2019. A new switching station has been built next to the old tap, which is being demolished as part of the project. Work includes reconductoring the transmission line between Arizona Public Service's new 500-kV Sun Valley Substation and the new tap, upgrading equipment in the pumping plant substation and constructing a mile of new double-circuit 230-kV transmission line into Sun Valley. Once complete, the Hassayampa Pumping Plant will have a secondary power source from the Sun Valley substation.

The WAPA-Southline Transmission public-private partnership will continue in 2019. Teaming up with a private partner removes about \$120 million in costs from DSW's 10-Year Capital Plan and, by extension, its customers' rates.

The Southline project is an upgrade to 120 miles of the Parker-Davis Project transmission system in Arizona, from the Electrical District No. 5 Substation to the Apache

Substation. It will also interconnect with Southline's new 250-mile transmission system from the Apache Substation to the Afton Substation in New Mexico. The project schedule has been extended to accommodate Southline's efforts to market its share of capacity, with completion anticipated in late 2021. DSW is currently focusing on system design; further negotiation of key agreements including construction, operations and maintenance; ownership and lease agreements; and preconstruction activities.

DSW improved transparency and customer service in 2018 by working with its customers to negotiate a new joint planning agreement, which customers began executing this year. The agreement memorialized DSW's improved capital planning process and will make planning, budgeting, construction, financial and rates processes more transparent. Under the agreement, customers receive increased insight and opportunities for input into WAPA's system needs. This engagement ultimately helps WAPA ensure continued reliability for its customers well into the future.

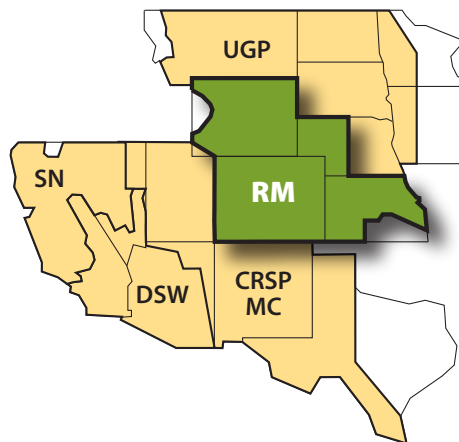
ROCKY MOUNTAIN

Rocky Mountain serves about 120 preference customers with Loveland Area Projects allocations in Colorado, Wyoming, Nebraska and Kansas. It sells more than 2.8 million megawatt-hours of power generated at 20 hydroelectric plants in the Loveland Area Projects, through both the Fryingspan-Arkansas Project and the Pick-Sloan Missouri Basin Program—Western Division. RM reliably delivers federal and nonfederal power through 3,422 miles of transmission lines and 80 substations.

As the hydrology of the river systems fluctuates, RM Power Marketing staff provides stability in navigating the ebb and flow of hydropower while keeping costs low. WAPA decreased the composite LAP rate by 12 percent in 2017 and 14 percent in 2018, and is holding the rate flat for 2019.

In preparation for continued changes moving toward markets, RM has realigned its Settlements organization to merge RM and Colorado River Storage Project staff in Loveland and Montrose, Colorado, into a single RM Settlements group. The single entity will be able to more readily adapt to changing industry demands and take advantage of opportunities to optimize efforts across offices to save funds and keep rates low.

Additionally, RM is working with the Bureau of Reclamation to review and upgrade hydropower generator meters as needed. The updates to meter accuracy and data transfer will improve how hydropower generation is tracked and marketed. This will properly capture the

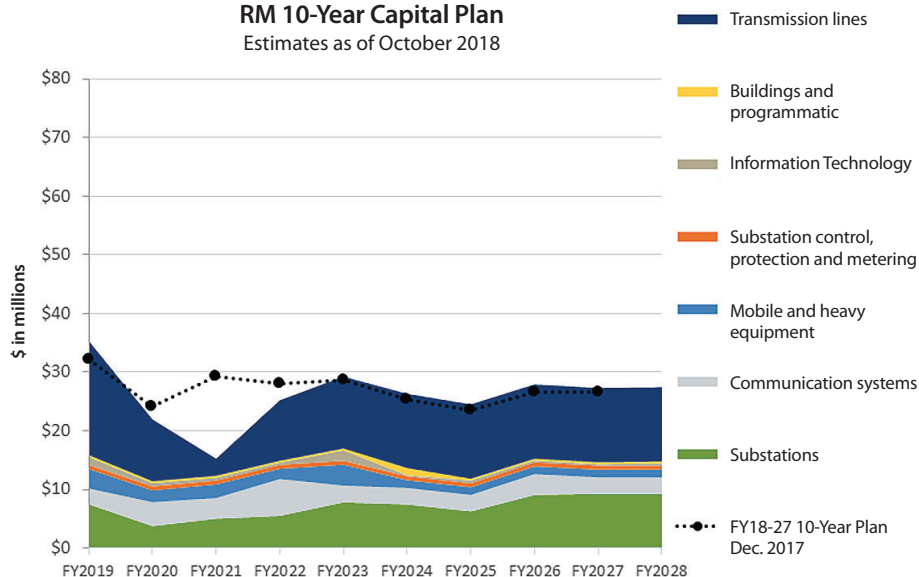


economic value of generated hydropower in any emerging market structure.

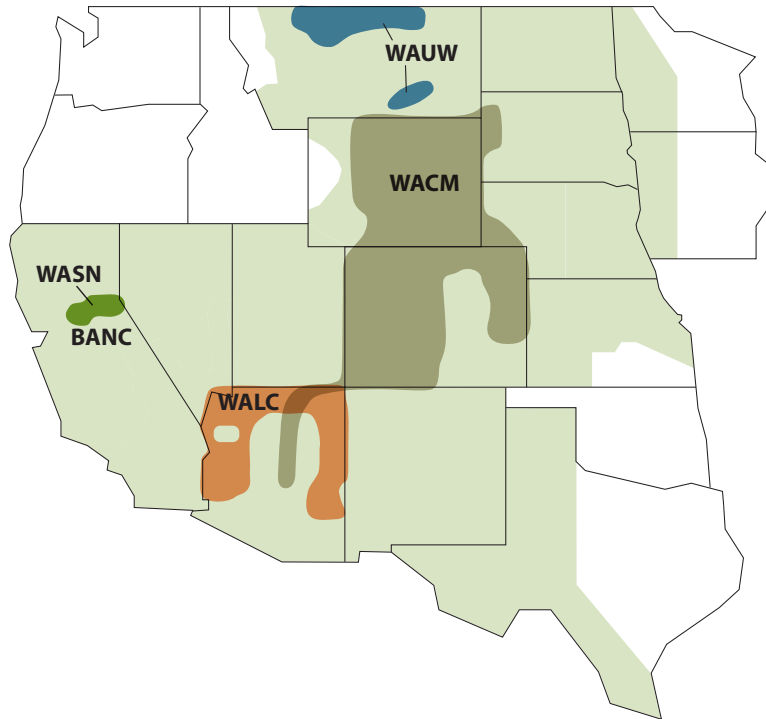
In October 2018, the Rocky Mountain Reserve Sharing Group voted to pursue joining the Northwest Power Pool. The move to NWPP allows for an overall decrease in costs related to WAPA's operating reserve requirement and avoids additional costs related to newly installed generation in the RMRSR footprint. The transition to NWPP is planned for fall 2019.

Maintaining a reliable, resilient transmission system also requires attention to capital, maintenance and operations projects. In 2018, RM completed the task of raising

RM 10-Year Capital Plan
Estimates as of October 2018



WAPA balancing authorities



wood pole structures in the Gering, Nebraska, area to preserve safe clearances for agriculture vehicles traveling under WAPA power lines. The completion of this project ensures safe access to landowners. The major projects RM plans to address this year include:

- Big George-to-North Cody Transmission Project, Wyoming: RM will begin installing a new 115-kilovolt line on existing poles between Big George and Cody in northwestern Wyoming. The project includes construction of a new 115-kV yard at the North Cody Substation. These additions will provide additional reliability and much-needed voltage support in the Cody area.
- Archer Substation, Wyoming: RM will complete the installation of new disconnect switches for the entire Archer Substation. This project has required significant coordination with surrounding entities because of the number of outages and impacts to the power system. This project showcases the importance of collaboration with other utilities.



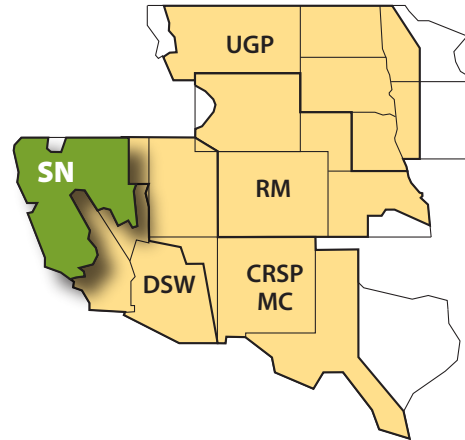
SIERRA NEVADA

Sierra Nevada markets hydroelectric power generated from the Bureau of Reclamation's Central Valley Project to 97 power customers, including municipal public power utilities, irrigation districts, federal and state entities, Native American tribes and rural electric cooperatives.

The CVP federal transmission system is owned, operated and maintained safely and reliably by SN and consists of 22 substations, 20 transformers and 957 miles of transmission line. SN is also the operating agent for the 350-mile California-Oregon Transmission Project, one of the three lines forming the California-Oregon Intertie.

In 2019, SN staff will work with Reclamation and SN's power customers to focus on issues related to the future of CVP hydropower as a result of changing market conditions in California. SN, its customers and Reclamation have formed a steering committee to address these issues and have scheduled several meetings that will allow a formal opportunity for individual power customers to provide feedback on these issues. The most significant issues this group is focusing on are the CVP Improvement Act Restoration Fund and activities, the stability of CVP power costs, power bypass operations, the overall value of CVP hydropower and customer service.

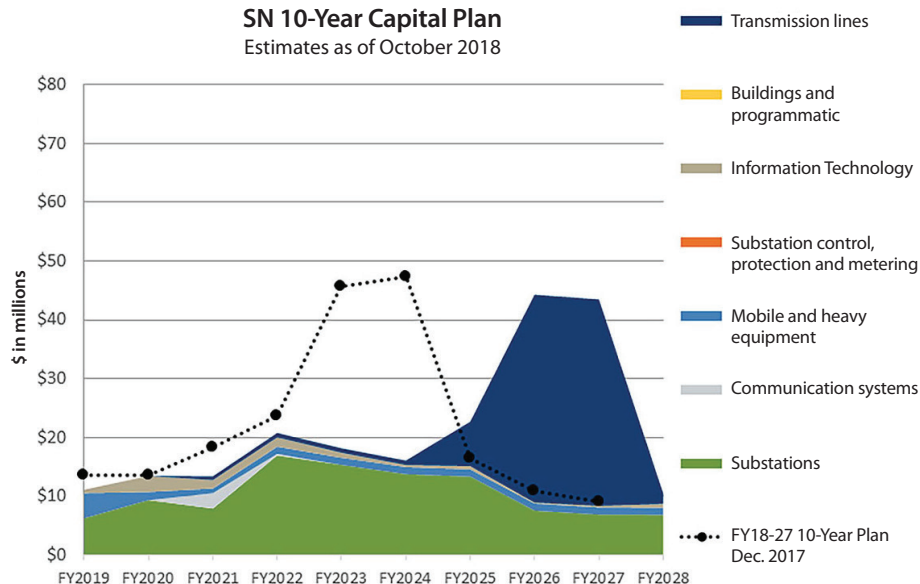
SN published a proposed rate extension in the *Federal Register*, which extends its existing formula rates through Sept. 30, 2024, for CVP power, transmission and ancillary services; California-Oregon Transmission Project transmission; Pacific Alternating Current Intertie transmission; and



third-party transmission. The current rates expire on Sept. 30, 2019. The comment period for the rate extension ended Jan. 11, 2019.

SN staff is exploring how it can voluntarily meet new standards in California State Senate Bill 901, a comprehensive wildfire prevention and safety package that also enables electric utilities to recover some expenses associated with catastrophic wildfires. Specifically, the bill identifies 12 factors to determine whether or not expenses will be covered. While the state cannot regulate federal activities, and SN is not bound by SB 901, the standards set by the state may affect federal activities. Therefore, SN will participate in an ad hoc Wildfire Committee set up by the Transmission Agency of Northern California. Through this effort, SN will determine where and how it can accommodate SB 901.

SN 10-Year Capital Plan
Estimates as of October 2018





In 2018, WAPA submitted notices of withdrawal for its balancing authorities and transmission operators to leave Peak Reliability Coordinator, at the end of 2019. Since SN is located within the Balancing Authority of Northern California footprint, SN will transition to receive coordinator services from the California Independent System Operator July 1, following BANC's schedule. This project will ensure SN maintains compliance with North American Electric Reliability Corporation requirements related to RC services, and ensures SN proactively responds to industry changes to provide the best possible outcome for the region and its customers.

SN staff continues to work closely with customers addressing today's issues and preparing for tomorrow's power-related services and system needs. In collaboration with its customers, SN has established a 10-year planning budget to continue safe, reliable grid operation. The proposed budget also supports new initiatives through public-private partnerships. These partnerships will generate benefits to the preference power and transmission customers by containing costs. In 2019, SN will continue to work with Duke-American Transmission Company on developing the San Luis Transmission Project. SLTP is a proposed 230-kilovolt transmission line that will carry Reclamation-generated hydropower to deliver water to agricultural and water users.

Precursor project development activities, particularly under the National Environmental Policy Act, will continue for the Beale Air Force Base Interconnection Project. The Beale Air Force Interconnection will provide the base access to reliable energy sources and help bolster security and resilience of this military installation in northern California.



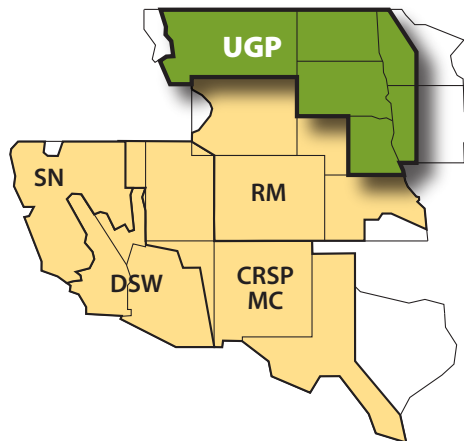
UPPER GREAT PLAINS

Upper Great Plains markets more than 9 million megawatt-hours generated at eight dams and powerplants in the Pick-Sloan Missouri Basin Program—Eastern Division to more than 339 power customers in Montana, North Dakota, South Dakota, Nebraska, Iowa and Minnesota.

UGP delivers enough hydropower to serve more than 3 million households through 124 substations with 118 transformers and across 7,922 miles of federal power lines in its 378,000-square-mile service territory. UGP’s preference customers include rural electric cooperatives, cities, towns, public utility districts, irrigation districts, state and federal agencies and Native American tribes.

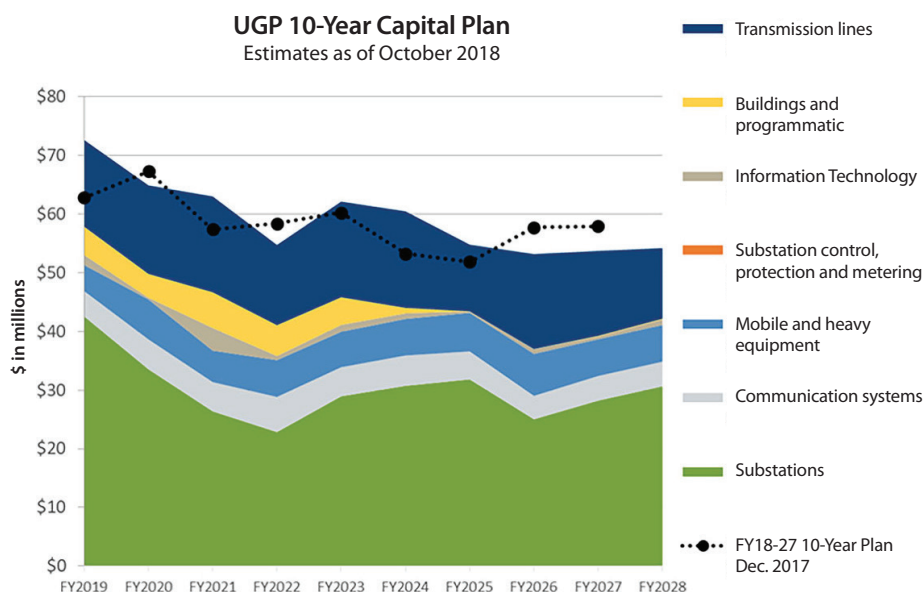
In 2018, Upper Great Plains had an exceptional year in the Southwest Power Pool. Stronger releases throughout the summer drove significant surplus energy sales into the market. Annual generation was about 24 percent higher than the previous year, increasing energy sales by more than 45 percent.

SPP market prices were also higher than in 2017. Excellent water conditions reduced the region’s purchase-power needs, resulting in about \$42 million more in net market revenue over the previous year. The cumulative result was net market revenue of more than \$48 million. Being able to sell excess generation into SPP and purchase energy from the market to meet contractual commitments has helped to keep WAPA’s costs low and its firm power rates stable.



With an eye toward gaining efficiencies and reducing costs, UGP has continued to review workload changes associated with joining SPP. As a result of the reviews, the UGP Operations office has consolidated its dispatch branches. This reorganization will allow for a more effective analysis of the existing workload, assist in determining if additional reductions in full-time staff are possible and allow for more efficient workload distribution.

In 2019, UGP is again supporting interconnection requests and prioritized capital projects that maintain the transmission system’s long-term health and reliability, as well as address the growing demands for energy throughout the region. In 2018, 10 construction projects were completed, 59 projects were in progress and 39 were in the planning stages.





Infrastructure projects completed in 2018 include:

- Groton South, Stage 01, which included a new 115-kilovolt breaker and half substation to relieve congestion at the existing substation and accommodate expansion requirements in Groton, South Dakota.
- VT Hanlon, Stage 02, which included a new 230/115/69-kV breaker and a half substation to replace existing East River facility, upgrade failing equipment, provide more reliable configuration and accommodate load growth in the area.
- Towner Substation, Stage 01, which included a new 115-kV ring bus substation to replace existing single bus facility to upgrade failing equipment and provide more reliable configuration.
- Wanblee Tap, which is a new 115-kV tap on the Philip-to-Martin Line to increase reliability on the LaCreek Electric Power System in western South Dakota.

Upcoming projects that were highlighted in WAPA's 10-Year Capital Plan include:

- Holt County Approach Spans: Transmission line structures and approach spans are being installed to

facilitate sectionalizing the Ft. Thompson-to-Grand Island 345-kV line at Nebraska Public Power District's new Holt County Substation. Sectionalizing an existing line into two smaller segments allows new loads or generation to interconnect at the new substation location.

- Washburn 41.8-kV: The new 41.8-kV interconnection at Washburn will provide additional feed to the existing facility that serves the Blue Flint Ethanol Plant. The line that currently serves this area is 194 miles long and is subject to significant voltage dips. The Washburn interconnection will alleviate outages at the plant caused by these voltage depressions.

Projects launched last year that will receive significant stage additions in 2019 include the Brookings, Roberts County and Martin substations.

In addition, UGP has two significant projects supporting wind interconnection requests for 304 megawatts of capacity at Utica Junction Substation and a new switching station on the Newell-to-Maurine 115-kV line called Sulpher.



Net generation
27,308
gigawatt-hours
or
107
percent of average

Hydrology conditions mixed in 2018

One of the biggest challenges for hydropower is water variability due to intermittent drought and flooding. By definition, hydropower needs water to generate electricity. Without it, WAPA must buy power on the open market from other sources to meet contractual obligations to its customers. This is referred to as purchased power.

In an ideal year, snowpack around the West is average or above average, yielding snowmelt runoff to recharge reservoirs behind the dams and powerplants that provide the power WAPA markets. Federal dam owners and operators such as the Bureau of Reclamation, the Army Corps of Engineers and the International Boundary and Water Commission move water to federal hydroelectric powerplants.

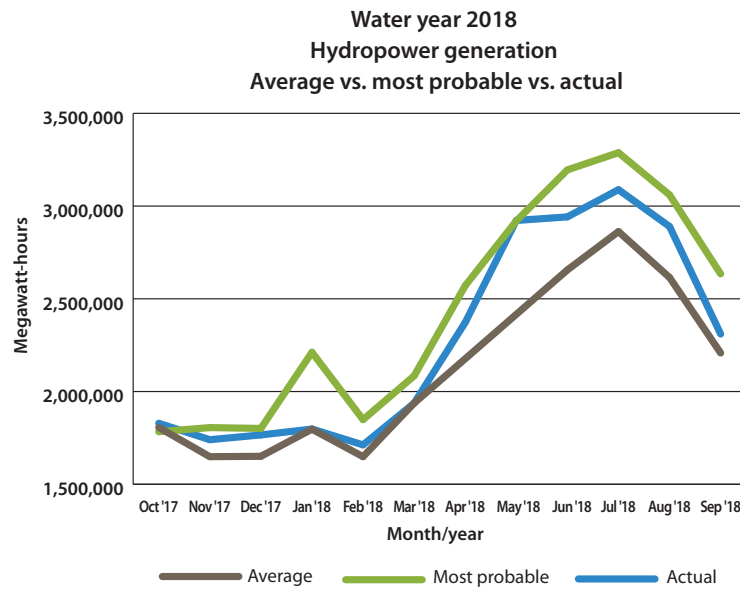
WAPA markets the subsequent power generated to more than 700 preference customers. Its customers, in turn, sell that power to more than 40 million Americans.

WAPA's year in water

WAPA's actual generation was 107 percent of average in water year 2018, for a total generation of 27,308 gigawatt-hours. For the same period, total purchased power was 1,982 GWh with actual purchase power expenses of \$53,834,864, which equates to \$27.16 per megawatt-hour.

The Colorado River Storage Project Management Center projected most probable purchase power expenses for water year 2018 to be \$18,490,664. Actual purchase power expenses were much lower, at \$6,472,235. The cost per MWh was \$25.87.

Lake Powell ended the water year with an elevation of 3,592 feet, which is about 96 feet above the minimum generation level and 108 feet below the maximum reservoir level. In water year 2019, dryness in the Upper Colorado River Basin may result in releases from Lake Powell being reduced from 9 million acre-feet to as low as 8.23 million acre-feet. If that were to occur, purchase power costs would increase by about \$10 million.



Desert Southwest’s hydrology is mostly dependent on the Colorado River Basin snowpack and precipitation above Lake Powell. Precipitation was 65 percent of average at the end of September. The region’s most probable projected purchase power expenses were \$12,818,219. Actual purchase power expenses were slightly higher at \$13,779,771, with a cost per MWh of \$62.15. Lake Mead ended the water year with an elevation of 1,078 feet, about 128 feet above the minimum generation level.

In Rocky Mountain, reservoir inflows were average or above average for the majority of the water year for all of the Loveland Area Projects. However, the July, August and September inflows were below average. At the end of September, inflows were only 47 percent of average. The projected purchase power expenses were \$13,805,126, but actual purchase power expenses were significantly lower at \$8,075,503. The cost per MWh was \$24.11.

In Sierra Nevada, cumulative precipitation of the Northern Sierra Eight Station Index was at 81 percent of average at the end of September. Accumulated inflow for the water year was 45 percent of the 15-year average for Trinity, 100 percent for Shasta, 103 percent for Folsom, and 136 percent for New Melones. Reservoir storage as of the same date was 107 percent of the 15-year average for Trinity, 100 percent for Shasta, 103 percent for Folsom, and 136 percent for New Melones. The region began water year 2018 with a most probable projection of purchase power of \$8,093,706 and ended notably higher at \$12,155,514. The cost per MWh was \$21.81.

In Upper Great Plains, runoff was above average at Gavins Point and below average in the Fort Peck, Fort Randall, Garrison and Oahe reaches. Portions of the upper Missouri River Basin continue to be affected by drought. Abnormally dry and moderate drought conditions are present in much

of North Dakota and north-central and central South Dakota, with some areas experiencing severe drought. The water year ended with the active conservation pools for the Canyon Ferry and Yellowtail dams at 86.4 percent and 93.2 percent full, respectively. UGP’s most probable projection for purchase power was \$11,306,473. Actual purchase power expenses were higher at \$13,351,842. The cost per MWh was \$21.62.

Anticipating the upcoming water year

The Seasonal Drought Outlook provided by the National Weather Service’s Climate Prediction Center in January 2019 predicted likely and persistent drought throughout the western United States. Notable drought conditions are not currently anticipated for the east. Drought removal or improvement is expected in Southern California, southern Arizona and some western regions of Oregon.

Exceptional drought, the NWS’ most extreme drought rating, is expected for central and eastern regions of Oregon, as well as the Four Corners region of Arizona, Colorado, New Mexico and Utah.

For more information...

WAPA provides updates on the hydropower conditions monthly on its website at wapa.gov, **Power Marketing, Hydropower Conditions**.

To learn about the drought outlook for 2019, visit the National Weather Service’s Climate Prediction Center at cpc.ncep.noaa.gov





Partnership, collaboration build secure, resilient grid

One of the most significant challenges facing the energy industry is protecting the electrical infrastructure from both natural and human disruptions. WAPA's Physical and Cyber Security programs focus on safeguarding valuable assets and mitigating risk to the entire system. The scope of this challenge requires that WAPA work closely with other government agencies as well as industry counterparts to share threat information and collaborate on response and recovery planning and threat mitigation strategies.

Protecting grid, adding value

In today's environment, customers expect value-added services at an affordable cost. WAPA's Physical Security Risk Assessment program is committed to meeting that expectation through continuous improvement. The program not only protects WAPA's critical transmission assets but also plays an important role in contributing to the grid's overall resilience.

The program has partnered with Asset Planning and Management and Enterprise Risk Management to develop a more risk-based, asset-specific protection strategy. This strategy, supported by rigorous methodology, emphasizes better protection for WAPA's critical assets, while eliminating some security requirements for lower-priority assets. The result is a more efficient security program and the likely reduction of more than 500 security remediation items that no longer need to be purchased, installed or maintained—a savings for our customers. WAPA begins 2019 by reprioritizing the amended list of remediation

items to prepare for revising the current remediation funding strategy.

A hallmark of an effective security program is its ability to find, track and fix security shortfalls or vulnerabilities. Currently, WAPA conducts risk assessments of its facilities and assets across 15 states and will be conducting 94 assessments in 2019. This task has been handled in the past by contractors; however, WAPA's regional Physical Security staff is gearing up to take over onsite asset assessments starting in 2020.

A training partnership with the Department of Energy's National Training Center is part of WAPA's preparation. The NTC will send a mobile team to WAPA later this year to provide Physical Security staff with two weeks of the latest training on asset-specific assessment methodologies, planning and implementation. Several members of WAPA's Physical Security team will also attend NTC training in New Mexico this year on topics such as performance assurance, physical security systems operations, selection and testing.

This year, WAPA will be finalizing a risk-based approach for determining the need for onsite assessments of lower-priority assets. Normally, the assets in this class receive an onsite assessment every five years. The risk-based approach involves determining if a site has high enough risk indicators to merit a site visit. Eliminating unnecessary site visits significantly reduces related time and travel expenses. This process will be implemented to coincide with WAPA assuming assessment responsibilities early in 2020.

To complement improvements in the risk-assessment process, changes have been made to standardize Physical Security's approach to fixing or remediating assessment findings. Beginning in 2019, regions will use common methodologies and processes rooted in best practices, risk management and cost-benefit analysis to track and fix vulnerabilities identified in their areas. Teams have been created to vet solutions as they are developed and share them across the organization. This will rapidly disseminate tested practices and solutions, increasing the effectiveness of WAPA's Physical Security program and supporting grid resilience.

Supporting national security

WAPA provides expertise and support to the Department of Defense's Defense Critical Energy Infrastructure Program to help ensure reliable energy delivery and effective communications to facilities that are necessary to the nation's defense. WAPA also participates in fiber-route sharing and trading agreements with its customers and federal partners. This is a cost-effective strategy for improving grid resilience by establishing alternate communication routes in case of a communications failure during an emergency.

WAPA is collaborating with customers and the Department of Energy to evaluate the feasibility of leasing dark fiber—existing optical fiber networks that are not currently being used in fiber-optic communications—as indicated in the American Broadband Initiative Milestones Report.

Cybersecurity program matures

Based on the activity reported throughout 2018, the cyber threat to the electricity sector will not decrease in the upcoming year. Partnerships in both the electricity industry and government will continue to be central to addressing the threats. Joint research projects and information sharing arising from these partnerships improve WAPA's cybersecurity resilience and contribute to the security posture of the electric utility community.

In 2019, WAPA expects to build on its solid foundation of protecting its cyber assets by:

- Installing advanced security sensor systems on three of WAPA's six Supervisory Control and Data Acquisition networks.
- Integrating part-time analysts from the intelligence community into WAPA security teams.
- Participating in the Department of Homeland Security's Continuous Diagnostics and Monitoring program.
- Providing WAPA data to national-level advanced analytical programs.
- Integrating user behavior analytics data into WAPA's Network Security Operations Center processes.
- Continuing efforts to resolve 90 percent of cybersecurity events within two days.
- Continuing to support the DOE Digital Transformation effort.

In addition to the above efforts, WAPA will undertake a large-scale upgrade and modernization of its cyber sensor suite as part of the normal lifecycle replacement. This effort will sharpen WAPA's visibility into its cyber environment at no additional cost.

WAPA and its partners will continue to work together to identify leading practices, efficient deployment of security resources and, where possible, share in the costs of safeguarding the grid.



Asset Planning and Management upgrades transformer acquisition process

As WAPA's Asset Planning and Management Program evolves, transformer acquisition—for new capital additions or for replacement—has emerged as an area of focus because of the traditionally long lead time for procuring this critical equipment.

The team is focusing on two particular aspects of acquisition:

- Reducing the lead time on transformers for typical maintenance and construction projects.
- Reducing the lead time on replacement transformers catastrophically damaged by high-impact, low-frequency events, or HILFs.

Streamline transformer procurement

The Asset Planning and Management Program has teamed up with Procurement and Design and Engineering to investigate ways to shorten the purchasing process for new large-power transformers from the traditional lead time of 18-24 months to 9-12 months.

A small team conducted market research in 2018, asking transformer vendors a standard set of questions about the

ordering process focused on reducing lead times. Vendors consistently offered two suggestions for expediting orders:

- Standardizing transformer specifications as much as possible so that equipment can be preapproved and pre-engineered.
- Establishing a long-term contract with a limited number of vendors to enable continuous process improvement in both manufacturing and ordering transformers.

WAPA key stakeholders accepted the recommendations from the team last year. During 2019, the Asset Planning and Management team will:

- Draft a milestone schedule for the acquisition process with Procurement.
- Work with regional subject matter experts and Design and Engineering to develop standard specifications.
- Determine vendor-qualification criteria.
- Solicit potential vendors.

A long-term contract is expected to be in place by mid-2020.





Create more flexible HILF strategy

As concerns increase around physical attacks on infrastructure, WAPA is proactively developing a transformer risk strategy that builds grid resilience against a catastrophic attack or extreme weather damage. These rare and—for the most part—unpredictable events have serious and widespread consequences and must be mitigated as quickly as possible.

Unlike mitigation efforts that focus primarily on the operational loss of one or two transformers, a HILF strategy must address the loss of multiple units at once. Originally, WAPA approached HILF planning with one mitigation strategy for its entire 15-state footprint. However, after collecting feedback from customers and internal subject matter experts in 2018, Asset Planning and Management found a clear preference for a regional approach to HILF transformer acquisition. A regional strategy will provide greater flexibility with potential industry partners in respective regions and a more transparent and manageable funding source to support whatever mitigation plan each region adopts.

WAPA customers offered input on potential recommendations for a regional approach, including:

- Signing long-term contracts for expedited transformer acquisition.
- Using existing spare transformers.
- Partnering with other regional utilities to share spares needed by both parties.

In 2019, WAPA will identify its new regional strategy, with the goal of finalizing plans and starting implementation in 2020.

Staying in STEP

WAPA staff will continue to participate in the Edison Electric Institute Strategic Transformer Equipment Program. The program is a coordinated approach to increasing the electric power industry's inventory of spare transformers and streamlining the process of transferring those transformers to companies experiencing a transmission outage caused by an event that has been declared a national emergency.



Reserve Balance Strategy closes in on targets

Customers rely on WAPA to deliver clean, affordable electricity every hour of the day, every day of the year, yet any number of factors can affect WAPA's ability to fulfill its contractual obligations. Variable hydrological or drought conditions may prevent federally owned hydropower facilities from generating sufficient electricity to meet demand. New regulatory requirements or aging infrastructure may demand unexpected expenditures to maintain the safety and reliability of the transmission grid. WAPA's Reserve Balance Strategy ensures power keeps flowing.

WAPA has been refining its reserve strategy since 2016 and has made significant progress toward achieving balance in the three areas of primary focus:

- Annual operation and maintenance expenses.
- Capital investments.
- Purchase power and wheeling expenses.

Annual O&M expenditures are driven by grid safety and security, and include replacing aging equipment, removing constraints that would impede power flows and ensuring WAPA's transmission system is at or above industry standards. WAPA has reduced its annual O&M balances by around \$64 million through the use of prior year balances. At the end of fiscal year 2018, the \$87 million balance was

slightly under the reserve target levels for the construction, rehabilitation, operations and maintenance account.

Capital investments ensure WAPA is able to continue transmitting power to wholesale customers and meet their changing needs. WAPA has collaborated with customers to determine the amount to retain for capital investments. Reserve capital balances were \$188 million, well within the \$252 million maximum the strategy would support. The balances reflect greater regional alignment with the strategy, which will help ensure the capital balances are maintained within targets and within stakeholders' expectations.

The purchase power and wheeling reserve allows WAPA to meet energy obligations to customers during variable hydrological or drought conditions. The balances were increased by \$45 million, and WAPA is on target to reach the \$427 million strategy objective by the end of FY 2020.

Overall, the combined reserve balances for the three primary purpose categories came in at \$600 million, well under the combined \$768 million level the strategy would support. The total FY 2018 balance is \$717 million, including \$117 million for budget categories that do not affect rates and for other revolving funds held for generation agencies' reserve balances. During this same timeframe WAPA has returned nearly \$1 billion to the U.S. Treasury Reclamation Fund.

	Annual O&M	Capital investments	Purchase power and wheeling
Example	Salaries, supplies and equipment	Building new transmission lines and related structures	Buying power on behalf of customers when water conditions require it
Purpose	Allows WAPA to sustain operations during emergencies, continuing resolutions or lapses in appropriations	Provides funding in advance of starting capital construction projects and flexibility with schedule or priority changes in collaboration with customers	Improves both WAPA and customer cash management, allowing for continued funding of critical capital construction and maintenance projects
Strategy	Retain 31 percent of annual funding need	Retain sufficient funding to cover up to three years of capital investments	Retain three years estimated funding during drought

CUSTOMER **Circuit**
WINTER 2019

WESTERN AREA POWER ADMINISTRATION
P.O. Box 281213
Lakewood, CO 80228-8213
720.962.7411
www.wapa.gov
email: publicaffairs@wapa.gov

Editor: KEVON STORIE
Graphic Designer: GRANT KUHN
Contributors:
LISA MEIMAN
PHILIP REED



Western
Area Power
Administration



U.S. DEPARTMENT OF
ENERGY