STATE WATER PROJECT

Energy Roadmap

2021

Envisioning the Challenges and Opportunities of Leveraging SWP Assets for a More Sustainable Energy Future for California

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Introduction & Background

SWP and California's Energy Market: Recent History to Present

The Burns Porter Act was passed in 1959, which ultimately resulted in the development of the California State Water Project (SWP). Today, the California Department of Water Resources (DWR) manages the State Water Project and works with other state and federal agencies and the public to develop strategic goals and near-term and long-term actions to conserve, manage, develop, and sustain California's water resources. DWR also works to prevent and respond to floods, droughts, and other events that would threaten public safety, water resources and management systems, the environment, and property. In addition to managing water and moving approximately three million acre-feet of water annually, DWR also generates zero-carbon hydroelectricity.

Energy is a vital part of water resource management and intrinsically linked with water in a water-energy nexus. To produce energy and help offset the cost of moving large amounts of water, DWR has five hydroelectric power plants and four pumping-generating plants – making the SWP the fifth largest electrical utility in California with an installed generation capacity about 1,700 megawatts (MW). For comparison, the SWP's annual consumption of electricity is similar in size to the Sacramento Utility District's (SMUD) load and is about three percent of California Independent System Operator's (CAISO's) total load. The SWP is the fourth largest generator of clean hydropower in California, providing about 14% of California's hydropower.

Prior to the creation of CAISO, DWR purchased and sold its energy through bilateral power contracts, including agreements directly with investor-owned utilities, such as Pacific Gas and Electric (PG&E) and Southern California Edison (SCE). Since California's deregulation of electric utilities in 1998, DWR has been participating in the California energy market to procure and sell its energy. Today, DWR meets SWP energy needs through long-term contracts and short-term arrangements with other electric utilities and energy marketers, including CAISO, for transmission access and for power purchases and sales.

Current Regulatory Environment

Changes in the electrical grid today have been driven by California's recent legislation to introduce more green and clean energy. In 2002, California first established a Renewable Portfolio Standard (RPS) Program through Senate Bill 278 (SB278) requiring 20% retail electricity sales be served by renewable energy by 2017. Since then, California has taken progressively more ambitious steps toward introducing more clean energy. The main pieces of legislation introducing these changes are California Senate Bill 100 (SB100),

SWP History and Key Milestones

1959 — Burns Porter Act is enacted, authorizing the construction of the SWP

1963 — The SWP power office is created

1968 — Power generation begins at Oroville dam

1972 — DWR contracts with Los Angeles Department of Water and Power (LADWP) to construct and operate Castaic Powerplant

1979 — DWR enters long term contract with Kings River Conservation District for the Pine Flat powerplant

1979 — DWR enters into agreement with Nevada Power Company to build the Reid Gardner No. 4 powerplant, a coal fired plant

1982 — DWR enters long term contracts with PG&E (1982) and SCE (1983) for purchase and sale of energy

1983 — DWR becomes a bulk power agency making the SWP the 5th largest electric utility in California

1996 — FERC Order 888 (1996) & 889 (1996) enacted to allow non-discriminatory access to transmission customers, ultimately overseen by the new CAISO

2001 — DWR establishes California Energy Resource Scheduling (CERS) division as a result of an Executive Order to save the three main California Investor-based utilities from bankruptcy

2008 — DWR enters agreement with Northern California Power Agency and other public agencies to build the Lodi Energy Center

Assembly Bill 813 (AB813), and the Renewable Energy Standard. The current RPS goal is to utilize 60% renewable energy by 2030 and 100% renewable energy and zero-carbon resources energy by 2045.

DWR is committed to environmental stewardship by meeting its own water resource sustainability goals and helping California meet its GHG emission goals.

Currently, 50 percent of the SWP's power is provided by its own carbon-free hydroelectric generation, and another 15% is provided by contracted renewables and zero-carbon resources. In 2020 and 2021, DWR executed four long-term power purchase agreements to add 284 MWs of solar generation to its portfolio with a delivery date starting in late 2022, the genera-

- **2009** — CAISO market redesign allows DWR access to day-ahead and real-time energy allowing DWR to become less reliant on marketers and other utilities to meet its energy needs
- **2010** — DWR joins The Climate Registry committing to mitigate the impacts of climate change by managing operations to better fit the Water-Energy nexus
- **2012** — DWR completed Climate Action Plan Phase 1: Greenhouse Gas Emissions (GHG) Reduction Plan setting GHG reduction targets exceeding those in Assembly Bill 32 of 2006
- **2013** — DWR executes 20-year Power Purchase Agreement (PPA) with RE Camelot for solar power
- **2015** — DWR becomes the first public agency to receive the National Climate Leadership award from the Environmental Protection Agency for greenhouse gas management. DWR was awarded again in 2016, 2018, and 2020.
- **2015** — DWR executes 20-year PPA with sPower for solar power from Solverde 1
- **2015** — DWR reduces emissions to 50% below 1990 levels
- **2015** — DWR contracts with Western Systems Power Pool (WSPP) for renewable energy capacity and credits from five small hydro facilities from Metropolitan Water District (MWD)
- **2017** — North American Electric Reliability Corporation (NERC) initiates efforts to require owners of Bulk Electric Systems (BES) elements to formally assign Transmission Planner and Transmission Operator to their transmission elements
- **2017** — DWR enters 50-year contract with Western Area Power Administration (WAPA) and United States Bureau of Reclamation (USBR) for zero carbon energy from Hoover Dam from Solverde 1
- **2018** — Senate Bill 100 is signed into law, requiring the CA energy sector to be 100% renewable energy and zero-carbon resources by 2045
- **2019** — DWR becomes founder of the Water-Energy Nexus registry
- **2019** — DWR contracts with MWD to procure small hydro resources
- **2019** — DWR executes 25-year PPA with 8 Minute Solar Energy to build Big Rock Solar
- **2020** — DWR update its Climate action Plan Phase 1: Greehouse Gas Emissions Reduction Plan, setting GHG reduction targets to meet SB 100 and Executive Order B-55-18
- **2021** — DWR executes 20-year PPAs with Terra-Gen to build Edwards Solar and Sanborn Solar bring DWR's renewable power purchases to over 400 MW
- **2022**

tion from the three solar plants will meet about 12% of SWP's energy needs. Additionally, DWR continuously explores additional sources of clean energy such as solar power and small and large hydropower installations. To mitigate its climate impact, DWR began identifying and using renewable resources of energy at SWP facilities.

Current Progress

DWR's near-term goal in its 2012 Climate Action Plan – Phase I was to reduce its emissions to 50% below the 1990 emissions level by 2020. DWR achieved this goal five years early and received a Climate Leadership Award for this accomplishment in 2018. For the 2020 update, DWR laid out the following

mid-term and long-term GHG emissions reduction goals to guide decision-making beyond 2020:

- Mid-term goal: By 2030, reduce GHG emissions to at least 60% below the 1990 level
- Long-term goal: By 2045, supply 100% of electricity load with zero-carbon resources and achieve carbon neutrality

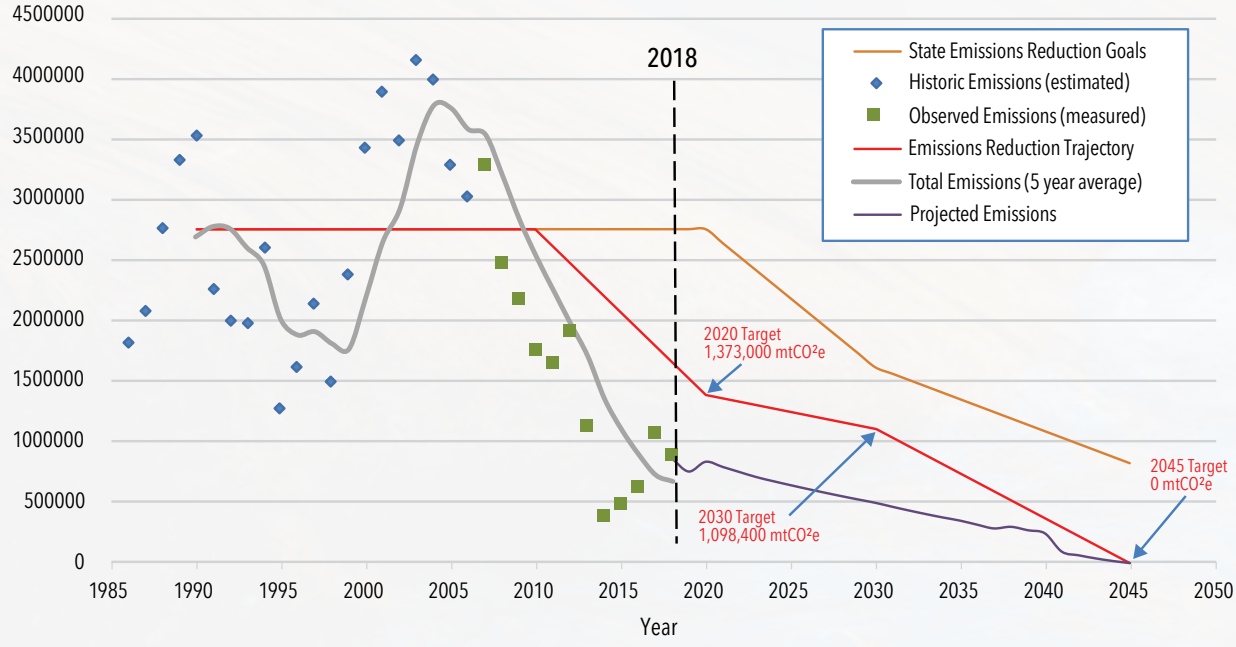
DWR seeks to be a leader in adapting to the changing electrical grid and has steadily shifted operations to take advantage of high renewable generation during the day and generating power during the evening hours to help displace fossil fuel use. Additionally, DWR has begun investigating several tracks to improve SWP water delivery and energy efficiency, increase grid reliability, and reduce/control costs.

DWR Emissions Targets Compared to State Mandated Emissions Targets

	1990	2019	2020	2030	2045
			AB32	**SB350**	**SB100**
State Mandated Emissions Targets			1990 levels	40%<1990	0*
SWP Mandated Emissions Target (MMTCO2e)	2.746		1.373	1.09	0*
		SWP Reported/Projected Emissions			
GHG Emissions (MMTCO2e)		1.09	0.825	0.489	0
Reduction from 1990 Level		60%	70%	82%	100%

*Note: 2045 targets may include some renewable resources with emissions.

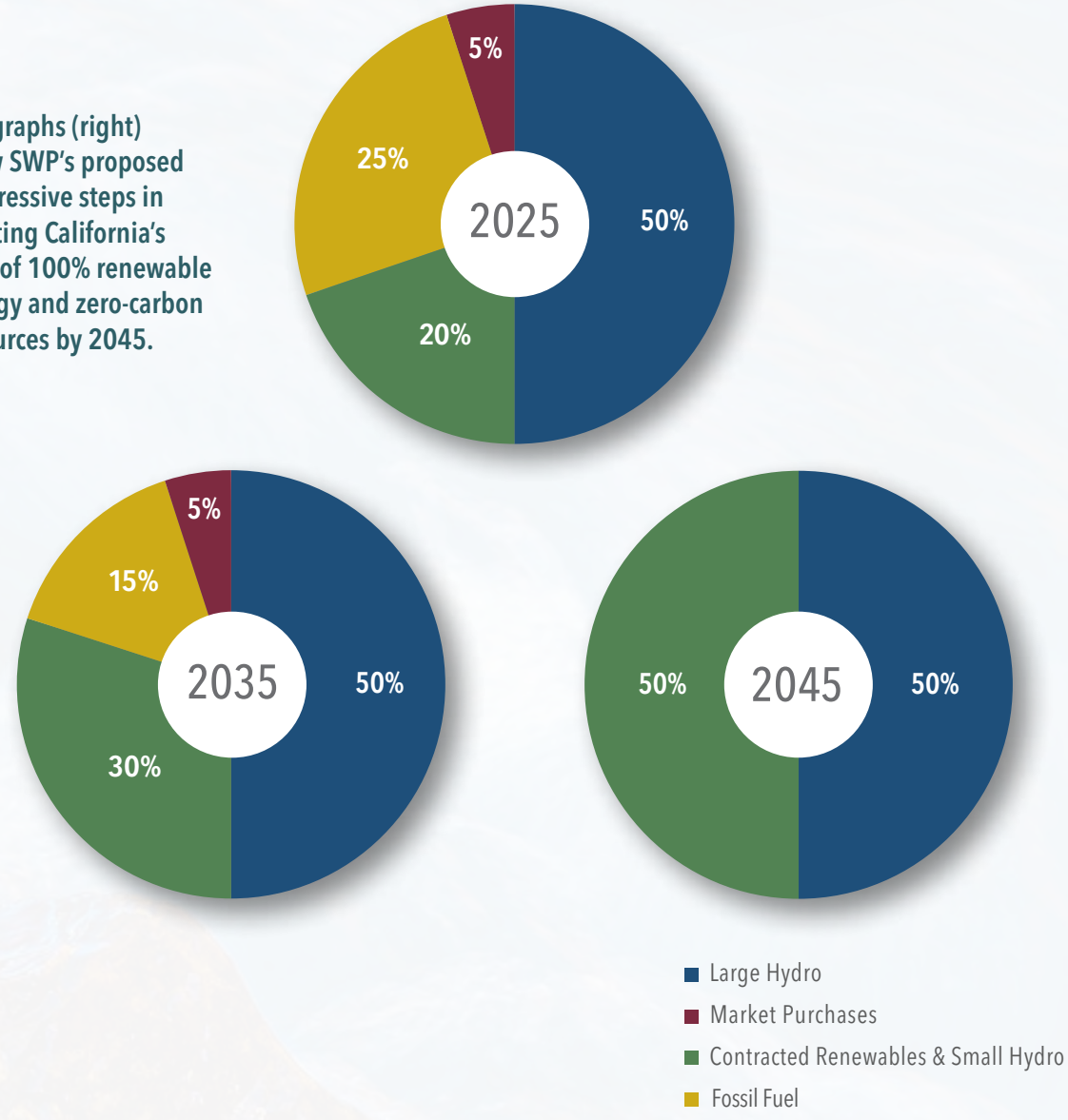
DWR Total Emissions (Historic, Current, Future)



Each of these tracks can take years to develop and, in some cases, the current market structure would need to be changed to incentivize more innovation and deployment of services to fully explore what the SWP could offer. For these tracks to be successful, DWR will need financial support of the State and stakeholders who will benefit.

The SWP has one of the cleanest power portfolios of all major utilities in California.

The graphs (right) show SWP's proposed progressive steps in meeting California's goal of 100% renewable energy and zero-carbon resources by 2045.



Oroville Dam located in Butte County is the tallest dam in the nation.

Executive Summary

Water and Power Operations

DWR administers a comprehensive power resources program that is proactively responding to an evolving power market. Key elements of the program include studies of power resources for future needs, acquisition of long-term power resources and transmission services, short-term purchases or sales of power, and the strategic vision for the operation of generation and pumping facilities.

Strategic Vision

DWR energy management strategies will be proactive, adaptive, progressive, and innovative in developing solutions that better position the SWP to participate in current and future power markets. SWP strategic plans will aim at modernizing SWP infrastructure while being good stewards of the environment, adapting to climate change, and building better partnerships with the communities served by the SWP. The SWP needs to consider adopting new operational strategies, make physical changes to owned facilities, and deploy new technologies at existing pumping and generation plants.

This Energy Roadmap identifies short-, mid- and long-term opportunities and challenges for SWP energy investments and strategies that would position the SWP to be in the lead in maintaining an efficient and effective power portfolio and serve DWR and the State Water Contractors in achieving their goals. These strategies are intended to guide the SWP as it pursues its core mission of providing a reliable source of water, while pursuing cost-effective energy resource options that support and meet California's Californ-nia's renewable energy and zero-carbon resources goals and state and federal electric transmission grid reliability requirements. The SWP's Flexible Resources planning efforts will continue to evolve as state mandates addressing climate change, technology developments, CAISO's market design, reliability needs, and price trends continue to evolve; creating more opportunities for SWP to further help grid reliability needs, integrate renewables or seizing viability of past or current recommended improvements, as State and Federal funding is made available.

SWP Power Portfolio

The SWP power portfolio consists mainly of DWR's hydroelectric generation. Additionally, DWR obtains a significant amount of capacity and energy for SWP operations from other utilities and through the CAISO's power markets. DWR also enters into long-term renewable and zero-carbon energy power purchase agreements with various entities

which assist DWR in meeting its GHG reduction goals. In addition to generating power, the SWP operates 21 pumping plants and is the largest single consumer of electricity in the state.

The SWP's Role in Changing Markets

Energy Roadmap Purpose

The purpose of this Energy Roadmap document is to develop, through a collaborative process, a joint vision and action plan for DWR and the State Water Contractors (SWC) to address emerging challenges associated with managing the State Water Project (SWP) energy power portfolio due to legislative and regulatory requirements, including power markets changes, that may impact SWP operations, water supply, ability to contribute to grid reliability, aging infrastructure, climate change effects, increasing transmission costs, legislative and regulatory requirements, and public perception.

The Roadmap builds upon ongoing efforts to continue the transition of the SWP to comply with California's clean energy regulations and to the extent practicable, its goal of a clean energy future in a reliable, cost-effective manner.

In developing the Roadmap, it is acknowledged that it will be reviewed periodically, every three to four years, to adjust, as required, to address the rapidly changing energy industry, emerging technologies and the State of California's clean energy goals and regulations.

Energy Roadmap Goal

The Roadmap identifies opportunities and challenges in the short-, mid- and long-term for SWP energy investments and strategies that are intended to continue to position the SWP to maintain a cost-effective power portfolio that serves the needs of the State Water Project. These strategies and the goal of the Roadmap is to guide the SWP as it pursues its core mission of providing a reliable source of water, while successfully responding to various power markets changes impacting SWP operations, costs, water supply reliability, and ability to contribute to grid reliability and clean energy. The subgoals of the Energy Roadmap are:

- Develop a vision, strategies, and timing to proactively manage SWP power portfolio
- Continue identifying and gathering information and understand existing and assessing emerging risks, concerns, costs and perspectives.
- Adopt solutions to reduce reliance on fossil fuel energy resources and transition to development and ownership of renewable projects
- Assist in maintaining California's grid reliability through deploying and enhancing SWP operational flexibilities
- Continue to engage the SWC Energy Committee and joint SWC/DWR Risk Oversight Committee to provide input and recommendations.

Benefits of the development of the Roadmap include:

- Developing solutions that reduce reliance on fossil fuel energy and transition to the development, ownership, and management of renewable resources.
- Contributing to California's grid reliability through the deployment and enhancement of SWP operational flexibilities.
- Control energy costs for the State Water Contractors through further optimizing operations of the SWP, and developing the flexibilities needed to better participate in current and future power markets
- Enhance NERC/ Western Electricity Coordinating Council (WECC) compliance through retaining and developing the needed resources and skillsets
- Continuously recruit and develop staff to maintain the needed level of skillsets and expertise to manage the SWP power portfolio
- Demonstrate through presentations, workshops and outreach to the public, legislature, and other stakeholders that the SWP energy management


Elevation in feet
0
1000
2000
3000
Distance in miles
0
100
200
300
400
500
600
The Delta
Redding
Sacramento
Sacramento River
Feather River
Lake Oroville
Lake Davis
Antelope Lake
Frenchman Lake
North Bay Aqueduct
The Bay-Delta
Clifton Court Forebay
South Bay Aqueduct
Lake Del Valle
San Luis Reservoir
Los Banos Reservoir
Little Panoche Reservoir
California Aqueduct
Coastal Branch
Quail Lake
West Branch
Castaic Lake
Pyramid Lake
East Branch
Silverwood Lake
Los Angeles
West Branch
East Branch Extension
Crafton Hills Reservoir
Lake Perris
4000
Elevation in feet
State Water Project Facilities
Power Plant (P)
Pumping Plant (PP)
Pump Generation Powerplant (PGP)
Pump Station (PS)
1 Hyatt PGP
2 Thermalito Diversion Dam P
3 Thermalito PGP
4 Barker Slough PP
5 Cordelia PP
6 Banks PP
7 South Bay PP
8 Del Valle PP
9 Gianelli PGP
10 Dos Amigos PP
11 Las Perillas PP
12 Badger Hill PP
13 Devil's Den PP
14 Bluestone PP
15 Polonio Pass PP
16 Buena Vista PP
17 Teerink PP
18 Chrisman PP
19 Edmonston PP
20 Alamo P
21 Oso PP
22 Warne P
23 Castaic PGP
24 Pearblossom PP
25 Mojave Siphon P
26 Devil Canyon P
27 Greenspot PS
28 Citrus PS
29 Crafton Hills PS
30 Cherry Valley PS

strategies are proactive, adaptive, progressive, and innovative
in developing solutions that better position the SWP to participate in current and future power markets.

- Informing the strategic vision and plan on how successful, implementable, and measurable the recommended actions and schedules.
- Provide a cost- effective power resource plan for the SWP.

The Energy Roadmap is built upon understanding the SWP's purpose, the need for a joint vision and collaborative process, power management strategies and underlying core values, key goals and their priority, challenges and opportunities, potential and preferred funding resources, within DWR's authority boundaries. The goals and processes of this Roadmap must also be effectively communicated to statewide stakeholders and decision-makers.

High level summary for each section:

The Roadmap builds upon ongoing efforts to continue the transition of the SWP to comply with California's clean energy regulations and to the extent practicable, its goal of a clean energy future in a reliable, cost-effective manner.

In developing the Roadmap, both entities acknowledge it will be reviewed periodically to make adjustments, as required, to address the rapidly changing energy industry, emerging technologies and the State of California's clean energy goals.

Section 3 SWP Purpose outlines the mission, purpose, additional responsibilities, and future role of the State Water Project.

Section 4 Energy Roadmap Development identifies key drivers and impacts that facilitate the need for an energy Roadmap.

Section 5 DWR/SWC Collaboration highlights the unique dynamic relationship between DWR and the SWC and the need for close collaboration.

Section 6 Core Values, Overarching Water and Power Strategies identifies core values as articulated in the SWP Strategic Plan, as well as overarching opportunities to improve energy utilization.

Section 7 Alignment and Prioritization of SWP and SWC Goals details the approach to aligning SWP and SWC goals.

Section 8 Opportunities and Challenges identifies short-, mid-, and long-term opportunities for managing the SWP, challenges, and the need for flexible resources planning studies.

Section 9 Recommendations for State and Federal Funding identifies California opportunities for state and federal funding SWP modernization and enhancements.

Section 10 Communication and Outreach Plan outlines the plan to ensure effective communication and outreach to the public, SWC member agencies, other governmental agencies and stakeholders.

Section 11 Interim Action Plan (2021-2025) identifies steps for short- and long-term action plans.

State Water Project Facilities and Field Division and SWP Contractors

The 444-mile long California Aqueduct during a spring evening in the San Joaquin Valley.

SWP Purpose

Energy Roadmap Mission Statement

The SWP aims to ensure water supply reliability and affordable energy rates, respond to market evolution, and make prudent investments to achieve California's clean energy goals.

Purpose

DWR has been tasked with managing and maintaining the reliability of California's water resources while protecting, restoring, and enhancing natural and human environment. To increase state-wide water supply reliability, the Burns-Porter Act of 1959 formally known as the California Water Resources Development Act, was passed to authorize construction and on-going management of a trans-California water storage and supply system. The same year, California voters approved a $1.75 billion bond to build DWR's State Water Project. The goal of this project was to capture and store rainfall and snowmelt runoff in Northern California and deliver it to areas of need throughout the state. This is accomplished through a network of SWP dams, canals, and pumping plants that store and deliver water to people, farms, the environment, and industry.

The core of the SWP is the California Aqueduct and its branches, which transport water through more than 700 miles of canals, tunnels, and pipelines from California's Northern Sierra Nevada mountains to Southern coastal Los Angeles, the Sacramento and San Joaquin Valleys, and beyond. Throughout the state, DWR manages a series of 21 dams built for flood control and water supply. DWR's 36 storage facilities supply water to irrigate about 750,000 acres of farmland. DWR operates SWP water storage and conveyance capacities that can cost-effectively control pump loads and generation. Approximately 27 million of California's estimated 39 million residents benefit from SWP water.

Currently, water deliveries go to 29 state water contracting public agencies (SWC) that have contracts for annual deliveries of water. Through these contracts, the SWC are repaying the general obligation bonds, plus interest, and additional bonds issued for added facilities. They also

PUMPING-GENERATING PLANTS

Pumping-Generating Plants	Generating Capacity	Pumping Capacity
Castaic	214 MW	
Gianelli	363 MW	400 MW
Hyatt	645 MW	387 MW
Robie Thermalito	114 MW	90 MW

GENERATING PLANTS

Generating Plants	Generating Capacity
Alamo	15 MW
Devil Canyon	235 MW
Mojave Siphon	29 MW
Thermalito Diversion Dam	3 MW

PUMPING PLANTS

Plant	Pumping Capacity
Badger Hill	9 MW
Barker Slough	4 MW
Bluestone	7 MW
Buena Vista	95 MW
Cherry Valley	1 MW
Chrisman	213 MW
Citrus	13 MW
Cordelia	4 MW
Crafton Hills	10 MW
Del Valle	1 MW
Devil's Den	7 MW
Dos Amigos	179 MW
Edmonston	776 MW
Greenspot	4 MW
Harvey O. Banks	248 MW
Las Perillos	3 MW
Oso	70 MW
Pearblossom	157 MW
Polonio Pass	7 MW
South Bay	33 MW
Teerink	97 MW

Fifty percent of the SWP's power is provided by it's own carbon-free hydroelectric generation.

pay for operations and maintenance costs and environmental projects that help mitigate impacts from the SWP's water operations. 27 of the 29 contractors form an association – The State Water Contractors who continue to be a vital partner in DWR operations.

Additional Roles and Responsibilities

Today the SWP is the largest state-built, multi-purpose, user-financed water project in the country. It was designed and built to deliver drinking and irrigation water, control flooding, generate power, groundwater recharge, and provide environmental benefits.

The SWP also generates a large amount of zero-carbon electricity at its reservoirs and generating plants, which ultimately helps offset half of the SWP's power consumption and need, and reduces California's reliance on fossil fuel generation. The SWP uses five hydroelectric generating plants and four hybrid pumping/generating plants to generate clean power. The energy produced – which is highly variable due to changes in annual hydrologic conditions–averages around 6 million megawatt-hours (MWh) a year (which can power about 1 million houses in California). SWP facilities provide a mix of frequency regulation, spinning, and non-spinning reserves to the CAISO's ancillary services market. SWP offers its pump load as demand response service to support grid reliability through a participating load agreement with CAISO.

DWR sells the power it generates from the SWP to the CAISO market, primarily in the evening hours when grid net load is highest and wholesale energy prices are high, which helps displace fossil generation and lower overall GHG emissions for the grid. The revenue from these sales helps the net cost of water deliveries more affordable for the SWC. In addition to generating power, the SWP operates 24 pumping plants and is the largest single consumer of electricity in the state. SWP annual pump load ranges from 6 million to 9.5 million megawatt-hours (MWh) depending on the type of water year (dry, average, wet), which is about the same as the utility load for the Sacramento Municipal Utility District which serves over 1,500,000 customers.

DWR is not an electric utility in the traditional sense as the main purpose of the SWP is to safely provide consistent and reliable water supply, not the sale of power. The SWP spans the majority of California and the transmission system interconnecting DWR's pumping and generating plants stems from previous long-term contracts with PG&E and SCE that were absorbed into CAISO through interconnection agreements. Most of this interconnection is by generator tie-lines but DWR does own three Orville-Table Mountain transmission lines as well as capacity rights on the Midway Wheeler Ridge line. DWR also owns the transmission line connecting the Pine Flat Power Plant to the CAISO grid.

Future Role

DWR is currently the largest single provider of demand response to the CAISO market and also participates in ancillary services and congestion revenue rights. SWP aligns its pump load to Solar hours to help absorb excess Solar generation and help reduce curtailments, and aligns its hydro-generation to late evening hours, displacing what otherwise would be fossil generation. DWR continues to adapt to market evolution by improving efficiency while exploring other market mechanisms and making investments to achieve California's clean energy goals as well as helping to maintain affordable energy rates. With additional support from State and Federal funding sources, the SWP could provide additional benefits to California's grid.

DWR is continually identifying system operational and physical improvements under its Flexible Resources Study. These improvements would allow the SWP to add more flexibility to its operations and be better

positioned to participate in the CAISO market in supporting grid reliability and clean energy policy.

Other Considerations

While reliable water delivery is the primary objective, other factors may be considered in any future investment. Challenges faced by the SWP include climate change, aging infrastructure, evolving energy markets, subsidence, shifting, variability in water supply, and sometimes competing state and federal mandates.

Efforts by the SWP to continue to incorporate renewable energy and mitigate future energy and transmission cost increases are necessary and desirable. The continuing consideration of how SWP decisions impact these costs are critical. When assessing these costs, the SWP would continue to consider:

1. Long-term cost trends that can be absorbed and managed by the SWP versus extraordinary expenses
2. Proactive and progressive approaches to energy and transmission management
3. Continuous alignment of goals and objectives across projects
4. Benefits, risks, and the time horizon that the SWC are expected to incur costs
5. Future energy costs and their impacts on both fixed and variable costs

Incorporating long-term costs in SWP activities will help stakeholders better assess the true value of projects in the face of rising costs. It will also clearly differentiate between goals that are the result of state and federal mandates, and those that may be voluntary but yield benefits that should be considered, but may require additional state and federal funding, specifically when investments yield benefits beyond the SWP needs

Teerink Pumping Plant, part of the California State Water Project, is located in Kern County.

South Bay Aqueduct, the State Water Project's first delivery system completed, is 42.9-miles long.

SECTION 4

Energy Roadmap Development

Why is this Energy Roadmap being developed?

The following factors drive the need for an energy Roadmap:

- **Variability of SWP pumping load:** SWP pumping load is based on hydrology and can have large variations from year to year – making long term hedging strategies challenging.

- **Changing resource mix:** As the California power grid transitions to a cleaner, yet more variable and energy limited resource fleet to meet SB100 goals, it will require new market products. These new products could increase costs, but could also provide new opportunities for the SWP to collect market revenues by offering flexible capacity from its pumping and generating fleet while meeting its core responsibility of water delivery.

- **GHG reduction mandates:** The SWP is required to meet SB100's 100% renewable energy and zero-carbon resources target by 2045. This would require re-examination of the SWP's investment in the Lodi Energy Center (LEC) and exploration of options such as green hydrogen technology to replace natural gas as the primary fuel source.

- **Wildfire mitigation:** As wildfires become more frequent and more intense, new measures may be required to mitigate wildfire risk. If Public Safety Power Shutoff (PSPS) events employed by utilities continue to increase, it could impact SWP operations and may require new options for power resiliency such as a microgrid featuring solar power generation paired with energy storage to mitigate PSPS events.

- **Flexible Resources need:** California's energy market is evolving from the increased penetration of renewables, retirement of fossil fuels, and climate change. The SWP needs to adapt its infrastructure and operations to add more flexibility to the system, be able to operate in a more responsive pattern, and capture market opportunities. More flexible SWP operations would be a great resource for enhancing grid reliability and supporting the state's clean energy policy.

- **Focus on core issues:** As California continues its drive to a 100% renewable and zero-carbon energy grid, opportunities may arise that have not been considered by DWR or the SWC. Additionally, since 2000, additional roles and responsibilities have been given to DWR to provide stabilization to

California's grid and the potential procurement of additional energy resources. It is important this Roadmap articulate the guidelines that future investments do not distract or takeaway from DWR and the SWP's core mission.

CAISO Market Evolution Highlights

This Energy Roadmap also navigates energy management challenges that arise with market evolution.

To lower the cost of electricity, the California legislature passed a bill in 1996 to open its electric power industry to competition. Following the deregulation of electric industry in 1998, California experienced the 2000–2001 energy crisis when power supplies were tight, wholesale energy prices surged, and rolling blackouts occurred. The low power supply was caused by a combination of reduced in-state hydroelectric generation due to a dry summer in 2000, reluctance of power suppliers to import to California, and lack of power plant buildout in the state in the prior ten years coupled with market manipulation by a few power trading companies.

Next, California initiated a comprehensive market design to mitigate and eliminate the factors that contributed to the energy crisis. One major initiative was the introduction of the Resource Adequacy program to ensure that sufficient resources were available to meet the electricity demand.

Grid conditions during the August 2020 heat wave necessitated further refinement of the Resource Adequacy program to ensure sufficient capacity is available during periods of net load peak when solar resources cease generation.

Air pollution caused by fossil fuel generation and climate change also prompted California to enact clean energy mandates to drastically cut greenhouse gas emissions and bring new clean energy resources into the power grid. Integration of renewable resources required buildout of new transmission lines to bring power from new clean energy resources to serve California load.

Challenges to the SWP Due to Market Evolution

- Increasing costs for transmission buildout, resource adequacy, and new market products to reliably integrate renewable resources
- Lack of sufficient cost recovery for clean energy projects that would help the grid – unless funding is provided by legislature or other sources

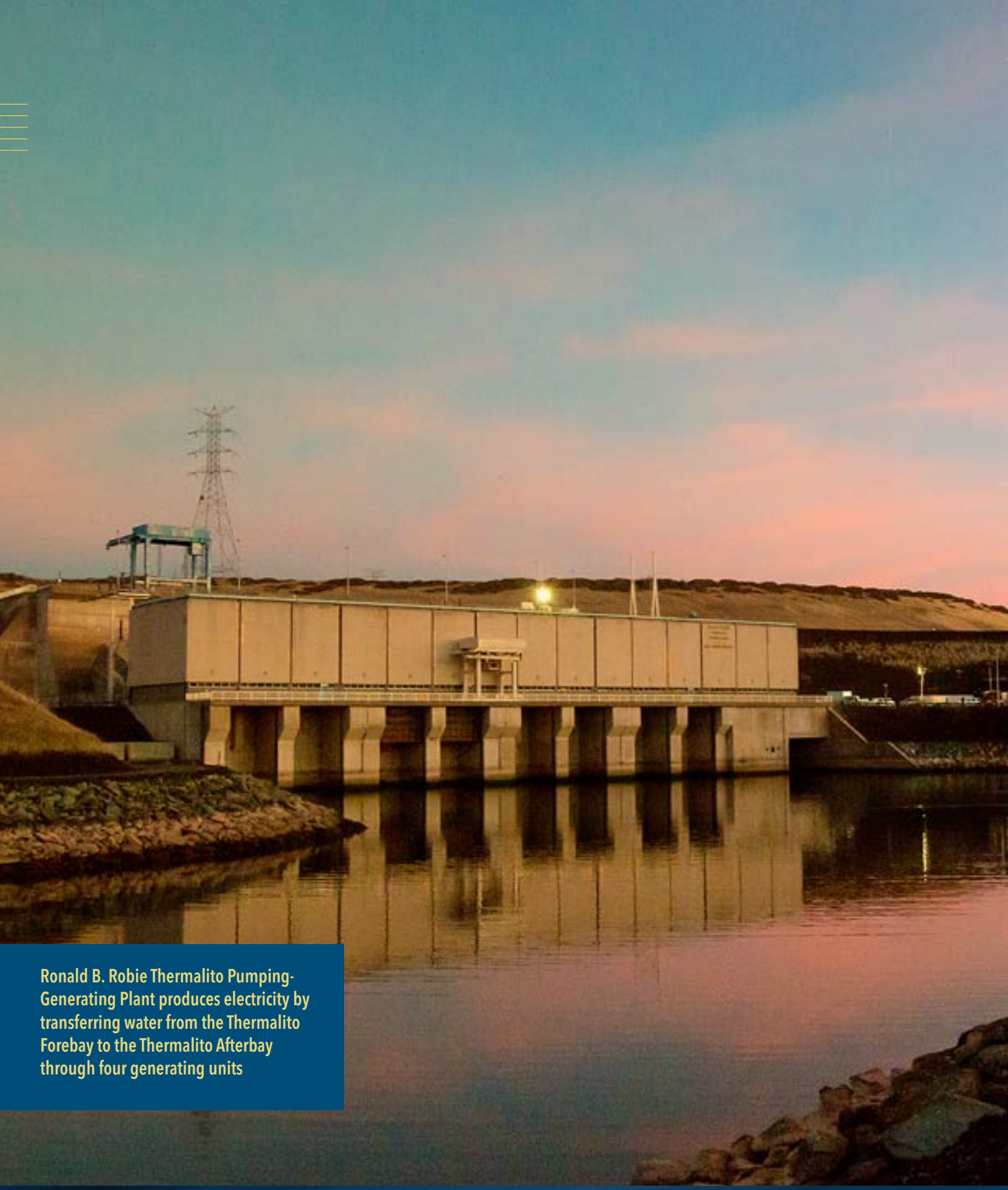
Expectations & Measures of Success

- DWR will remain active in the CAISO initiative process to work on developing market practices that benefit the SWP and similar generators.
- DWR will also examine opportunities to mitigate future increases in the transmission costs that do not place a reliable and sustainable water supply at risk.

Joint Strategic Vision Between the DWR & the SWC

- When practicable, DWR will coordinate these efforts with the SWC and other stakeholders. This could be done through initiatives at the CAISO, public education campaigns and with potential legislation.

Banks Pumping Plant located in Byron, California, marks the start of the California Aqueduct and has a pumping capacity of 248 megawatts.



Ronald B. Robie Thermalito Pumping-Generating Plant produces electricity by transferring water from the Thermalito Forebay to the Thermalito Afterbay through four generating units

SECTION 5

DWR & SWC Collaboration

A Shared Vision for a Reliable State Water Project

By its very nature, the SWP binds many disparate issues together under one project that spans the state. Fostering collaboration among entities that are involved in these issues will be critical to ensure the SWP's success in the future. For the SWP to continue to meet California's climate goals, DWR, the SWC, and other stakeholders will need to work together to support DWR in maintaining an energy policy and investment strategy that protects the primary purpose of the SWP while outlining opportunities for investments that meet regulatory obligations as cost-effectively as possible, supporting the greening of the electric system, and developing a safe and resilient water supply for California. With the SWC's support, DWR will consider the minimization of future energy costs in long-term SWP decision-making actions and ensure the process is communicated to all stakeholders.

California Energy Policy as a Force for Collaboration

Through SB100 and other key climate legislation, California has set some of the most aggressive emission-free generation targets in the country . To meet these targets, it will take collaboration between many stakeholders, including state and federal agencies, water and electric utilities, generators, utility customers and environmental advocates. The joint agencies of the California Public Utilities Commission, California Energy Commission, and the California Air Resources Board (Joint Agencies) have identified several potential paths forward all of which will take the collective efforts of stakeholders to meet. These actions include construction of clean electricity generation and storage facilities, flexibility in demand management, and exploration of technologies that are not yet economically viable. Close collaboration between DWR and the SWC is essential in these efforts.

Unique Relationships between DWR and the SWC

The unique relationship between DWR and the SWC is the interaction between state and local governments that take place within the decision-making structures of SWP. DWR, a department under the California Natural Resource Agency, manages the SWP, while near- and long-term funding of SWP is mainly provided by public water agencies that contract with DWR to deliver water across California.

Organizational Structures of DWR and the SWC

Most of DWR's work related to energy issues comes from the Division of Operations and Maintenance (O&M), and the SWP Power and Risk Office (PARO). O&M manages project facilities, including pumping and hydro-electric plants. PARO is responsible for long-term and mid-term power and transmission planning. PARO is responsible for developing and performing strategic planning studies to obtain reliable, environmentally friendly, and competitively-priced power resources and transmission services to operate the SWP. The SWP Analysis Office (SWPAO) is responsible for contracting for the project water, including negotiation, administration, and billing for the contractors. The SWC is comprised of 27 of the 29 public water agencies that contract for water from the SWP. The association is governed by a board of directors made up of staff from those member agencies.

Collaboration Ensures All Participants are Informed and Have the Ability to Provide Input

As the energy market in California continues to evolve to address new legislative policies and mandates, impacts from climate change and a changing energy resources portfolio mix, ensuring alignment of SWC and DWR goals is imperative. To achieve this alignment, each organization must identify their respective roles to ensure that participation in the process is part of the solution and that both organizations' input is incorporated.

For energy issues, the relationship between DWR and the SWC is challenged by the critical role power plays in water management and deliveries. The primary mission of the project is to deliver water throughout California. An incidental product of this mission is the immense amount of power it takes to move that water from northern California to the rest of the state.

Ronald B. Robie Thermalito Pumping-Generating Plant has a pumping capacity of 90 megawatts .

To manage the power side, DWR employs a team of wholesale energy market experts in PARO and O&M to position the SWP to operate and navigate through California's wholesale energy market.

For the SWC, all facets of SWP management and operation are important. However, many of the agencies lack the resources and knowledge to engage in energy discussions in the same way they engage in water supply and delivery. To address this knowledge gap, constant communication is required between the organizations to establish a common knowledge base from which meaningful discussions result in advancing initiatives. For the SWC as an association, the alignment of energy goals and objectives between member agencies, staff and the board is necessary to achieve consistent messaging and communications to DWR. SWC association staff must be able to communicate to its board, internal staff, and outside parties how wholesale energy markets operate, and how evolving legislative and regulatory policies may impact DWR energy costs and operations.

To facilitate collaboration, the organizations have established joint committees that meet on a regular basis in several areas, including but not limited to operations, maintenance and engineering, energy, water operations, legal and finance. These meetings are used to share knowledge, develop consensus, and recommend courses of action between the DWR and SWC teams. DWR and the SWC have annual, monthly, and as-needed meetings to discuss a variety of topics throughout the year. Continuing these meetings will ensure that both organizations are kept abreast of existing and upcoming issues.

Case Study in Collaboration: San Luis Transmission Project

In 2016, an analysis was undertaken by DWR to examine the potential participation in a high-voltage transmission project being proposed by the Bureau of Reclamation and the Western Area Power Administration (WAPA). The project would have allowed for the SWP's San Luis facilities to be directly tied to the WAPA transmission system and potentially be partially served from the WAPA balancing authority rather than the CAISO balancing authority. The purpose of this analysis was to determine whether savings could be realized in energy and transmission costs.

Edmonton Pumping Plants pumps elevate State Water Project water nearly 2,000 feet over the Tehachapi Mountains to Southern California.

In 2018, DWR, SWC staff, and contractors formed a policy committee to consider the potential of this project. Both sides were open to discussing the project's issues that included operational, economic, and political impacts while examining alternatives and utilizing value engineering to examine the feasibility of the project. Although the parties determined the project was not cost effective and DWR decided not to participate in the project, the cooperation between the organizations can be used as a model for future discussions.

Case Study in Collaboration: SB 49 Report

SB49 also provided another opportunity for DWR and the SWC to collaborate to examine potential options to enhance the SWP. DWR developed research tracks and shared the status of their research with the California Water Commission, State Water Contractors and other stakeholders. During the development of the report, DWR identified potential areas for SWC involvement: finding land to site solar and battery systems along select pumping stations and the ability of contractors to shift delivery schedules to accommodate grid conditions. The SWC and DWR held meetings to better understand the scope and applicability of these tracks which culminated in SWC providing feedback on the report which culminated in a convening of the Risk Oversight Committee for final review.

Continuing and Strengthening Collaboration

Between DWR and the SWC, it is important for each organization to have a clear understanding of each other's roles, responsibilities, authorities, and goals. For the contractors, understanding the organizational structure of DWR and its many offices and divisions allows them to understand the roles and responsibilities of DWR. Additionally, learning more about the DWR team, their roles, and backgrounds helps clarify their role within the organization.

For DWR, it is important to understand the unique nature of each contractor and the use of their project water. Each contractor has their own history, decision making structure, and future aspirations. For some contractors, water security helps offsets issues with local groundwater quality, for others it may be to serve a growing population and for others to allow crops to thrive. Learning more about these variances helps DWR understand how their actions impact contractors.

Close collaboration begins with early communication of issues and plans between SWC member agencies and DWR and will be key to achieve the buy-in for future investments that may require additional funding or create new risks. It will also allow both organizations to measure their respective appetites for these risks to meet the state's ongoing challenges. Lastly, the parties should continue to discuss and explore new and effective ways to share information and expand the contractor's base of knowledge in the energy field.

Bethany Reservoir that conveys SWP water through the California Aqueduct and serves as a forebay for South Bay Pumping Plant is located downstream of Banks Pumping Plant.

Camelot Solar Plant located in Mojave, California.

SECTION 6

Core Values & Overarching Water & Power Strategies

SWP Core values are articulated in the SWP Strategic Plan and include the following:

Building Strong Partnerships

Through continuous collaboration and communication, the SWC and DWR will partner with energy industry participants to develop integrated solutions that: promote a reliable SWP which will ensure water supply reliability and power supply sustainability, promote resiliency, maintain compliance, help advance clean energy goals, and help mitigate grid reliability challenges.

Strong partnership will be built through:

- Common goals and a shared vision
- Clear expectations
- Defined and delineated roles, responsibilities, and authorities
- Promoting partnerships and leveraging expertise
- Maintaining transparency
- Continuous communication and collaboration

Maintaining and Promoting Reliability, Sustainability, and Resiliency of SWP Assets

Under the SWP Strategic Plan, there are several goals that aim at promoting reliability, sustainability, and resiliency of SWP assets. These goals include: obtaining permits to begin the implementation of a delta conveyance facility, bolstering the nation's leading regulatory state dam safety program, effectively operating and maintaining the State Plan of Flood Control facilities, developing strategic long-term plans and data resources to address California's water management challenges, deploying new technologies to renovate and modernize SWP pumping and generating plans, and investing in on-site power generation resources, and add plans and investments for subsidence remediation.

Developing a Clean Energy Master Plan for the SWP

Another core value is the development of a Clean Energy Master Plan for the SWP that strategically leverages and enhances SWP flexibility to increase SWP's clean energy consumption, reliability and help ensure a cost-effective energy supply. Collectively, the SWP Flexible Resources Study, Energy Road Map, SWP Strategic Plan, Integrated Resource Plan, and Climate Action Plan serve as a Clean Energy Master Plan for the SWP.

SWC Flexibility in Shaping Water Deliveries

DWR and the SWC will continue to collaborate on assessing and defining the potential, coordination sequence, and protocols on the timing, extent, and additional savings that can be achieved by deploying water demand side flexibility. There are SWC agencies interested and can possibly provide water delivery schedule flexibility – mainly those agencies using SWP-delivered water for groundwater recharge. Participating SWC member agencies will have full discretion on the magnitude, approach, and protocol for providing demand side flexibility, such as whether delivery targets will need to be maintained on a daily, weekly, or monthly basis.

Modernization of Project Facilities for Improved Energy Conservation

A SWP Senior Leadership Team is being established to lead the efforts or initiatives focused on managing the SWP's aging infrastructure. This team will develop a vision document and an implementation plan, with the following objectives:

- Expand the SWP's executive-level resources
- Proactively balance risks, costs, and performance
- Prioritize resource allocation
- Drive consistent practices
- Enhance delivery of initiatives, programs, and projects
- Increase financial predictability and transparency
- Strengthen and unify long-range planning
- Ensure organizational alignment with DWR and SWP strategic plans

Analyzing Opportunities to Improve Energy Efficiency

DWR analyzes current and future opportunities and plans accordingly to improve the SWP's pumping and generating plants' energy efficiency. Under the Flexible Resources Study, DWR is investigating retrofits such as upgrades to select single-speed pumps to enable variable speed operations, which would increase pump operations' flexibility and energy efficiency. DWR is also investigating the feasibility of utilizing variable frequency drives to soft start/stop pump units, which would reduce the wear and tear of equipment, and enable better participation in supporting grid reliability.

Reliability and Carbon Reduction Benefits

DWR is continuously transitioning the SWP's power portfolio to achieve a 100% zero-carbon portfolio by 2045 or earlier through developing and procuring renewable energy resources and utilizing SWP operational flexibility in aligning SWP pumping and generation to consume more renewables and generate hydropower to displace fossil generation on the grid.

The SWP's Flexible Resources Study recommendations, updates, and interim implementation plan ensure that actions and projects align with supporting the state's clean energy policies and GHG reductions plan.

Codifying the Benefit-cost Framework Between the SWC and DWR

This framework is arranged through commitments and buy-in of DWR management and the SWC on the following guiding authorities, policies, and principles:

- Maintaining DWR's core values, Water Code, Water Supply Contract, Energy Risk Management policy, and guiding policies
- Communicating with SWC to achieve understanding and support
- Prioritizing compliance, water supply reliability, and resilience
- Conforming to DWR financial management policy and guidelines, and striving for fiscal efficacy
- Adopting progressive and proactive planning and implementation approach
- Demonstrating trustworthy stewardship, collaboration, and partnerships
- Aspiring for excellence and prestige

The State Water Project's power portfolio currently consists of 70 percent carbon-free resources, including solar facilities, and will be 100 percent by 2045.

California Aqueduct in Palmdale, California, transports water as part of the State Water Project.

SECTION 7

Alignment and Prioritization of SWP & SWC Goals

Ensuring Continuous Alignment with Other SWP initiatives

SWP initiatives involving the environment, public safety, and aging infrastructure must be considered when prioritizing and aligning energy related goals and action items.

- **Environmental:** The sustainability of California's water resources depends heavily on the health of the environment. DWR operates the SWP to balance meeting water delivery schedules and protecting the environment.
- **Public Safety:** DWR manages California's resources to ensure public safety. These duties include preventing and responding to floods, droughts, and other catastrophic events.
- **Aging Infrastructure:** Built in the 1960s, the primary objective of the SWP is water conveyance. The SWP was not designed with the intent to operate as a fast ramping, dispatchable resource that can respond the grid reliability needs. Aging infrastructure and subsidence limits the operational flexibility that the SWP can provide. However, the SWP currently offers reliability services – such as ancillary services – within system constraints from both load and generation resources.

Promote Proactive and Progressive Approaches to Energy Management

The viability of different approaches to energy management should be investigated.

SB49/Flexible Resources Study

Through the Flexible Resources Study, DWR has been continuously investigating different approaches in energy management.

- **Solar behind-the-meter and battery storage with renewables:** The integration of different technologies and interconnection configurations allow for the increase of renewables in the SWP portfolio and management of its load exposure to high energy prices during super peak hours. Behind-the-meter (BTM) solar and battery storage are being considered at various pumping facilities along the SWP. Behind-the-meter solar would be used to reduce the overall SWP load moving across the grid while BESS would be used to provide additional services to the CAISO market.
- **SWP pump loads offering reliability services typically provided by natural gas-fired resources:** DWR is investigating retrofits of select single-speed pumps to variable speed pumps to provide more flexibility to maintain grid reliability. DWR is also exploring economical bid of pump load into the real-time market, within SWP safe limits.

Solverde1 Solar Plant located in Lancaster, California.

- **Physical infrastructure upgrades to decouple interdependencies of the hydraulically linked system:** Locations and set-up of off-stream storage are being analyzed to reduce the limitations of the hydraulically linked system. Off-stream storage can be utilized to unleash the full potential of the flexibility that the SWP can provide, to better respond to the needs of the energy grid and mitigate subsidence impacts.

Timing for the Integration/Exploration of New Technologies

A diversified power portfolio is needed to ensure the right resources are procured to reliably meet SWP energy needs and ensure compliance with clean energy policies. However, new and emerging technologies may initially have high capital costs. DWR is continuously investigating various clean energy resources' capital costs trends and market performance to make recommendations on when and where various technologies best fit in the SWP portfolio based on current and future market trends and regulatory policy environments, and available funding support.

- **Improve technologies and decline in costs for solar and battery developments:** Costs for solar photovoltaic (PV) and battery energy storage system (BESS) technologies are projected to decline with gradual improvements in technology and scale. DWR continues to analyze the cost-effectiveness and timing of procurements of additional solar resources, solar resources coupled with BESS, and stand-alone BESS, to reduce SWP's carbon footprint and provide flexible services.
- **Green hydrogen:** Although most hydrogen is created from coal and natural gas, today, green hydrogen is emerging as an alternative fuel to fossil, which is produced through electrolysis that could be powered by renewable resources. This carbon-free, high-density energy carrier can be utilized to increase flexibility in SWP operations and support

DWR's clean energy goals, through deployment at Lodi Energy Center, where the SWP has a 33.33% share in the plant. This will help mitigate the risk of stranding DWR investment in the Lodi Energy Center and ensures the asset's participation in the CAISO market. With the growing amount of renewables penetration on the grid, there is an increasing need for energy storage to help maintain grid reliability and stabilize load. Green hydrogen can be used to provide flexibility, generation capacity, ancillary services, and mitigate renewable curtailment during peak solar hours. It can also serve long-duration energy storage needs not currently met by battery storage. Although hydrogen technology is still in its infancy as far as displacing fossil fuel in power generation plants, it is expected to advance and become more economical in future years.

Setting up the SWP to Transact Beyond CAISO Markets:

Currently, the SWP contracts and trades power through the Western Systems Power Pool (WSPP), and could consider expanding its activities to other platforms, therefore, expanding its counterparty pools to potentially reduce energy costs related to operating the SWP. Some of the available trading options are:

- **EEI – Energy and capacity, any term.** The EEI Master Agreement is a model bilateral agreement developed by the Edison Electric Institute (EEI) for North American power trading. This agreement contains the essential terms that govern forward purchases and sales of wholesale electricity.
- **ISDA – Financial or physical energy, any tenor.** The ISDA Master Agreement is published by the International Swaps and Derivatives Association (ISDA). It is a framework used to govern over-the-counter (OTC) derivatives transactions between two or more parties. An energy derivative has a value based on an underlying energy asset, such as electricity. OTC derivatives include forwards, swaps, and options; and are mainly used for hedging purposes.
- **Energy Exchanges**

Market Evolution and Different Types of Investments, Assets, and Hedging Instruments

As the wholesale energy market continues to evolve, SWP operations will continue to adapt to new market trends. DWR will also continue analyzing the effectiveness of hedging strategies and instruments with different terms that balance costs and risks under various operational scenarios and forecasted/modeled future market conditions:

- **Future market conditions:** With the increase of renewables build outs and fossil fuel generation retirements in California due to the state's clean energy policies, over generation and flexible ramping needs are emerging as challenges to grid reliability. With the potential of accelerated compliance with the zero-carbon targets, these challenges may become more pronounced.
- **Different types of investments, assets, hedging instruments:**
  - **DWR procures renewable contracts to meet its Renewable Energy Procurement Plan targets in accordance with DWR's Climate Action Plan:** Phase I Greenhouse Gas Emissions Reduction Plan which typically sets emissions reductions targets below those of state mandates. Timing of the procurements must be strategic to ensure compliance is met with minimal cost impacts to stakeholders.
  - **Battery Storage:** Due to the intermittent nature of renewable resources, integrated energy storage is crucial to increase the efficient utilization of renewables generation. Battery storage operations can be optimized to provide load shifting where it would be charged when solar generation is abundant and discharged to provide energy and ancillary services to the grid or SWP load

during super peak hours, reducing the grid's reliance on gas-fired resources in periods when renewables generation is not in abundance.

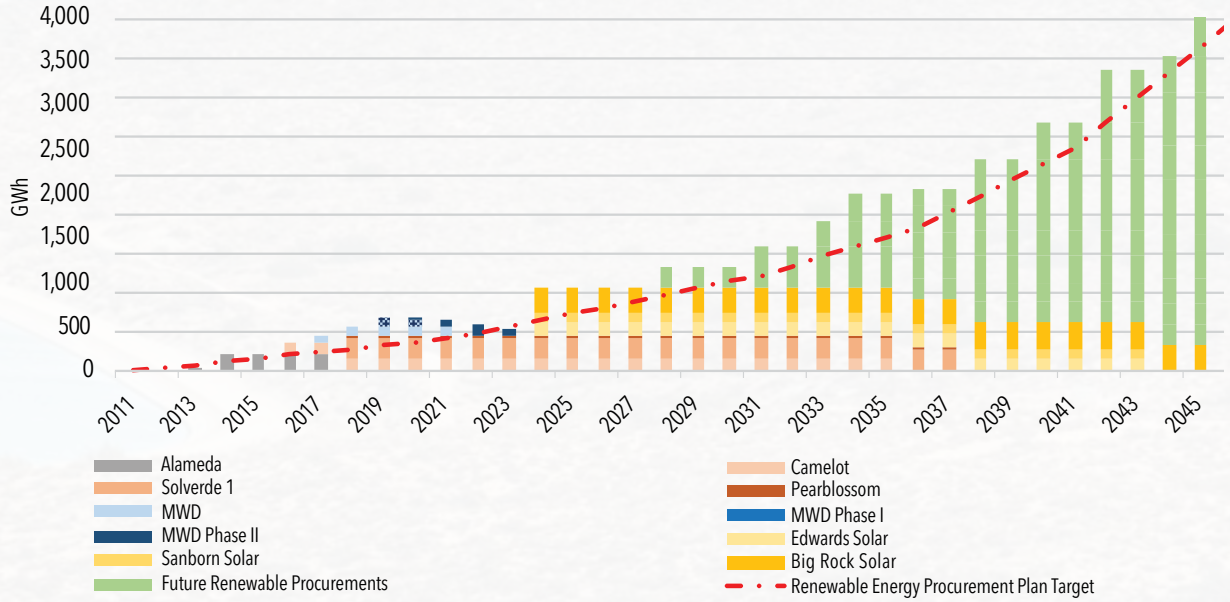
- **Ownership of Solar and BESS**: DWR is investigating the benefits of ownership of solar plants in lieu of entering long-term contracts with solar developers. Although low interest rates with financing puts the cost of this option below the cost of a PPA contract, it does not allow for the usage of the investment tax credit (ITC). Furthermore, there is lack of available land with optimal slope in close proximity to the SWP pumping plants. The development of BESS on SWP property may become more favorable as it provides support to the notion of SWP resiliency.
- **Mid- and Long-term Forward Contracts:** Swap or Energy Forward contracts are for a fixed capacity at a fixed price for specific hours of the contracted period. Custom products are available, including recently introduced "Solar hours" and "Super Peak hours" products, but utilization of these and other custom energy related products found on the exchange has been limited and is typically embedded with high premiums. Through outreach to counter-parties for indicative prices and information from advisory services, DWR evaluates if the costs in contract premiums effectively manages the risk exposure to wholesale market volatility.
- **Call Options:** A call option contract is a financial contract that grants the buyer the right, but not the obligation, to buy the underlying asset and the seller is obliged to sell that product at a fixed price on or before a date for a premium. Call options are being analyzed in the Integrated Resource Plan to determine if call options are a better hedging instrument than a standard forward contract.
- **Long Duration Energy Storage:** Long duration energy storage is expected to be one of the key assets that the grid needs in mitigating excess solar generation and shifting that energy to displace fossil generation during high demand hours. This type of storage can help the grid by providing ancillary services and ramping needs. SWP is looking at restoring the Oroville complex capability of pumped storage operation.

Recruit, Develop, and Retain Knowledgeable Workforce in Energy Industry

DWR is committed to create and maintain a high-performance workplace through the following activities:

- Continue participation in the Stanford Energy Internship and target renowned power engineering programs at different universities
- Participate in job fairs to engage and educate candidates on the SWP
- Partner with other industry participants on training and workshops
- Transition to online employment examinations and ability to conduct interviews via internet will expand DWR's pool of candidates that have interest or experience in the energy industry
- Develop branch-level strategic plans to develop and maintain knowledgeable staff.
  - Cross training so that knowledge does not reside in any one employee
  - Develop training plans and mentoring opportunities to identify and monitor training objectives needed to meet work expectations
  - Provide staff with interesting work and opportunity for training and participation in industry events to meet work expectations and develop career goals
  - Maintain a professional, positive, and supportive work environment

DWR Renewable Energy Procurement Plan (2011–2045)



DWR's Renewable Energy Procurement Plan is a progressive plan to procure renewable energy for the SWP power portfolio, enabling SWP to meet a target of 100% carbon-free electricity by 2045.

- Continue to update succession plans specific to energy related positions to ensure long-term continuity.

Maintain Long-term Energy Cost Effectiveness

With consideration of past, current, and future SWP operations and market drivers, DWR develops strategic plans to maintain long-term energy cost effectiveness.

- **Integrated Resource Plan:** Every three years, an Integrated Resource plan (IRP) update is developed that comprises of investigations and analysis into the existing SWP energy supply and demand, operational profiles based on state water supply contract, water delivery obligations and availability, an assessment of state and federal energy policy impacts to the SWP energy portfolio, operations, and resource procurement strategies meant to meet long-term SWP energy and policy needs.

- **Current and future regulations and polices related to energy:** Significant state and federal legislative and policy decisions have been introduced focused on reducing greenhouse gas emissions by increasing the use of zero-carbon and renewable resources. Wholesale market energy design changes has been focused on managing grid reliability challenges due to the intermittent nature of renewable resources coupled with generation retirements resulting from clean energy mandates.

- **Recent and future power market outlook to assess what SWP's future operations and open position exposure:** Market trends and profiles are drawn from historical and forecasted energy prices. Forecasted market trends, water resources planning models, identified SWP system constraints, and various analytical techniques are used to develop an approach to model probable SWP future operations. Actual market data and

operational trends are used where possible to calibrate and validate SWP power planning scenarios and hedging strategies.

- **Investigate different market instruments to reduce risks and costs associated with SWP operations:** The IRP evaluates the effectiveness of different market products and instruments to hedge the SWP's open position under various hydrologic conditions. The hedging strategies tested consist of energy procurements in the day-ahead market and through swaps or energy forward contracts, call option contracts, and dispatchable energy contracts.

- **Phased approach for the Renewable Energy Procurement Plan (REPP):**
  - **Ensures most competitive prices at the time:** DWR balances meeting renewable energy procurement targets with entering into competitively priced PPAs. In order to do this, DWR considers relevant information such as the ITC availability, the outlook of levelized cost of energy for renewable resources, wholesale energy market rates, and trends in technology advancements, and a competitive procurement processes.
  - **Allows for the procurement of the latest technologies:** Following a phased approach

Valve refurbishment at Gianelli Pumping-Generating Plant in Gustine, California.

Communication & Outreach Plan

Communication

DWR communicates with industry partners on SWP priorities, configuration, operations, and limitations. Outreach efforts also include discussions on how the SWP has helped the state in reaching its clean energy goals and maintaining grid reliability, and DWR's continuous studies to investigate how the SWP can be positioned to do more.

Printed materials: brochures, Energy Roadmap, and other publications

Online communications: DWR website, news releases, and updates

Presentations: on SWP operational and financial reports, updates to FRS tracks, and other projects

Workshops: to educate others on the SWP

Collaboration with universities: to attract graduates from targeted programs

Collaboration

From the outreach efforts, multiple working groups were established to collaborate with industry partners related to regulations, Energy Markets, CAISO Initiatives, etc. DWR meets with these groups, on an annual or quarterly basis, to discuss the latest activities and changes in market trends, market instruments, and clean energy goals.

- Develop working groups: engage with industry partners and provide updates, gain feedback, and exchange ideas
- Participate in regulatory proceedings: to help ensure that requirements and manuals are compatible with SWP operations and appropriately structured
- Work with Developers and OEMs: to build renewable resources or energy storage projects, and for retrofits/upgrades wto existing SWP facilities

will allow for contracting with developers using the latest technology, typically resulting in lower manufacturing costs, and possibly, further government investment and financial incentives.

- **Allows for adjustments:** Adjustments to the renewable resource procurement targets can be made as mandates changes.
- **Replacement of expiring renewable contracts:** Expiring renewable PPAs will be replaced with new procurements or developments.
- **Allows for utilization of latest power market outlooks:** Continue assessment of various forecasting models and data to be used in long-term planning studies.

Develop a Clean Energy Network Through Partnerships with Industry Participants

Through these partnerships, DWR can better align SWP priorities with the state's clean energy goals and help mitigate grid reliability challenges.

- **CAISO:** Continuous dialogue between CAISO and DWR on how the SWP can help mitigate grid reliability challenges and what market changes will need to be implemented for the SWP to provide more flexible services. These discussions help CAISO to better understand SWP capabilities

and limitations and allows DWR to share concerns about potential impacts of market design changes to SWP operations.

- **SWC:** The SWC can also play an important role in working with the CAISO to further initiatives that may requite additional stakeholder and legislative input.
- **Energy planning forums:** To optimally position the SWP in the shift towards a net-zero carbon power portfolio, DWR will work with key industry partners, such as the California Energy Commission (CEC), California Public Utility Commission (CPUC), WECC, NERC, investor-owned utilities (IOUs), and the California Municipal Utility Association (CMUA), to stay informed of key considerations to meet clean energy goals and other changes in energy policies.
- **Continuous outreach to developers and manufacturers to stay abreast on new technologies, industry trends, operational strategies/optimization:**
  - **Renewable and energy storage developers:** DWR is continuously in communication with renewable and energy storage developers to better define and develop RFPs ensuring competitive contract prices.
  - **Engagement with original equipment manufacturers (OEMs) to investigate feasible retrofits to SWP to increase operational flexibility and efficiency and provide more flexible services to the CAISO grid:** Through this engagement, DWR assesses the operational and economic feasibility of proposed retrofits to existing SWP assets.
  - **Network of advisory groups:** DWR utilizes data, models, reports, and white papers from several sources to make informed decisions in developing hedging strategies, ensuring affordability and fiscal responsibility of the SWP.

Maintain Active Outreach Efforts to Industry Participants, Stakeholders, and Public

DWR maintains outreach efforts to provide industry partners, stakeholders, and the general public information on the SWP's unique set-up and priorities, what the SWP has done to help the state meet its clean energy goals, as well as challenges that can limit what the SWP can do to help provide more grid reliability services. Outreach efforts include:

- Discussions with CAISO on market designs that would enable the SWP to increase its ability to help mitigate grid reliability challenges.
- Staying informed of industry standards and research through participation of energy and environmental forums at Universities, Water Commission, CMUA, Association of Clean Water Administrators (ACWA), National Hydropower Association (NHA), Federal Energy Regulatory Commission (FERC), Northwest Hydroelectric Association (NWHA), Power Association of Northern California (PANC).

Alamo Powerplant completed in 1985 on the East Branch of the State Water Project has a generating capacity of 15 megawatts.

Solar panels and wind farms just outside of Mojave, California.

Opportunities & Challenges

Senate Bill 49 – The Need for Flexible Resources

On October 9, 2019, Governor Newsom signed SB49 – Energy: appliance standards and State Water Project assessment. The bill requires the California Natural Resources Agency (CNRA), California Energy Commission (CEC), and DWR to collaborate on assessing the opportunities and constraints for potential operational and structural upgrades to the State Water Project to aid California in achieving its climate and energy goals, and to provide associated recommendations consistent with specified purposes and California's energy goals.

The SWP's Flexible Resources Study is an ongoing power planning study that started a few years ago to develop a Roadmap for the SWP's future participation in CAISO's evolving market. The scope and recommendations of the Flexible Resources Study has and will continue to evolve as state mandates addressing climate change, technology developments, CAISO's market design, reliability needs, and price trends continue to evolve; creating more opportunities for SWP to further help integrate renewables or seizing viability of past or current recommendations.

The following are a few of the current and on-going planning tracks under the Flexible Resources Study:

1. **Shaping SWP Load & Generation:** Shaping of SWP load and generation helps reduce the grid needs for fossil fuel generation and increases the utilization of renewable resources generation.
2. **Reoperations of Select SWP Pumping Plants (Unrestricted):** Existing SWP flexibility limits are assessed, and the needed system improvements to unleash constrained capacities by civil, electrical and mechanical system setups will be identified.
3. **Pumped Storage:** This track models future potential of restoring pumpback operations at Hyatt-Thermalito complex and investigates the needed infrastructure improvements and retrofits to resolve constrained operations due to physical setup or operational and compliance challenges.
4. **Integrating Battery Storage with Renewable Resources:** Energy storage is being investigated to shift SWP load in some locations in lieu of physical storage to add more operational flexibility and to hedge SWP exposure to volatile market prices.

5. **Retrofit of Select Pumping Plants: Variable Speed Pumps:** This track explores SWP capital investments and system retrofits through selectively integrating variable speed drives at SWP plants. This will enable the SWP to participate in renewable integration and in the ancillary services market.
6. **SWP Hydraulic and Transient Modeling, and Aqueduct Stability:** Hydraulic and hydrodynamic models are developed to assess potential transient challenges (i.e. hydraulic instability) from the contemplated more responsive SWP operations, and to redefine the California Aqueduct's safe operation limits.
7. **Real-Time Market Load Bidding:** Studies are being performed to find SWP safe limits in operating pump load in real-time markets. The SWP is collaborating with CAISO to explore economical bid of pump load into the real-time market to aid in providing reliability services and respond to intermittent renewable resources variability.
8. **Adding Pockets of Storage at Strategic Locations:** Investigating the viability of adding pockets of storage in strategic locations along the California Aqueduct to decouple interdependencies of the SWP conveyance system and pumping plants' operations.

SWP has and continues to optimize, when feasible, its operations to generate when wholesale energy prices are high, and pump when prices are low.

9. **Integration of On-Site Solar Generation at Pumping Plants:** Investigating the potential for on-site solar generation at various DWR pumping plants, including: direct grid interconnection and behind-the-meter with non-export interconnection. The BTM interconnection will help reduce SWP exposure to TAC escalation and reduce the grid's need for transmission buildouts and reliability upgrades.

Opportunities

Short Term

- **Shape SWP load and generation to respond to market signals:** SWP has and continues to optimize, when feasible, its operations to generate when wholesale energy prices are high, and pump when prices are low – which incidentally aligns well with grid needs.
- **Procure renewables to capture ITC –** Timing of renewable procurements to maximize the amount of captured ITC benefits will allow for the SWP to add renewable resources to its portfolio at competitive prices.
- **Sell excess SWP RA Capacity:** Because SWP load operations are dependent on hydrology, the SWP may have excess RA capacity to sell. This helps other load serving entities meet RA obligations and offsets the SWP's costs of delivering water.
- **Actively participate in CAISO Stakeholder processes to influence market design changes:** The SWP actively monitors and participates in CAISO stakeholder processes and analyzes the proposed market design changes to ensure that the SWP's unique setup is considered and not adversely impacted.
- **Maintain industry outreach:** The SWP continuously engages with industry participants, stakeholders, and the public. The SWP will continue to partner with others as the industry and technology evolves, and maintain communications with respect to opportunities and challenges related to clean energy and grid reliability.
- **Monitor power market dynamics and resource mix:** Subscribe to multiple advisory services and participation in energy forums (NHA, PANC, Stanford University, etc.) to stay abreast on power

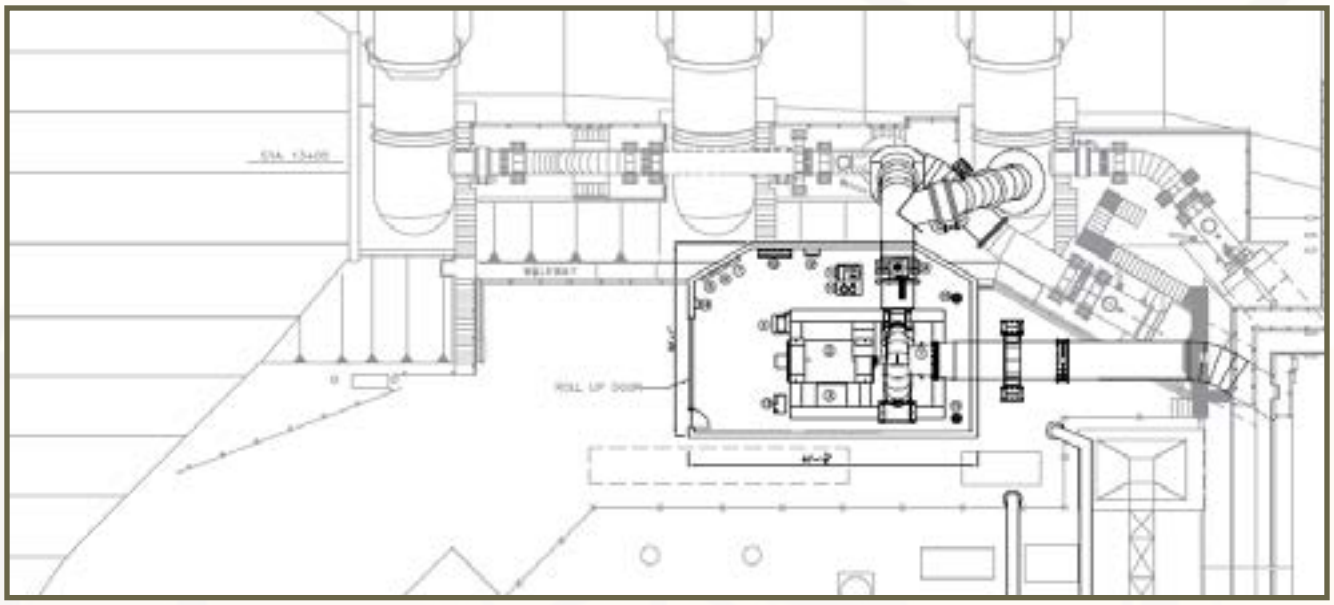
market dynamics and resource mix trends and impacts to the power markets.

- **Partner with the SWC to develop the SWP Energy Roadmap:** The Energy Roadmap maps out the joint vision between DWR and the SWC to maintain a balance between water supply reliability, competitive energy rates, responding to energy market evolution and dynamics, and needed investments to achieve the clean energy portfolio goals.
- **Develop the Flexible Resources Study Plan:** The Flexible Resources Study plan is a dynamic vision plan for repositioning the SWP for future power markets and for adapting a proactive and progressive approach to managing the SWP power portfolio.
- **Maintain active participation in IOUs Transmission rate case filings at FERC:** Transmission access charges (TAC) are one of the major cost components related to energy for SWP operations. The SWP actively participates in multiple transmission rate cases and settlement efforts meant to negotiate down revenue requirements and return on equity filed by transmission owners seeking FERC approval. These settlements include filings by PG&E, SCE, and SDG&E.

Mid Term

- **Investigate and implement integration of solar and BESS at main pumping plants:** Integration of solar coupled with BESS can help integrate more renewables into the SWP power portfolio.
- **Collaborate with CAISO to enable the SWP to have more latitude in offering more grid reliability services:** Based on the study findings and recommendations from the SWP Flexible Resources Study, the SWP will collaborate with CAISO to propose market design changes that would allow for the SWP to offer more grid reliability services.
- **Implement physical improvements to reduce subsidence impacts on SWP operational flexibility:** Near-term actions through the California Aqueduct Subsidence Program (CASP) address subsidence and include raising portions of the aqueduct and repairing gates and bridges. Developing off-

Conceptual renderings of potential off-stream storage locations near Edmonston Pumping Plant in Kern County.



Pine Flat Unit 4: Preliminary Powerhouse layout

aqueduct storage near Valley String and Edmonston pumping plants can alleviate some of the subsidence impacts on shaping SWP pump load.

- **Integrate new technologies at SWP pumping plant to reduce wear and tear on equipment:** The SWP is investigating technologies such as variable frequency drives to soft start and stop pumps, allowing SWP to be more responsive and offer more grid reliability services, without increasing the wear and tear on equipment.
- **Collaborate with the SWC on developing a program that coordinates water demand flexibility:** Current power planning studies limit demand flexibilities to meet daily water delivery targets. The SWP is working with the SWC to develop a program to increase the water demand flexibility to increase the flexible services that the SWP can offer to CAISO.
- **Update the SWP Integrated Resources Plan (IRP) to adjust plans and strategies:** The plans and strategies in the IRP are reassessed and adjusted every 2-3 years based on current and anticipated future mandates, and power market trends.
- **Revitalize pumpback operations at the Hyatt-Thermalito complex:** Pumpback operations at the Hyatt-Thermalito complex ceased due to temperature constraints at the Feather River. In order to restore pumpback operations at Hyatt-Thermalito, the temperature compliance issues must be resolved.
- **Adjust power procurements strategies to target "Purchase Option" within the term of the contract:** To reduce cost exposure to premiums associated with bilateral contracts, DWR is investigating the benefits of including terms within contracts to allow for a "Purchase Option" for DWR to own the generation asset.

Long Term

- **Develop plans to neutralize GHG emissions from Lodi Energy Center:** In accordance with SB100 targets, and as stated in the Climate Action Plan Phase 1, the SWP will develop plans to neutralize GHG emissions from LEC by 2040. Recent turbine replacements allow for blending green hydrogen with fossil fuel; and as technology advances, displace fossil fuel for the plant altogether.

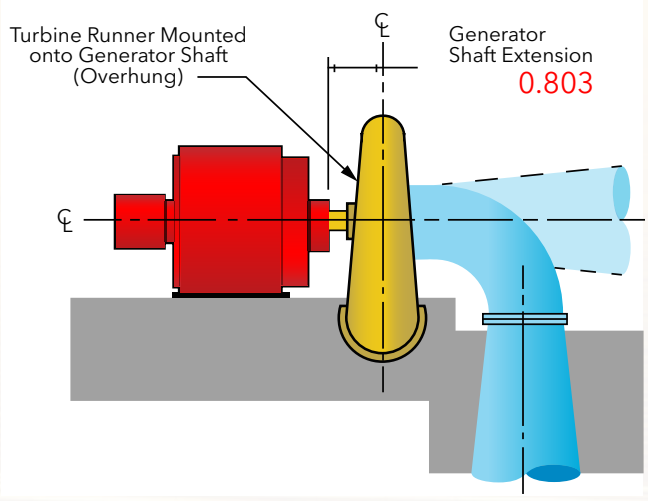
. . . the SWP will develop plans to neutralize GHG emissions from LEC by 2040.

- **Develop plans to fully resource SWP portfolio with clean energy:** Approximately half of SWP operation's energy needs are met with its own carbon-free hydrogeneration resources and another 20% from contracted renewables. Renewable and zero-carbon resources will continue to be procured to meet all of the SWP's energy needs.
- **Develop bidding strategies to fully hedge SWP positions in the power market:** SWP's operations are currently optimized to generate when wholesale energy prices are high and pump when prices are low. Bidding strategies can be developed and tested to identify the feasibility of fully hedging the SWP's open position through adding more flexibility and resources to its operations.
- **Neutralize power costs through deploying supply and demand side flexibilities:** The SWP can neutralize power costs by self-providing ancillary services, selling excess RA capacity, through market design changes that can offer demand side flexibility (e.g. real-time load bidding, frequency wresponse from pump load), and through adding more infrastructure and equipment flexibility.
- **Collaborate with CAISO and others to develop bi-lateral agreement that can utilize SWP capabilities to support grid reliability:** To ensure cost recovery for capital investments made to SWP owned assets that are meant to support grid reliability.
- **Develop power supply resiliency to maintain partial SWP water operations during emergencies:** Communications protocols have been developed in collaboration with the SWC and CAISO to allow the SWP to maintain water operations and provide assistance during power system emergencies.
- **Secure right-of-way needed for future power resources developments:** Investigations are currently underway to develop power resources adjacent to DWR-owned assets. Limited DWR-owned property will require securing the right-of-way needed. In collaboration with the SWC, identifying possible developments on SWC-owned property may reduce capital costs.

Challenges

- **Power market evolution:** In recent years, the power market (energy prices, grid reliability needs) has evolved as a result of renewable capacity that has been integrated into the CAISO market.
- **Transmission access charge escalation:** To integrate mandated renewables, necessary transmission buildout in California has resulted in significant escalation of TAC. For the SWP, TAC costs represent a significant portion of the overall energy costs.
- **Regulatory policies and mandates:** Clean energy policies are forcing early retirements of fossil fuel generators, which exacerbates grid reliability challenges.

Pine Flat Unit 4: Horizontal view of proposed turbine



Solar panels at a rice farm/drying operation in Northern California.

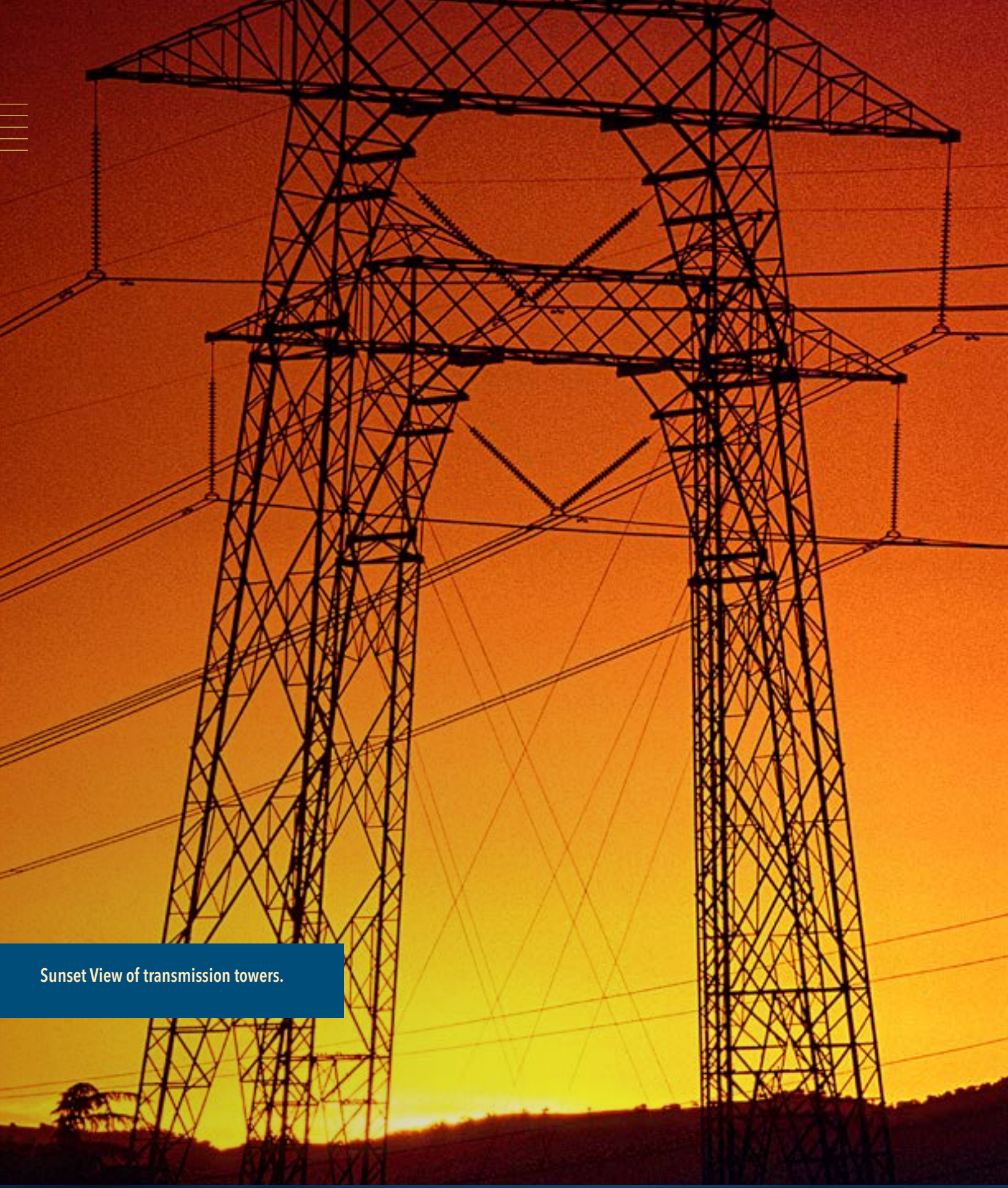
Policies must also be in place to ensure a reliable and resilient electric system while maintaining affordability. Additionally, changing policies in the water sector may have potential impacts.

- **CAISO market design changes:** CAISO's market design changes do not always consider the SWP's unique set-up and proposed market design changes could negatively impact SWP operations and energy costs.
- **SWP aging infrastructure and inherent constraints**: The SWP was built in the 1960s with the primary purpose of delivering water. Its infrastructure was not designed to respond to current and anticipated grid reliability challenges – unless transformation for infrastructure and equipment is implemented.
- **Subsidence of California Aqueduct:** Continued aqueduct subsidence threatens to impair the functionality of the SWP.
- **Climate change impacts:** Climate change is resulting in new hydrological trends that are beyond the design limits of the SWP and require consideration in mid- and long-term planning to ensure safety and water supply reliability. Climate change policies are forcing early retirements of natural gas and nuclear power plants, reducing the fleet of flexible resources. Replacements of these resources are uncertain and can be costly. Climate change can also impact snowpack, water quality in the Delta and reduce SWP delivery capability.
- **Competing SWP priorities:** The SWP serves as a multi-purpose water and power system. The SWP provides: drinking water for 27 million people, irrigation water for 750,000 acres of farmland, generation of clean hydropower, flood protection, and a habitat for fish and wildlife. Water delivery obligations and environmental policies takes priority over power generation.

- **Financial impacts to the SWC:** The SWP's primary purpose is to delivery water. Proposed changes to SWP's operations or physical setups – in order to provide more flexible services to the grid – shall not increase costs of delivering water to the SWC.
- **Water demand inflexibility:** Limitations in water demand flexibility can constrain the amount of flexibility that the SWP can offer. A carefully developed framework including protocols, periodic check-ins, planning, coordination, and feedback from the SWC, will be needed to be in place to allow for flexibility in water delivery schedules.
- **Safety, security, and compliance:** DWR engages in activities to maintain compliance with Western Electricity Coordinating Council's (WECC) reliability standards. The objective of this program is to ensure regulatory compliance as well as develop processes to mitigate or eliminate potential violations to avoid costly fines and manage compliance costs.
- **Workforce and retention:** Limited opportunities and salaries make it a challenge to attract and retain top talent and expertise from the power industry. A carefully developed succession plan is needed to ensure that institutional knowledge is not lost.
- **Climate Action Plan Phase I, II, and III**
  - Climate Action Plan Phase I: Greenhouse Gas Emissions Reduction Plan is consistent with Executive Order B-55-18 and SB100 goals for emissions reduction levels for the year 2045. Ensure that publicly reported data is made available and progress is monitored to guide DWR's reduction commitments.
  - The Climate Action Plan: Phase II is a consistent and rigorous climate change analysis of the DWR's programs and projects. Phase II guides, aligns, and reviews potential climate change impacts for planning and investment decisions, improving understanding of potential risks and consequences. Applying best available science, Phase II supports policy and management decision-making.
  - Phase III of the Climate Action Plan is a vulnerability assessment of DWR's business operations and assets. Additionally, Phase III develops and implements an adaptation process to protect staff, assets, and department operations while improving climate resilience. Guidance provided by Phase III ensures a diverse portfolio of adaptation planning tactics to meet DWR's needs under a changing climate.

Periodic Review and Adjustment

Periodic review and adjustments will need to be considered as regulation policies and mandates, power market trends, grid reliability needs, and costs associated with capital costs investments continue to evolve; and as more opportunities and challenges may arise. Hence, it is prudent to review and update the SWP Energy Roadmap every 3 to 4 years.



Sunset View of transmission towers.

Recommendations for State & Federal Funding

Most of the State Water Project's funding comes from three major areas: water supply, power sales, and federal and state reimbursements through long-term water supply contracts with 29 local water agencies. These water agencies agree to repay principal and interest on both the general obligation bonds that funded the initial SWP construction and the revenue bonds that paid for additional facilities. General obligation bonds are backed by a municipality, in this case, the State of California whereas revenue bonds are supportive by a specific source, such as the contractor agencies that have paid for extensions of the SWP, most notably the East Branch and Coastal Branch extensions. Additionally, these water agencies or contractors also pay all associated costs, including labor and power, incurred for maintaining and operating the SWP facilities.

In addition to its primary mission of delivering water throughout the state, the SWP has played a stewardship role in providing flood protection, protecting the environment through water quality and habitat, supporting operations of the energy sector, and offering recreational benefits. As aging SWP infrastructure is updated and replaced, it is important to evaluate opportunities the SWP might be able to provide to support electric grid operations and statewide carbon reduction initiatives while taking into the account how to pay for those opportunities.

In addition to new potential sources of funding, the SWP should also consider looking at historical funding sources and levels. Funding should not be competitive among SWP initiatives, but instead be used to enhance existing water infrastructure with added benefits for energy. Additionally, funding sources should be reflective of the benefits provided DWR in collaboration with SWC, will continuously explore additional funding opportunities to partner with others to implement improvements to the SWP that would yield benefits to enhance grid reliability and support the state's clean energy policy.

Communication & Outreach Plan

Industry partners include:

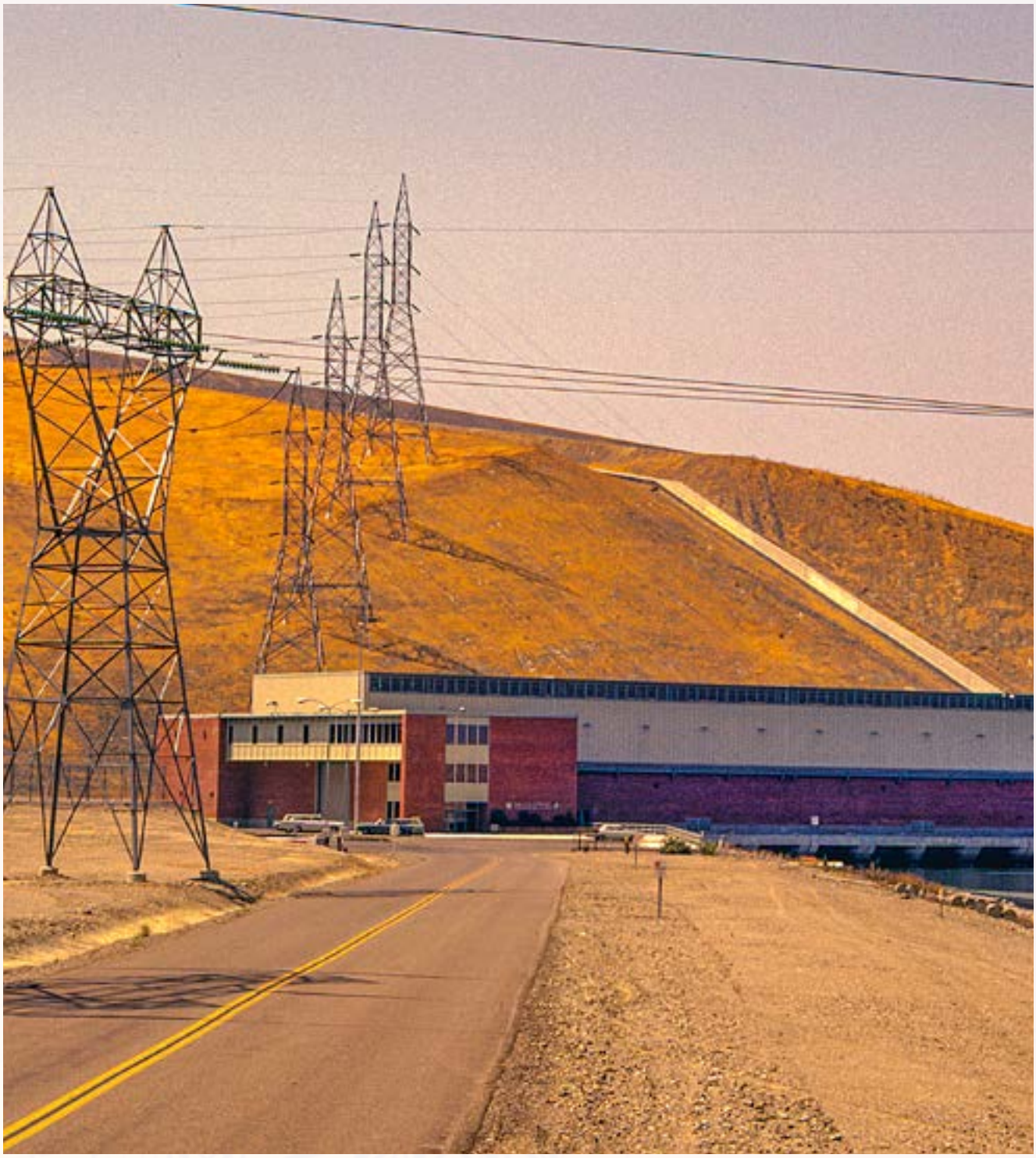
- Regulatory agencies: Federal Energy Regulatory Commission (FERC), Western Electricity Coordinating Council (WECC), California Independent System Operator (CAISO)

- Engagement with other State Agencies: California Water Commission (CWC), California Energy Commission (CEC), California Public Utilities Commission (CPUC)
- Utilities: PG&E, SCE, SMUD
- Associations: CMUA, ACWA, NHA
- Developers: for renewable resources, energy storage, and original equipment manufacturers (OEMs)

Interim Action Plan (2021-2025)

Short- & Medium-term Action Plans

- Continue planning work for SB49 tracks and get them ready for implementation
- Continue to shape SWP load and generation to respond to the evolving power markets
- Ensure state policy mandates do not interfere with primary mission of the SWP
- Track, monitor, and assess future energy technologies
- Monitor power market dynamics and evolution of resource mix, influence market design changes, assess their impact on SWP and refine SB49 tracks if necessary
- Continue outreach to CAISO and other state agencies highlighting the SWP's plans for supporting the grid
- Collaborate with CAISO to enable the SWP to offer real time load bidding and frequency regulation through investment in pumps with variable speed drives
- Provide flexibility from demand and well as clean energy resources including battery storage
- Search for funding for SB49 tracks that don't have immediate market revenues
- Continue to procure solar resources to take advantage of the ITC
- Sell excess SWP RA capacity
- Partner with the SWC to develop water demand flexibility
- Continue to maintain active participation in PTOs transmission rate case filings at FERC



Gianelli Pumping-Generating Plant, located in Merced County, can generate up to 363 megawatts, and has a pumping capacity of 376 megawatts.

ENERGY ROADMAP FUNDING SOURCES

Sources	Bond Funding	Loan	General Funds	Water User Surchage Fee	PROs: Flexible Application of Funds	PROs: Likely to Qualify	PROs: Incentivizes efficient use of existing	PROs: Long-term repayment facilities	CONs: Volatile/Limited Funding Availability	CONs: Competitive / SWP may not qualify	CONs: High Interest Rates, limited amounts	CONs: Time/ Complicated Competitive Process
CALIFORNIA OPPORTUNITIES FOR FUNDING SWP ENHANCEMENTS												
General Fund												
The General Fund is used for the daily and long-term operations of State agencies. The State General Fund is typically supported with revenues, primarily income and sales taxes, collected on a regular basis with few restrictions on the use of those funds.			■		■				■			
Greenhouse Gas Reduction Fund												
The California Legislature appropriates money from the Greenhouse Gas Reduction Fund (GGRF) to state agencies to administer California Climate Investments programs that facilitate greenhouse gas emission reductions and provide additional economic, environmental, and public health benefits, consistent with existing legislative guidance.			■		■				■	■	■	■
Electric Program Investment Charge (EPIC)												
In 2012, the Electric Program Investment Charge (EPIC) was established by the California Public Utilities Commission to fund public investments in research to create and advance new energy solutions, foster regional innovation, and bring ideas from the lab to the marketplace. The California Energy Commission (CEC) and the state's three largest investor-owned electric utilities–Pacific Gas and Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company–were selected to administer the EPIC funds and advance novel technologies, tools, and strategies that provide benefits to electric ratepayers.			■						■	■		
General Obligation Bonds												
One potential source of funding for the State Water Project energy upgrades could be general obligation bonds. Bond measures must pass both houses of the legislature with a two-thirds vote to be placed on the ballot.	■							■	■	■		■
Revenue Bonds												
DWR issues revenue bonds on a frequent basis to refund portions of outstanding debt, pay costs of previous bond issuances and to deposit funds into account for specific projects. DWR's borrowing ability benefits from the structure of the contracts with participating water agencies, the value of the SWP to California, and the credit rating of the water agencies themselves.	■				■	■		■				
CAEATFA Qualified Energy Conservation Bonds / Clean Renewable Energy Bonds												
The California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) is the main state issuer of Qualified Energy Conservation Bonds (QECB) and Clean Renewable Energy Bonds (CREBs). These bonds are designed to provide a rate savings for the purchaser which allows the public entity to receive low-interest financing upon the sale of the bonds.	■											■
State Infrastructure Bank												
The California Infrastructure and Economic Development Bank (IBank) was created in 1994 to finance public infrastructure and private development. IBank has broad authority to issue tax-exempt and taxable revenue bonds, provide financing to public agencies, provide credit enhancements, acquire or lease facilities, and leverage State and Federal funds.		■				■			■	■		

Sources	Bond Funding	Loan	General Funds	Water User Surchage Fee	PROs: Flexible Application of Funds	PROs: Likely to Qualify	PROs: Incentivizes efficient use of existing	PROs: Long-term repayment facilities	CONs: Volatile/Limited Funding Availability	CONs: Competitive / SWP may not qualify	CONs: High Interest Rates, limited amounts	CONs: Time/ Complicated Competitive Process
Water User Surcharge Fee												
While finding alternative sources of funding for energy projects along the State Water Project is important, there could also be some investments contractors could be willing to make if the benefits can be quantified. Should these investments provide a positive benefit cost ratio over time, contractors could consider a surcharge to pay for these upgrades.				■			■	■				■
FEDERAL OPPORTUNITIES FOR INVESTMENT												
American Jobs Plan												
The United States federal government's response to stimulate the economy has provided a windfall for infrastructure project funding. President Biden's "American Jobs Plan" calls for an investment of $2 trillion in infrastructure and jobs. $100 billion has been specifically earmarked to improve America's water and power infrastructure by building a more resilient electric transmission system and modernizing power generation.		■					■	■	■	■		■
Congressional Budget Appropriation												
Approximately a year and a half before a budget goes into effect, federal agencies begin work on their budget proposals. Proposals are eventually sent to the President's office to help create the Presidential budget request. From there, the President submits his plan to Congress where each house reviews the proposal and begins drafting budget resolutions setting overall spending levels.			■							■		■
United States Environmental Protection Agency												
The US Environmental Protection Agency occasionally has grant opportunities available for various projects benefitting the environment. This funding can be inconsistent and unreliable and is typically the result of earmarks or special projects by Congress or the administration.		■								■		■
WaterSMART Water and Energy Efficiency Grants - US Bureau of Reclamation												
The US Bureau of Reclamation provides 50/50 cost share funding to entities with water or power delivery authority through their WaterSMART Water and Energy Efficiency Grants. Eligible projects should conserve and use water more efficiently, increase the production of hydropower, and achieve other benefits that contribute to water supply reliability in the western United States.			■				■		■	■		
Water Infrastruction Finance and Innovation Act (WIFIA)												
The Water Infrastructure Finance and Innovation Act of 2014 (WIFIA) established the WIFIA program, a federal credit program administered by EPA for eligible water and wastewater infrastructure projects. WIFIA and the WIFIA implementation rule outline the eligibility and other requirements for prospective borrowers.		■			■			■		■		
OTHER FUNDING OPPORTUNITIES												
Public Private Partnerships (P3) have played a growing role in infrastructure development and delivery in California and the United States. A study by the Bay Area Council in 2018 indicated there were 23 projects in active procurement or planning stages across a range of sectors. To date, governmental entities have engaged in these types of arrangements to build city structures and college campuses, and to overhaul and build water and wastewater systems.		■	■					■				■

Glossary

Ancillary Services – Regulation, Spinning Reserve, Non-Spinning Reserve, and Voltage Support with such other interconnected operation services as the CAISO may develop in cooperation with Market Participants to support the transmission of Energy from Generation resources to Loads while maintaining reliable operation of the CAISO Controlled Grid in accordance with WECC standards and Good Utility Practice. (Source: CAISO tariff)

Regulation Energy – Regulation energy is used to control system frequency, which must be maintained very narrowly around 60 hertz, and varies as generators change their energy output. Resources providing regulation are certified by the ISO and must respond to automatic control signals to increase or decrease their operating levels depending upon the need. (Source: CAISO.com)

Spinning Reserve – The portion of unloaded synchronized resource capacity that is immediately responsive to system frequency and that is capable of being loaded in ten (10) minutes, and that is capable of running for at least thirty (30) minutes from the time it reaches its award capacity. (Source: CAISO tariff)

Non-Spinning Reserve – The portion of resource capacity that is capable of being synchronized and Ramping to a specified load in ten minutes (or that is capable of being interrupted in ten (10) minutes) and that is capable of running (or being interrupted) for at least thirty (30) minutes from the time it reaches its award capacity. (Source: CAISO tariff)

Net-Load – the total electric demand in the system minus wind and solar generation–represents the demand that CAISO must meet with other, dispatchable sources such as natural gas, hydropower, and imported electricity from outside the system. (Source: EIA)

Energy Storage Systems – The Public Utilities Code defines an energy storage system as commercially available technology that is capable of absorbing energy, storing it for a specified period, and then dispatching the energy. (Source: CEC)

Participating Load – An entity, including an entity with Pumping Load or Aggregated Participating Load, providing Curtailable Demand, which has undertaken in writing by execution of a Participating Load Agreement to comply with all applicable provisions of the CAISO Tariff. (Source: CAISO tariff)

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