# State Water Project

## Flexible Resources Study – SB49 Update

August 2021

# Agenda

- Project Objectives, Strategic Need, SB-49
- Project Scope of Work and Schedule
- Flexible Resources Study Goals
  - Benefits/Challenges Summary
- SB49 Report Contents Overview
- Track Updates
- Opportunities and Challenges
- Next Steps

# Flexible Resources Study- SB49

**Project Objective Statement:**

Identify, Plan, and Recommend specific SWP improvements and strategies that add sustainable operational flexibilities needed to meet future power market opportunities, challenges, and obligations.

**SB 49- Energy: appliance standards and State Water Project assessment:**

"This bill would require the Natural Resources Agency, in collaboration with the Energy Commission and the Department of Water Resources, to assess 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 bill would require that the assessment and recommendations include specified elements, including recommendations for state, federal, and other applicable funding sources, as specified. The bill would require that the assessment and recommendations be provided to the appropriate policy committees of the Legislature before January 1, 2022."

**SWP Assessment Goals:**

Assess SWP's potential to increase its potential to provide grid reliability support, further help the state meet its clean energy goals by positioning the SWP to help integrate renewable resources, reduce greenhouse gas emissions, and support clean energy policies, while sustaining reliable SWP water deliveries.

# Flexible Resources Study - SB49 Goals

**SB49 Goals:**

- Increase ability to provide grid reliability support and services
- Enable the Integrate of Renewable Resources
- Reduce overall Greenhouse Gas Emissions
- Support Clean Energy Policies implementation
- Provide recommendations for State and Federal Funding for specific elements

# Flexible Resources Study- Benefits/Challenges

**Flexible Resources Study - Benefits/Challenges Summary**

| Track No. | Track Description | Grid Reliability Benefits | | | | | | | Clean Energy Benefits | | | Challenges | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Load Shifting | Peak Shaving | Energy Storage | Frequency Regulation Capacity | Resource Adequacy Capacity | Fast Ramping Resource | Increased Grid Responsiveness | GHG Emissions Reduction | Integration of Renewables | Reduces Reliance on Fossil Fuel Generation | Market Design Changes Needed | Power Market Volatility | Additional Funding Source Needed |
| 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 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. | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ○ | ● | ● |
| 5 | **Retrofit of select pumping plants:** Variable Speed Pumps: Exploring SWP capital investments and system retrofits through selectively integrating variable speed drives at SWP plants. | | ○ | | ● | ● | ● | ● | ○ | ● | ● | ● | ● | ● |
| 6 | **SWP Hydraulic and Transient Modeling, and Aqueduct Stability:** Developing hydraulic and hydrodynamic models to assess potential transient challenges (i.e. hydraulic instability) from the contemplated more responsive SWP operations. | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ |
| 7 | **Real-Time Market Load Bidding:** Studies are being performed to find SWP safe limits in operating pump load in real-time markets. SWP is collaborating with CAISO to explore economical bid of pump load into the real-time market to aid in 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 Aqueduct to decouple interdependencies of the SWP conveyance system and pumping plants' operations. | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ● | ● |
| 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. Solar plant capacity will be determined based on various operations and load profiles. | ● | ● | | | ● | | ○ | ● | ● | ● | ● | ● | ● |

● - Direct Benefit/Challenge
○ - Indirect Benefit/Challenge

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# Flexible Resources Study- SB49 Project Scope of Work and Schedule


| Q1 2020 | Q2 2020 | Q3 2020 | Q4 2020 | Q1 2021 | Q2 2021 | Q3 2021 | Q4 2021 |
|---|---|---|---|---|---|---|---|
| ***Initiate Reconnaissance and Scoping*** | ***Identify Potential and formulate Operational Scenarios*** | | ***Identify Potential and formulate Operational Scenarios*** | | ***Perform Viability Assessment*** | ***Develop Preliminary Alternatives*** | ***Development of Assessment Report*** |
| • Concepts Discussion<br>• Scoping Assessment planning tracks<br>• Identify Project Expectations<br>• Define deliverables | • Historical SWP Operation Data Analysis<br>• Energy Market Data Analysis<br>• Model Development<br>  • Hyatt Pump-back Model<br>  • Hec-Ras Hydrodynamics model<br>  • SWP Reoperation Optimization | | • Concepts/Planning tracks Investigation<br>• Operational and Markets analysis<br>• Analysis and Model Results<br>• Portfolio and strategic fit<br>• Cost Benefit Analysis | | • Project Constraints and limitations<br>• Alternatives implementation challenges<br>• Competing SWP priorities | • Finalize Viable Project Findings and Results<br>• Report Opportunities and Challenges | • Finalize Assessment report<br>• Present assessment findings to Core and Expanded participants groups |
| | | | • Report Progress to Stakeholders and CWC | • Report Progress to Stakeholders and CWC | • Report Progress to Stakeholders and CWC | | • Conduct meetings with Industry and Public |

# SB49 Report Content Overview

**Introduction**

- Overview of the SWP
- California's Energy Efficiency and Clean Energy Goals
- SWP helping the grid to integrate renewables and mitigate reliability challenges
- Power Markets evolution and continuous change

# SB49 Report Content Overview (cont.)

**Flexible Resources Study – Individual Tracks**

- Background
- Flexible Resources Need
- CAISO Market, Electricity, and Transmission Pricing
- Flexible Resources Tracks
  - Purpose
  - Background
  - Study/Methodology
  - Results
    - Reliability Benefits
    - Emissions Reductions Benefits

# SB49 Report Content Overview (cont.)

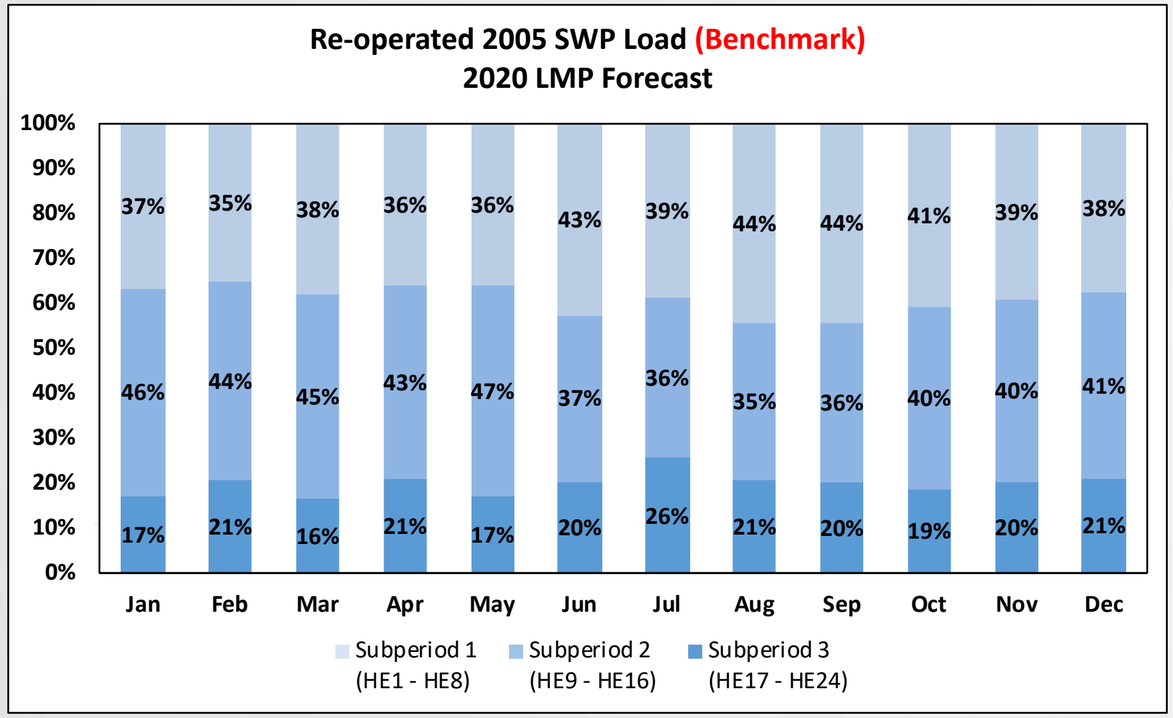
**Aggregated Summary Results, Recommendations, and Interim Action Plan**

- Aggregate Results:
  - Capacity
  - GHG Emissions Reductions
- Opportunities and Challenges
- Stakeholder Outreach
- Funding Requirements
- Adaptation of Markets
- Interim Action Plan

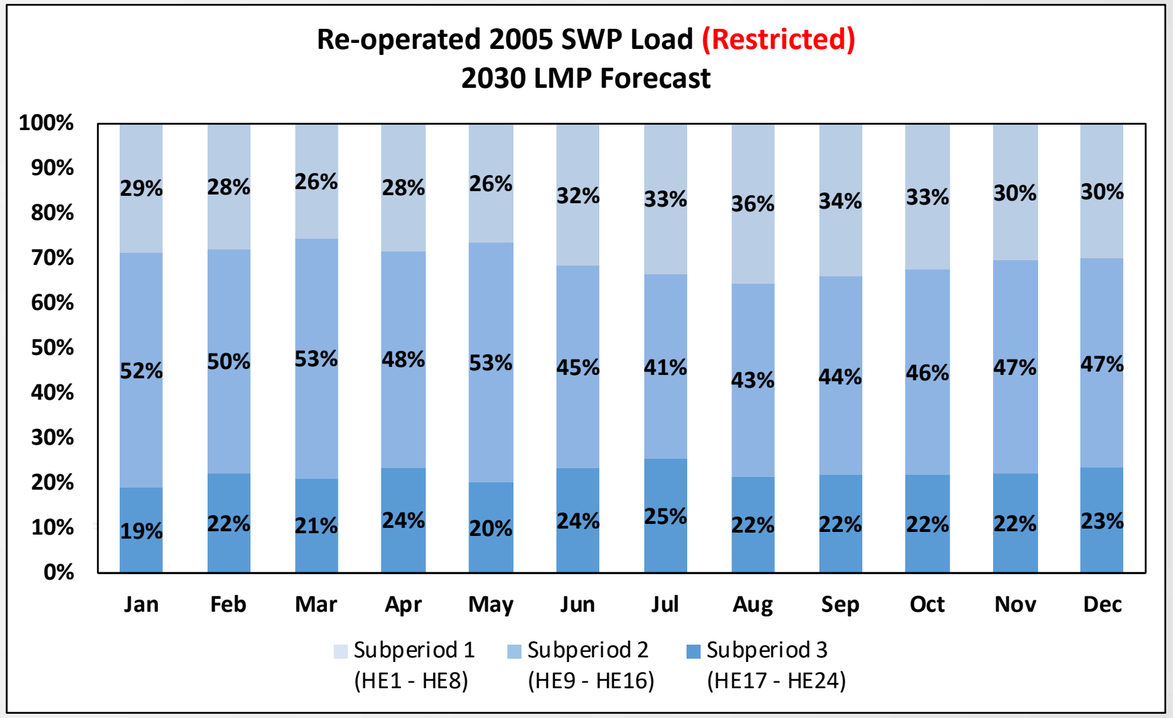
# Flexible Resources Study Update

## Track 1- Shaping SWP Load & Generation (Restricted)

Benchmark (2020)




Reoperations - Restricted

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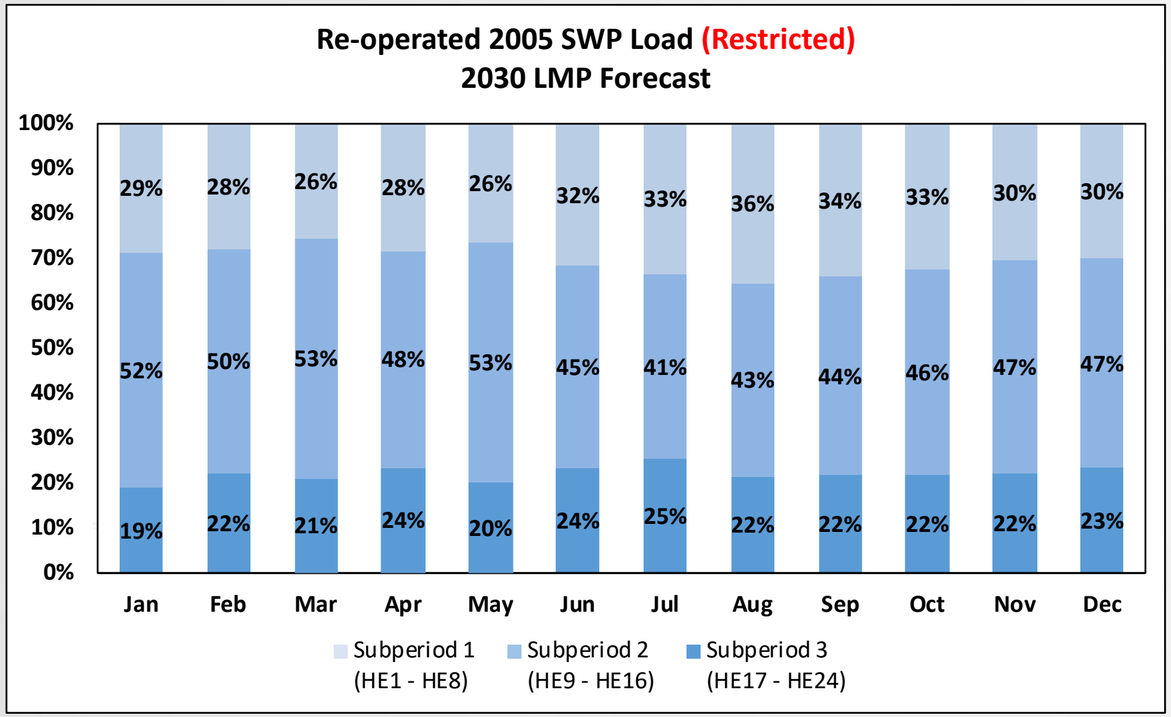
Note: Preliminary and Proprietary; Do not reproduce

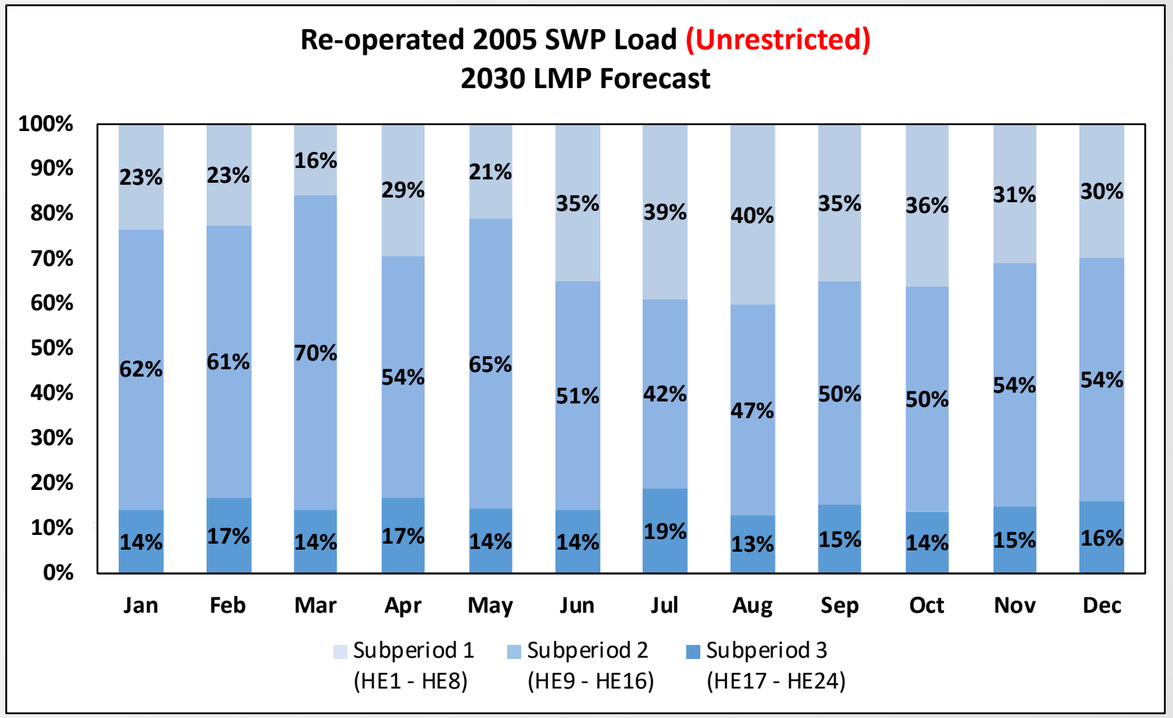
# Flexible Resources Study Update

## Track 2- Reoperations of select SWP Pumping Plants (Unrestricted)

Reoperations - Restricted




Reoperations - Unrestricted

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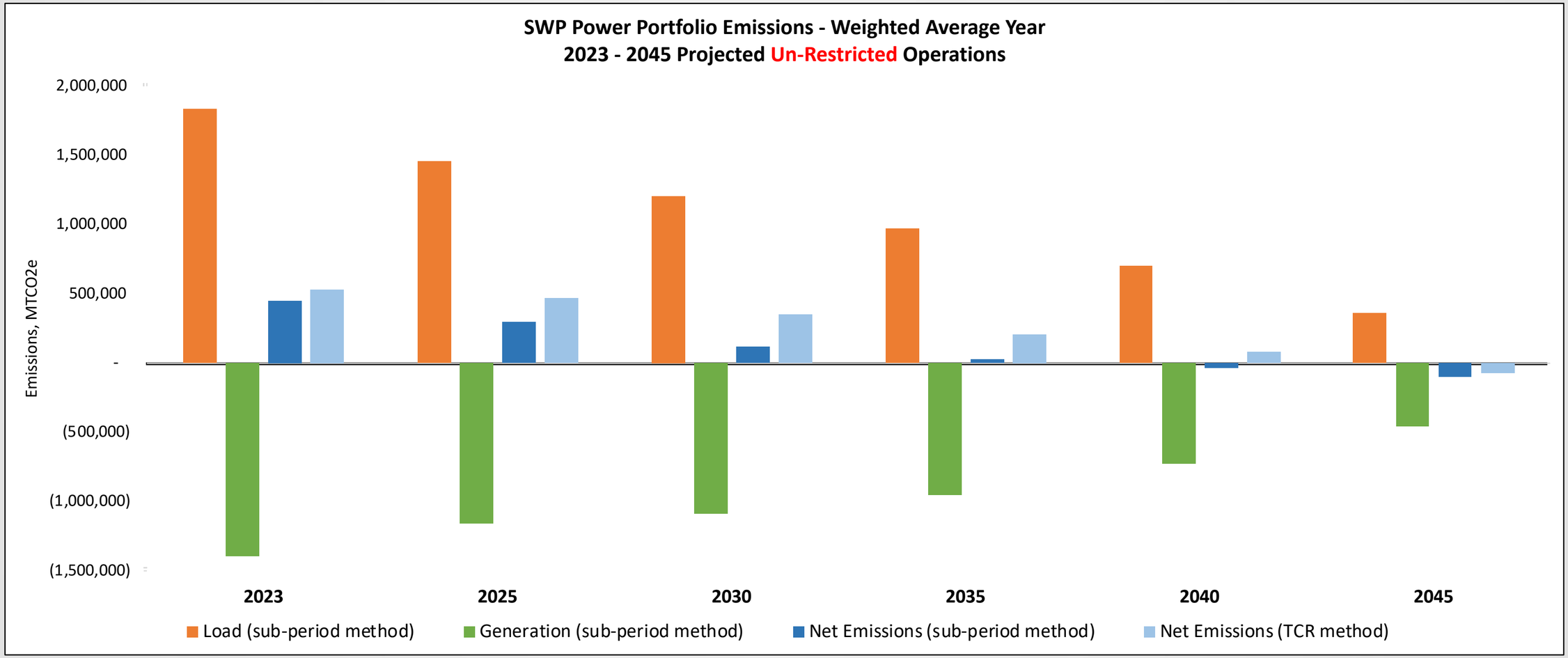


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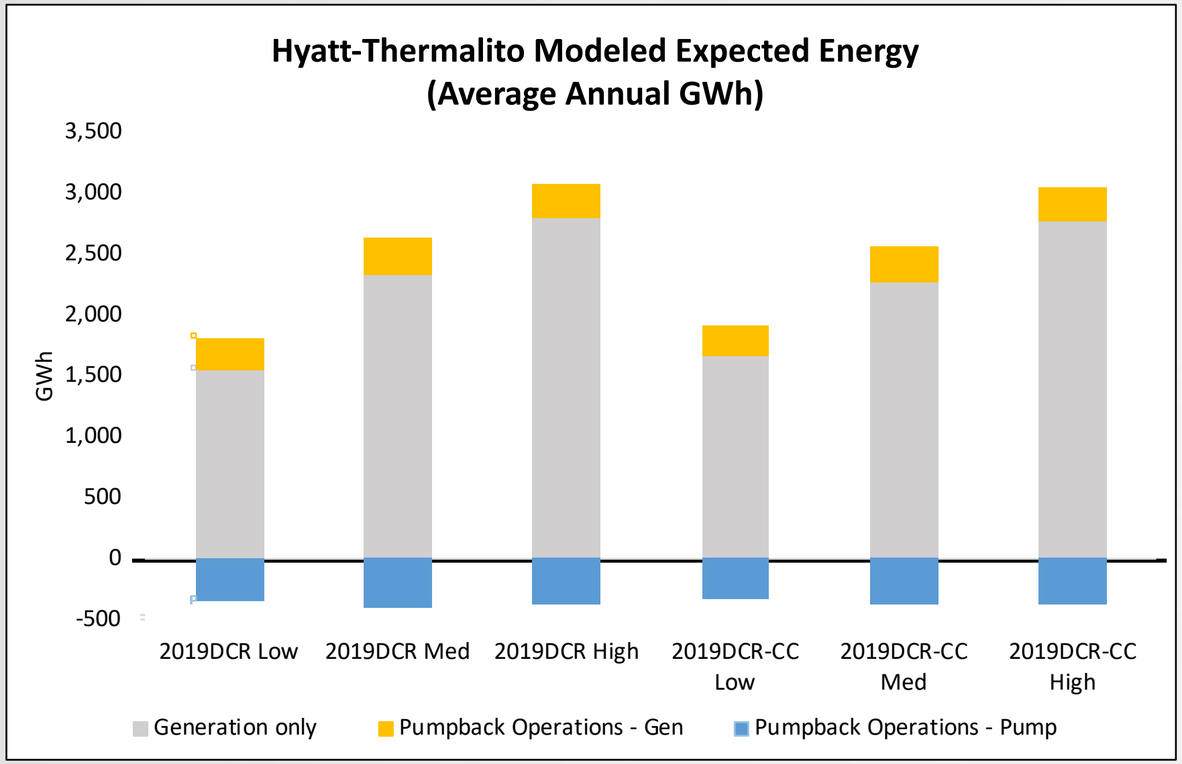
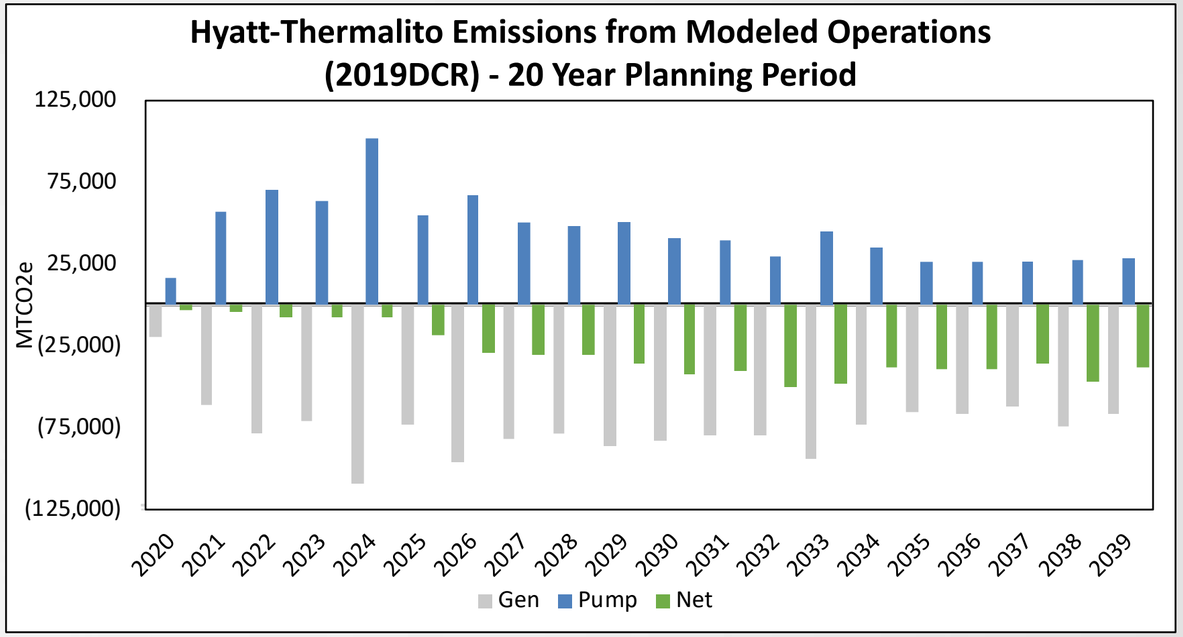
# Flexible Resources Study Update

## Track 3- Pumped Storage




**Notes:** 2019DCR – SWP Delivery Capability Report and Studies. These reports update the estimation of the current (2019) and future (2040) State Water Project delivery capability. These reports incorporate current regulatory requirements for SWP and CVP operations.

2019DCR-CC - SWP Delivery Capability Report and Studies with considerations of impacts due to Climate Change.

**Hyatt-Thermalito Modeled Outputs - Capacity**

| Scenario | Generation (MW) | | Pumping (MW) | |
|---|---|---|---|---|
| | Med - Capacity | Max - Capacity | Med - Capacity | Max - Capacity |
| | 925 | | 480 | |
| 2019DCR Low | 707 | 892 | -310 | -349 |
| 2019DCR Med | 773 | 892 | -310 | -390 |
| 2019DCR High | 848 | 883 | -297 | -381 |
| 2019DCR-CC Low | 707 | 880 | -309 | -387 |
| 2019DCR-CC Med | 775 | 885 | -311 | -404 |
| 2019DCR-CC High | 831 | 883 | -304 | -377 |

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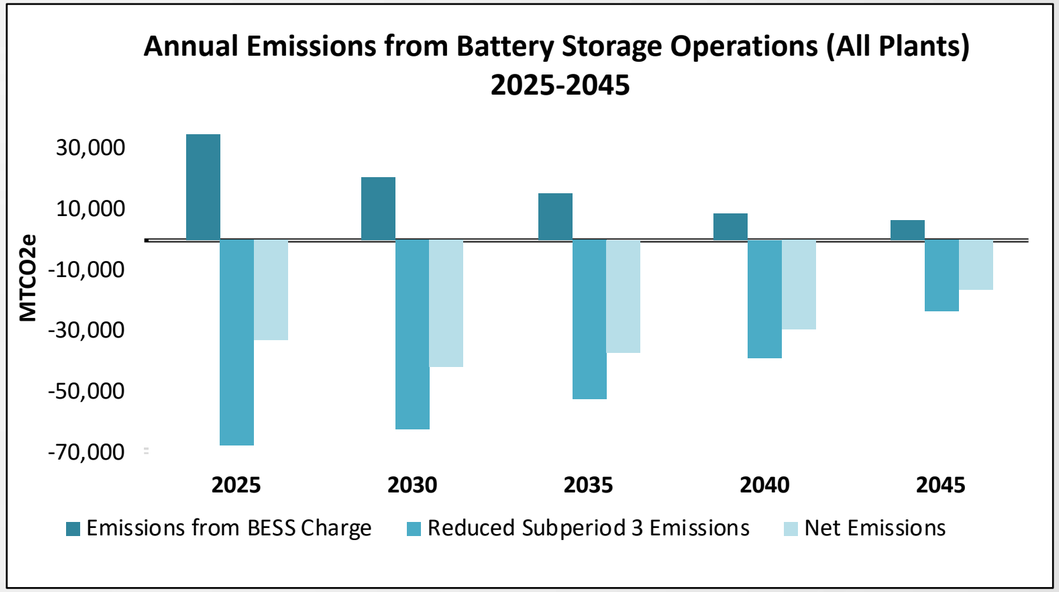
# Flexible Resources Study Update

## Track 4- Integrating Battery Storage with Renewable Resources

| Recommended Battery Storage Capacities (MW) Per Pumping Plant | | | | |
|---|---|---|---|---|
| Buena Vista | Teerink | Chrisman | Edmonston | Pearblossom |
| 15 | 14 | 29 | 123 | 18 |

Note: Battery storage capacities sized based on pumping plants' subperiod 3 net-load exposure.

| Battery Storage - Grid Reliability Benefits Summary | | |
|---|---|---|
| | Buena Vista | Edmonston |
| **BESS Capacity (MW)** | **15** | **123** |
| **Total Annual Energy (MWh) - Modeled** | | |
| BESS Charge during Solar Hours | (22,163) | (179,230) |
| BESS Discharge during Super-Peak Hours | 19,947 | 161,307 |
| **Capacity (MW)** | | |
| Regulation Up | 14 | 110 |
| Regulation Down | 15 | 123 |
| Resource Adequacy (System) Capacity | 15 | 123 |

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# Flexible Resources Study Update

## Track 5- Retrofit of select Pumping Plants- Variable Speed Pumps

### Reliability Benefits of VSP:

- Optimized use of excessive energy on the grid – continuous adjustable energy consumption
- Quick start of pumps without water loss
- Reactive power compensation – VFDs can be used without the pump to operate as a reactive power compensation system.
- Frequency Regulation – Variable Speed Pumps can ramp up and down within the proposed minimum and maximum operational ranges and offer Frequency Regulation capacity.
- Resource Adequacy – Retrofits to the existing large units can increase the pump's operational range and offer more RA Capacity.

| Variable Speed Pump Retrofit<br>Grid Reliability Services Capacity Availability based on OEM proposals | | | | | |
|---|---|---|---|---|---|
| Capacity (MW) | Capacity (1 Large Unit per Pumping Plant) | | | Total Capacity | |
| | Buena Vista | Teerink | Chrisman | 1 Large Unit | 2 Large Units |
| Frequency Regulation (Max) | 5.3 | 7.7 | 13.4 | 26.4 | 52.8 |
| Resource Adequacy (Max) | 4.3 | 6.7 | 9.1 | 20.1 | 40.2 |

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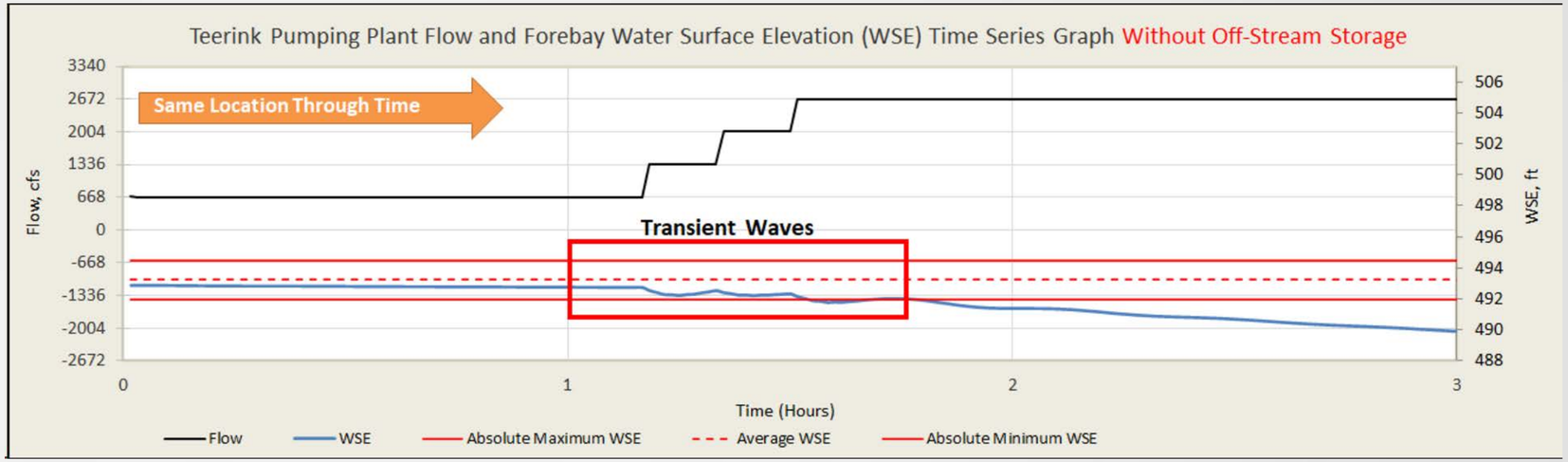
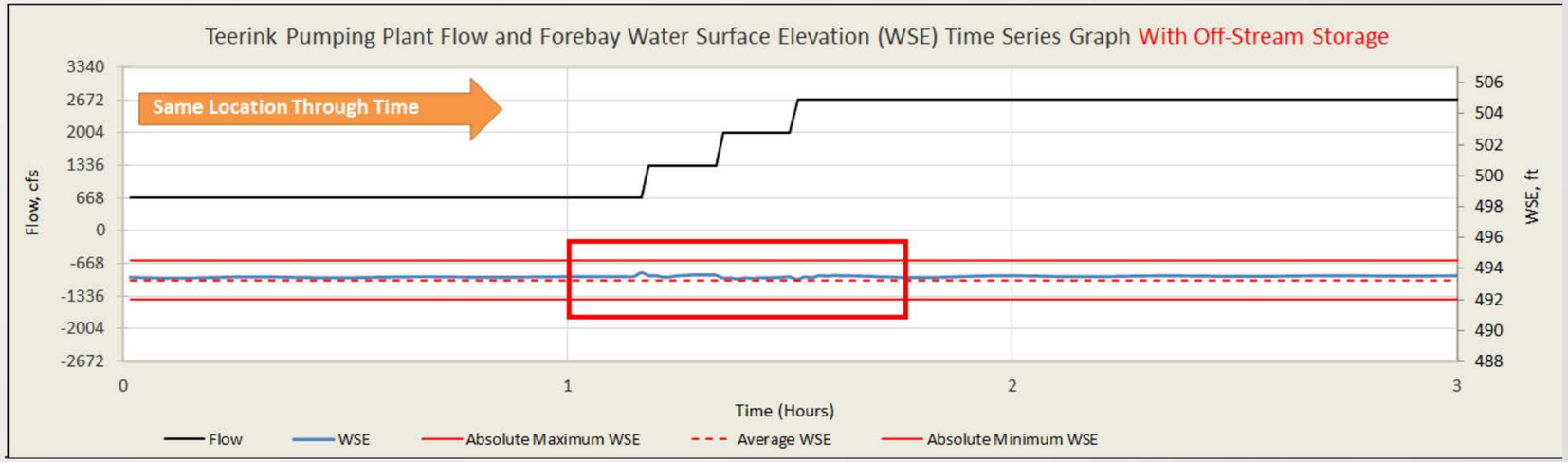
# Flexible Resources Study Update

## Track 6- SWP Hydraulic and Transient Modeling, and Aqueduct Stability

**Purpose:** Developing hydraulic and hydrodynamic models to assess potential transient challenges (i.e. hydraulic instability) from the contemplated more responsive SWP operations.

**Example:** Turning on three large units consecutively at the Teerink Pumping Plant.

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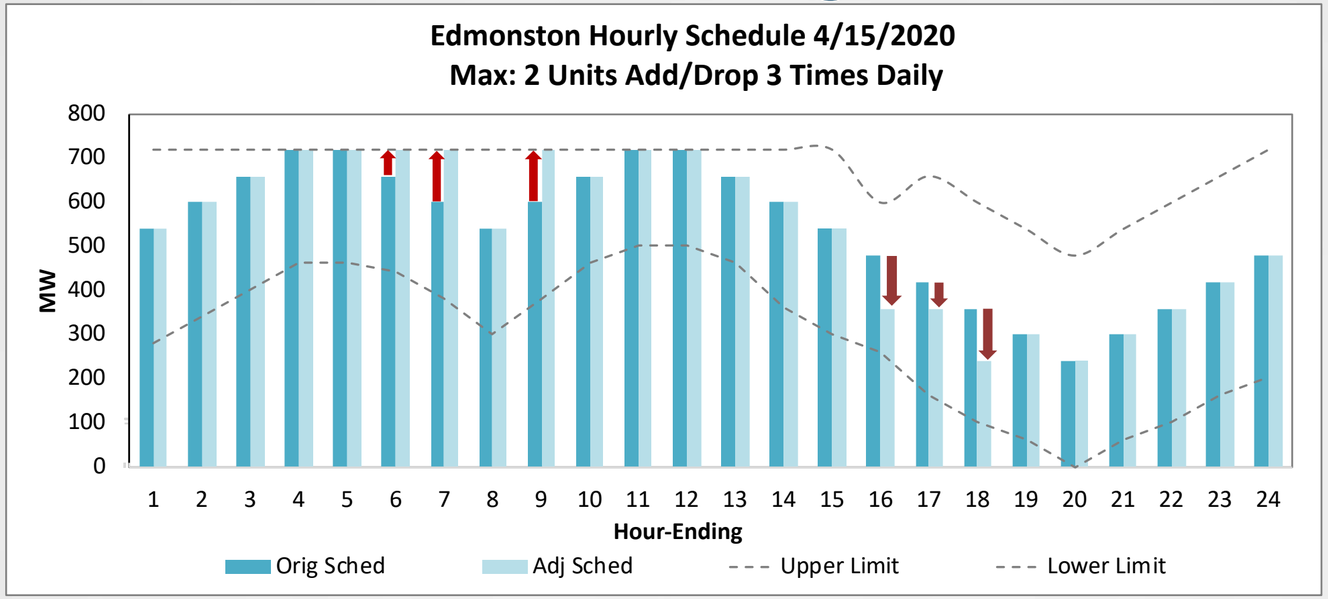
# Flexible Resources Study Update

## Track 7- Real-Time Market Load Bidding




**Real-Time Load Bidding Maximum Daily Adds/Drops (MWH)**

| Scenarios (Daily RT Load Bid) | | Restricted Operations | | | | | Unrestricted Operations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Units | Hours | Buena Vista | Teerink | Chrisman | Edmonston | Total | Buena Vista | Teerink | Chrisman | Edmonston | Total |
| 1 | 1 | 6.3 | 7.5 | 16.4 | 60 | **90.2** | 12.7 | 14.9 | 32.8 | 60 | **120.4** |
| | 2 | 12.6 | 15 | 32.8 | 120 | **180.4** | 25.4 | 29.8 | 65.6 | 120 | **240.8** |
| | 3 | 18.9 | 22.5 | 49.2 | 180 | **270.6** | 38.1 | 44.7 | 98.4 | 360 | **542.4** |
| 2 | 1 | - | - | - | - | - | 19 | 22.4 | 49.2 | 180 | **270.6** |
| | 2 | - | - | - | - | - | 38 | 44.8 | 98.4 | 360 | **541.2** |
| | 3 | - | - | - | - | - | 57 | 67.2 | 147.6 | 540 | **881.8** |

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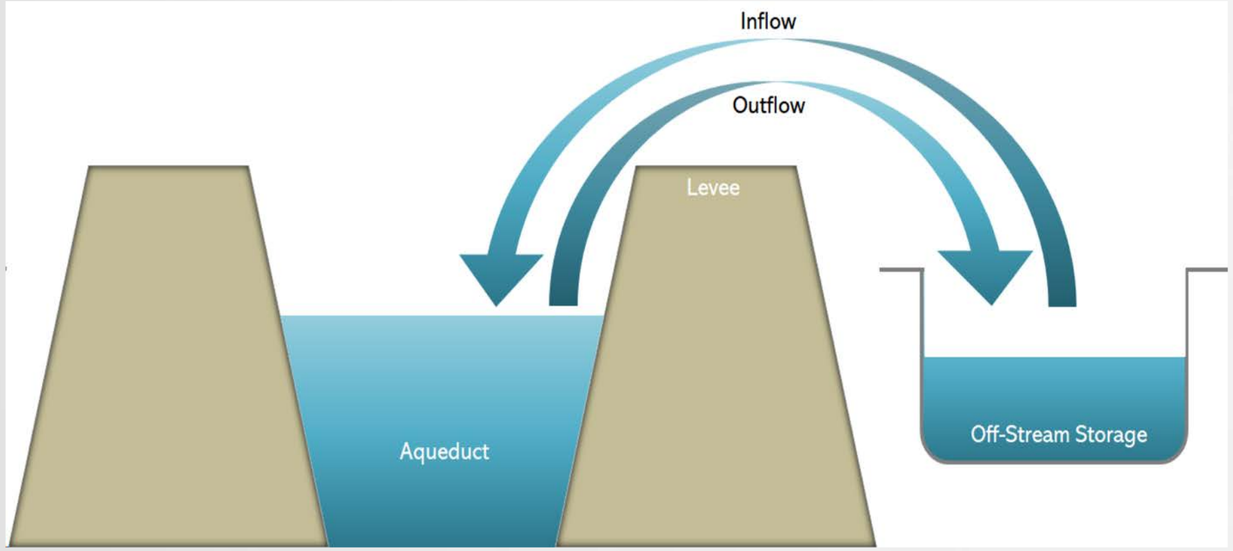
# Flexible Resources Study Update

## Track 8- Adding Pockets of Storage at Strategic Locations

- Off-stream storage will be used to supplement for the additional water or storage space needed in the forebays for various combinations of turning on/off units in the upstream and/or downstream pumping plants, in order to keep the forebays within allowable draw down rates or maximum/minimum water surface elevations.




Possible Location for an Off-Stream Storage Upstream of the Buena Vista Forebay. (DWR owned land)

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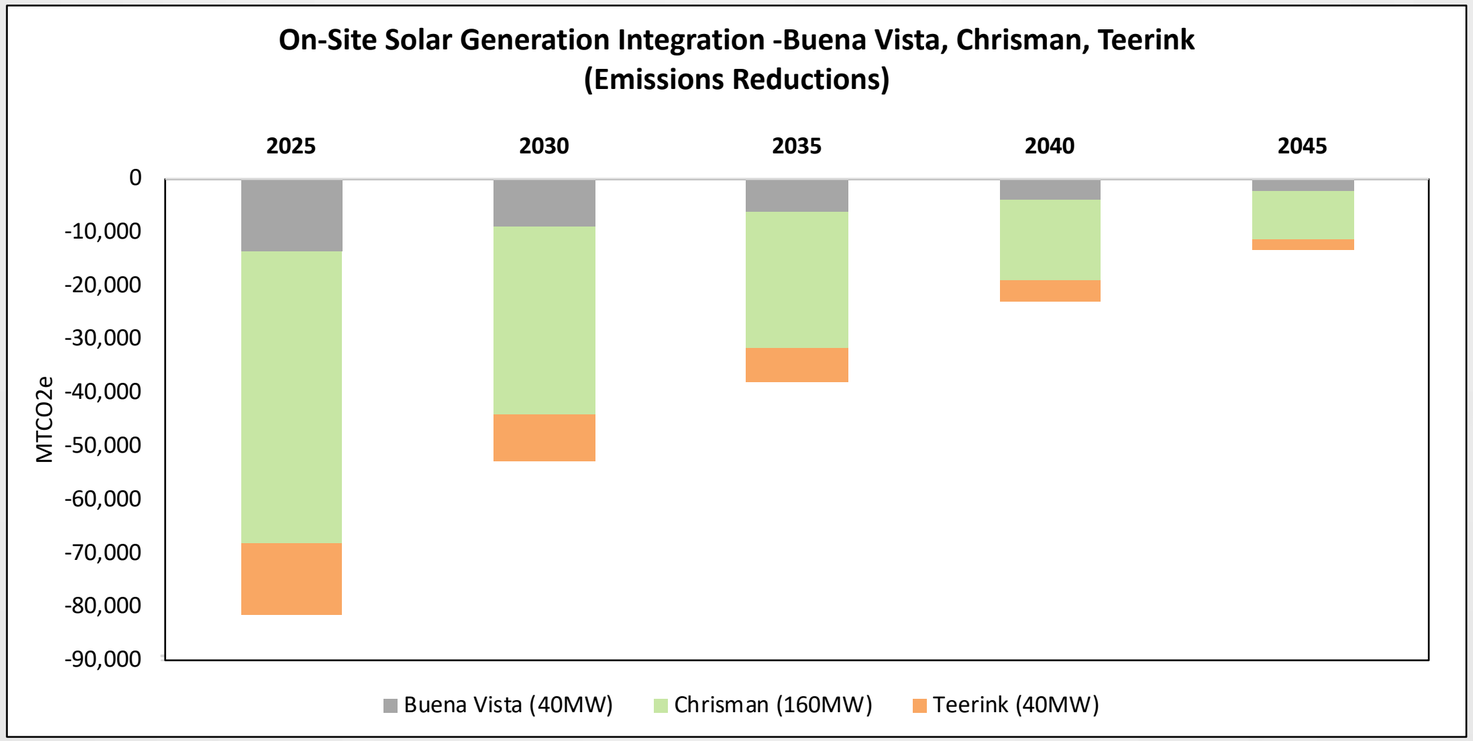
# Flexible Resources Study Update

## Track 9- Integration of On-Site Solar generation at Pumping Plants

| Recommended Solar Plant Capacities (MW) Per Pumping Plant | | |
|---|---|---|
| Buena Vista | Teerink | Chrisman |
| 40 | 40 | 160 |

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# SWP Opportunities – Short Term

- Continue to align and shape SWP load and generation to respond to grid needs
- Procure more renewables to achieve DWR's Climate Action Plan goals
- Offer excess SWP RA Capacity to support grid reliability needs
- Actively participate in CAISO Stakeholder processes to influence market design changes
- Maintain industry outreach and develop partnerships on initiatives and projects
- Monitor power market dynamics, and adjust SWP operations and procurement strategies
- Partner with the SWC to develop the SWP Energy Roadmap
- Develop the Flexible Resources Study Plan – Phase 2
- Maintain active participation in IOUs Transmission rate case filings at FERC

# SWP Opportunities – Mid Term

- Investigate and implement integration of solar and BESS at main SWP pumping plants
- Work with CAISO to enable the SWP to have more latitude in offering grid reliability services
- Implement physical improvements to reduce subsidence impacts on SWP operational flexibility
- Integrate new technologies at SWP pumping plant to reduce wear and tear on equipment
- Collaborate with the SWC on investigating water demand side flexibility
- Update the SWP Integrated Resources Plan (IRP) to adjust plans and strategies
- Restore pumpback operations at Hyatt-Thermalito plants to provide Long Duration Energy Storage  services to the grid

# SWP Opportunities – Long Term

- Develop plans to achieve zero emissions portfolio by 2035
- Develop plans to neutralize GHG emissions from Lodi Energy
- Develop plans to integrate energy storage in SWP operations and setup
- Develop plans to fully resource SWP portfolio with clean energy
- Develop bidding strategies to fully hedge SWP positions in the power market
- Neutralize power costs through deploying supply and demand side flexibilities
- Collaborate with CAISO and others to develop bi-lateral agreement that can utilize SWP capabilities to support grid reliability
- Develop power supply resiliency to maintain partial SWP water operations during emergencies
- Secure right-of-way needed for future clean energy resources developments
- Inform Energy policy and initiative to achieve resilient, and efficient power market design

# SWP Challenges

- Power market evolution
- Transmission access charge escalation
- Changing Regulatory policies and mandates
- CAISO market design changes
- SWP aging infrastructure and inherent constraints
- Subsidence of California Aqueduct
- Climate change impacts
- Competing SWP priorities
- Financial impacts to the SWC
- Water demand inflexibility
- Safety, security, and compliance
- Workforce and retention

# Next Steps

- Brief CWC before Finalizing The SB49 assessment report
- Finalize Draft Report
  - Circulate Draft to Industry Partners for Review
    - State Water Contractors
    - California Natural Resources Agency
    - California Energy Commission
  - Consult with CAISO
- Finalize Report and submit to Legislature

Thank You

# Questions?