Board of directors

April 28, 2022
WAPA hydropower update

Carol Ballantine, senior manager of power markets
Agenda

• Background
  • Colorado River Storage Project (CRSP)
  • Loveland Area Projects (LAP)
• What has changed since fall 2021
• Operational impacts
• Platte River hydropower resource cost impact
• Summary
• Next steps
Background – Colorado River Storage Project

- Colorado River has been under drought conditions for 20 years
  - 2021 extreme drought has led to a significant reduction in CRSP energy
- The Bureau of Reclamation has declared a water shortage
- Western Area Power Administration (WAPA) distributes the electricity produced to its CRSP firm electric service customers
- Low hydropower output and high power and gas prices have negatively impacted WAPA's purchased power expenses
- Concerns that Glen Canyon Dam (main source) will dip below minimum power pool level
What has changed since fall 2021

• Drought conditions worsened
• Impact on CRSP
  • Further energy allocation reduction of approximately 5% from 2022 budget
  • Possible rate increase in 2024
• Impact on LAP
  • Proposed rate increase Jan. 1, 2023
CRSP resources
Glen Canyon dam

1984

- At full level

2022

- 180 feet below full
Operational impacts resulting from CRSP purchases

- CRSP is the larger of Platte River's two hydropower purchase agreements from WAPA
  - Platte River’s share of CRSP hydropower production has decreased from approximately 500,000 MWh in 2020 to approximately 330,000 MWh in 2022 under the most probable (50/50) scenario
  - Decrease has resulted in less scheduling flexibility
- Under the most probable scenario for 2023, Platte River's share of the annual CRSP hydropower production will be approximately 332,000 MWh
  - 10% possibility that minimum power pool level will occur in spring 2023
  - If minimum power pool level occurs, WAPA's annual hydropower production will be reduced by 85%
  - Reduced allocations are being modeled as a sensitivity
- Resource planning is considering long-term drought impacts to ensure Platte River's Resource Diversification Policy goals are achievable
CRSP contract rates and purchases

Current rates effective Dec. 1, 2021

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>$5.25/kW-month</td>
</tr>
<tr>
<td>Energy</td>
<td>$12.36/MWh</td>
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<tr>
<td>Blended rate 2022 budget</td>
<td>$34.20/MWh</td>
</tr>
<tr>
<td>Blended rate projections</td>
<td>$35.33/MWh</td>
</tr>
</tbody>
</table>

Platte River’s CRSP energy purchases

<table>
<thead>
<tr>
<th>CRSP energy purchases</th>
<th>Annual total</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020 actual</td>
<td>502,467 MWh</td>
<td>--</td>
</tr>
<tr>
<td>2022 budget</td>
<td>348,637 MWh</td>
<td>(153,830) MWh</td>
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<tr>
<td>2022 and 2023 projection</td>
<td>331,386 MWh</td>
<td>(171,081) MWh</td>
</tr>
</tbody>
</table>
CRSP energy purchases in 2021 and 2022
CRSP historical energy, blended cost and projections

- 2022 and 2023 are Platte River projections
Resource impact – 2022

Replacement sources of the 171,081 MWh of reduced hydropower

- Surplus sales reduced, 47%
- Coal, 37%
- JDA and market purchases, 16%
LAP background

• LAP hydropower on the front range has decreased each of the last four years
• WAPA distributes the electricity produced to its LAP firm electric service customers
  • Platte River, historically, purchases approximately 109,000 MWh per year
• WAPA has proposed a base rate increase and a drought adder, beginning January 2023
• Less hydropower and high power and gas prices have increased WAPA’s purchased power costs
LAP resources
Historical LAP hydro generation

December 2021 forecast
Proposed LAP rates

- Proposed rate increase of approximately 16% as the result of
  - Increase in base rate (1/3 of rate increase)
  - Reinstatement of the drought adder (2/3 of rate increase)

<table>
<thead>
<tr>
<th></th>
<th>Blended rate 2022 ($/MWh)</th>
<th>Blended rate 2023 ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022 LAP rate</td>
<td>$29.73</td>
<td>$34.64</td>
</tr>
</tbody>
</table>
LAP historical energy, blended cost and projections

- 2022 and 2023 are Platte River projections
### Platte River Cost Impact of CRSP and LAP Changes

<table>
<thead>
<tr>
<th></th>
<th>Annual cost prior to changes ($/millions)</th>
<th>2023 projection ($/millions)</th>
<th>Incremental costs ($/millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRSP demand</td>
<td>$7.5</td>
<td>$7.6</td>
<td>$0.1</td>
</tr>
<tr>
<td>CRSP energy</td>
<td>$6.1</td>
<td>$4.1</td>
<td>($2.0)</td>
</tr>
<tr>
<td>LAP demand</td>
<td>$1.5</td>
<td>$1.8</td>
<td>$0.3</td>
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<tr>
<td>LAP energy</td>
<td>$1.7</td>
<td>$2.0</td>
<td>$0.3</td>
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<tr>
<td>Total WAPA purchased power</td>
<td>$16.8</td>
<td>$15.5</td>
<td>($1.3)</td>
</tr>
<tr>
<td>Replacement cost impact</td>
<td>-</td>
<td>$4.3</td>
<td>$4.3</td>
</tr>
<tr>
<td>Total cost increase</td>
<td>$16.8</td>
<td>$19.8</td>
<td>$3.0</td>
</tr>
<tr>
<td>% change in resource cost impact</td>
<td></td>
<td></td>
<td>17.9%</td>
</tr>
</tbody>
</table>
Summary

- Severe drought conditions persist
- Losing significant flexibility in scheduling CRSP energy
- Risk of lower CRSP allocations, if Glen Canyon Dam dips below minimum power pool level
- Lower CRSP energy allocations and higher rates possible in future
- Resource impacts
  - Loss in surplus sales revenue
  - Replace with higher cost energy
- Lower hydropower output and higher CRSP and LAP rates will increase Platte River’s annual WAPA costs by approximately $3.0 million, a 17.9% increase over historical hydropower expenses
Next steps

- Model future drought conditions with additional WAPA CRSP and LAP rate increases and deeper cuts in CRSP allocations
- Continue to pursue Platte River’s Resource Diversification Policy
  - Find replacement resources for decreasing hydropower noncarbon energy
  - Evaluate the risk of operating below minimum power pool level for extended period
  - Develop a risk mitigation strategy for operating below minimum power pool level
Questions
Board of directors

April 28, 2022
Energy storage performance and systems

Raj Singam Setti, chief transition and integration officer
Agenda

- Rawhide Prairie Solar battery
  - Statistics
  - Performance
  - Lessons learned
- Battery charging scenario
- Energy storage systems
Rawhide Prairie solar battery

Stats

- 2 MWh Tesla Megapack, max dispatch – 1 MW, 2-hour discharge
- COD March 19, 2021
- 613 MWh as of March 31, 2022
- Approximately 90% availability
Rawhide Prairie solar battery

Performance

• **Charge** in the morning using solar

• Missed approximately 47 days
  • 17 non solar days
  • 30 days, automated scripts

• 2.5 hours to charge 2 MWh

• **Discharge** at 7 p.m. to manage evening peak (automatic)

• Discharges 1.8 MWh with 90% efficiency

• Expected 2% degradation per year, however after one year there is insignificant change
Dispatch profile

Battery charge

Battery discharge

Solar production
Rawhide Prairie solar battery

Lessons learned

• Tesla management of battery
• Algorithm is a black box
Battery charging scenario

Day 1

- Batteries 1, 2, and 3 will start to charge at 6 a.m.
- Need to add batteries 4 and 5 for continued reliability from 2-10 a.m.

Day 2

- Batteries 1, 2, and 3 will start to charge at 6 a.m.
- Need to add batteries 4 and 5 for continued reliability from 2-10 a.m.
# Energy storage systems

<table>
<thead>
<tr>
<th>Description</th>
<th>Electro-chemical</th>
<th>Thermal</th>
<th>Mechanical</th>
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</thead>
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<tr>
<td><strong>Types</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Batteries</td>
<td>• Lithium-ion</td>
<td>• Latent heat</td>
<td>• Compressed air</td>
</tr>
<tr>
<td></td>
<td>• Lead acid</td>
<td>• Sensible heat</td>
<td>• Hydro pumped (gravity)</td>
</tr>
<tr>
<td></td>
<td>• Sodium sulfur</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Iron air</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Redox flow</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hydrogen fuel cell</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Latent heat</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• Sensible heat</td>
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<tr>
<td>Mechanical</td>
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</tr>
<tr>
<td></td>
<td>• Compressed air</td>
<td></td>
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<tr>
<td></td>
<td>• Hydro pumped (gravity)</td>
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<table>
<thead>
<tr>
<th>Advantages</th>
<th>Minimum degradation</th>
<th>Scalable</th>
<th>Long life</th>
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</table>

<table>
<thead>
<tr>
<th>Disadvantages</th>
<th>Higher O&amp;M</th>
<th>Heat loss</th>
<th>Low round trip efficiency</th>
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<tbody>
<tr>
<td></td>
<td>High operating temp.</td>
<td>Geological requirement</td>
<td>Geological requirement</td>
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<tr>
<td></td>
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<td>High investment cost</td>
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<table>
<thead>
<tr>
<th>Development stages</th>
<th>Limited track record</th>
<th>Limited track record</th>
<th>Proven technology</th>
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<table>
<thead>
<tr>
<th>Vendors</th>
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<td>Batteries</td>
<td>Tesla</td>
<td>Form Energy</td>
<td>Bloom Energy</td>
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<td>Thermal</td>
<td>Fluence</td>
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<tr>
<td>Mechanical</td>
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Questions
Resource diversification and system integration opportunities

Raj Singam Setti, chief transition and integration officer
Agenda

• Resource integration
  • Wind and solar purchase power agreement (PPA) cost
  • Resource integration schedule - resource plan 2022 (RP22)
  • Reliability
• 2030 distributed energy resources (DER)
  • Three Ds – digitalization, decarbonization, distribution
  • System integration
  • DER action plan
• Average generation cost comparison
Resource integration introduction

Asset integration schedule
Solar and wind resources integrated 2027-2028

Generation cost
Average generation cost is 21% higher than 2020 IRP

Reliability
More wind and dispatchable resources in portfolio

Commodity cost run up
Solar and wind PPA prices higher than 2020 Integrated Resource Portfolio (IRP)
Wind and solar PPA cost

Wind

Solar
Resource integration schedule

Wind

Solar

Storage

Dispatchable capacity

IRP
RP22
Reliability

- Loss of load hours in which resources may not meet the system demand entirely
- Unserved energy (USE) for this plan is 0.1 hours or 6 minutes
# 2030 distributed energy resources

## DER capacity in MW

<table>
<thead>
<tr>
<th>DER category</th>
<th>Maximum capacity</th>
<th>Summer peak capacity</th>
<th>Winter peak capacity</th>
<th>Average capacity</th>
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<tbody>
<tr>
<td>Distributed solar</td>
<td>87</td>
<td>25</td>
<td>0</td>
<td>12</td>
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<tr>
<td>Demand response/flexible load</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>5</td>
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<tr>
<td>Electric vehicles</td>
<td>62</td>
<td>10</td>
<td>10</td>
<td>14</td>
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<tr>
<td>Building electrification</td>
<td>20</td>
<td>0</td>
<td>20</td>
<td>8</td>
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</table>
Three Ds – digitalization, decarbonization, distribution

Integration
- Digitalization
  - Operational technology
  - Information technology
  - Data science
  - DERMS
  - SCADA/EMS
  - DMS/ADMS
  - Infrastructure
  - Data communication
  - Cybersecurity
  - Dashboard/KPI
  - Predictive analytics
  - artificial Intelligence/machine learning

Transition
- Distributed energy resources
  - Policy
  - Energy solution
  - Customer solution and engagement (CIS)
- Organized market
  - SPP
  - Energy/ancillary services
  - FERC
    - Order No. 2222
    - Order No. 841
- New and existing assets
  - Request for proposals
  - Evaluation/procurement
  - Grid innovation
  - Modeling
  - Resource planning

Decarbonization
- DER

Platte River
- Owner communities
System integration

Information needed from the owner communities

- Distributed generation and DER availability
- Distributed generation and DER capability/derates
- Demand response status by program
- EV/devices aggregated status
  - Flex demand

Virtual power plant (DERMs)

Building electrification

Demand response

Electric vehicles

Distributed generation
System integration

Platte River’s resources and community DERs will integrate with an energy market

- Wind energy
- Solar energy
- Energy storage
- Dispatchable resources
- Virtual power plant (DERMs)

Markets
- Price signal
- Energy dispatch

• Market integration - energy/capacity/AS
• Flexible generation and flexible demand - forecast
**DER action plan**

**Grid infrastructure**
- Technology, neutral sourcing
- Data communication and cybersecurity
- Utility “2.0” infrastructure
  - AMI/MDMS/ADMS
  - CIS
  - Planning
  - Interconnection

**Market integration**
- DER participation in wholesale market
- FERC 2222/841
- Dynamic pricing
- Ancillary services

**Rates**
- Value of DER (system support)
- Time varying rates
- Carbon reduction rates
- Affordable to non-DER customers
Average generation cost comparison

Average annual generation cost

<table>
<thead>
<tr>
<th>Year</th>
<th>Current budget</th>
<th>RP22</th>
<th>$ difference</th>
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<tbody>
<tr>
<td>2023</td>
<td>$32</td>
<td></td>
<td></td>
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<tr>
<td>2024</td>
<td>$37</td>
<td></td>
<td></td>
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<tr>
<td>2025</td>
<td>$42</td>
<td></td>
<td></td>
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<tr>
<td>2026</td>
<td>$46</td>
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<td>2027</td>
<td>$48</td>
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<td>2028</td>
<td>$59</td>
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<td>2039</td>
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<tr>
<td>2040</td>
<td>$63</td>
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Cost increase RP22 relative to the current budget

Platte River Power Authority
Questions
Appendix
DER system of systems vendor landscape

Technology enablers for DER
- DERMS
- ADMS
- Demand management
- EVC management

Vendor landscape
- AutoGric
- OSI
- Spirae
- CAMUS
- Siemens
- ABB
- Survalent
- Schneider Electric
- Itron
- EnergyHub
- evconnect
Board of directors

April 28, 2022
Water resources reference document

• What it is
  • A report outlining Platte River’s water resources (supplies, agreements, operations)
  • A summary of the key water-related items, updated annually

• Why it was created
  • Numerous water-related policies and resolutions
  • Needed to find a way to bundle the information
  • Supported the development of the water policy
  • Collaborative process with board and owner community staff (2012-2016)

• Updates to this April 2022 edition
  • Operational data through October 2021 (2021 water year)
  • Chimney Hollow Reservoir activities in the past year
  • Minor formatting and language changes
Board of directors

April 28, 2022
## March operational results

<table>
<thead>
<tr>
<th>Category</th>
<th>March variance</th>
<th>YTD variance</th>
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<tbody>
<tr>
<td>Owner community demand</td>
<td>6.2%</td>
<td>5.1%</td>
</tr>
<tr>
<td>Owner community energy</td>
<td>0.1%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Wind generation</td>
<td>2.6%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Solar generation</td>
<td>24.4%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Net variable cost to serve owner community load*</td>
<td>(0.5%)</td>
<td>(3.5%)</td>
</tr>
</tbody>
</table>

Variance key:  
- Favorable: ● >2%  
- Near budget: ◆ +/- 2%  
- Unfavorable: ■ <-2%

*Total resource variable costs plus purchased power costs less sales revenue
Board of directors

April 28, 2022
## March financial summary

<table>
<thead>
<tr>
<th>Category</th>
<th>March variance from budget ($ in millions)</th>
<th>Year to date variance from budget ($ in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net income*</td>
<td>$(1.0)</td>
<td>$0.4</td>
</tr>
<tr>
<td>Fixed obligation charge coverage</td>
<td>.20x</td>
<td>.37x</td>
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<tr>
<td>Revenues</td>
<td>$0.3</td>
<td>$0.6</td>
</tr>
<tr>
<td>Operating expenses</td>
<td>$0.4</td>
<td>$2.9</td>
</tr>
<tr>
<td>Capital additions</td>
<td>$1.3</td>
<td>$7.5</td>
</tr>
</tbody>
</table>

- **Favorable**: 2% | 2% to -2% | At or near budget | < -2% **Unfavorable**

*Net Income results impacted by unrealized losses on investments, $1.7M in March and $3.2M year to date*
Board of directors

April 28, 2022