Western Area Power Administration
CRSP Management Center
10-Year Planning Meeting
October 20, 2017

RMR Projects
Jason Groendyk

Rocky Mountain Region Ten Year Plan Version Control

– R0-version of Ten Year Plan submitted to customers and to headquarters for consolidation of WAPA-wide budget; late October-November
– R1-version of Ten Year Plan with any corrections or changes after customers and senior management review; mid-January
– RFINAL-final version submitted to headquarters for consolidation of WAPA-wide budget submission to the Dept. of Energy; April

FY 18-27 Rocky Mountain Region Ten Year Plan

– Completed Projects
– Changed/Ongoing Projects
– New Projects
Completed Projects

FY 2017 Rocky Mountain Region Completed Projects

• Ault Station Service
  – In-service Date: Q4 FY17
  – Actual Cost: $956k ($195k CRSP)
  – Budget: $940k ($183k CRSP)

• Curecanti KZ1A Transformer Replacement
  – In-service Date: Q2 FY17
  – Actual Cost: $2.308M ($2.05M CRSP)
  – Budget: $2.308M ($2.05M CRSP)

• Hayden 230 kV breaker replacements
  – In-service Date: Q2 FY17
  – Actual Cost: $539k
  – Budget: $539k

• Waterflow Phase Shifter and breaker replacements
  – In-service Date: Q1 FY17
  – Actual Cost: $17.04M (including accrued interest during construction)
  – Budget: $16.06M as presented Nov 2016. Initially 20M+
FY 2017 Rocky Mountain Region Completed Projects

• Collbran 115-kV breaker replacement
  – In-service Date: Q4 FY17
  – Actual Cost: $195k
  – Budget: $187k

• Ault-Weld West OPGW
  – In-service Date: Q3 FY17
  – Actual Cost: $841k
  – Budget: $774k

• Western Area Power Administration

FY 2017 Rocky Mountain Region Completed Projects

• Montrose Operations Center Station Service Upgrade
  – In-service date: Q4 FY17
  – Actual Cost: $663k
  – Budget: $1.113M

• Montrose Operations Center Video Surveillance Upgrade
  – In-service date: Q2 FY17
  – Actual Cost: $170k ($146k CRSP)
  – Budget $231k ($199k CRSP)

• Western Area Power Administration

FY 2017 Rocky Mountain Region Completed Projects

• PMOC UPS Upgrade
  – In-service date: Q4 FY17
  – Actual Cost: $1.246M ($387k CRSP)
  – Budget: $1.314M ($408k CRSP)

• Western Area Power Administration
FY 2017 Rocky Mountain Region Completed Projects

- **WCMO Snow Cat and Trailer**
  - Purchased June 2017
  - Actual Cost: $143k
  - Budget: $150k

- **Craig 72’ bucket truck**
  - Purchased January 2017
  - Actual Cost: $502k
  - Budget: $475k

FY 2017 Rocky Mountain Region Completed Projects

- **Montrose wire/conductor reel trailers**
  - Purchased September 2017
  - Actual Cost: $94k
  - Budget: $120k

Changes in Transmission Line Projects
FY 18-27 Rocky Mountain Region Changes in Transmission Line Projects

- Pleasant View-Ruin Canyon 24.9-kV UG T-line replacement
  - Construction contract award Q4 FY16
  - Project suspended May-Sep 2017 to serve irrigation load
  - Overall budget reduced from $750k to $440k
  - Low bid approx. 60% of construction estimate
  - Anticipated ISO: Q1 FY18

Changes in Substation Projects

- Clean Path Energy Interconnection (Shiprock)
  - Construction start anticipated for FY21
  - Includes control building addition for additional panels and separate battery room
  - Overall project budget $7.5M (100% Trust funded)
  - Anticipated ISO: Moved from FY20 to FY23
FY 18-27 Rocky Mountain Region Changes in Substation Projects

• Archer KV2A Transformer Replacement
  – Project construction complete – commissioning ongoing
  – In-service Date: Delayed from Q3 FY17 to Q1 FY18 due to resource limitations
  – Actual Cost to date: $2.622M
  – Budget: $3.369M

FY 18-27 Rocky Mountain Region Changes in Substation Projects

• Weld 115-kV & 230-kV breaker replacements
  – Construction complete, commissioning ongoing
  – In-service Date: Delayed from Q4 FY17 to Q1 FY18 due to resource limitations
  – Actual cost to date: $1.561M
  – Budget: $1.611M

Changes in Communication Projects
FY 18-27 Rocky Mountain Region Changes in Communication Projects

- **Colorado Fiber Ring**
  - Anticipated in-service date: **Moved from FY17 to FY18**
  - GPP-WGP portion needed for complete "ring"
  - Initial budget: $1.473M ($592 CRSP)
  - Increased budget: $1.693M ($641 CRSP)
  - Budget when first proposed in 2013 was $1.75M

New Transmission Line Projects

FY 18-27 Rocky Mountain Region New Transmission Line Projects

- **South Canal Underground line rebuild**
  - $1.8M in FY27
New Substation Projects

FY 18-27 Rocky Mountain Region New Substation Projects

- Archer Circuit Breakers and Switches
  - $710k in FY18 and FY19
  - Total project cost of $1.97M as this completes previous breaker install project
- Flaming Gorge Breaker 4032 & 4132
  - $239k in FY20
- Hayden Transfer Breaker 1886 & relays
  - $244k ($122k CRSP) in FY20
- Poncha Breakers 386 & 1186
  - $600k in FY20

FY 18-27 Rocky Mountain Region New Substation Projects

- Shiprock 138kV Breaker 5322
  - $213k in FY20
- Montrose Equipment Storage Building modification
  - $245k in FY20
- Montrose Warehouse & Machine Shop Transformer
  - $335k ($288k CRSP) in FY18
- Blue Mesa Transformer replacement and 30 MVAR Reactors
  - ~$5.0M from FY22-FY25
New Mobile and Heavy Equipment

28

28

30

30
## FY 18-27 Rocky Mountain Region New Mobile and Heavy Equipment

<table>
<thead>
<tr>
<th>Item</th>
<th>FY</th>
<th>Cost</th>
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<tr>
<td>Craig Digger Derrick Replacement</td>
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<tr>
<td>Montrose 95' Bucket Truck Replacement</td>
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<tr>
<td>Craig Scissor lift</td>
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<td>Mobile Transformer Replacement</td>
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Questions?

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Western Area Power Administration

CRSP Management Center
10-Year Planning Meeting
October 20, 2017

Amy Cutler
Two Joint Projects

Page Warehouse

- 60 years old, structurally sound
- Requires updating and modification to meet current needs
**Metering Project**

- Joint assessment effort based on SPP metering protocol
- Current Plan (now – 2019)
  - Assess all generation sites
  - Ensure planned replacement efforts meet SPP metering standard

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**Western Area Power Administration**

CRSP Management Center
10-Year Planning Meeting
October 20, 2017

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**Desert Southwest Region**

**AGENDA**

1. Communication Projects  
   • Completed, Active, & Now
2. Protection & Control Projects  
   • Completed, Active, & Now
3. Maintenance & Construction Projects  
   • Completed, Active, & Now
4. Integrated Vegetation Management Program
Desert Southwest Region Communication Projects

Completed Communication Projects

**WIN/CIP5**
- Location(s): Pinnacle Peak, Flagstaff, Long House Valley, Glen Canyon
- Driven by compliance requirements
- Provided remote access to interrogate devices at the Medium Impact sites and meet CIPv5 requirements
- Completed: Q3 FY17
- Total budget: $30,000
- Actual cost to date: $30,942

Active Communication Projects

APS Tower at Jacks Peak
Active Communication Projects

Microwave System Upgrades
- Project establishes a new communication path and increases reliability
- Preston Mesa – Jacks Peak (APS)
- Significant cost savings (property & tower structure) was achieved at Jack’s Peak as DOW negotiated use of existing APS tower
- Anticipated ISD: Q4 FY18
- Total budget: $117,100 (FY17:$57,100, FY18:$60,000)
- Actual cost to date: $82,441

Active Communication Projects

Glen Canyon Communication Tower Replacement (New Project)
- Requirement for dual redundant routes to Glen Canyon and larger antennas to increase capacity adds additional loading to the tower
- Tower Purchased: Q4 FY17
- Equipment to Purchase: Q1 FY18
- Specification into Procurement: Q1 FY18
- Work to commence: Q2 FY18
- Anticipated ISD: Q1 FY19
- FY18 budget: $352,000
- Total Budget: $482,309
- FY17 cost to date: $130,309
Active Communication Projects

Microwave System Upgrades (New Project)
• Jacks Peak (APS) – Glen Canyon
• Work Plan/Out Years – this relates to the Glen Canyon Tower Project
• Government furnished equipment purchased: Q2 FY18
• Anticipated ISD: Q4 FY18
• Total Budget: $170,000 (FY17: $0, FY18: $170,000)
• Actual cost to date: $10,574

Radio Equipment Upgrades
• Communication Path portions on hold pending the completion of Glen Canyon communication tower project:
  • Zilker Mesa – Glen Canyon
  • Zilker Mesa – Lolami
  • Jacks Peak – Glen Canyon
  • Jacks Peak – Preston Mesa
• Project increases bandwidth and reliability
• Bandwidth requirements in accordance with NERC
• Anticipated ISD: Q1 FY19
• Total Budget: $210,000
• Actual cost to date: $85,564

FY18 Communication Projects

WIN/CIP
• Location: Kayenta Substation
• Remote access to interrogate relays and meet compliance requirements
• Anticipated ISD: Q4 FY18
• Total budget: $20,000
FY18 Communication Projects

Mingus Mountain Communication Building
- Building was analyzed by engineering and deemed structurally unsound.
- Project was pushed back based upon reprioritization of the Glen Canyon Comm Tower replacement.
- DSW is repurposing the existing EDS 10'x24' building for relocation to Mingus Mountain, savings will be realized in the repurposing.
- Funding carried over from FY16 to FY17 to FY18.
- Funding used to start work for Glen Canyon Comm Tower in FY17.
- Anticipated ISD: Q4 FY19.
- Total Budget: $100,000 (FY18)

New Communication Projects

"Towers" Mountain Communication Building Replacement
- $1M across FY20-FY21.

Mingus Microwave Replacement
- $72,983 across FY18-FY19
  (Construction to install existing EDS building).

Communication Battery/Charger System Replacements
- $50,000 per FY in FY20-FY27

Remote Terminal Unit (RTU) Replacements
- $85,000 per FY in FY20-FY27

Desert Southwest Region Protection & Control Projects
Completed Protection & Control Projects

Glen Canyon Visitor Center Revenue Meter Replacement
- Added a demand meter at Glen Canyon Substation to meter the Visitor Center electrical load
- Load previously unmetered
- ISD: February 2017
- Total budget: $50,000
- Actual cost to date: $68,000

Active Protection & Control Projects

Pinnacle Peak Relay Replacement - Transformer KU1A and KU2A
- Completed protection and control panel design work in FY17
- Four relay panels were fabricated, constructed and wired in FY17
- Cost drivers: Increased cost due to FY18 labor rate increase & installation and commissioning constraint discovered during design phase.
- Anticipated ISD: Q3 FY18
- Total budget: $263,519 (FY18 Budget: $200,000)
- Actual cost to date: $63,519

Active Protection & Control Projects

Glen Canyon Remedial Action Scheme (RAS)
- Previously in the 10-Year Plan
- Cost drivers:
  - Completion of the RAS scheme for Path A/B being contingent upon integration of Bureau of Reclamation portion of the scheme.
  - FY18 WAPA labor rate increase
- Anticipated ISD: Q4 FY2018
- Total budget: $443,000 (FY18 Budget: $120,000)
- Actual cost to date: $323,000
Active Protection & Control Projects

Pinnacle Peak Digital Monitoring Equipment (DME) Upgrades
- Driven by compliance requirements; both 230-kV & 345-kV to be monitored.
- FY18 Scope:
  - Program DME & RTU programming
  - Build network and storage for DME data collection
  - Field install and commissioning
- Anticipated ISD: Q4 FY18
- Total estimated budget: $345,000 (FY18 Budget: $175,000)
- Total Cost to date: $162,417

FY18 Protection & Control Projects

Pinnacle Peak Relay Replacement
- Transfer Breaker & Bus Differential
  - Scope: Upgrade transfer line protection along with breaker failure Protection. Replace E/M north & south 230kV bus differential Protection.
- Anticipated ISD: Q4 FY2019
- Total Budget: $475,000
  (FY18 Budget: $90,000, FY19 Budget: $385,000)

FY18 Protection & Control Projects

Glen Canyon Relay Replacement
- 69/24 kV Protection upgrade at GCS
- Replace electro-mechanical relays-line, breaker and bus protection on the 69-kV and 24-kV elements.
- Anticipated ISD: Q4 FY19
- Total Budget: $600,000
  (FY18 Budget: $150,000, FY19 Budget: $450,000)
New Protection & Control Projects

Kayenta Relay & RTU Line Replacement
- $150,000 - $300,000 in FY20 (Contingent on GC-SHR Reactor Project)

Pinnacle Peak/Glen Canyon/Kayenta Relay Replacement
- $200,000 per FY, FY20-26

Pinnacle Peak/Glen Canyon/Long House Valley/Kayenta Meter Replacement Revenue & Panel FY20 – FY26
- $50,000 per FY, FY20-26

Glen Canyon/Kayenta Communication Digital Monitoring Equipment Upgrades
- $200,000 per FY, FY19-23

Desert Southwest Region Maintenance/Construction Projects

Completed Maintenance Projects

Substation HVAC Replacement Program
- As HVAC systems approach/exceed their engineered life span assessments and replacements are initiated
- Replacement units are more energy efficient & lower routine maintenance

Locations:
- Pinnacle Peak ISD: Q4 FY16
- Glen Canyon ISD: Q4 FY17
- Long House Valley ISD: Q4 FY17
- Kayenta ISD: Q4 FY17

Total budget: $190,016 (all locations)
- Actual cost to date: $136,207 (all locations)
- Pinnacle Peak $42,637, Glen Canyon $50,886, Long House Valley $21,051, Kayenta $21,133
Completed Construction Projects

**Pinnacle Peak-Rogers 230-kV Install Inset Structures**

- Double circuit inset structures on Line 1 and Line 2
- • Project addressed a phase-ground clearance violation
- • Install steel pole mid-span to mitigate line sag
- • Work performed in conjunction with Parker Davis Power system
- • ISD: Q2 FY17
- • CRSP Financials
  - • Total budget: $500,000
  - • Actual cost to date: $209,892

Active Maintenance Project

**Pinnacle Peak Breaker 2982 - Emergency Replacement**

- Excessive leaking on the breaker was observed during routine maintenance, requiring urgent replacement
- • Spare breaker was utilized from the Parker-Davis Power System, this reduced procurement/response time
- • Anticipated ISD: Q3 FY18
- • FY18 Budget: $200,000
- • Total Budget: $350,000
- • Actual cost to date: $122,403

Active Maintenance Project

**Pinnacle Peak 230-kV Disconnect Switches**

- • Replacements Bays 23 & 33
- • Switches purchased FY14, Assembled in FY16
- • Work was delayed for outage coordination & labor resource prioritization
- • Anticipated ISD: Q1 FY19
- • Total budget: $460,000
- • Actual cost to date: $175,448
Active Construction Projects

Glen Canyon Erosion & Waterline Project Phase II

• Phase I – Emergency repairs, completed Q1 FY17

Scope:
• Drainage and drainage capacity study
• Remaining waterline replacement
• Driveway resurfacing

Anticipated ISD: Q1 FY2019

Total budget: $2.6M
• Hydrology Study & design: $300,000
• Construction: $2,300,000
• Actual cost to date: $164,774

Active Construction Projects

Glen Canyon Erosion & Waterline Project – Phase II

• Phase I Drainage Repair
• Phase I Channel Stabilization

Active Construction Projects

Glen Canyon Erosion Aerial

Active Construction Projects
Active Construction Projects

Physical Security & Remediation Plans
- Scope: Security Assessments, install cameras, card readers, and upgrade physical security to FIPS-201 compliance
- All equipment awarded in FY17
- FY2018 Locations: Glen Canyon, Flagstaff, Pinnacle Peak
- Anticipated ISD: Q3 FY2018
- FY2019 Locations: Kayenta and Long House Valley
- Anticipated ISD: Q4 FY2019
- FY17 Budget: $1,300,000
- FY18 Budget: $450,000
- Total Budget: $1,750,000
- Actual cost to date: $1,020,722

FY18 Construction Projects

Shiprock – Glen Canyon Reactor Project
- Previously in 10-Year Plan
- System voltage study showed voltage disturbances resulting in operational issues and station equipment risks.
- An addition of 60 MVAR of shunt reactance is needed to reduce post disturbance voltages.
- Evaluated alternatives in reactor types: air coil, oil filled, and variable shunt reactors (VSR).

FY18 Construction Projects

Shiprock – Glen Canyon Reactor Project
- An Analysis of Alternatives (AOA) Study was completed FY17 Q4
FY18 Construction Projects

Shiprock – Glen Canyon Reactor Project

Recommended conceptual design includes installing one 50MVAR Variable Shunt Reactor (VSR) at Kayenta and one 50MVAR VSR at Long house.

• AOA Study Alternatives Investigated
  • Alternative 1- Status Quo
  • Alternative 2- One VSR at KAY, and one VSR at LHV – Recommended
  • Alternative 3- One VSR at KAY and two air coil shunt reactors at LHV.
  • Alternative 4- Four air coil reactors at KAY substation.
  • Alternative 5- One VSR at KAY and two oil filled shunt reactors at LHV.
FY18 Construction Projects

- Glen Canyon KV2D 24/4-kV Transformer Replacement
  - Driven by age and condition. Oil is contaminated and showing signs of internal degradation
  - Anticipated ISD: Q4 FY18
  - Total Estimated Budget $500,000

New Construction and Maintenance Projects

- Pinnacle Peak 345kV Breaker 2199, 2299, 1196
  - $2,700,000 in FY20-FY22
- Glen Canyon 230kV Breaker 7482, 7282, 8082
  - $1,500,000 in FY21-FY23
- Pinnacle Peak 345kV Breaker 1596 & 1692
  - $1,350,000 in FY21 - FY23
- Flagstaff 345kV Breaker 194 & 594
  - $1,350,000 in FY23 - FY25
New Construction and Maintenance Projects

- **Glen Canyon** 345kV Breaker 1092, 1196, 3292
  - $2,025,000 in FY24-26
- **Glen Canyon** 230kV Breaker 7682, 7982
  - $1,000,000 in FY24 - FY26
- **Glen Canyon** 345kV Breaker 1292, 3492, 5596, 5682
  - $2,700,000 in FY26-FY27

New Construction and Maintenance Projects

**Pinnacle Peak Shunt Capacitor Banks**
- Previously in 10-Year Plan $6,814,756 across FY19-FY22
- Analysis of Alternatives Study initiated in FY17 Q4
- Due to a capacitor bank failure, a breaker was lost to damaged in FY17
- Due to the degraded condition, the equipment cannot be utilized to its full design capacity

Desert Southwest Region Integrated Vegetation Program
Integrated Vegetation Program
Completed Projects

Five Task Orders Issued – 83 Miles of Right-of-Way Cleared

- Contract awarded: Q4 FY14
- Total project costs to date: $3,778,575
  - Flagstaff-Pinnacle Peak 1 - $1,890,543
  - Flagstaff-Pinnacle Peak 2 - $1,702,327
  - Glen Canyon -Flagstaff 1 - $177,011
  - Glen Canyon -Flagstaff 2 - $101,049
  - Pinnacle Peak-Rogers 1 & 2 - $57,845
- All work completed by FY 2016

Integrated Vegetation Program
Completed Projects

Snake Ridge Fire @ 15,333 acres consumed w/no impact to reliability

Integrated Vegetation Program
Completed Projects

Work Completed in FY 2017
- Project costs to date: $167,108
  - Flagstaff-Pinnacle Peak 1 & 2
  - Pinnacle Peak-Rogers 1 & 2
- Corrective “hotspotting” removing incompatible vegetation in pinyon pine-juniper areas south of the Verde River at the Fossil Creek and urbanized areas along the PPKRGS 1 & 2
Integrated Vegetation Management

Next Steps

New contract to be awarded for final two task orders: Flagstaff-Pinnacle Peak-Glen Canyon 345kV lines
- Locations:
  - Verde River (Fossil Creek) South to Pinnacle Peak
  - Bloody Basin Road south to Pinnacle Peak
- Work to begin: Q1 FY18
- Anticipated completion date: Q2 FY18
- Cost drivers: remote, rugged terrain requiring extensive hand clearing

Herbicide for Flagstaff, Glen Canyon, Pinnacle Peak, and Rogers substations (approximately 60.8 acres)
- Contract awarded: Q2 FY17
- Total project cost estimated: $46,800 (All sites)
- Rebooted substation vegetation program with existing contracted technicians.
- Anticipated completion date: Q1 FY18

Herbicide and Road Access
- Estimated award date: Q3 FY18
- Total estimated budget: $1 million for approximately 17,980 acres
- Anticipated completion date: Q4 FY18

Pinnacle Peak-Rogers Line 1 & 2 230kV
- Continue removing incompatible vegetation within urbanized portion of circuit
- Follow-up with an herbicide application
Integrated Vegetation Management

Next Steps

Once in Maintenance Mode, 5-year cycle;

• Herbicide treatment & corrective hotspotting for;

<table>
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<tr>
<th>Circuit</th>
<th>Herbicide</th>
<th>Corrective</th>
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<td>BUMSL 1 &amp; 2</td>
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</table>

• Annual substation treatment (2 apps/year) @ estimated $46,800/year
  - Pinnacle Peak
  - Flagstaff
  - Rogers
  - Glen Canyon

Questions for Desert Southwest Region Office?

Thank you
Power Marketing Updates

• Mountain West Transmission Group Update
• SLCA/IP Marketing Plan Update/Contracts
• Olmsted Marketing Plan Update/Rates
• New PRS software – customer training

Mountain West Updates

• Federal Register Published October 12 – Vol. 82, No. 196, 47505
  "Recommendation for the Western Area Power Administration Loveland Area Projects and Colorado River Storage Project to Pursue Final Negotiations Regarding Membership in a Regional Transmission Organization."

• Steve Johnson sent notification e-mail that morning
  Upcoming CRSP Customer Meetings for this FRN:
  • November 9, 2017, 10 a.m. DSW Office in Phoenix
  • November 14, 2017, 10 a.m., CRSP Office in Salt Lake City

• Comments Due November 27, 2017
  Send Comments to Rodney Bailey (SPP-Comments@wapa.gov)

Olmsted and SLCA/IP
Marketing Plan Updates
Olmsted Replacement Project

- Final Marketing Plan and Call for Applications FRN published October 11, 2017
- Call for Applications on-going
- Please submit applications for an Olmsted allocation by December 11, 2017
- Energy production will average 27,000 MWh/year
- Proposed allocations will be developed and published in Federal Register
  - 30 day comment period
  - Final allocations published afterwards

Proposed Olmsted Rate

- Federal Register Notice Published October 12
- Public Information and Comment Forum
  - November 17, 2017, at CRSP MC office
  - Begins at 10:00 a.m. MST
- Comments due by January 10, 2018
- Olmsted in commercial operation July 2018

SLCA/IP Contracts

Final SLCA/IP Power Marketing Plan

- Published November 29, 2016, at 81 FR 85946
- 2025 FES Contracts
  - Provide existing Contract Rate of Delivery (CROD) commitments with associated energy to current SLCA/IP customers
  - Essentially the same contract as the amended Post-89 Contracts with some necessary conforming changes
SLCA/IP Contracts

2025 FES Contract
• Signature phase
  – First contracts sent September 22, 2017
  – About 135 contracts
  – Working through the various delivery points
  – Should be finished this week or next

New PRS Software
• New WAPA-wide rate and repayment system is a single platform, secure software solution that ensures accuracy, transparency and consistency for all 15 WAPA power and transmission projects.
• WAPA rates staff have working with Utilities International Inc. (UII), have completed much of the PRS development

New PRS Software
Building out: November – January 2018 UII will continue programing and will build the customer portal and request comments from the customers

Training and Documentation: February 2018 - March 2018
UII will prepare training materials and deliver training sessions for WAPA staff

Parallel Studies: March 2018
Studies in the old system and the new system for the Final 2016, Preliminary and Final 2017 and Preliminary 2018 project studies.

Go Live: April 2018
WAPA will convert to the upgraded PRS for the Preliminary 2018 and Final 2018 studies.
Western Area Power Administration

CRSP Management Center
10-Year Planning Meeting
October 20, 2017

Transformer Risk Strategy
Chris Lyles

Topics

- Transformer Spare Need
- Objectives
- Events and Quantities
- Strategies for short lead time spares
  - WAPA Inventory
  - WAPA System Robustness – In-Service “Spares”
  - Grid Assurance
- Customer Feedback

Why are Spare Transformers Needed?

- WAPA has a commitment to its customers and the bulk electric system to be prepared for the loss of transformers.
  - Operational failures.
  - Catastrophic event – high impact, low likelihood.
- The unanticipated loss of a transformer in the bulk electric system directly impacts the resiliency/reliability of the system.
- High Voltage Power Transformers typically have an acquisition lead time of 18-24 months.
  - Unique characteristics of transformers require custom build.
  - Transformer can weigh up to 100 tons and contain 25,000 gallons of oil.
  - Transportation requires multiple specialized vehicles, road permits, and task specific crews.
Typical WAPA High Voltage Transformer

Specialized Transportation

Analysis Objectives

- Develop and analyze alternatives for response to high impact events resulting in loss of multiple transformers.
  - Reduce/eliminate acquisition interval of transformers.
  - Complementary to existing sparing strategies.
- Solicit Feedback from WAPA SMEs and WAPA Customers.
- Develop recommendation incorporating customer feedback and regional expertise.
- Initiative is a WAPA-wide strategy intended to produce a recommendation that most efficiently uses WAPA’s entire fleet of transformer options.
**Event Definition**

- **WAPA Analysis**
  - Define three event types.
  - Assume loss of all assets within event zone.

- **Local Event**
  - Event center at WAPA facility.
  - Impacted sites are within a 5-mile radius of center.
  - All WAPA facilities could be center of event.

- **Seismic Event**
  - Event center at Tracy or Mead facility.
  - Impacted sites are within a 80-mile radius of center.

- **Targeted Event**
  - Event center at major population centers and military installations – 9 sites identified.
  - Impacted sites are within a 50-mile radius of center.

**Spares Needed**

- **Quantities**

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<th>Secondary Voltage</th>
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<td>Single Phase</td>
<td>1</td>
</tr>
<tr>
<td>115kV</td>
<td>13200</td>
<td>Single Phase</td>
<td>1</td>
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- **Why Now?**
  - Physical attacks on infrastructure have become more prevalent.
  - Grid resiliency has garnered more interest in recent years as potential weaknesses in the utility industry have been identified.
  - Power systems are being operated closer to their operating limits.
Alternatives Currently Under Evaluation

- WAPA Warehoused Alternative
- WAPA System Enhancement Alternative
- Grid Assurance Alternative
- Hybrid Alternative
- No Action – Status Quo

WAPA Warehoused Alternative

- WAPA Spare Transformers
  - Will warehouse in existing WAPA locations.
  - Event impact areas must be considered.
  - Locations TBD.
  - May inventory more than one unit per voltage class.
  - Use multiple locations.
  - May use different specifications.
  - Will maintain and test on periodic basis.

- WAPA Responsibilities
  - Carry full cost of investment and maintenance.
  - Disassembly, assembly, installation and commissioning.
  - Logistics from warehouse to location.
  - Method for funding and cost allocation will need to be defined.

WAPA System Enhancement Alternative

- WAPA Spare (Re-deployable) Transformers
  - Will be placed in-service in WAPA's system.
  - Event impact areas must be considered.
  - Locations TBD.
  - May inventory more than one unit per voltage class.
  - Use multiple locations.
  - May use different specifications.
  - Will maintain as an operational unit.

- WAPA Responsibilities
  - Carry full cost of investment and maintenance.
  - Disassembly, assembly, installation and commissioning.
  - Logistics from location to location.
  - Method for funding and cost allocation will need to be defined.
Grid Assurance Alternative

- Grid Assurance Subscription Service.

- Method for funding and cost allocation will need to be defined... for all the options where assets may cross regional boundaries.

Feedback

- We want your feedback. We are in the beginning stages of assessing the various options and customer feedback is critical to our success.
  
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  - Mr. John Quintana. 720-962-7296. Quintana@wapa.gov

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  www.wapa.gov