

# Chelan County PUD

## Rock Island Rehabilitation Powerhouse One – Units B5-B8

Board Presentation on Nov 17, 2014  
Study Session



# Purpose of Discussion

- Background
- What Has Changed Since 2010
- Recommendation
- Key Analyses
- Next Steps



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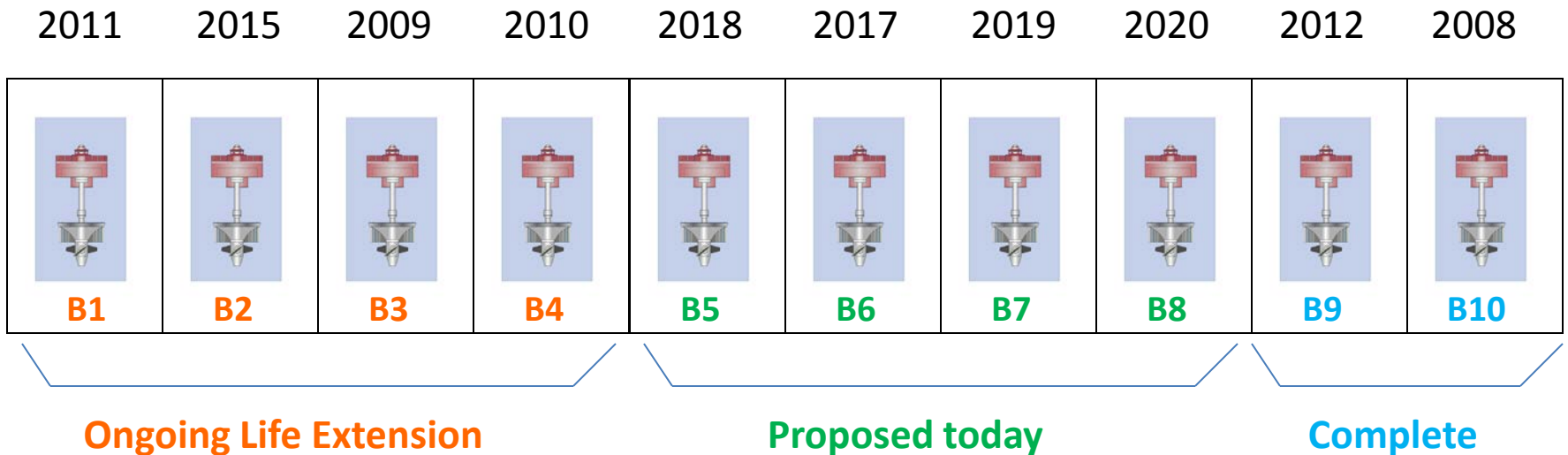
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# Background

- 2003 – District and Puget approve PH1 modernization and rehab of units B5-B10.
- 2006 – B1-B4 stator replacement approved
- 2010 – District defers B5-B8 rehabilitation
  - Continue stator work on B1-B2
  - Complete B9
  - Evaluate condition of PH2
  - Maintain B5-B8 using a least cost approach



# Powerhouse 1 Generating Units



Year = date returning to service

# B5-B8 Retirement Considered

Retirement is not recommended for the following reasons:

- Expected value range is \$0 to \$3 Million per unit less than the planned rehab, excluding encroachment value.
- Risks of failure
- Propeller operation - shorter life, reduced efficiency
- FERC license amendment \*
- HCP impacts
- Need for equivalent hydraulic capacity \*
- Impacts power purchasers
- B1-B4 have lower value and would be considered for retirement before B5-B8

\* Cost and risk impacts are expected to be significant in a unit retirement scenario



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# What Has Changed Since 2010

## Unit condition assessments

- B6 air gap – out 50% of the time
- B5 - Runner blade degradation
- B8 – oil leak at trunnion seals

## Increased risk of failure

- Personnel safety
- Plant safety
- Economic loss
- Environmental
- FERC License



# What Has Changed Since 2010

- Additional improvements
  - Enhanced modeling techniques
    - Normal and planned outages included
    - Flexible capacity value included
  - New long-term power contracts
  - Hedging program reduces revenue volatility
- Additional information B5-B8
  - Empirical study performed
  - Theoretical run time 5 to 16%
  - Actual operations, ~33%



# Recommendation

Resume rehabilitation of Rock Island PH1 units B5-B8

- Total cost for 4 units is estimated to be \$99 million
- Provide Order to Proceed with B6 (\$23.8)
- Increase capital budget for B6 from \$9.8 M to \$23.8M.
- The long term financial forecast has been increased from \$44 M to \$99 M as reflected in the financial update to the Board on 11/3.
- Decision analysis reviewed for each unit prior to approval
- Order to Proceed approved by Board for each unit





# Recommendation

Resume rehabilitation  
of Rock Island PH1  
units B5-B8

## Scope

- Replace generator for all 4 units
- Refurbish turbine on all 4 units
- Replace runner for 1 unit (previously purchased)
- New exciter voltage regulators and governor controls



# Recommended Schedule

- B6 December 2014, complete 2017
- 2nd unit March 2016, complete 2018
- 3rd unit March 2017, complete 2019
- 4th unit March 2018, complete 2020



Decision for each subsequent unit reviewed prior to giving contractor Order to Proceed

# Decision Analysis

- Probabilistic: Incorporates risks, determines best path forward
- Deterministic: Economic validation of recommended alternative



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# Probabilistic Analysis

- Decision tree method used to evaluate alternatives
- Four alternatives
  - 1) Run to Fail
  - 2) Rehabilitate Generator now, Turbine at failure
  - 3) Planned Rehabilitation, existing runner
  - 4) Planned Rehabilitation, new runner
- Risks and benefits quantified and modeled





# Probabilistic Analysis

- Run to Fail and Planned Rehabilitation
  - Similar expected values
- Mitigating risk of failure is the major driver to proceed
- Sensitivity analysis
- Planned Rehabilitation has highest expected value



# Deterministic Analysis

## Recommended program

- Key metrics \*
  - 7.9% Internal rate of return (IRR)
  - \$10.9M Net present value (NPV)
  - 1.1 Benefit/cost ratio
- Sensitivities
  - Energy prices (forward price curve)
  - Capacity and flexibility value
  - Cost of project

\* Economics performed independent of Wanapum encroachment



# Reasons to Rehabilitate Now

- Reduces risk of failure
- Improved reliability with new 40 year life expectancy
- Minimizes risk of overlapping rehabilitations
- Restores Kaplan capability
- Maintains flexible capacity for District and power purchasers
- Existing contract in place with proven design and known performance



# Financial Impacts

- Forecasted financial policy targets met under expected and unusual conditions
  - These metrics were provided in the financial update to the Board on 11/3.





# Contract Assessment

- Contract in place with Andritz Hydro
- Firm fixed pricing with escalation provisions
- Scope and schedule flexibility including unit by unit release
- Remedies for schedule delays
- Remedies for not meeting performance guarantees
- Two year warranty after unit acceptance
  - “In and Out” costs included
- Allows the District to shift work to contractor if District craft labor not available



# Contract Penalties and Incentives

- Liquidated Damages

- Additional outage time during construction and trial operation period: \$5,000 per day.
- Failure to achieve unit acceptance: \$10,000 per day.
- Unit performance guarantees: \$4000/kW for generator losses; \$5000/kVA for failure to meet heat rise of generator; \$5000 for every kW reduction in horsepower.
- Turbine Cavitation: aggregate \$1.25 Million cap.
- Limitation on LD's: Outage time – 15% of unit price. Unit performance – 15% of unit price. Aggregate 20% of unit price.

- Incentives

- Incentives: Unit outage time for construction and trial operation period - split value 50/50 with District with cap of \$100,000 per unit.
- Generator and turbine efficiencies: \$50,000 per 1 percent with a cap of \$100,000 per unit



# District Resource Impacts

- Engineering and Project Management
  - Experienced team from B9 and B10
  - New Mechanical Engineer for 2015
- Use of District Wireman and Mechanics
  - Experienced with the work from B9 and B10
  - Evaluated annually
  - Additional cost to use contractor



# Big Picture

- Fleet-wide asset management approach
  - District monitors and performs condition assessments
  - Decision to proceed based on condition and risk
- Units B5-B8 expected to be completed prior to Powerhouse 2 rehabilitation
- Repairs on C8-C11 at Rocky Reach will be completed prior to Powerhouse 2 rehabilitation
- Minimizes overlapping rehabilitation projects
- Levelizes resource requirements



# Decision Evaluation Criteria

1. What is the impact on our Customer-Owners?
  - Two reviews were performed of the economics and risk.
    - A deterministic review indicates that proceeding with all four units produces a 7.9% IRR.
    - A probabilistic risk – based review indicates that the economics between Run-To-Fail and Planned Rehabilitation are generally neutral
    - There is small but not insignificant risk of unit failure that could lead to catastrophic failure.
    - The option of run to failure or retirement would economically disadvantage customer-owners.



# Decision Evaluation Criteria

2. What are the implications for the environment?
  - Risk of oil leak and HCP implementation compliance is reduced through rehabilitation.



# Decision Evaluation Criteria

## 3. What are the legal implications?

- Contractors performance
  - Performance tests, unit acceptance
  - Incentives and liquidated damages
- Other contractual implications if not performed
  - Power purchasers, Slice contracts, Encroachment
- FERC license impacts if unit fails or retirement



# Decision Evaluation Criteria

## 4. What are the workforce/operations implications?

- District personnel are needed to perform portions of the work which will have implications for other projects that is still undergoing review.
- Previous experience indicates our personnel can perform the work competently and safely.
- Continuing review is needed to determine work to be performed by District vs. contract employees.





# Decision Evaluation Criteria

5. What are the other stakeholder implications?
  - Long term power and slice purchasers will see benefits from increased reliability.
  - Outreach will be necessary to explain costs and schedule.



# Future Decision Analysis

Prior to each unit release review what has changed:

- Reassess unit condition and risk profile
- Sensitivity analysis
  - Energy price outlook
  - Capacity/flexible capacity value
  - Project cost
  - Timing of unit failure
  - Frequency of rehabilitation



# Next Steps

Board resolutions to be presented Dec. 1<sup>st</sup>:

## 1. Resolution to amend contract with Andritz Hydro

- Revise scope, schedule and pricing of existing contract
- Issue notice to proceed on Unit B6
- Future unit releases will be approved by Board resolution

## 2. Resolution to approve 2015 Budget

- Increases total project budget for Unit B6 from \$9.4M to \$23.8M
- Includes \$5.6M of budget to be spent on B6 in 2015
- Future budgets will request Board approval on a unit by unit basis



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