Hydraulic Power Committee
Fall Meeting

September 2007

AGENDA

Hydraulic Power Committee Fall Meeting
September 23-26, 2007
Holiday Inn, Duluth, Minnesota

Sunday, September 23 – Sneakers Sports Bar

5:30 – 6:30 Welcome Reception hosted by Minnesota Power

Monday, September 24 – Lyric Room

6:30 BREAKFAST AND NETWORKING
7:30 WELCOME AND INTRODUCTIONS – Minnesota Power
8:00 SAFETY SURVEY RESULTS – Mary Helen Marsh
9:00 NERC ISSUES COORDINATION – Steve Wenke
9:15 BREAK
9:30 FERC UPDATE & Q/A – Bill Allerton, FERC
10:45 HOT TOPICS ROUNDTABLE – Jason Redmond
12:00 LUNCH
12:45 NHA CONFERENCE PLANNING – Jeff Leahey
1:30 PROJECT TOUR PRESENTATION – Minnesota Power
2:00 EXPLANATION OF SUBCOMMITTEE MEEETINGS – Jason Redmond
2:15 SUBCOMMITTEE MEETINGS:
-- Dam Safety Subcommittee – Joel Galt – Draft Water Conveyance Guidelines Working Group Meeting.
-- O&M Subcommittee Meeting – Jason Redmond – (For those not participating in the Dam Safety Working Group).
6:00 GROUP DINNER (Spouses/Guests Welcome)
– sponsored by Mead & Hunt and Devine Tarbell & Associates

Tuesday, September 25 – Lyric Room

7:00 BREAKFAST AND NETWORKING
8:00 Load buses for Minnesota Power's St. Louis River Projects Tour – sponsored by Minnesota Power (Spouses/Guests Welcome)

72 MW Thompson Hydroelectric Project – celebrating 100 years
Lunch - Oldenburg Picnic Shelter at Jay Cooke State Park
12 MW Fond du Lac Hydroelectric Project – large arch dam

5:00 RETURN TO HOTEL
6:00 GROUP DINNER (Spouses/Guests Welcome)
– sponsored by Mead & Hunt and Devine Tarbell & Associates

Wednesday, September 26 – Lyric Room

7:00 BREAKFAST AND NETWORKING
8:00 HPC BUSINESS MEETING – Jason Redmond
- Election of Officers
- Future Meetings
8:20 NHA LEGISLATIVE AND REGULATORY UPDATE – Jeff Leahey
9:00 BREAK
9:15 SUBCOMMITTEE REPORTS – Joel Galt/Jason Redmond
9:30 HOT TOPICS ROUNDTABLE – Jason Redmond
12:00 ADJOURN – box lunches

Results of the 2007 Safety Survey

Presented to
The Hydraulic Power Committee
Duluth, MN

1

The 2006 Survey

- Sixteen member companies responded
- Questions centered around (2003-2005):
  - Number safety incidents
  - Severity safety incidents
  - Contents safety program
  - Hours worked
  - Trends?

2

The 2007 Survey

- Eleven member companies responded
- Questions centered around (2000-2006):
  - Age at the time of the incident
  - Contributing Factors
  - When are incidents happening?
  - Trends?

3

General Trends

- Zero fatalities
- Number of medical attention/injuries decreasing.
- Number of lost time cases flattened.
- OSHA Recordables flattened over the last three years
- Hydro Generation slightly out performs fossil by comparison.

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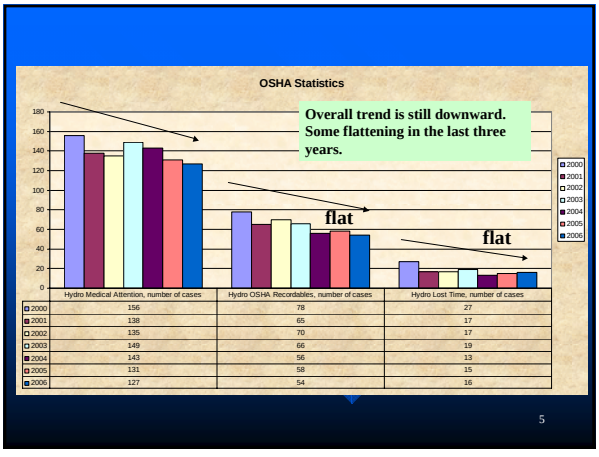

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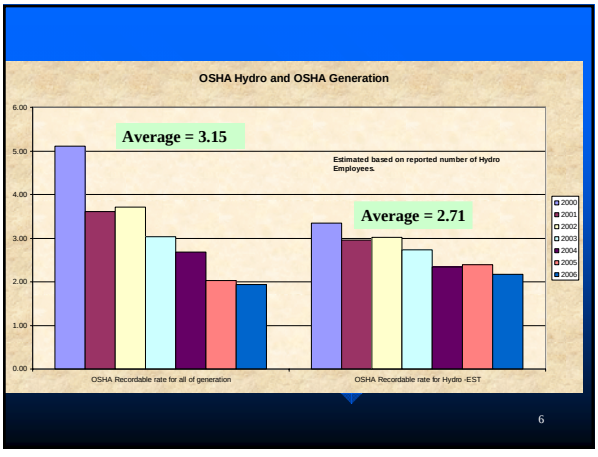

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Continuous Improvement

- Where should we direct our efforts?
- Is there a general profile?
- Is there a more dangerous
  - Time of day?
  - Working Age?
  - Day of week?
- Are there contributing factors?

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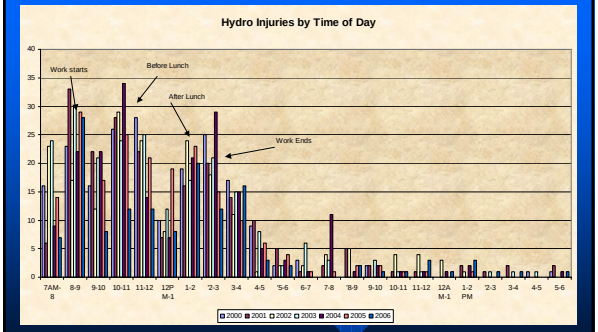

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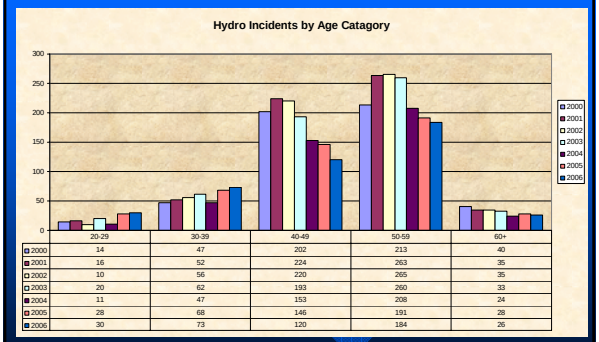

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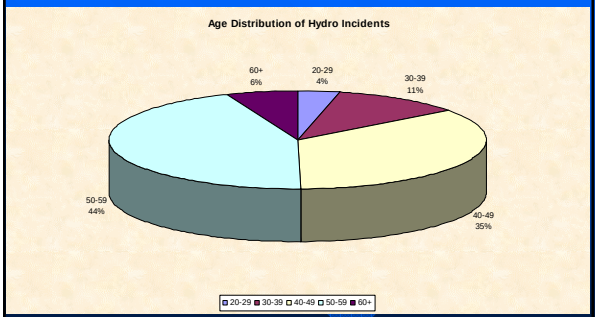

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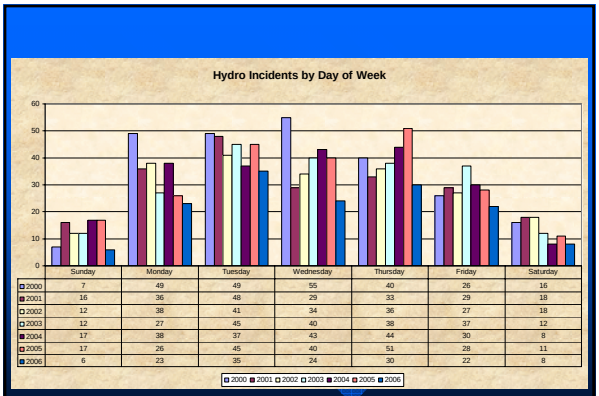

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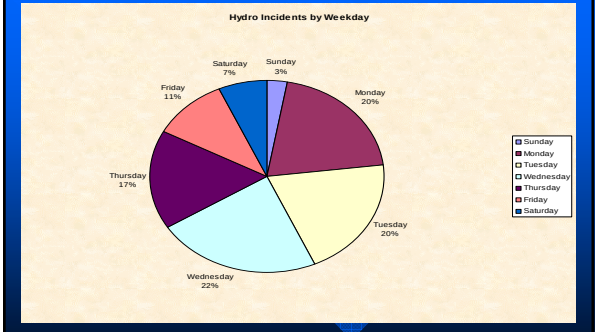

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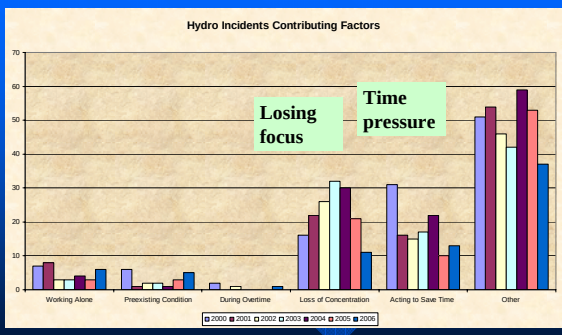

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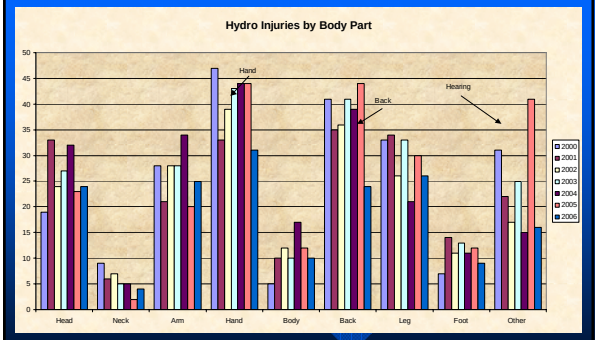

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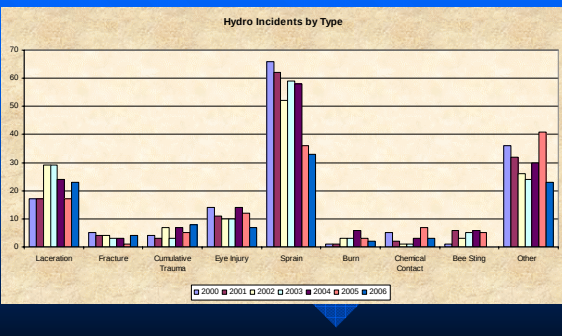

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Statistical Profile

- Monday
- After Lunch
- 50 year old worker
- Trying to get finished by the end of the day (time pressure)
- Sprained Back/Cut Hand

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Action Plan/ Business Plan Ideas

- Re-focus employees after lunch or breaks.
- Hold Safety Stand-downs on Wednesdays.
- Hold soft tissue prevention workshops for employees on safety days.
- Encourage stretching before work begins. Hang posters with stretching exercises.
- Have supervisors and foremen learn basic stretching techniques to lead crews in stretching exercises.
- Share data with Employees for heightened awareness.
- Hold employee focus groups to review data and look for other opportunities.

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Next Year?

Discussion

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National Hydropower Association
HPC Fall Meeting

Hot Topics Session Worksheet

Utility	Hot Topic	Resolution or Question	Contact
Alabama Power	Draft Tube Stoplog Bolt Failure Investigation	Discussion	Jason Redmond hjredmon@southernco.com
AEP	1) Started a diving program during 2nd quarter of this year 2) Experienced headgate sealing problems with Smith Mountain Unit Five headgate, which is at a depth of 200-feet	1) Discuss pros and cons of program 2) To receive recommendations on who (consultants/engineering groups) has the experience to design a pilot gate as a means of correction	Jim Thrasher jrthrasher@aep.com
Avista Utilities	1) Wicket Gate In-Place Repair 2) Commutator Marking on 65 MW Main Exciter 3) NERC Compliance Audit 4) Dolan Lawsuit (River bed rental)	1) See Attached 2) See Attached 3) Update 4) Update	1) PJ Henscheid (509) 495-4323 2) Dave Schwall (509) 495-2330 3) Steve Wenke (509) 495-4197 4) Steve Wenke (509) 495-4197

Consumers Energy	Water Level (headwater and tailwater) gauges	Different types available and pros and cons of each. What are the biggest and most important issues to look for when selecting a gauge?	Judy Schneider Hydro Operations Superintendent judith_schneider@cmsenergy.com
Exelon	Concrete work to intake structures at depths of 100 ft	What alternatives are there to building a cofferdam?	Mary Helen Marsh Maryhelen.marsh@exeloncorp.com
Grant County PUD	1) SOP for operating equipment during times when critical support equipment is impaired or disabled 2) Hiring Technical Staff	1) What are the experiences/practices of other members of the HPC for this situation? For example: If a station service transformer is down for maintenance, what is your policy regarding taking the emergency generator out of service for maintenance at the same time? 2) This seems to be a recurring theme. What are your experiences/practices regarding hiring technical staff and engineering supervisors? Have you had good results attracting experienced personnel or are you hiring new graduates and training them? Have you been able to fill open spots from within your organization?	Dave Moore damoore@gcpud.org

Final Project Report

Date: June 12, 2007
Project Number: 401-61207
Project Title: Noxon Unit#2 Wicket Gate Repair
Facility-System: Noxon Rapids, Mechanical
File Number: 401-02-061

Project Manager/Engineer: PJ Henscheid
(509) 495-4323

Project Description:

1-1. Background

In mid-May of 2007, a wicket gate broke a shear pin on Unit 2 at Noxon Rapids Dam in Montana. After investigation by the station crew, station mechanics, and engineers, it was found that the wicket gate shaft had twisted to the point of yielding.

1-2. Solution /Conclusion

After careful consideration, it was decided that Avista crews would cut the existing wicket gate out of its location (leafs and gate shaft) in any fashion as to remove it quickly. A spare wicket gate we had on hand would be utilized as a replacement. The spare wicket gate leafs were carefully cut off of its shaft. These leafs were machined back four inches from the location of the cut, and new steel extensions were welded on the ends of these leafs. These extensions were then machined to mate up with the shaft in the correct position and with the same profile as the existing wicket gates. The shaft was machined down from 10 to 8 inches in diameter to accommodate inserting it from above the head cover down thru the bushings to the bottom bushing. The gate leafs and shaft were indexed to one another prior to shipment from the machine shop to provide a precise locating mechanism prior to welding. This was done by welding small pieces of bar stock to the inside of the leafs, and machining a small index mark in the shaft at the location needed. Once the shaft was lowered into place, and the leafs were suspended in place and clamped to the shaft, they were welded together. On June 7th, the unit was started up, and was motored. It ran as needed and the gate closed and sealed as required. No vibrations were felt from the gate lever, and the new gate operated as normal.

1-3. Photographs

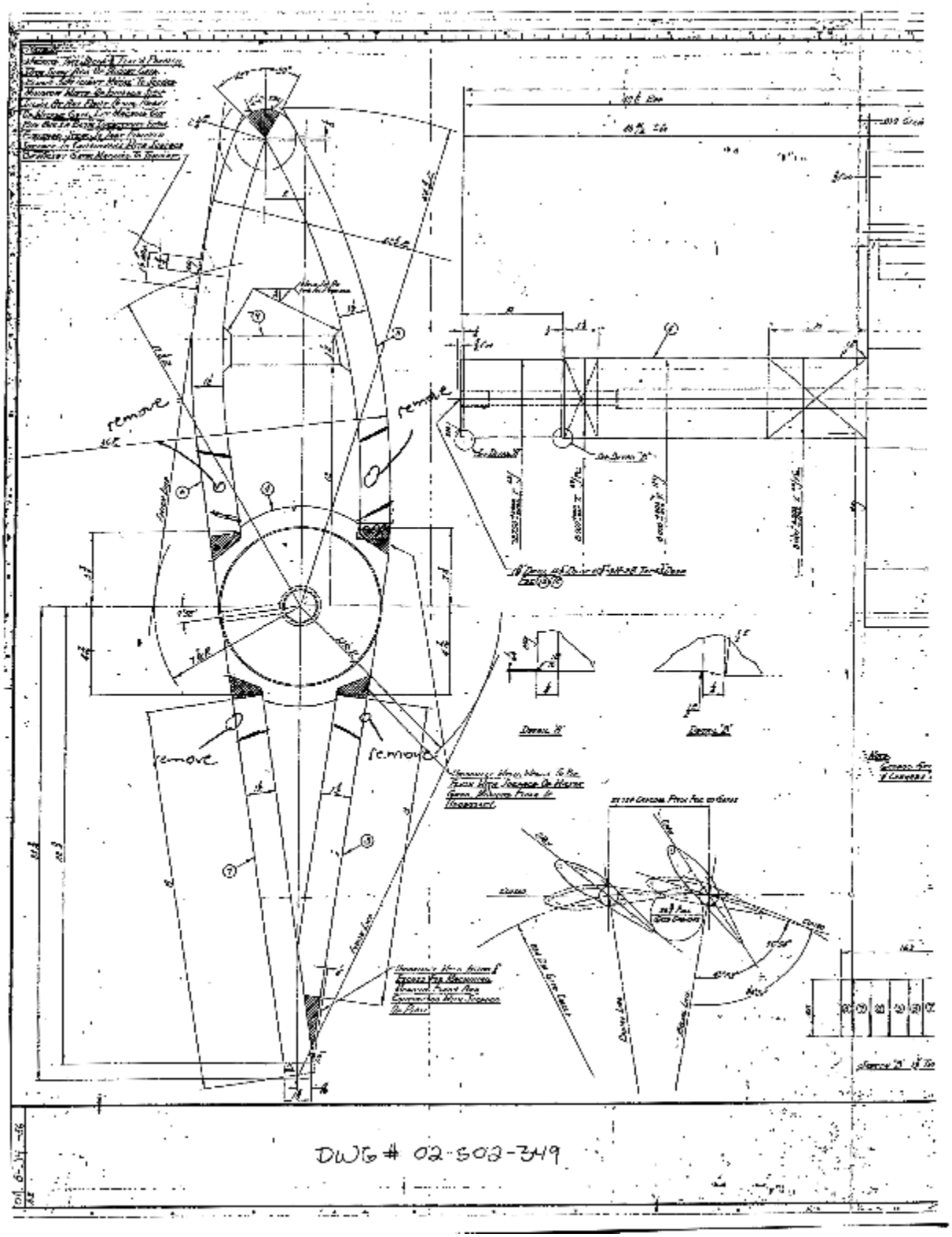
Figure 1. Cutting the wicket gate leafs

Figure 2. Temporary clamping device

Figure 3. Indexing features on leafs

Figure 4. Mid-weld

Figure 5. Final passes of weld.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Cabinet Gorge Powerhouse

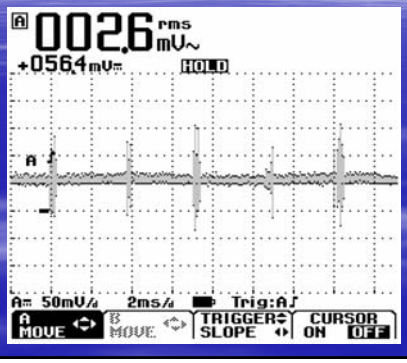
Commutation Problems

Cabinet Gorge Unit 1
February 2007

Cabinet Gorge Unit 1

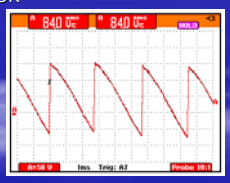
- Bar burning pattern developed progressively over the past 2 years
- Testing in Feb 07 included:
  - Neutral plane checked OK
  - AWA test of Exciter Field Pole – Passed
  - Meggered Main Field – Passed
  - Meggered Bus from slip rings down behind commutator would not pass – carbon build up removed – passed at 500VDC but still failed at 1500V (operating voltage = 250 VDC)
  - Discovered spike current to DC to field poles in excess of operating current. (i.e. 600 Amps DC with transient Spike 700-800 Peak to Peak)
  - Frequency of transient is 3.8ms which correlates to the every 3rd bar burn pattern.

Cabinet Gorge Unit 1

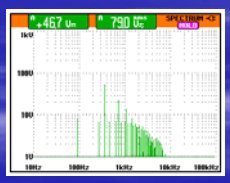


Cabinet Gorge Unit 1

- We were concerned about the output of the AVR so this was also tested.
- All the Units at Cabinet Gorge have Basler DECS 300 AVRs.
- AVR Output was checked and verified by Basler technicians – Tested OK



- Voltage output

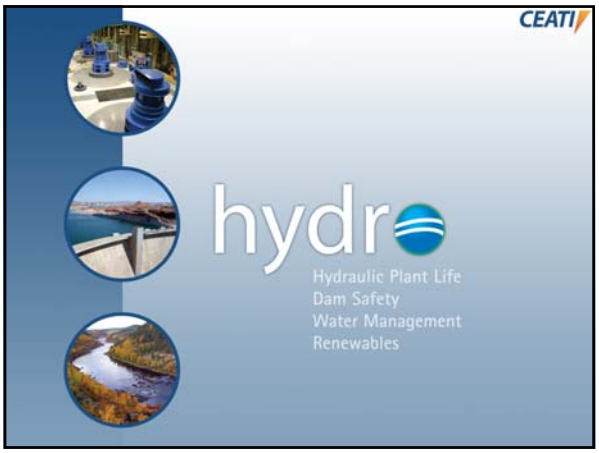


Spectrum Analysis

Cabinet Gorge Unit 1
August 2007

Cabinet Gorge Unit 1
What Next?

- Conventional Static Pole Drop Test
- Planning to install a flux probe next month to dynamically analyze field poles under various running conditions
- Chase down the voltage transient which has also appeared in other cables in the powerhouse – RTD leads for Unit 4
- Take exciter armature to Electric shop to be steam cleaned, baked and tested
- Tap exciter shunt field poles to bring out taps to check voltages during dynamic load conditions



Participation; Interest Group Representatives

- **Hydraulic Plant Life Interest Group**
  - Asset / Plant / Operations / Engineering Managers
  - http://www.ceatech.ca/HPLIG.php
- **Dam Safety Interest Group**
  - Dam Safety Managers / Civil Engineering Managers
  - http://www.ceatech.ca/DSIG.php
- **Water Management Interest Group**
  - Water Managers / Hydrologists / Inflow Forecasters
  - http://www.ceatech.ca/WMIG.php
- **Strategic Options for Sustainable Power Generation**
  - Emerging Energy Systems Managers
  - http://www.ceatech.ca/SOIG.php

CEATI Hydro Participation – North America

FERC Licensees
- Allegheny Energy Supply
- Ameren UE
- American Electric Power
- Brookfield Power Corporation
- Chelan County Public Utility District
- City of Seattle
- Douglas County PUD
- Duke Energy
- Eugene Water and Electric Board
- Grant County Public Utility District
- Hetch Hetchy Water & Power
- New York Power Authority
- Portland General Electric
- Sacramento Municipal Utility District
- Seattle City Light
- Southern Company
- Tacoma Power
- TransAlta Energy Corporation
- TransCanada Pipelines
- Tri-Dam Project

US Government
- Bonneville Power Administration
- California Department of Water Resources
- Tennessee Valley Authority (TVA)
- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation

Canada
- ALCAN Inc.
- BC Hydro Generation
- Churchill Falls (Labrador) Corporation
- EPCOR
- FortisBC Inc.
- Hydro-Quebec
- Manitoba Hydro
- Natural Resources Canada
- New Brunswick Power Generation Corporation
- Newfoundland and Labrador Hydro
- Ontario Power Generation
- SaskPower

CEATI Hydro Participation – Worldwide

Europe
- E.ON Wasserkraft GmbH
- Electricite de France (EDF)
- ELFORSK
- ESB (Electricity Supply Board)
- Fortum Generation AB
- Scottish and Southern Energy
- Vattenfall AB

Australia/New Zealand
- Hydro Tasmania
- Mighty River Power
- Meridian Energy
- Snowy Hydro Limited

Africa
- ESKOM

Interest Group Annual Activities

- 2 - 3 Meetings
- 3 - 5 Conference calls
- Workshops, seminars, conferences
- Bi-weekly electronic communications
- Password-protected discussion board
- Short term projects resulting in practical deliverables that have an immediate impact for participants
- Technology Review Programs which yield 6-7 studies a year
- Developed, promoted and supported by the CEATI team
  - Technology Coordinator
  - Program Manager
  - Support Staff

2006 – Raccoon Mountain (TVA)

2005 – Hoover Dam

Hydraulic Plant Life Interest Group (HPLIG)

(Asset/Plant/Operations/Engineering Managers)

- HPLIG is a collaborative, technology-focused program designed to assist hydroelectric utilities in their efforts to:

1. Lower capital and operations costs,
2. Extend equipment life,
3. Improve efficiency,
4. Increase reliability and reduce outage times for equipment repair and maintenance,
5. Improve safety and environmental performance,
6. Improve risk based asset management decision making, and
7. Improve performance evaluation and benchmarking techniques.

Dam Safety Interest Group (DSIG)

(Dam Safety Managers / Civil Engineering Managers)

» **Focus**
- Evaluation of Dam Safety Performance
- Dam Risk Management
- Geophysical Methods for Assessing Seepage, Internal Erosion and Piping
- Ice Loading on Dams
- Non-Destructive Testing of Dam Anchors
- Dam Safety Surveillance Training
- Erosion Modeling
- Extreme Flood Research
- Flood Debris Management
- Sliding Resistance of Concrete Dams
- Dam Concrete Deterioration
- People, Technology, Organization
- Flow Discharge Equipment Reliability
- Dam Monitoring – Data Analysis and Management

HPLIG & DSIG Spotlight Projects: Hydro Debris Management

Hydraulic Plant Life Interest Group

» **T062700-0337 Hydro Plant Debris Exclusion and Management**
- Part 1 – Trash Exclusion: Identifying design and material trends which have recently been applied in hydro plant trash rack design.
- Part 2 – Debris Management: Gathering information on the state of the art technologies and tools in equipment for managing forebay debris (removal from the trash racks and off the dam).

Dam Safety Interest Group

» **T052700-0209A Debris Management In Spillways and Waterways during Floods**
- Part 1 - "Debris Yield Reduction by Management"
- Part 2 - "Evaluation of Failure Modes of Debris Booms"
- Part 3 - "Behavior of Debris Booms Under Dynamic Loads"
- Part 4 - "Debris at Spillways-Model Test"

Water Management Interest Group (WMIG)

(Water Managers / Hydrologists / Inflow Forecasters / Dispatchers / River Schedulers)

» **Focus**
- Watershed Management/Water Use Planning
- Meteorology/Hydrology
- Data Acquisition
- Operational Modeling and Optimization
- Hydroelectric Operation and Environmental Concerns
- Risk Management
- Improved Safety of Waterways
- River Ice Prediction

» **Water Resource Management Roadmap**
- Published August 2006
- Drivers & Trends
- Positioning Recommendations
  - Business
  - Regulatory
  - Technology

WMIG Spotlight Program: The Impacts of Climate Change on Hydro Power

» **T072700-0409 The Impacts of Climate Change on Hydroelectric Generation**
- The objective of this program is to benchmark the current state of knowledge, industry research activities and investment in quantifying the impacts of global climate change on hydropower production on a regional scale.

» **Upcoming Workshop:**
- **"Climate Change on Hydroelectric Water Resource Management"**
  - Theme: Bridging the Gap between Scientists and Practitioners - Short, Medium and Long Term Planning
  - October 8-9, 2008 in Montreal, Quebec

Upcoming Workshop

» **Water Management Interest Group**
- Improved Inflow Forecasts for Hydropower
  - November 15-16, 2007 in Knoxville, Tennessee

The goal of the workshop is to improve short term inflow forecasting knowledge through collaborative information sharing.

For more information, including details on exhibiting and attending, please visit http://www.ceatech.ca/Meetings/WM2007/

For more information

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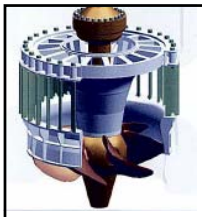
www.ceati.com | info@ceati.com



EPRI ELECTRIC POWER RESEARCH INSTITUTE

Hydropower Environmental Issues Program (#58) Update

Doug Dixon
Water & Waste Area
NHA-HPC Update
September 2007

804-642-1025 (Virginia Office)
ddixon@epri.com

Current Program Key Research Areas

- Assessing **Waterpower** (conventional hydro + wave and instream resources) potential and R&D needs
- Maintenance of fish passage and protection manual (on-line access at EPRIweb)
- Commenting on Endangered Species Act assessments, FERC Technical issues, and fishery management plans of relevance to hydropower industry (predominantly American eel ESA listing & management actions)
- Advance "fish-friendly" turbine development, deployment and testing
- Developing an information resource document on hydropower project decommissioning and dam removal

Key 2006-2007 Project:

WATERPOWER R&D Roadmap

OBJECTIVE: Document that illustrates renewable waterpower potential and RDD&D needed to get there while protecting/enhancing environmental resources

- Gains in efficiency and capacity improvements,
- Additional hydro capacity at existing hydro dams,
- New hydro capacity at existing dams,
- New low head, low power applications
- Hydrokinetic (tidal instream, current, and man-made channel)
- Ocean energy (offshore wave, ocean thermal, and ocean current)

Water Power Potential

- **Waterpower** = energy from conventional hydropower, new hydro at existing dams, new conventional hydro developments, hydrokinetic turbines (rivers, tides, ocean currents, and constructed waterways) and waves
- Available resource = 85,000 to 95,000 MW
- Realizable capacity gains by 2025 = 23,000 MW
- Potential efficiency gains at existing conventional hydro conservatively estimated to be 2 to 5% (5,300 to 14,000 GWH)
- Achievement dependent upon RDD&D and economic incentives
- Advanced Water Energy Initiative Program proposed

EPRI Report: Assessment of Waterpower Potential and Development Needs

- Report 1014762, March 2007: free download
- Overview of the waterpower industry
- Waterpower potential
- Technology development needs (RDD&D, economic incentives, and regulatory issues)
- Achievable capacity and efficiency gains
- Waterpower's relevance to U.S. energy needs including other renewables

Eel ESA Listing Results & Lessons Learned

ASMFC still pushing upstream & downstream passage!

- **FWS did NOT list eels as threatened or endangered**
- ASMFC (fishery management) developed technically flawed stock assessment
- FWS and ASMFC engaged in information sharing without public oversight
- FWS decision was balanced and more insightful than expected
- **VERY limited industry engagement & oversight**

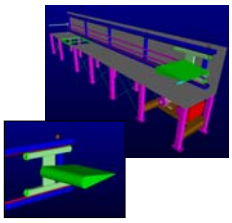
EPRI 'Fish-Friendly' Turbine Research

GOAL: Efficient turbines with low passage mortality. EPRI maintaining research in absence of Federal (DOE) funding

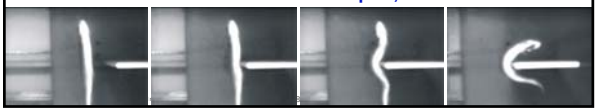
KEY RESEARCH QUESTIONS:

- Can turbine blades be shaped to reduced injury & mortality?
- Can the Alden/Concepts NREC Advanced turbine demonstrate commercial viability?

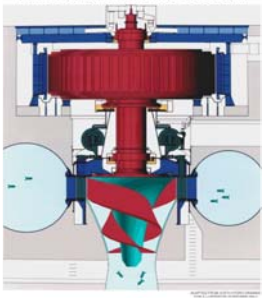
2004-2007: Turbine Blade Thickness & Fish Mortality



- **Phase I 2004**: CFD used to identify blade shapes for testing
- **Phase II 2005**: Constructed test facility
- **Phase III 2006-2007: Conducting flume tests (research extended 1 year)**
- Blade shapes could be selected during turbine upgrades to minimize mortality (<5%) and optimize operating efficiency
- **Final Report, March 2008**



EPRI Advanced Turbine Project: NEED INDUSTRY SUPPORT!



OBJECTIVE: Re-design Alden turbine for increased power density and field deployment:

- Phase I (2006) – re-design scroll case
- Phase II (2007) – re-design runner and draft tube
- Phase III (2008) – prepare field deployment & testing plan (Brookfield Power's School Street Project on Mohawk River, NY is the proposed test site)
- Phase IV (2009-11): Test

Project Decommissioning/Dam Removal Resource Document

- Increasing occurrence of decommissioning/dam removal across the U.S.
- FERC "guidance" on project decommissioning limited to one paragraph
- EPRI Resource Document (~2009 delivery) will examine:
  - Project economics
  - Permit requirements
  - Sediment management
  - Study plans
  - Case studies

Recent PGE demolition of the Marmot Dam on the Big Sandy River, OR

Collaborative Project Proposal

"Improving Flow Measurements in Short, Converging Intakes"

WaterpowerXV

Meeting Room 7
10:00 AM – 11:30 AM

July 24, 2007

ASME STANDARDS TECHNOLOGY, LLC

EPRI ELECTRIC POWER RESEARCH INSTITUTE

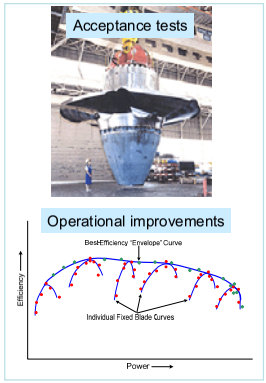
Project Background

- **History –** Early 2005 ASME PTC 18 Committee originally proposed a project to CEATI for comparison of different flow measurement technologies at three hydropower power facilities (Lower Granite, WA, St. Lawrence, NY and Kootenay Canal, BC)
- **Objective –** Achieve higher overall operational efficiencies through more accurate flow measurements.
- **Payoff –** More profitable operations, improved justifications for repairs and upgrades, improved acceptance testing for new turbines, and proper computation of Production Tax Credits and other efficiency-related incentives.

Current Status of the PTC 18 Proposed Project

- Tests were completed at the U. S. Army Corps of Engineers' Lower Granite Project in December 2004 (Results reported in paper by R. Wittinger, June 2005), funded by BPA, additional tests have been discussed.
- Scintillation and current meter tests are scheduled at New York Power Authority's FDR St. Lawrence Project in the fall 2007, funded by NYPA/EPRI
- Tests are proposed at BC Hydro's Kootenay Canal Project, 2008, details in discussion and work is partially funded by BC/EPRI.
- ***Additional partners, other technologies, and/or sites are up for discussion***

Typical Uses for Flow Measurements



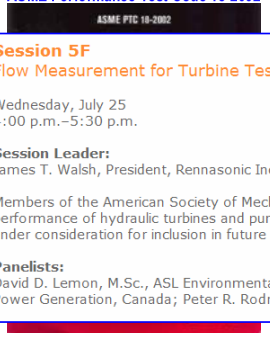
- Improved acceptance testing for new and repaired turbines
- Improved justifications for repairs and upgrades
- Improved optimization through more accurate unit characteristics
- Improved computation of Production Tax Credits and other efficiency-related incentives

Industry Interests in Improved Flow Measurements

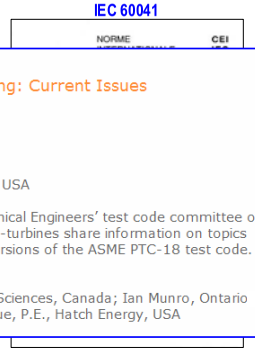
- Contractual reasons
  - Code-level flow measurements, particularly measurements for short, converging intakes
  - Application, costs, and uncertainties for alternative measurement methods (currentmeters, acoustic scintillation, acoustic time of flight, and other methods)
  - Economical flow measurement methods for smaller plants
- Optimized hydraulic production
  - Economical absolute flow measurement methods
  - Approach flow effects on relative and absolute flow measurements
  - Transferring experience from "ideal" to "poor" conditions

Performance Test Codes

ASME Performance Test Code 18-2002



IEC 60041



Session 5F
Flow Measurement for Turbine Testing: Current Issues

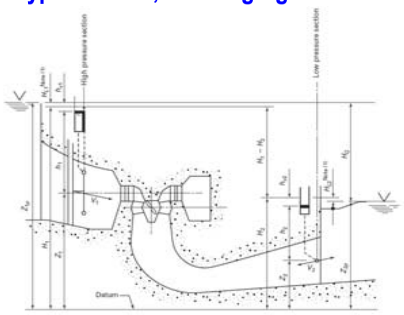
Wednesday, July 25
4:00 p.m.–5:30 p.m.

Session Leader:
James T. Walsh, President, Rennasonic Inc., USA

Members of the American Society of Mechanical Engineers' test code committee on performance of hydraulic turbines and pump-turbines share information on topics under consideration for inclusion in future versions of the ASME PTC-18 test code.

Panelists:
David D. Lemon, M.Sc., ASL Environmental Sciences, Canada; Ian Munro, Ontario Power Generation, Canada; Peter R. Rodrigue, P.E., Hatch Energy, USA

Typical Short, Converging Intake



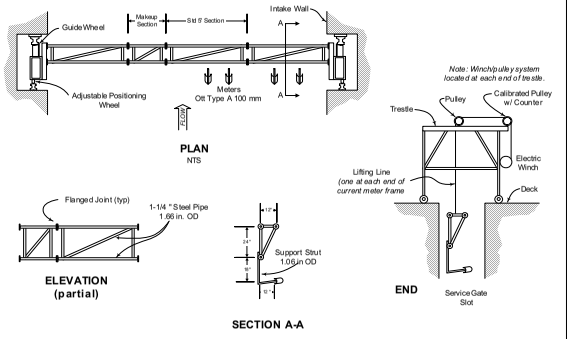
NOTE:
(1) Head losses H_{L1} and H_{L2} are shown for the turbine mode. For the pump mode, the head losses will be of the opposite sign.
GENERAL NOTES:
(a) Z_{UH} (not shown) will be level Z_{UH} at zero flow rate.
(b) Z_{DH} (not shown) will be level Z_{DH} at zero flow rate.

Fig. 2.AB Head Definition, Vertical Shaft Kaplan or Propeller Machine with Semi-Spiral Case

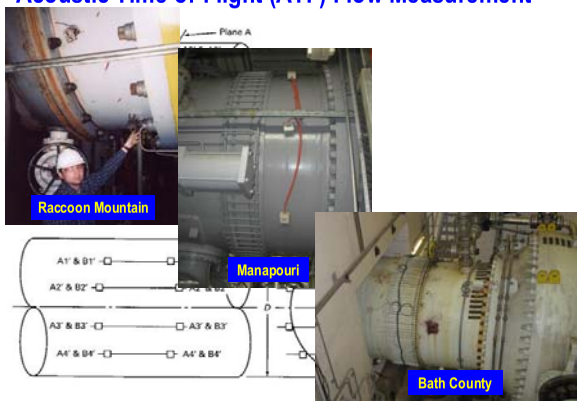
Flow Technologies for Short, Converging Intakes

- Currentmeters (CM)
- Acoustic Time-of Flight (ATF)
- Acoustic Scintillation (AS)

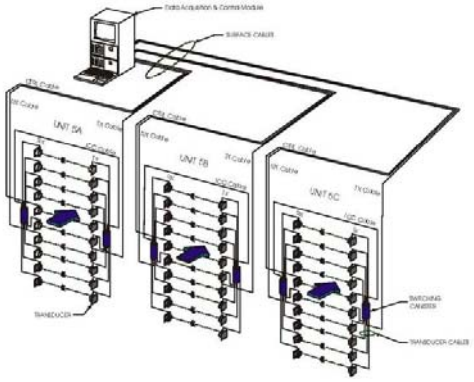
Current Meter (CM) Flow Measurement



Acoustic Time-of-Flight (ATF) Flow Measurement



Acoustic Scintillation (AS) Flow Measurement



Comparison of AS, ATF, and CM Methods

Acceptance Testing			
Method	**Installation Costs**	**Testing Costs**	**Code Acceptance**
AS	Medium	Medium	Not yet
ATF	High	Medium	Not yet (Limited)
CM	Medium	High	Limited

Operational Improvements			
Method	**Continuous Monitoring**	**Reliability**	**Maintenance**
AS	Yes	High	Low
ATF	Yes	High	Low to Medium
CM	No (see note 1)	Medium to High (see note 1)	Low (see note 1)

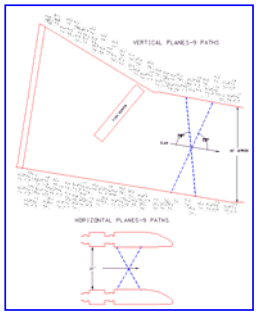
Note 1: CM can be used to calibrate a relative flow measurement method, such as Winter-Kennedy taps.

Testing Program, as Proposed by ASME PTC 18

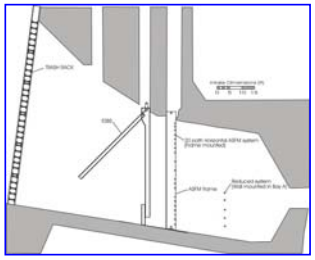
- Comparisons at three sites (average, difficult, and calibrated), as opportunity and funding permit
- Lower Granite Project: Completed in December 2004, with acoustic time-of-flight and acoustic scintillation; additional analysis of test results is needed
- FDR - St. Lawrence – Planned for Fall 2007; currentmeters and acoustic scintillation
- Kootenay Canal – 2008(?); testing will take place when funding is arranged; acoustic time-of-flight, acoustic scintillation, currentmeters (and other methods?)
- Add epri bullets

Lower Granite Project
(U. S. Army Corps of Engineers)

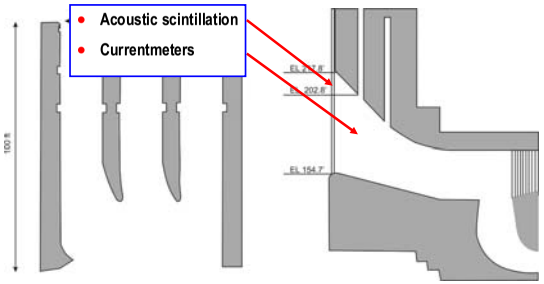
Acoustic Time-of-Flight



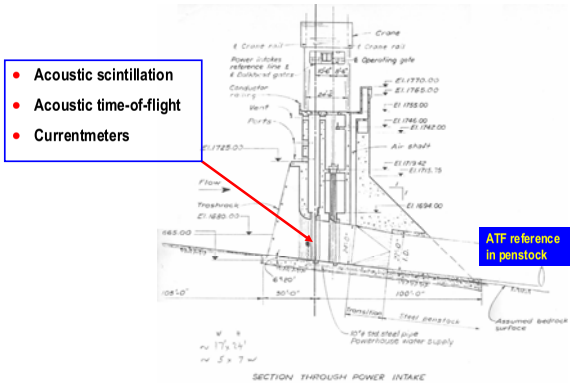
Acoustic Scintillation



FDR-St. Lawrence Project
(New York Power Authority)

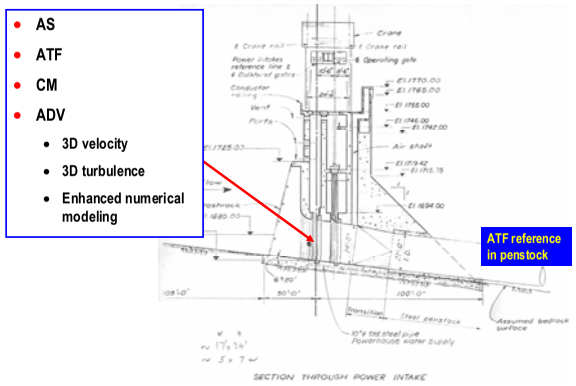


Kootenay Canal Project
(BC Hydro)



Acoustic-Doppler Velocimeter (ADV)

Kootenay Canal Project (with increased funding)
(BC Hydro)



Current Estimate on Funding Required

Test Site	Estimated Cost	Funding to date & in kind	Additional funds needed
Lower Granite original SOW	~$200k	~$200k (BPA/ USACE)	$0
St. Lawrence - AS and CM, no ATT	~$550k	~$550k (NYPA/ EPRI)	$0
Kootenay - AS, ATT, CM	~$700k	~$350k (BC Hydro/ EPRI)	$350
Other scope for *Old Sites*			
New scope at *New Sites*			
Totals			

New Scope / Potential Support

- Kootenay - Point Doppler / DOE Hydro?
- General Support Potential….
  - EPRI (Hetchy) - $24k (needs match)

Proposed Next Steps – Recommendation

- Add during meeting…..

Proposed Next Steps – Recommendation, cont.

- Add during meeting…..

Reducing flow measurement uncertainty through improved water level measurements

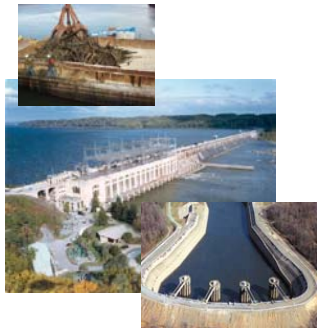
- **Objective:** Improving operation of a tightly coupled generating and pumped-storage complex
  - Task 1: Review instrumentation types and select appropriate types and locations for temporary level instrumentation at RMNPP
  - Task 2: Procure and install temporary level instrumentation; establish communication to central data acquisition system.
  - Task 3: Monitor temporary level instrumentation for multiple-month period of normal plant operations.
  - Task 4: Analyze and correlate results of plant operational data, including existing level measurements
- **Deliverable:** summary report, including specific recommendations for additional permanently installed level measurements at Niagara and make general recommendations to industry.

Development of analytical tools for application of flow data to NYPA operations

- Review Flow and Related Operational Data
  - Characteristics-based flows (RMNP and LPGP)
  - Volume-based flows
  - Relative flows, if available (Winter-Kennedy differential)
- Perform Detailed Analyses using Flow/Performance Data
  - Characteristics-based flows vs. volume-based flows (e.g., LPGP)
  - Operation, correlation, scheduling, and sensitivity analyses
- Develop and Demonstrate Analytical Tools and Appropriate Data Metrics
- Integrate Analytical Tools and Metrics into Plant Operations

Hydropower Interests

- Realizing full value of waterpower in markets (coordinating dispatch with WaterView® optimizations)
- Trash monitoring and analysis to determine cost vs avoidable loss strategies
- Valuation of hydro assets… regulation, contingency reserve, load following and energy arbitrage
- Sharing experiences on environmental and re-licensing challenges



EPRI Hydropower Program

- **Enhanced I&C, Efficiency Improvement**
- **Valuation of Pumped Storage and Hydropower assets**
- **Technology Roundup Reports (hot topics) such as trash management**
- **Dam Safety and Relicensing**
- **Machine condition monitoring**
- **Hydropower modernization**
- **Hydrokinetic (e.g., wave, tidal) energy development**

National Hydropower Association - Hydraulic Power Committee Meeting - Duluth, MN - September 24-26, 2007

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