

I N N O V A T I O N T H R O U G H C O L L A B O R A T I O N



Centre for Energy Advancement
through Technological Innovation

Presented to:



Presentation Outline

- Review of CEATI Background
- Conventional Hydro Program Update



CEATI Interest Groups:

CEATI currently operates 14 focused Interest Groups

Generation & Utilization

- Hydraulic Plant Life
- Dam Safety
- Water Management
- Strategic Options for Sustainable Power Generation
- Thermal Generation
- Customer Energy Solutions

Distribution

- Distribution Assets Life Cycle Management
- Power Quality

Transmission

- Life Cycle Management of Substation Equipment and Apparatus
- Power System Planning and Operations
- Overhead Line Design Issues & Wind and Ice Storm Mitigation
- Transmission Line Asset Management
- Transmission Underground Cables
- Transmission Infrastructure Protection

Participation: 2008



For more information regarding our Interest Groups, Events and Publications, visit www.ceatech.ca

Over 700 participants from utilities around the world

Grant County
PUBLIC UTILITY DISTRICT

CHELAN COUNTY
PUBLIC UTILITY DISTRICT

Douglas County

TACOMA POWER
TACOMA PUBLIC UTILITIES



PSE PUGET SOUND ENERGY

EWEB

PGE



SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT

WSPUC
WADE WATSON
PURITY WATER & POWER
CLEAN WATER



APS

SNP

Participation: 2008

CEATI

Central Hudson
Gas & Electric Corporation

NYSEG

ISO new england

New York Power
Authority

nationalgrid

conEdison

KEYSPAN

Allegheny Energy

Northeast
Utilities

PSEG

ATC
AMERICAN TRANSMISSION COMPANY

Public Service

Consumers Energy

AEP
AMERICAN
ELECTRIC
POWER

Exelon

FirstEnergy

Ameren

IPL
An AES Company

TVA

Duke
Energy

SCE&G

SOUTHERN
COMPANY

Entergy

FPL

National Organizations

National Rural Electric
Cooperative Association

US Army Corps
of Engineers

US DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Presentation Outline

- Review of CEATI Background
- **Conventional Hydro Program Update**



Hydraulic Plant Life Interest Group

(Asset/Plant/Operations/Mechanical/Electrical Engineering Managers)

» 47 utilities represented

» The 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.



Hydraulic Plant Life Interest Group

- » **2009 HPLIG Meeting #1:**
 - February 12-13, 2009 in Los Angeles, CA

- » **2009 HPLIG Meeting #2:**
 - September 17-18, 2009 in Montreal, QC



Hydraulic Plant Life Interest Group

» On-Going Technology Reviews:

- Hydroelectric Fire Probabilities & Fire Risk Assessment
- Brush Gear Maintenance
- Head Gate Testing Protocols
- Training for Hydro Plant Staff (Including Web Based Approaches)
- Head Gate and Spill Gate Bushings Wear Assessment
- Quantifying the Non-Energy Benefits of Hydro Power
- Development of a Learning & Reference Tool to Improve Awareness and Understanding of Hydraulic Phenomena Which Can Occur in Operating Hydraulic Turbines



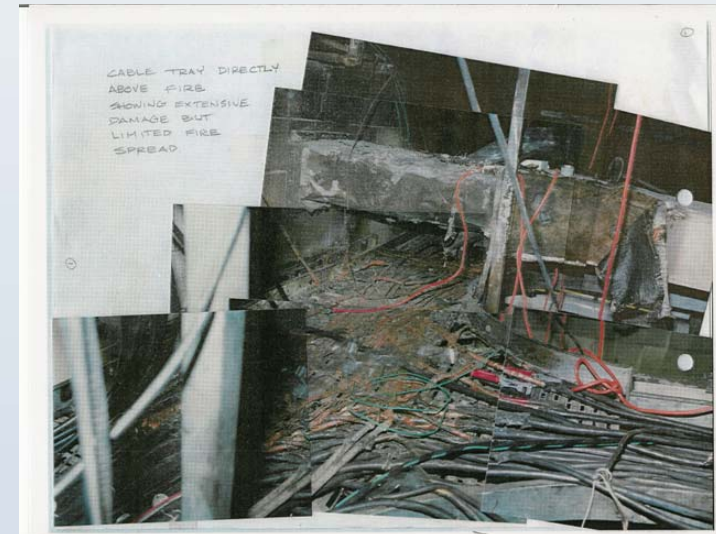
Hydraulic Plant Life Interest Group

- » **On-Going Technology Reviews: Hydroelectric Fire Probabilities & Fire Risk Assessment**
 - A framework will be developed for fire hazard risk assessment. Fire types to be considered include:
 1. Indoor oil-insulated Transformer fires
 2. Generator fires
 3. Control room fires
 4. Cable fires
 5. overhaul/Transient fires

Hydraulic Plant Life Interest Group

- » **On-Going Technology Reviews: Hydroelectric Fire Probabilities & Fire Risk Assessment**
 - Lessons Learned Data Base:
ex. Lightning Strike to Telephone Service of major hydroelectric generating station.

- **Lightning strike on local telephone company system approx 3 miles away;**
- **Major fault occurred in telephone entry panel in station relay and telecom room;**
- **Fault burned wiring and entry cabinet, ignited plywood backing the panel;**
- **Fire spread to the cable tray above the panel.**

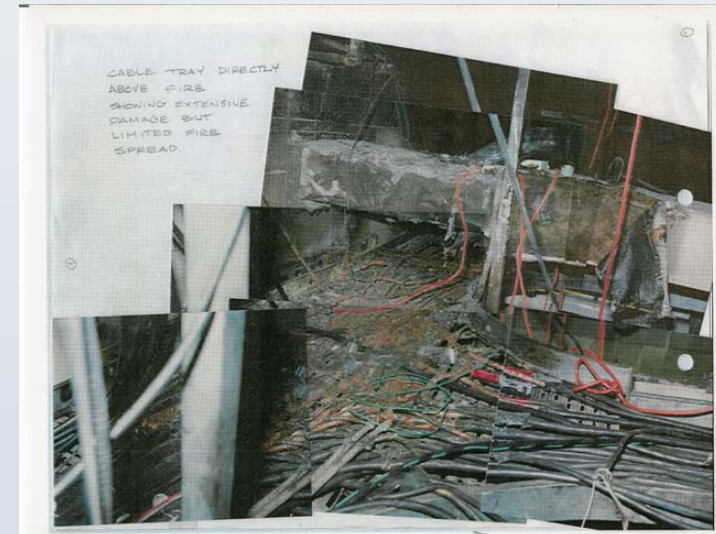


Hydraulic Plant Life Interest Group

» On-Going Technology Reviews: Hydroelectric Fire Probabilities & Fire Risk Assessment

- Lessons Learned Data Base:
Lightning Strike on Telephone Service of major hydroelectric generating station.

- **Damage isolated to telecom and relay control room;**
- **Plant was out of operation for 10 days;**
- **Total costs of approx \$10 million;**
- **Cost of fire protection and prevention equipment for floor space = \$50k.**



Hydraulic Plant Life Interest Group

» On-Going Technology Reviews: Quantifying the Non-Energy Benefits of Hydro Power

- Hydropower and Transmission Benefits (metrics):

Sector	Direct Net Value \$	Annual Value \$	Annual Regional Income \$	Direct Present Value \$
Energy	<i>\$/kWh</i>	<i>Total \$</i>	<i>\$/Region</i>	<i>\$/Project</i>
Demand	<i>\$/kW</i>	<i>Total \$</i>	<i>\$/Region</i>	<i>\$/Project</i>
Reserves	<i>\$/kWh</i>	<i>Total \$</i>	<i>\$/Region</i>	<i>\$/Project</i>
Back-Up Load Following	<i>\$/kWh</i>	<i>Total \$</i>	<i>\$/Region</i>	<i>\$/Project</i>
Market Hedging	<i>\$/kWh</i>	<i>Total \$</i>	<i>\$/Region</i>	<i>\$/Project</i>
Voltage Stability	<i>\$/kWh</i>	<i>Total \$</i>	<i>\$/Region</i>	<i>\$/Project</i>

Hydraulic Plant Life Interest Group

» On-Going Technology Reviews: Quantifying the Non-Energy Benefits of Hydro Power

- **Public Use and Industrial Benefits (metrics):**

<i>Sector</i>	<i>Direct Net Value \$</i>	<i>Annual Value \$</i>	<i>Annual Regional Income \$</i>	<i>Direct Present Value \$</i>
<i>Recreation</i>	<i>\$/Day of Recreation</i>	<i>Total \$</i>	<i>\$/Project/Region</i>	<i>\$/Project/Region</i>
<i>Land Management</i>	<i>\$/Acre</i>	<i>Total \$</i>	<i>\$/Project/Region</i>	<i>\$/Project/Region</i>
<i>Irrigation</i>	<i>\$/Acre-ft.</i>	<i>Total \$</i>	<i>\$/Project/Region</i>	<i>\$/Project/Region</i>
<i>Flood Control</i>	<i>\$/Acre-ft.</i>	<i>Total \$</i>	<i>\$/Project/Region</i>	<i>\$/Project/Region</i>

Hydraulic Plant Life Interest Group

» **On-Going Technology Reviews: Quantifying the Non-Energy Benefits of Hydro Power**

• **Public Use and Industrial Benefits (metrics):**

<i>Sector</i>	<i>Direct Net Value \$</i>	<i>Annual Value \$</i>	<i>Annual Regional Income \$</i>	<i>Direct Present Value \$</i>
<i>Municipal</i>	<i>\$/Acre-ft.</i>	<i>Total \$</i>	<i>\$/Project/Region</i>	<i>\$/Project/Region</i>
<i>Navigation</i>	<i>\$/Ton/Mile</i>	<i>Total \$</i>	<i>\$/Project/Region</i>	<i>\$/Project/Region</i>
<i>Industrial Cooling</i>	<i>\$/Acre-ft.</i>	<i>Total \$</i>	<i>\$/Project/Region</i>	<i>\$/Project/Region</i>
<i>Climate Change</i>	<i>\$/Ton (CO2)</i>	<i>Total \$</i>	<i>NA</i>	<i>NA</i>

Hydraulic Plant Life Interest Group

» On-Going Projects:

- Vibration Analysis – Force and Vibration Relationship
- Mechanical Overhaul Guide for Hydroelectric Turbine Generators
- Best Practice Guide for Planning and Executing Hydro Overhaul and Retrofit Projects/Optimization of Rehabilitation
- Dissection, Condition Assessment and Analysis of Failed and Un-Failed Aged Stator Windings Taken from Hydrogenerators
- Turbine/Generators Shaft Stress Analysis – Methods and Limitations
- ASME PTC18 Short Converging Intake Plow Project: Kootenay Canal Comparative Flow Tests

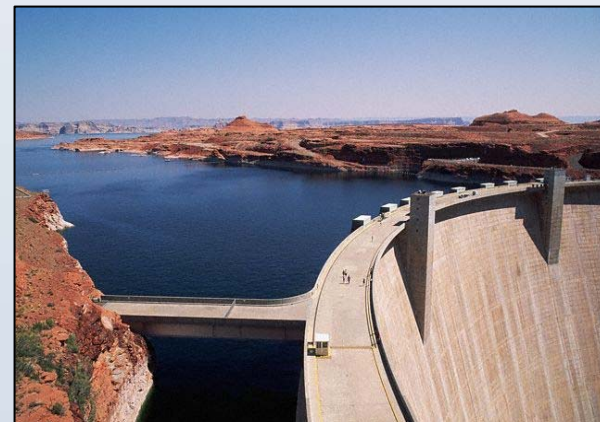


Dam Safety Interest Group

(Civil Engineering and Dam Safety Program Managers)

» 38 owners represented

- » The Dam Safety Interest Group is composed of Dam Owners who jointly sponsor research & development projects designed to help assess and improve the safety of dams.
- » Today, the DSIG is represented internationally by participants from Canada, the United States, Australia, Sweden, the Netherlands, France, the United Kingdom and Germany.



Dam Safety Interest Group



- » **2009 DSIG Meeting #1:**
 - March 24-25, 2009 in Los Angeles, CA – Industry Workshop
 - March 26-27, 2009 in Los Angeles, CA

- » **2009 DSIG Meeting #2:**
 - October 8-9, 2009 in Whistler, BC



Dam Safety Interest Group

- » DS2009 Industry Workshop – **Case Studies: Learning from International Dam Incidents and Failures**
- » Planning in coordination with the FERC.
- » Total of **15** case studies presented on **Liquefaction, Piping/Seismic Deformation, Piping along Outlets/Sliding of Concrete Dams, and Operation Controls and Human Interactions.**
- » **Over 140 attendees**
- » **35 owners represented.**

A CEATI International Dam Safety Interest Group Workshop
 Planning in coordination with the Federal Energy Regulatory Commission (FERC)
 Division of Dam Safety and Inspections

Case Studies:
Learning from International Dam Incidents and Failures
 The sharing of incidents is one of the most effective tools in driving down the risks in dam safety

March 24-25, 2009 - Los Angeles, CA

Most dam failures are not the result of extreme loading conditions. Rather, dams typically fail due to unforeseen or unrecognized conditions that result in piping failures, overtopping at less than the design inflow, foundation failures, errors in operation, or other "non-standard" failure modes.

Managing the risk of owning and operating dams requires the best available knowledge on both potential failure modes and the associated consequences. It is imperative that dam owners, dam regulators and consulting engineers are familiar with the typically analyzed failure modes as well as those that occur for non-standard reasons. The retirement of experienced dam engineers and the world-wide trend towards less dam construction leaves today's dam safety professionals with fewer opportunities to gain the experience necessary to adequately assess the risks posed by dams and to protect the public from the consequences of a dam failure.

The lessons of the past must not be forgotten, it is imperative that the combined knowledge of the dam safety community be shared in order to minimize the risk to those who live downstream of dams or otherwise benefit from them. The goal of the workshop is to share case studies of dam failures and incidents in order to: 1) educate each other 2) provide knowledge necessary to manage the risks associated with dams; 3) identify areas where additional research may improve our knowledge of potential failure modes and identify ways to prevent or mitigate their development; 4) identify ways to assure that the knowledge of the past is available for the future; 5) develop a plan to ensure the continuation of global communication, coordination and collaboration.

Who Should Attend?
 Dam Safety Managers
 Dam Safety Regulators
 Manufacturers/Suppliers
 Civil/Structural Engineers
 Consultants
 Maintenance Supervisors
 Operations Supervisors
 Project Managers
 Service Contractors

Dam Safety Interest Group

- » On-Going Project: **Dam Monitoring and Data Analysis – Best Practices**
 - Contractor: Paul C. Rizzo & Associates
 - Sponsored by 17 owners and the FERC
 - Project commenced on April 9, 2009 at the Georgia Power Offices in Atlanta (approximately 22 months in duration).

- » Primary Focus on Program Management:
 - Identify the responsibilities of management;
 - Review the key components for managing performance of the overall monitoring program;
 - Outline proper coordination and communication protocols between and among these program components;
 - Transferring expertise and intimate knowledge of projects from one generation to the next.

Dam Safety Interest Group

- » On-Going Project: **Gauging the Effectiveness of a Dam Safety Program**
- » Objectives:
 - To enable participants to review and improve the ways in which they judge the effectiveness of their dam safety programs.
- » A one-day workshop was held in October 2008, providing participants the opportunity to present and discuss their organizations' safety program;
- » Presentations by 9 dam owners and the FERC, over 30 owners in attendance;
- » This led to the identification of 7 attributes that demonstrate a good dam safety program;
- » For each of these attributes DSIG participants have been asked to provide at least 1 suggested performance measure

Dam Safety Interest Group

- » On-Going Project: **Gauging the Effectiveness of a Dam Safety Programs**

- » Seven Attributes of a good Dam Safety Program Identified:
 1. Clear understanding of responsibilities at all levels;
 2. Regulatory compliance;
 3. Conformance with risk criteria and standard good practices, including for example:
 - design criteria
 - inspections and monitoring
 - periodic reviews
 - emergency preparedness
 - change management;

Dam Safety Interest Group

- » On-Going Project: **Gauging the Effectiveness of a Dam Safety Programs**

- » Seven Attributes of a good Dam Safety Program Identified (Cont'):
 4. Systematic management to address non-conformance and reassess changing hazards;
 5. Progress of risk reduction;
 6. Dynamic organisation with learning and continual improvement, evidenced in:
 - training of staff/ competency
 - education of stakeholders
 - learning from incidents (own and others')
 - improving collective knowledge (R&D, industry groups);
 7. Financial responsibility.

Dam Safety Interest Group

- » On-Going Project: **Reliability and Capability of Discharge Facilities Task Force**
- » Areas to be reviewed:
 - Discharge experiences (active and passive failures) at dams;
 - Review problems, concerns, needs, etc facing owners;
 - Identify and pursue study areas that address these;
 - Identify owners, engineers and manufacturers demonstrating best practices;
 - Conduct workshops that facilitate this development work.



Contact Information – Thank You!

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