

Hydropower Track 1

Grid Reliability and Resilience

Washington/Jefferson

Grid Reliability and Resilience Peer Review Panel

- **Scott Flake**, Independent Consultant (Panel Lead)
- **John Simonelli**, Retired (formerly ISO New England)
- **Charlton Clark**, formerly DOE
- **Tom Acker**, Northern Arizona University



THANK YOU, REVIEWERS!

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- **A yellow card will be flashed at the last 5 minutes, and then a red card will be held when time is up.**
- **Please respect your fellow presenters by keeping within your allotted time.**
- **The Review Panel Lead will kick off the Q&A, then allow questions from the other reviewers, and then the audience, time permitting.**
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Track 1: Agenda-at-a-Glance

Tuesday,
October 8th

Plenary

Hydropower
Program Overview

Hydropower Vision
Roadmap Update

HydroWIRES

Grid Reliability and
Resilience

Wednesday,
October 9th

Hydro Plenary

Grid Reliability and
Resilience

Technology R&D for
Low-Impact Hydro
Growth

Thursday,
October 10th

Hydro Plenary

Modernization,
Upgrades, and
Resilience

Town Hall

Track 1: Tuesday, October 8th

Start	End	Agenda Session	Presenter	Affiliation	Track
2:15 PM	2:25 PM	Introduce HVS & NARIS	Sam Bockenbauer	WPTO	Grid
2:25 PM	3:10 PM	Hydropower Value Study	Abhishek Somani	PNNL, ANL, INL, NREL, ORNL	Grid
3:10 PM	3:40 PM	North American Renewable Integration Study	Greg Brinkman	NREL	Grid
3:40 PM	3:50 PM	Coffee Break			
3:50 PM	4:00 PM	Introduce Laboratory Projects	Sam Bockenbauer	WPTO	Grid
4:00 PM	4:30 PM	Valuation Guidance and Techno-Economic Studies for Pumped Storage Hydropower	Vladimir Koritarov	ANL	Grid
4:30 PM	5:00 PM	Integrated Hydropower and Storage Systems Operation for Enhanced Grid Services	Thomas Mosier	INL	Grid
5:00 PM	5:30 PM	Modeling the Value of Networked, Small Hydro Generators to the Grid	Greg Stark	NREL	Grid
5:30 PM	5:50 PM	End-of-Session Networking Activity	All recent presenters	All recent presenters	Grid
5:50 PM	6:30 PM	Hydro-Grid Peer Reviewer Only Meeting			

- **Annual Operating Plans**
 - EERE is committed to funding multi-year project plans
 - Plans include Go/No-go decisions in 12-18 month period
 - Merit reviewed externally on a 3-year cycle project cycle
 - Reviewed and approved by WPTO annually



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Track 1: Wednesday, October 9th

Start	End	Agenda Session	Presenter	Affiliation	Track
9:40 AM	9:45 AM	Introduction of Ternary-Type Pumped-Storage Hydropower and Ground-Level Integrated Diverse Energy Storage	Marisol Bonnet	WPTO	Grid
9:45 AM	10:15 AM	Transforming the U.S. Market with a New Application of Ternary-Type Pumped-Storage Hydropower Technology	Mark Jacobson	NREL	Grid
10:15 AM	10:45 AM	Ground-Level Integrated Diverse Energy Storage (GLIDES)	Ahmad Abuheiba	ORNL	Grid
10:45 AM	10:55 AM	Coffee Break			
10:55 AM	11:00 AM	Introduce 1455	Marisol Bonnet	WPTO	Grid
11:00 AM	11:30 AM	Hydro Battery Systems Catalog Development	JT Steenkamp	Shell Energy North America	Grid
11:30 AM	12:00 PM	Cost Effective Small Scale Pumped Storage Configuration	Henry Obermeyer	Obermeyer Hydro Accessories, Inc.	Grid
12:00 PM	12:15 PM	End-of-Session Networking Activity	All recent presenters	All recent presenters	Grid
12:15 PM	12:30 PM	Closing Remarks on Grid Integration	Sam Bockenbauer	WPTO	Grid
12:30 PM	1:15 PM	Lunch			

Date:

- Issued 7/26/2016; Selections announced 7/26/2016

Objective:

- Develop innovative technologies that will reduce capital costs and deployment timelines for pumped-storage hydropower and non-powered dams.

Topic Areas

- Topic Area 1: Efficient Low-Head Hydropower Turbine/Generator Technologies with Capability to Reduce Civil Works
- Topic Area 2: Concept Feasibility of Innovative Technologies for Closed-Loop Pumped Storage Hydropower (PSH) Systems

Projects for Review:

- **Natel Energy, Inc.** (EE0008011 - *Efficient, Modular Low-Head Linear Pelton Turbine with Simple, Low-Cost Civil Works*)
- **Shell Energy North America** (EE0008013 - *Hydro Battery Systems Catalog Development*)
- **National Renewable Energy Laboratory** (*Transforming the U.S. Market with a New Application of Ternary-Type Pumped-Storage Hydropower Technology*)
- **Obermeyer Hydro Accessories Inc.** (EE0008014 - *Cost Effective Small Scale Pumped Storage Configuration*)

FY16 Conference

“...not less than \$5M to support competitive demonstrations to assess the commercial viability of new or advanced pumped storage technologies.”

FY17 Conference

“Provides up to \$3M within available funds for a techno-economic analysis of the value of pumped storage hydropower at two sites with high levels of intermittent renewable energy generation in the U.S.”

FY18 Omnibus

“Within available funds, \$10,000,000 is recommended for a competitive funding opportunity for multiple awardees to test the commercial viability of new use cases for pumped storage hydropower at locations to enhance grid reliability and manage variable generation.”

FY19 Conference

“Within available funds, \$35,000,000 is provided for conventional hydropower and pumped storage activities”

Concept Feasibility of Innovative Technologies for Closed-Loop PSH Systems

Objectives:

- Support early-stage research to evaluate new PSH system designs
- Reduce capital costs and deployment timelines of PSH projects
- Improve capabilities to model and assess grid system value of PSH

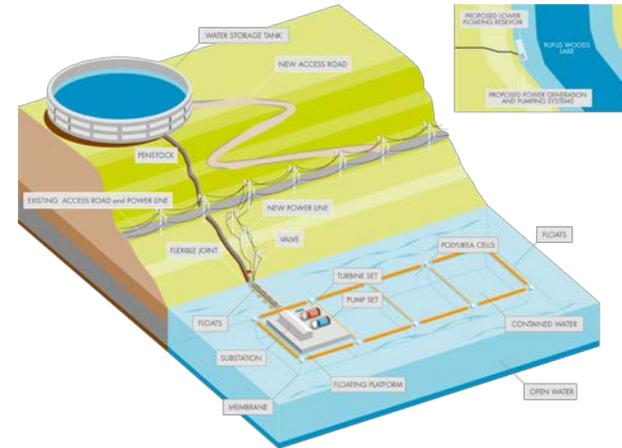
Desired PSH Systems:

- Closed loop
- Modular, site-agnostic systems that can be easily replicated
- Innovative deployment schemes and/or methods of producing head differentials (e.g., underground, compressed air)
- Demonstrated cost parity with other storage technologies (in \$/Kwh)
- Roundtrip efficiency of at least 70%

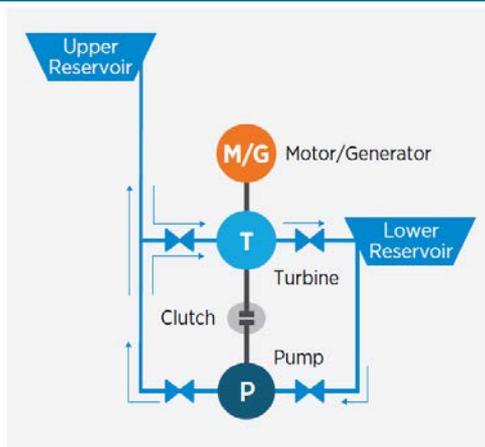
Modular Compressed-Air PSH (ORNL)



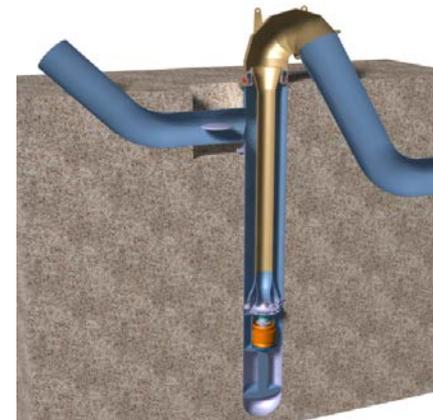
Small Modular Hydro Battery (Shell)



Ternary PSH System (NREL)



No-Powerhouse PSH (Obermeyer)



Hydropower Track 1

New Technology and Modernization

Washington/Jefferson

New Technology and Modernization Peer Review Panel

- Greg D. Lewis, Duke Energy (Hydro Review Chair/Panel Lead)
- David Hanson, Retired (formerly Sacramento Municipal Utility District)
- David Sinclair, Advanced Hydro Solutions
- Steve Lewis, Sapere Consulting



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Town Hall

Track 1: Wednesday, October 9th

Start	End	Agenda Session	Presenter	Affiliation	Track
1:15 PM	1:35 PM	Overview of Technology R&D for Low-Impact Hydro Growth	Marisol Bonnet	WPTO	New Tech+Mod
1:35 PM	1:45 PM	Introduce FOAs 1006, 1286, 1455	Marisol Bonnet	WPTO	New Tech+Mod
1:45 PM	2:15 PM	Modular Roots-Based Rotor Turbine-Generator System for Small Hydro	David Yee	Eaton Corporation	New Tech+Mod
2:15 PM	2:45 PM	Rapidly Deployable Advanced Integrated Low Head Hydropower Turbine Prototype	Arnie Fontaine	Pennsylvania State University	New Tech+Mod
2:45 PM	2:55 PM	Coffee Break			
2:55 PM	3:25 PM	Optimized Composite Prototype for Archimedes Turbine Manufacture	Marisol Bonnet (on behalf of Percheron)	Percheron Power, LLC	New Tech+Mod
3:25 PM	3:55 PM	The Design and Development of a Composite Hydropower Turbine Runner	Paul Fabian	Composite Technology Development, Inc.	New Tech+Mod
3:55 PM	4:25 PM	A Cost-Disruptive, Low-Impact, Modular Form Factor Low-Head Hydropower System	David Duquette	Littoral Power Systems, Inc.	New Tech+Mod
4:25 PM	4:55 PM	Efficient, Modular Low-Head Linear Pelton Turbine with Simple, Low-Cost Civil Works	Abe Schneider	Natel Energy	New Tech+Mod
4:55 PM	5:40 PM	Standard Modular Hydropower Technology Acceleration	Brennan Smith	ORNL	New Tech+Mod
5:40 PM	6:00 PM	End of Session Networking Activity	All recent presenters	All recent presenters	New Tech+Mod

Date:

- Issued 9/23/2014; Selections announced 12/1/2014

Objective:

- Apply advanced materials and advanced manufacturing techniques to the development of new “low-head” hydropower technologies.

Areas of Interest:

- Designing an integrated hydropower turbine generator system applies advanced materials.
- Integrating additive manufacturing techniques.
- Producing a prototype unit at an appropriate scale.

Project for Review:

- Eaton Corporation (EE0006927 – *Modular Roots-based Rotor Turbine-Generator System for Small Hydro*)
- Pennsylvania State University (EE0006928 – *Rapidly Deployable Advanced Integrated Low Head Hydropower Turbine Prototype*)

FOA 1286 – Low Impact Hydropower Technologies

Date:

- Issued 4/9/2015; Selections announced 9/14/2015

Objective:

- To advance hydropower drivetrains, which transfer rotational energy from turbines to generators, and structural foundations that could significantly reduce the lifetime operating and maintenance costs and minimize environmental impacts of new hydropower projects.

Topic Areas:

- Topic Area 1: Rapidly Deployable Hydropower Civil Works Technologies
- Topic Area 2: Innovative Methods and Materials for Hydropower Construction
- Topic Area 3: Powertrain Component Innovations

Projects for Review:

- Littoral Power Systems (EE0007243 – *A Cost-disruptive, low impact, modular form factor low-head hydropower system*)
- Percheron Power, LLC (EE0007247 – *Optimized Composite Prototype for Archimedes Turbine Manufacture*)
- Composite Technology Development, Inc. (EE0007248 – *The Design and Development of a Composite Hydropower Turbine Runner*)

Date:

- Issued 7/26/2016; Selections announced 7/26/2016

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- Topic Area 2: Concept Feasibility of Innovative Technologies for Closed-Loop Pumped Storage Hydropower (PSH) Systems

Projects for Review:

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- **Shell Energy North America** (EE0008013 - *Hydro Battery Systems Catalog Development*)
- **National Renewable Energy Laboratory** (*Transforming the U.S. Market with a New Application of Ternary-Type Pumped-Storage Hydropower Technology*)
- **Obermeyer Hydro Accessories Inc.** (EE0008014 - *Cost Effective Small Scale Pumped Storage Configuration*)

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Town Hall

Track 1: Thursday, October 10th

Start	End	Agenda Session	Presenter	Affiliation	Track	Room	
10:20 AM	10:30 AM	Introduce Laboratory Projects	Tim Welch	WPTO	New Tech+Mod	Washington /Jefferson	
10:30 AM	11:00 AM	An Assessment of Conduit Hydropower Potential at Public Drinking Water Systems—Pilot Study	Shih-Chieh Kao	ORNL	New Tech+Mod	Washington /Jefferson	
11:00 AM	11:30 AM	Solid State Processing for Improved Performance of Current and Next-Generation Hydropower Components	Ken Ross	PNNL	New Tech+Mod	Washington /Jefferson	
11:30 AM	11:50 AM	End-of-Session Networking Activity	All recent presenters	All recent presenters	New Tech+Mod	Washington /Jefferson	
11:50 AM	12:25 PM	Hydro New Tech + Mod Peer Reviewer Only Meeting					Madison
12:25 PM	1:15 PM	Lunch					

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Track 1: Thursday, October 10th

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1:15 PM	1:35 PM	Overview of R&D to Support Modernization, Upgrades and Security for Existing Hydropower Fleet	Mark Christian	WPTO	New Tech+Mod	Washington /Jefferson	
1:35 PM	2:05 PM	Hydro Fleet Database Development and Analyses (Hydro Source)	Brennan Smith	ORNL	New Tech+Mod	Washington /Jefferson	
2:05 PM	2:35 PM	Low-Head, Short-Intake Flow Measurement Research	Sam Harding	PNNL	New Tech+Mod	Washington /Jefferson	
2:35 PM	3:05 PM	Hydropower Fleet Intelligence	Stephen Signore	ORNL	New Tech+Mod	Washington /Jefferson	
3:05 PM	3:15 PM	End-of-Session Networking Activity	All recent presenters	All recent presenters	New Tech+Mod	Washington /Jefferson	
3:15 PM	3:35 PM	WPTO's Closing Words from the New Tech+Mod Panel	Marisol Bonnet	WPTO	New Tech+Mod	Washington /Jefferson	
3:35 PM	3:45 PM	Coffee Break and Transition					
3:45 PM	5:30 PM	Town Hall	Multiple	Multiple	Plenary	Grand Ballroom	
5:30 PM	6:00 PM	Peer Reviewer Only Meetings (all hydro reviewers)					Madison