#### Water Power Technologies Office 2019 Peer Review



Energy Efficiency & Renewable Energy

# **Big-Data Access and Management**



#### **WPTO Hydropower Program**

Tuesday, October 8, 2019

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Water Power Technologies Office

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# Hydropower Program Strategic Priorities

Environmental R&D and Hydrologic Systems Science

**Big-Data Access and Management** 

Technology R&D for Low-Impact Hydropower Growth R&D to Support Modernization, Upgrades and Security for Existing Hydropower Fleet Understand, Enable, and Improve Hydropower's Contributions to Grid Reliability, Resilience, and Integration

#### **Program Challenges: Strategy and Objectives**



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#### **Big-Data Access and Management**

- Information on technologies, available resources, species distribution, markets, etc. is widely dispersed, of differing qualities, and difficult to identify and gain access to
- Regulatory processes are cost and timeintensive, and there is poor information and data available / accessible on regulatory process outcomes and drivers



#### **Program Approaches: Strategy and Objectives**

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#### **Big-Data Access and Management**

- Create effective structures by which disparate data sources can be collected and compared.
- Develop the means to manipulate, combine, derive, and make available information/insights regarding hydropower data for internal and external use.



## **Big Data Access and Management**

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• <u>State of the Industry:</u> the hydropower industry exists in a unique data paradigm wherein many cases a rich body of data exists for an individual attribute or component but in many other instances data is of limited availability, quality, availably for distribution, or consolidation.



#### <u>WPTO Focus:</u>

- An effective means of consolidating data between multiple datasets from different structures.
- Tools and capabilities to perform high priority data analysis.

# **Data Structures**

- <u>Overview:</u> Data from the hydropower industry is extremely diverse in resolution and specification. This makes deriving value from data (enabled by large, federated datasets) difficult and the results of limited applicability.
- <u>Success</u>: Developing a foundation to empower effective data collection, compilation, analysis, and analytical processes across disparate data sets and structures. This is foundational to any effort to capitalize on big data in Hydropower



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# **HydroSource**

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- Overview: A majority of hydropower facilities serve multiple purposes and exist across a wide range of monitoring and governance structures. Effective hydro-system analysis and decision making requires that this information be both available and structured to enable consolidation.
- <u>Success</u>: The end vision of this is a holistic compilation of data sourced from across the hydropower industry empowering a wide range of analysis.



# **HydroSource**

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- Data Progress: Significant efforts have been made in data consolidation and availability efforts including the development of a Data Dictionary, Report Repository, Data Visualization Capabilities and Database Development.
- <u>Impact</u>: this consolidated database significantly reduces access barriers to quality data from a diverse set of sources empowering a broad set of analysis.



## **Basin-Focused River Data**

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**Overview:** Riverine systems and the planning / decision-making about them involve a complex mix of stakeholders with a wide variety of available and accessible data and questions that need to be answered. In an era of ever-increasing information availability, much of the information about our rivers is still disparately held and difficult to access



• <u>Success</u>: A system that any user could use to access, visualize and manipulate data on river-related hydrology, infrastructure, human-uses, species distribution, and previous research / studies to support short/long term decisions and better-informed analyses.

## **Regulatory and Environmental** Data Analysis

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**Overview:** Improving relicensing processes represents a significant opportunity for the hydropower industry to not only maintain the existing fleet but also to upgrade/add generation. The FERC eLibrary represents an invaluable resources in this process that is extremely difficult to utilize.



• <u>Success</u>: A tool which gathers the necessary relicensing information from available sources and provides the user with information and limits the amount of time and resources spent in the process.

# Examination of the Hydropower Licensing Process (project)

- Data Progress: Data has been collected from a wide range of sources on relicensing timelines, costs, and drivers.
- Impact: this work is helping provide unprecedented insight into the relicensing process which has the potential to improve outcomes and reduce time and cost burdens.



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### **Program Management Approach**

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## Stakeholder Engagement, Outreach, and Dissemination

- Publications
  - Stream Classification Explorer
  - The National Hydropower Map: U.S. Operational Plants in 2018

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- 2017 U.S. Hydropower Market Report (published May 2018)
- U.S. Hydropower Market and Trends 2018 Summary Data (published Spring 2019)
- 2015 Total Pumped Storage Capacity (MW) by state
- 2015 Average Annual Gross Pumped Storage Hydopower Generation by state
- Hydropower Capacity by Watershed Boundary Dataset Region in 2015
- New Stream-reach Development (NSD) Potential by Subbasin for the United States (2014)

# **Future Work**

- **Data Structures:** Performing a foundational analysis of data structural characteristics from different sources and developing preliminary means for dataset unification.
- <u>Hydro Source</u>: Continued updates to the types of data represented on the platform and the ease to identify and access them. Also a significant focus on further developing a userbase and outreach to stakeholders to ensure they are aware of the data that exists on the platform.
- <u>Basin-Focused River Data</u>: Create comprehensive sets of geospatial basin-level data available in a user-friendly platform for 3-4 watersheds to demonstrate the value of access to these types of information for diverse sets of stakeholders.
- <u>**Regulatory Analytics:**</u> Creating advanced Machine Learning capabilities to extract data from the FERC eLibrary regardless of labeling or source data quality.

## Track 2: Tuesday, October 8th<sup>th</sup>



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12:30 PM	1:20 PM	Lunch				
1:20 PM	2:05 PM	Overview of HydroWIRES	Sam Bockenhauer	WPTO	Hydro Plenary	Washington/Jefferson
2:05 PM	2:15 PM	Break and Transition				
2:15 PM	2:45 PM	Overview of Big-Data Access and Management	Hoyt Battey	WPTO	Enviro+Data	Potomac
2:45 PM	3:15 PM	Annual Hydropower Market and Trends Report	Rocio Uria-Martinez	ORNL	Enviro+Data	Potomac
3:15 PM	3:45 PM	Hydropower Regulatory and Permitting Information Desktop (RAPID) Toolkit	Aaron Levine	NREL	Enviro+Data	Potomac
3:45 PM	3:55 PM	Coffee Break				
3:55 PM	4:25 PM	An Examination of the Hydropower Licensing and Federal Authorization Process	Aaron Levine	NREL	Enviro+Data	Potomac
4:25 PM	4:45 PM	End-of-Session Networking Activity	All recent presenters	All recent presenters	Enviro+Data	Potomac
4:45 PM	5:15 PM	Hydro Enviro + Data Peer Reviewer Only Meeting				Madison

# Track 2: Thursday, October 10th<sup>th</sup> ENERGY

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#### Hydropower - Track 2

10:10 AM	10:20 AM	Coffee Break and Transition				
10:20 AM	10:30 AM	Introduction: Lab Projects	Dana McCoskey	WPTO	Enviro + Data	Potomac
10:30 AM	10:55 AM	Commercialization of Sensor Fish Technology to Support Hydropower Development (TCF)	Daniel Deng	PNNL	Enviro+Data	Potomac
10:55 AM	11:20 AM	Self-Powered Acoustic Transmitter	Daniel Deng	PNNL	Enviro+Data	Potomac
11:20 AM	11:50 AM	Evaluation of the Whooshh Fish Transport System	Alison Colotelo	PNNL	Enviro+Data	Potomac
11:50 AM	12:05 PM	End-of-Session Networking Activity	All recent presenters	All recent presenters	Enviro+Data	Potomac
12:05 PM	12:25 PM	Closing Remarks on Enviro + Data	Dana McCoskey	WPTO	Enviro+Data	Potomac
12:25 PM	1:15 PM	Lunch				
1:15 PM	3:30 PM	Hydro Enviro + Data Peer Reviewer Only Meeting				Madison

#### Hydropower - Track 1

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	12:25 PM	1:15 PM	Lunch				
	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				

# **Time Keeping**

- Project presentations will be kept to a strict 20 minutes, with 10 minutes of Q&A following, unless otherwise stated on the agenda.
- 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.
- Any questions left unanswered due to time limitations can be addressed during the Endof-session Networking Activity.



