



Environmental R&D and Hydrologic Systems Science

Hydropower Program

Wednesday, October 9, 2019

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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

Environmental R&D and Hydrologic Systems Science

- Develop better monitoring technologies to evaluate environmental impacts
- Develop technologies and strategies that avoid, minimize, or mitigate ecological impacts
- Support development of metrics for better evaluating environmental sustainability for new hydropower developments
- Assess potential impacts of long-term hydrologic variations to hydropower generation and flexibility
- Improve abilities to assess potential methane emissions from reservoirs
- Better identify opportunities and weigh potential trade-offs across multiple objectives at basin-scales



Environmental R&D presentations in Hydro Track 2: Wednesday, October 9th

Start	End	Agenda Session	Presenter	Affiliation	Track	Room	
9:45 AM	10:10 AM	Overview of Environmental R&D and Hydrologic Systems Science	Dana McCoskey	WPTO	Enviro+ Data	Potomac	
10:10 AM	10:20 AM	Introduce 9505, Water Modeling	Simon Gore	WPTO	Enviro+ Data	Potomac	
10:20 AM	10:50 AM	Third SECURE Water Act Section 9505 Assessment	Shih-Chieh Kao	ORNL, PNNL	Enviro+ Data	Potomac	
10:50 AM	11:05 AM	Coffee Break					
11:05 AM	11:35 AM	Advancing Modeling Tools for Assessment of Long-Term Energy/Water Risks for Hydropower	Mark Wigmosta	PNNL	Enviro+ Data	Potomac	
11:35 AM	12:05 PM	Monitoring Technology Development for Sensitive Species (Eel/ Lamprey Tag Development)	Daniel Deng	PNNL	Enviro+ Data	Potomac	
12:05 PM	12:30 PM	End-of-Session Networking Activity	All recent presenters	All recent presenters		Potomac	
12:30 PM	1:15 PM	Lunch					

Environmental R&D presentations in Hydro Track 2: Wednesday, October 9th

Start	End	Agenda Session	Presenter	Affiliation	Track	Room	
1:15 PM	1:20 PM	Introduce BioDE, EDS	Dana McCoskey	WPTO	Enviro+ Data	Potomac	
1:20 PM	2:05 PM	Biologically-Based Design and Evaluation of Hydropower Turbines	Alison Colotelo	PNNL, ORNL	Enviro+ Data	Potomac	
2:05 PM	2:50 PM	Environmental Decision Support: Science-Based Tools for Hydropower Stakeholder Collaboration	Brenda Pracheil	ORNL	Enviro+ Data	Potomac	
2:50 PM	3:00 PM	Coffee Break					
3:00 PM	3:10 PM	Introduce 1662 projects	Dana McCoskey	WPTO	Enviro+ Data	Potomac	
3:10 PM	3:40 PM	Deep Learning for Automated Identification of Eels in Sonar Data	Paul Jacobson	Electric Power Research Institute (EPRI)	Enviro+ Data	Potomac	
3:40 PM	4:10 PM	Modular and Scalable Downstream Passage Systems for Silver American Eels	Steve Amaral	Alden Research Laboratory, Inc.	Enviro+ Data	Potomac	
4:10 PM	4:40 PM	Fishway Entrance Palisade	Kevin Mulligan	University of Massachusetts Amherst	Enviro+ Data	Potomac	
4:40 PM	5:00 PM	End-of-Session Networking Activity	All recent presenters	All recent presenters	Enviro+ Data	Potomac	
5:00 PM	5:30 PM	Hydro Enviro + Data Peer Reviewer Only Meeting				Enviro+ Data	Madison

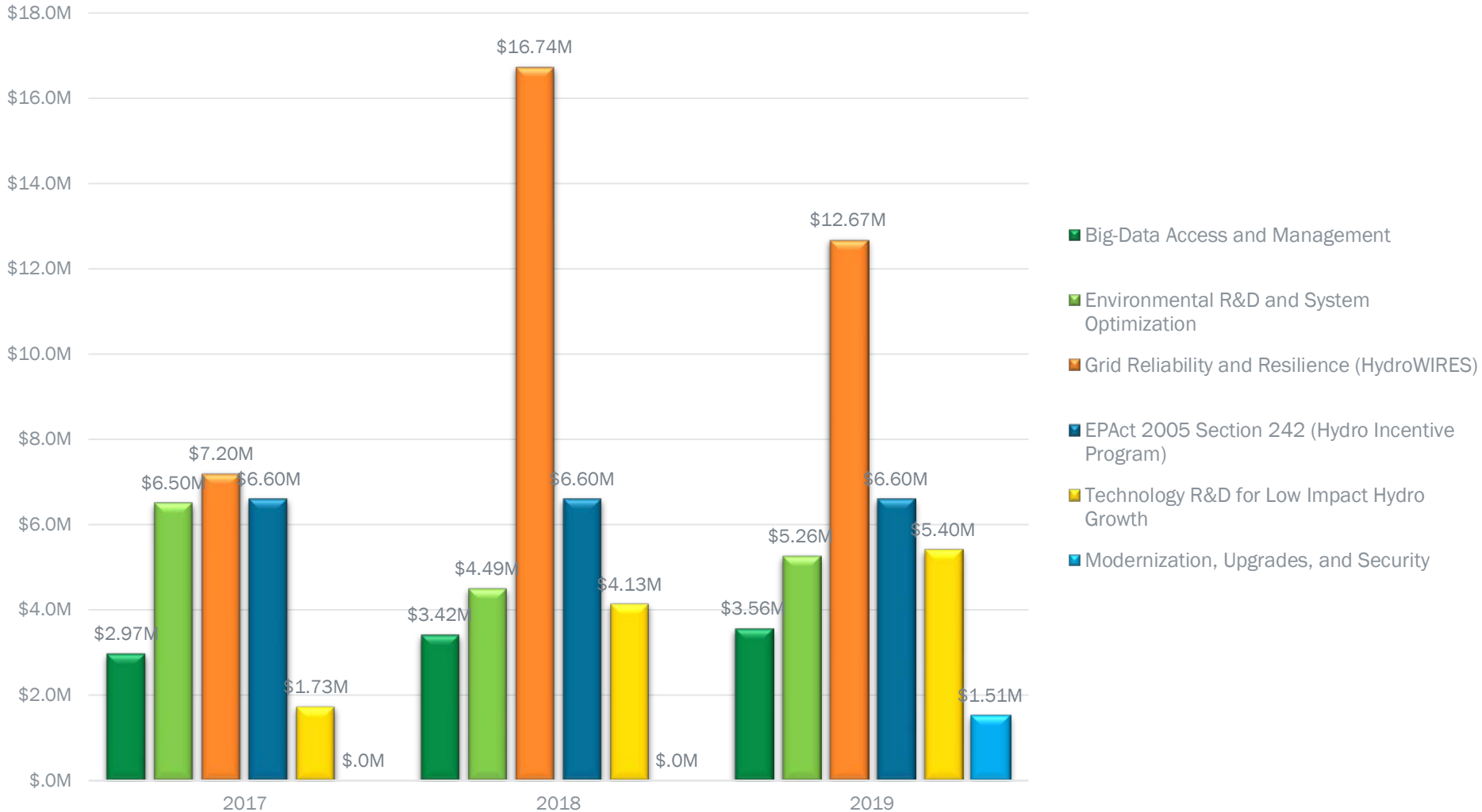
Environmental R&D presentations in Hydro Track 2: Thursday, October 10th

Start	End	Agenda Session	Presenter	Affiliation	Track	Room	
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	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
3:30 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)				All Hydro Tracks	Madison

- Early stage R&D focused on developing capabilities for fish acoustic telemetry tags
- Fish Passage Technology Awards
- Prize - Phase II Fish Exclusion
 - Focused on ideation to prototyping
 - In partnership with the US Bureau of Reclamation
- Literature Review of the relative environmental impacts of open-loop and closed-loop pumped storage hydro
- Upcoming release of next generation turbine evaluation tools:
 - Biological performance assessment (BioPA) Tool
 - Hydropower Biological Evaluation Toolkit (HBET)
- Demo of Environmental Decision Support Project Toolkit in a FERC relicensing



Program Management Approach



Program Management Approach

- Capability to develop a self-powered fish (PZT) tag demonstrated. Patent for transmitter filed – March, 2016
- HBET v1.0 released – October, 2016
- New water quality models to co-optimize energy *and* environmental outcomes demonstrated – April, 2017
- BioPA v2.0 released – May, 2017
- Injectable acoustic transmitter patented – July, 2018
- Sensor Fish Patented – September, 2018
- Sensor Fish Commercially Licensed – October, 2018
- Sensor Fish Mini Patented – April, 2019
- Eel/Lamprey Acoustic Transmitter Patented – September, 2019
- Deep learning capability to detect adult eel in DIDSON sonar data – August, 2019
- Catalog of environmental metrics for hydropower sustainability and Toolkit completed – September, 2018
- Whooshh Fish Transport System evaluation of scanning/sorting published – December, 2018
- Non-toxic coating for invasive mussel prevention patented – March, 2019



- How the program has sought and incorporated stakeholder input related to this activity area:
 - Developing, hosting, and facilitation of workshops and summits
 - Industry (FY17, FY19)
 - Resource/regulatory agencies and NGOs for environmental topics (FY18, FY19)
 - Quarterly Federal Inland Hydropower Working Group meetings (15 federal agencies)
 - Monthly Hydropower MOU Meetings (Reclamation and US Army Corps)
 - Targeted webinars with industry, researchers, and resource agencies
 - One-on-one meetings
- How program has disseminated important info:
 - Conferences (e.g., American Fisheries Society Symposiums, Fish Passage, HydroVision)
 - Demonstrations (e.g., lab, field, at conferences)
 - Publications in the peer reviewed literature
- Any important partnerships important for the activity area as a whole:
 - Hydropower MOU (Reclamation and US Army Corps); FERC-Corps MOU Facilitation; Mission and Science Advisory Boards (Environmental Metrics for Hydropower, Environmental Decision Support)
- Metrics of evaluation:
 - Citations of peer reviewed national laboratory publications; Number of attendees (conferences, workshops, etc.); Numbers of patents

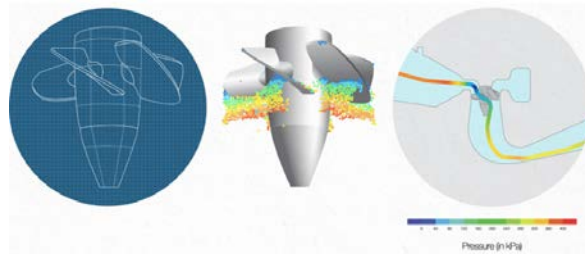


<https://hydrosource.ornl.gov/>

- Environmental information hub (geospatial tools, mitigation prediction tool, EDS Toolkit, US Stream Classification, etc.)

Next generation turbine evaluation tools and data on fish impacts to be released in Q2 FY20:

- Biological Performance Assessment Tool (BioPA)
- Hydropower Biological Evaluation Toolkit (HBET)



Engineers and biologists use data from computational fluid dynamics models, sensor systems, and lab experiments to enable manufacturers to design turbines that are safe for fish.



Sensor Fish provide *in situ* measurements of hydraulic conditions that can be analyzed and visualized with HBET:

- Available to be licensed by PNNL
- Commercially available from licensee Advanced Telemetry Systems (ATS)

FY 2020:

- Development/demonstrations of:
 - Real-time monitoring capabilities
 - Dissolved oxygen
 - Sensor Fish
 - Acoustic telemetry receivers
- Piloting Environmental Decision Support Toolkit in a FERC hydropower listening with stakeholders
- WPTO Strategy for Fish Passage with a focus on technology innovation & improvements
- Joint industry-resource/regulatory agency Environmental Workshop
 - Based on R&D needs/challenges for topics of mutual interest from FY17- FY19 workshops and summits
 - For example - Data needs for: fish passage, regional and basin-scales, new and advanced technologies, flow regimes, adaptive management and mitigation, etc
- Phase II of Fish Exclusion Prize Initiated with the US Bureau of Reclamation
- A series of environmental-themed maps

