



Federal Hydropower MOU Stakeholder Update

November 12, 2021



Welcome!

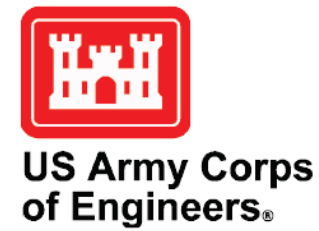
- Slides will be posted to the MOU website after the conclusion of the webinar.
- Attendees' microphones are muted and attendees are not visible on video.
- Questions will be answered during the Q&A after the presentation has ended.
- To ask questions:
 - Submit question into Chat Box and select "Everyone"
- If you have technical issues, try calling into the webinar via phone.

Thank you for participating!



Agenda and Speakers

- Opening – Corey Vezina (DOE)
- Asset Management – Kyle Desomber (DOE), David Tordonato (BOR)
- Value of Hydropower – Rebecca Johnson (WAPA), Clayton Palmer (WAPA), Katie Jackson (DOE)
- Workforce – Ashley Brooks (DOE)
- Water Supply Reliability – Madden Sciubba (DOE)
- Environmental Outcomes – Dana McCoskey (DOE), Clark Bishop (BOR), Brenda Pracheil (DOE – ORNL), Dan Ramirez (USACE)
- Q&A
- Closing – Corey Vezina (DOE)



Action Plan Topic: Asset Management

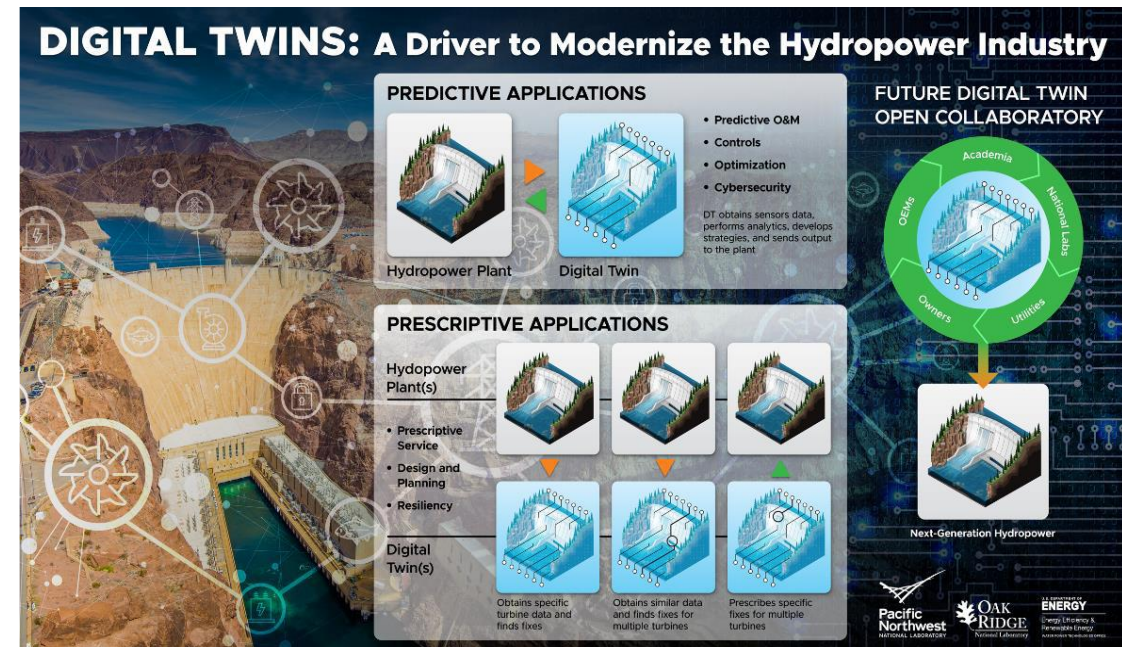
The Bureau of Reclamation, Department of Energy, and the US Army Corps of Engineers will focus on areas of collaboration for digitalization, maintenance management, asset condition health monitoring, and failure-mode analysis to maximize the value of investments in hydropower, increase reliability of generation and transmission assets, and minimize labor-hours required to keep assets reliable and available.



Action Plan Topic: Asset Management

Project: Digital Twin Development

- Background – Develop simple, information rich, digital multi-physics models of hydropower facilities to improve operational performance and maintenance practices.
- FY21 Progress – Developed open-platform framework
 - Workshop for industry involvement
 - Value proposition of a Digital Twin
 - Modeling scope to represent dynamics of hydro systems
- Next Steps– Develop and validate Digital Twin
 - FY22 Linear models for water, turbine, generator, grid link
 - FY23 Comprehensive modeling with user interface
 - FY24 Demonstration and impact evaluation

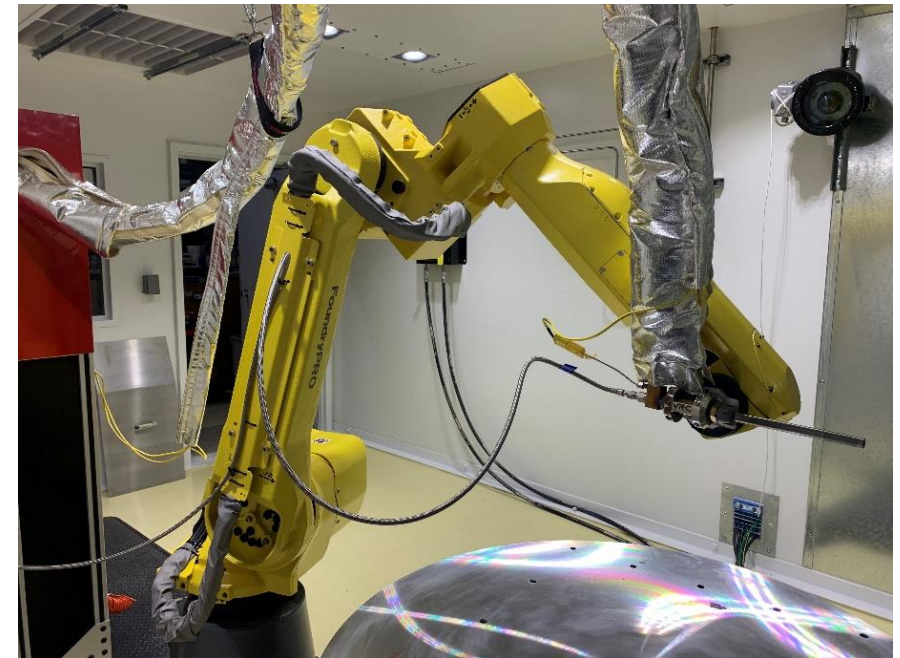




Action Plan Topic: Asset Management

Project: Cold Spray

- Background – Develop a commercially viable cold spray repair process as an alternative to arc welding for hydropower cavitation repair
- FY21 Progress – Cold Spray Validation Tests
 - 2 Trials, 1) stationary equipment 2) portable capable robotic arm
 - Improvements in cavitation resistance varies w/process & powders
 - Project plan developed for initial field application including SSB
- Next Steps – Field Demonstration & Monitoring
 - Federal and private field application sites are in discussion
 - Inspections will include adhesion, thickness and metallography
 - Long-term monitoring and testing



PNNL Robotic Cold Spray System



Action Plan Topic: Asset Management

Project: Advanced Manufacturing Roadmap

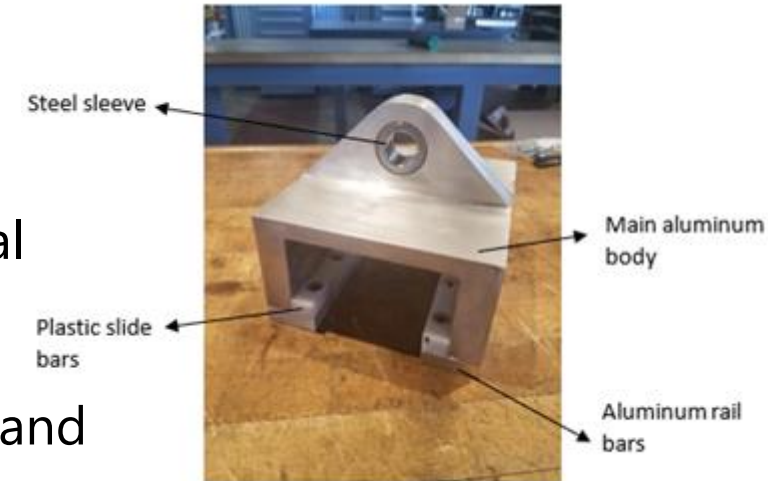
- Background – Develop roadmap identifying high-impact opportunities to leverage advances in manufacturing and materials for hydropower applications
- FY21 Progress – Develop Draft Report
 - Development of Draft Manufacturing for Hydropower R&D Gaps and Solutions Report
 - Includes information gathering and defining opportunities
- Next Steps – Task Finalization
 - Develop metrics to analyze opportunities
 - Workshop seeking industry feedback during the new year
 - Finalize and publish Manufacturing for Hydropower R&D Gaps and Solutions Report



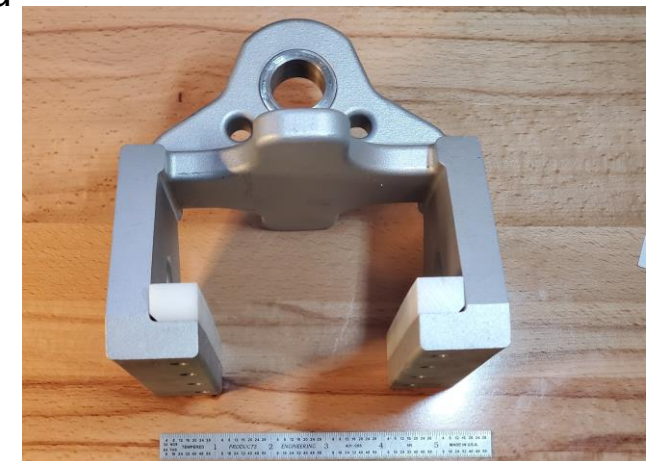
Action Plan Topic : Asset Management

Project: Additive Manufacturing For Hydro Components

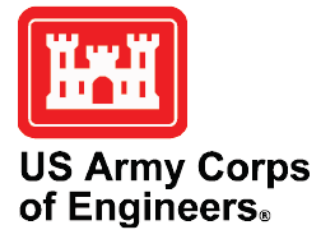
- Background –Utilize metal printing to create parts, minimizing material cost, labor, and improve design
- Phase 1 Progress – Materials and Mechanical Test programs complete and reports finalized for the following:
 - Direct energy deposition (DED) stainless, Laser Powder bed fusion (L-PBF) stainless, Cold Spray aluminum 6061
- Phase II Case Study Progress
 - Anchors (Nimbus Dam) – Printed & testing complete, field install & testing pending.
 - Slinger Rings (Grand Coulee) – To be printed by sub to ORNL. Explored 3D printed casting, warpage of test castings occurred. Final castings will not be pursued.
 - Governor parts (Glen Canyon) – Stainless portions printed by ORNL using powder bed fusion process. Brass portions to be printed w/aluminum bronze sub to ORNL.



Original Anchor



Printed Anchor



Action Plan Topic: Value of Hydropower

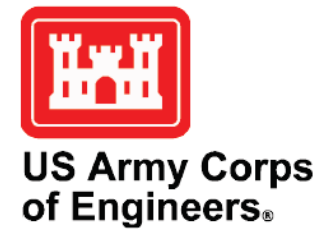
Hydropower provides value to the bulk electric system beyond clean energy generation through a variety of critical ancillary services. These ancillary services support other generation resources and helps balance the regional areas within the grid. This topic will look at value beyond present energy generation rates. Collaboration with Federal hydropower customers will be essential. Hydropower, as a carbon-free resource that provides both capacity and energy, will become increasingly important and valuable as the industry moves forward.



Action Plan Topic: Value of Hydropower

Project: Value of Hydropower in Regional Electricity Markets

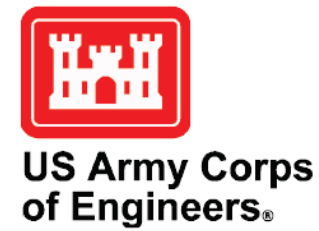
- Background
 - Industry evolution is driving shifts to centralized markets. WAPA is active in bilateral and energy imbalance markets and also evaluating centralized day-ahead and RTO market opportunities with neighboring entities.
 - Hydropower resources provide valuable, carbon-free, and dispatchable generating capacity that supports critical reliability functions and system flexibility in addition to providing energy. Drought, extreme weather events, regional shortages in generating capacity, and transmission constraints are significant threats.
- Project focus
 - Case studies on WAPA's system to evaluate implications of industry changes on the operation and value of WAPA's hydropower resources, including for resilience. Opportunities for synergies with HydroWIRES program.
- Next steps
 - WAPA regions collaborating with EERE to develop and refine case study focus.



Action Plan Topic: Value of Hydropower

Project: Marketing Federal Hydropower with Drought Conditions, Additional Renewable Resources, and Changing Markets

- A two part project:
 1. Study the impact and hydropower's potential role in facilitating the integration of non-dispatchable renewable energy resources within the Upper Colorado River Storage power system and the Colorado River Storage Project service area
 2. Improve hydropower modeling in energy production cost models to better inform decision-making about hydro production and river operations, and how to optimize Lower Colorado River Basin hydropower in increased inverter-based renewable generators and drought scenarios
- Funding established by DOE for Argonne National Lab and National Renewable Energy Lab
- Scope of work agreed upon by DOE for ANL and NREL
- Calls held with DOE and National Lab team to establish stakeholder communications plan
- Next steps
 - Develop USBR engagement plan



Action Plan Topic: Value of Hydropower

Project: HydroWIRES Pumped Storage Hydropower Valuation Framework (Pilot: Mt. Elbert Overhaul/Upgrade Evaluation)

- Develop a framework and methodology for valuation of a pumped storage hydropower facility to develop a cost-benefit and decision matrix valuation report for Reclamation's Mt. Elbert Pumped Storage Powerplant
- Funding and scope of work have been established by DOE and USBR for Argonne National Laboratory to begin work
- Kickoff meeting held in October
- Next steps
 - Begin collaborative work to develop the model

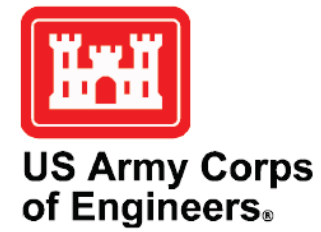


Action Plan Topic: Workforce

Under this MOU, the Agencies intend to analyze and expand training needs within the industry and develop opportunities to deploy collaborative training. In addition, the Agencies may collaborate on the development of recruiting strategies to attract qualified specialists necessary to ensure a diverse and multifaceted Federal hydropower workforce.

Action Plan Activities:

- Training needs analysis and development of training
- Hydropower collegiate competition
- Building out a hydropower STEM portal



Training needs analysis and development of training

Collaboration between the Army Corps of Engineers and the Bureau of Reclamation to develop an organized training path in fundamental electrical and mechanical concepts would result in a better base of knowledge for new hires and enhance current staff's knowledge.

Hydropower collegiate competition

A hydropower collegiate competition would be designed based on a collegiate competition model that DOE and NREL have successfully implemented for other technology sectors. The hydropower competition would bring together bright, soon-to-be workforce entrants to solve real-world problems with partner hydropower operators and utilities

Building out a hydropower STEM portal

Connect students and educators with DOE's Hydropower STEM Portal to outline career path opportunities within the hydropower industry. Project intends to have participating agencies advise and disseminate the portal to potential candidates.



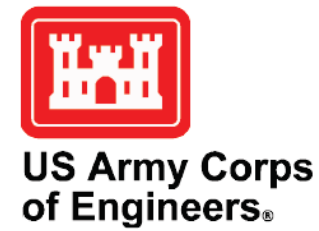
Action Plan Topic: Workforce

- Training needs analysis and development of training
 - Meetings continue with participating agencies and team from NREL to develop survey tools and reporting products to:
 - Identify common KSAs, existing training within participating agencies, and alternative training solutions
 - Perform training needs, gap, and DIF analysis
- Hydropower Collegiate Competition
 - First cohort to be launched in early 2022
 - Inaugural year deliverables: case study of current problems (to include plan development/systems integration) and industry/community outreach activities
- Hydropower STEM portal
 - Topics include hydropower workforce data and analysis, STEM resources, networking and career building, prizes and competition, and water power site tours
 - Site is currently accessible to the public and updated regularly



Action Plan Topic: Water Supply Reliability

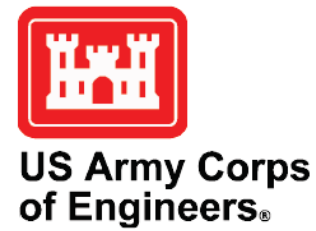
With the current water reliability challenges facing the United States, the US Army Corps of Engineers, the Bureau of Reclamation, and the Department of Energy plan to work together to share information and identify areas of collaboration and to understand and to build resilience into water-energy systems.



Action Plan Topic: Water Supply Reliability

Irrigation Modernization Visualization Tool for Grant Applicant Support

- DOE funds the Irrigation Modernization project at INL and PNNL to develop IrrigationViz, a pre-engineering design decision support and visualization tool for irrigation districts planning modernization projects – which could be useful in applying for grants such as WaterSMART
- The Bureau of Reclamation and the Department of Energy had several discussions including a briefing from the lab team on the status of the tool development and capabilities, and follow-ups
- The group agreed the tool needs further development before it could potentially serve as a resource for grant applicants



Action Plan Topic: Water Supply Reliability

- Water Supply Risk and Assurance
 - US Army Corps of Engineers and Bureau of Reclamation are considering how water supply reliability and risk relates to hydropower production
 - This project is for information sharing amongst partners to determine if there are any helpful steps for collaboration on these ongoing activities
 - Discovery is still underway



Action Plan Topic: Environmental Outcomes

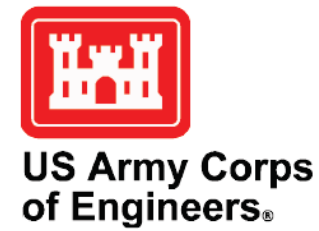
The Bureau of Reclamation, Department of Energy, and US Army Corps of Engineers seek to understand and optimize environmental outcomes and achieve cost stability through technology development, deployment, data collection, monitoring, modeling, and best available science. Because environmental costs make up a significant portion of Federal hydropower energy rates, the Agencies intend to investigate new methods and technologies to meet environmental standards at a lower cost while maintaining operational flexibility and generation.



Action Plan Topic: Environmental Outcomes

Project: Fish Protection

- **Project Summary:** Explore novel technologies and improvements to existing technologies to improve fish passage and exclusion.
- **Lead Agency:** DOE WPTO and Reclamation
- **Participating Agencies:** USACE
- **Deliverable:** Summary document providing recommendations on future funding pathways for viable ideas, traditional research at labs or Federal facilities, and additional programming to evaluate technologies through partnering with businesses.



Action Plan Topic: Environmental Outcomes

Project: Fish Protection

- Two Prize Competitions (FY19 and FY20)
- Three FY20 winners conducting R&D with PNNL support:
 - Alden Research Lab, *"Deal with the Devilfish: Biometric-Informed Screening Technology"*
 - Prometheus Innovations, LLC, *"Fish Diversion Material & Inspection Improvements"*
 - Natel Energy, LLC, *"The Center Sender"*
- USACE/Reclamation interested in proof-of-concept R&D on cavitation barriers (using cavitation as a physical barrier to fish passage)
- DOE/Reclamation mapping next steps for R&D and support options (i.e., SBIR, FOA, or Build-Test Prize)

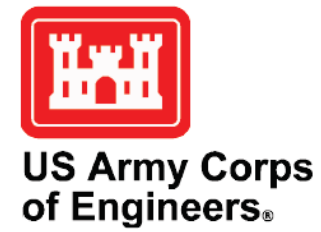




Action Plan Topic: Environmental Outcomes

Project: Environmental Cost Areas Research

- **Project Summary:** Identify primary cost drivers for environmental mitigation and associated impacts on energy rates. Determine the most logical areas to focus on future environmental cost mitigation research, leading to new project ideas to mitigate these costs.
- **Lead Agency:** Reclamation and USACE
- **Participating Agencies:** WPTO, DOE National Labs
- **Deliverable:** A database of environmental mitigation costs to inform cost reduction efforts and provide benchmarks for new technologies.



Action Plan Topic: Environmental Outcomes

Project: Environmental Cost Areas Research

- Preliminary planning discussions between USACE and Reclamation staff to identify applicable environmental mitigation activities
- Next Steps – activity impact analysis

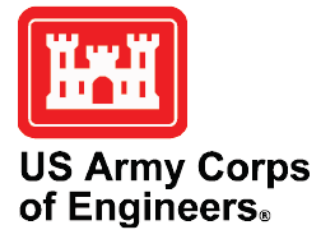




Action Plan Topic: Environmental Outcomes

Project: Hybrid Hydropower Storage for the Downstream Environment

- **Project Summary:** Focus ongoing grid-scale battery energy storage system research on storing hydropower energy to allow optimum environmental downstream water releases to mitigate impacts of hydropeaking water flow fluctuations.
- **Lead Agency:** DOE WPTO
- **Participating Agencies:** Reclamation
- **Deliverable:** Documented research needs and recommendations.



Action Plan Topic: Environmental Outcomes

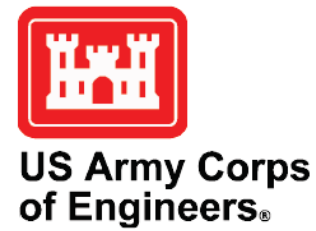
Project: Environmental Tradeoffs

Energy Flexibility-Environment Tradeoffs (HydroWIRES Topic A)

- Interactive map linking environmental to power outcomes through flow
- Dataset of instream flow requirements from FERC licenses
- Energy Flexibility-Environment Tradeoffs workshop leading to international collaborations and knowledge transfer
- Case studies and prototype tools creating pathways for finding energy-environment win-wins

Next Steps – Energy Flexibility Environment Tradeoff Tools

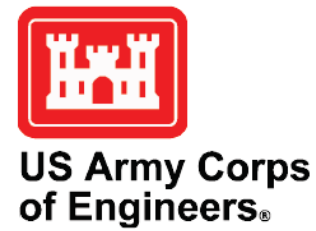
- Case studies that evaluate the tools including assessing environmental and economic outcomes of battery + hydro



Action Plan Area: Environmental Outcomes

Project: Oil-free Hydropower Technologies for Environmental Protection

- **Project Summary:** Explore elimination of oil in hydropower equipment that poses risks of water pollution, such as oil-free Kaplan turbine hubs.
- **Lead Agency:** USACE (HDC)
- **Participating Agencies:** Reclamation, DOE WPTO, and appropriate PMAs
- **Deliverable:** Report out on three-agency work-to-date in the area of oil-free hubs (to include lab testing completed-to-date, potential sites, etc.), identification on remaining critical unknowns, and developing and executing a pilot study that would field test and advance the application of oil-free hub equipment.



Action Plan Area: Environmental Outcomes

Project: Oil-free Hydropower Technologies for Environmental Protection

Two ongoing efforts for accelerated testing

1) Testing of self-lubricating bushing materials used in runner hubs

- Test stand design, fabrication and bushing testing to be performed by PNNL
- Goals of test program:
 - Identify material(s) which offer best performance
 - Establish friction requirements
 - Establish wear rates to better predict bushing life
- Current status – Test stand design being finalized. PNNL has a solid model rendering of test stand with key component

2) Corrosion fatigue testing of steel components used in hub internals (primarily blade operating mechanism)

- Limited fatigue information currently available for stainless steel materials used in water-filled runner hubs
- Corrosion fatigue testing is proposed to validate manufacturer data
- Current status – Testing is in proposal phase



Q&A

To ask a question: submit your question in the Chat Box and select "Everyone"



Thank you!