Alternative Opportunities for Hydropower

Advancing hydropower’s unique, untapped value beyond traditional electricity production and distribution

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WPTO R&D Deep Dive Webinar Series

• Archive of R&D Deep Dive Series available online (link in chat)

• Next webinar in August 2022
Welcome!

- This webinar will be recorded and made available to registrants.
- 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 the Q&A OR Chat Box
  - If you have technical issues, try calling into the webinar via phone.

Thank you for participating!
Speakers and Introduction

Madden Sciubba is a Hydropower Engineer Support Contractor to the Water Power Technologies Office. She supports the Innovations for Low-Impact Growth portfolio, which includes the Alternative Opportunities for Hydropower Project.
Why is this work important to WPTO?

Goal: Identify specific opportunities where hydropower investments can provide benefits beyond the energy sector

➢ Water security
➢ Economic development

Seeking to understand the technical and economic feasibility of these new opportunities
Speakers and Introduction

Rajiv Prasad is an Earth Scientist at Pacific Northwest National Laboratory. He works on projects related to water resources, environmental modeling, climate change impact assessment, and extreme events. His background includes civil and environmental engineering, surface water hydrology, and scaling. He is the lead principal investigator for the Alternative Opportunities for Hydropower project.

Trevor Atkinson is an Earth Scientist at the Idaho National Laboratory working on projects ranging from hydropower to geothermal energy. He comes with a background in environmental science, clean energy exploration and production, as well as subsurface energy research. He leads the INL’s efforts in Alternative Opportunities for Hydropower along with other researchers.
Alternative Opportunities – Work Summary

• First phase – understanding what Alternative Opportunities exist
  o Cataloged examples and corresponding benefits
    ✓ Identified most promising opportunities
• Second phase – understanding benefits, beneficiaries, and value streams
  o Identified complementary subopportunities
    ✓ Insights: why are some projects successful?
Alternative Opportunities – Work Summary

• First phase – understanding what Alternative Opportunities exist
  o Outreach
    o Interviews and phone calls with stakeholders
  o Synthesis
    o Understanding the state of hydropower implementation
Top 5 Alternative Opportunities

- Irrigation Modernization
- Environmental Restoration and Cleanup
- Deferrable Loads
- Water Supply and Treatment
- Source Water Recharge
Water Supply and Treatment

**Concept:** recover excess energy in water conveyance to support self use, export to the utility (e.g., net metering), and energy sales (e.g., power purchase agreements)

**Example:** San Gabriel Valley Water Company installed hydropower turbines in two of its water supply and treatment plants
Water Supply and Treatment

Successes:
- Relatively rapid payback
- Reduced net energy use
- Increased system reliability
- Increased revenues

Challenges and/or Barriers:
- Permitting
- Interconnection

https://www.nlineenergy.com/case-study-san-gabriel-sandhill-project/
Water Supply and Treatment

Enabling Technologies

• In-conduit hydro turbines
• Pump-as-turbine (PaT)

San Gabriel Valley Water Company-310 kW
Source Water Recharge

**Concept:** within source water recharge wells (e.g., aquifer storage and recovery (ASR)), recover excess pressure head as hydropower to reduce operational costs (e.g., net metering)

**Example:** City of Pendleton’s ASR system generates energy during recharge; net metering is used to reduce operational costs of the ASR system
Source Water Recharge

Successes:
- Sustainable water supplies
- Relatively rapid payback
- Reduced operational costs

Challenges and/or Barriers:
- Permitting
- Aquifer characteristics
- Water rights
- Variability of sources water flows
Source Water Recharge

Enabling Technologies

- In-conduit micro-hydro devices
- VFDs and regen drives on existing pumps (reverse flow)

City of Pendleton, Oregon

100 HP VFD

45 kW Regen Unit
Irrigation Modernization

**Concept**: recover excess energy in irrigation water conveyance to support self use, power farm equipment, and export to the utility

**Example**: Farmers Irrigation District in Oregon has two in-conduit hydropower facilities
Irrigation Modernization

Successes:
- Reduced pumping costs
- Reduced operation and maintenance costs
- Increased water availability and reliability
- Increased in-stream flows

Challenges and/or Barriers:
- Flow variability
- Power market access
- Capital availability
- Regulatory environment
Irrigation Modernization

Enabling Technologies

- Piped irrigation canals with appropriate turbine (Pelton, Francis, etc.)
- Fixed or floating in-canal hydrokinetic technologies

Farmers Irrigation District, Oregon- Francis units (3 MW total)
Environmental Restoration and Cleanup

**Concept:** reduce flow velocities in incised channels by capturing energy and promote reconnection of historical floodplains, increase groundwater recharge, and improve degraded habitat

**Example:** currently conceptual
Environmental Restoration and Cleanup

Potential Successes:
• Improved environmental outcomes
• Mitigate impacts of climate change
• Support microgrids in remote locations

Challenges and/or Barriers:
• Regulatory environment
• Public perception
• Lack of partnerships
Environmental Restoration and Cleanup

Enabling Technologies:

• Fish friendly turbine technologies are increasing
• Very low head turbines in a run-of-river scenario
• In stream hydrokinetic devices

Natel Energy-Restoration Hydro
MJ2 Technologies-Very Low Head (VLH) turbine
New Energy Corp-Envirogen Turbine
Deferrable Loads

**Concept:** use hydropower to service non-time-critical loads (e.g., generating hydrogen or charging batteries)

**Example:** Douglas County PUD in WA is installing a 5MW pilot project at its Wells Dam
Deferrable Loads

Potential Successes:
- Increased revenue from optimal use of hydropower
- Increased load balancing capabilities
- Clean energy storage

Challenges and/or Barriers:
- Largely conceptual
Deferrable Loads

Enabling Technologies:

• Traditional turbines coupled with existing facilities
• New technologies that combine hydro with electrolyzers or batteries

Cummins HyLYZER electrolyzer

Andritz-HyBaTec hybrid solutions
Q&A

Thank you for attending!
WPTO Alternative Opportunities Workshop

2-day virtual workshop (dates coming soon)

• 2 hours each day

Day 1: existing examples

• Presentations from owners of currently implemented alternative opportunities

Day 2: discussions

• Why are some projects successful?
• Why are similar projects not implemented more widely?
• What partnerships are needed?
• How can WPTO help?