1.5.1.502 – HydroSource

HydroSource

A comprehensive and unique National Energy-Water digital platform designed to help the hydropower community make data driven decisions

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Email: debd@ornl.gov
Presentation Date: 07/27/2022
**Project Overview**

### Project Summary

- HydroSource is the most comprehensive and unique National Energy-Water digital platform designed to help hydropower stakeholders make data-driven decisions with diverse datasets.
- Addresses lack of access to information necessary to support hydropower related decision-making.
- Uses data science and data analytics to develop data collections and tools to effectively assemble, consolidate, and compare diverse datasets from a range of sources across the hydropower spectrum.

### Intended Outcomes

- HydroSource provides streamlined access to authoritative information about U.S. hydropower assets and hydropower development potential to serve the data needs of a diverse user-base:
  - facilitate interdisciplinary investigations
  - use of new analytical capabilities and tools to weigh multi-objective tradeoffs and support stakeholder decision-making at basin scales
  - play a critical role in ‘water-data’ landscape

### Project Information

<table>
<thead>
<tr>
<th>Principal Investigator(s)</th>
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<tbody>
<tr>
<td>Debjani Singh</td>
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<table>
<thead>
<tr>
<th>Project Partners/Subs</th>
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<tbody>
<tr>
<td>Internet of Water</td>
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<tr>
<td>Hydro Research Institute (HRI)</td>
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<td>Kearns &amp; West</td>
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<table>
<thead>
<tr>
<th>Project Status</th>
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<tbody>
<tr>
<td>Ongoing</td>
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<table>
<thead>
<tr>
<th>Project Duration</th>
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<tbody>
<tr>
<td>Project Start Date: October 2010</td>
</tr>
<tr>
<td>Project End Date: Ongoing</td>
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<table>
<thead>
<tr>
<th>Total Costed (FY19–FY21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3.184 Million</td>
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</tbody>
</table>
Project Objectives: Relevance to Program Goals

Challenge: Lack of access to information to support decision-making

Programmatic Activities:
• Support the development of systems and standards to improve access to integrated water data and information relevant to hydropower stakeholders.
• Improve capabilities to analyze multifaceted types of hydropower and water data to better identify opportunities and weigh potential trade-offs at basin-scales

Intermediate Outcome
• Reduced cost/time and greater certainty in federal/state authorization processes for hydro development and relicensing
• Improvements in river/water data availability, accessibility, and management
• Commercialization and use of new analytical tools to weigh multi-objectives trade-offs at basin scales

Long Term Outcome
• Knowledge diffusion for improved decision making processes and basin-wide management of river resources for multiple objectives
• Contribute to clean, renewable future energy portfolio through sustainable development of hydropower
• Energy Security
Project Objectives: Approach
Project Objectives: Approach

HydroSource

A comprehensive and unique National Energy-Water digital platform designed to help the hydropower community make data driven decisions

Hydropower Market Information

Resource Assessment and Characterization

Environmental Research
Cost of Mitigating the Environmental Impacts of Hydropower Projects

Dataset Overview
This dataset compiles data on environmental impacts mitigation costs for 182 hydropower projects based on documents obtained from the U.S. Federal Energy Regulatory Commission (FERC). Data for all measures (which are generally found in the “Developmental Analysis” section of the EA documents) as well as their associated economic information, FERC categorization, and final FERC decision were collected. Due to differences in file type (i.e., PDF, Microsoft Word document, or image) and structure (i.e., different table formats, page and section numbering styles, and section titles), each EA document was manually investigated and all relevant P&M&E data were consolidated in a Microsoft Excel Workbook, referred to below as the EA Cost Database.

DOI
10.21951/1734879

Citation
US Hydropower Development Pipeline, 2021

Download high-res image.

Abstract
This map provides a snapshot of the composition of the U.S. hydropower development pipeline as of December 31, 2020. It displays the location of hydropower projects whose developers have formally registered interest in project development through documents submitted to FERC or Bureau of Reclamation. The map provides project-level information on size and type as well as a summary of the number and capacity of projects at each stage of development.
Project Objectives: Expected Outputs and Intended Outcomes

**Outputs:**

- A standalone data portal housing all publicly available hydropower related datasets at [https://hydrosource.ornl.gov](https://hydrosource.ornl.gov)
- Multiple tools and applications with use-case capabilities that will improve the usage of the datasets (housed on HydroSource) in decision making
- A dedicated user base for hydropower data
- HydroSource as a water data hub in the Internet of Water

**Outcomes:**

- Enhance access to most up-to-date hydropower related information
- Efficient stewardship of science-quality data.
- Facilitate interdisciplinary investigations by providing efficient and harmonized data systems.
- Management and analysis of complex hydrology data.
- Develop and maintain partnerships to expand the use of open data, promote open science, and increase the use of data across multi-disciplinary, multi-agency organizations.
- Demonstrate leadership in Hydropower related data system technology and techniques.
Project Timeline

NHAAP: National Hydropower Asset Assessment Project (HydroSource predecessor)

2010: NHAAP project initiated
- Data acquisition begins
- Existing Hydropower Assets (EHA) data development & validation begins

2011: NHAAP GIS framework & public website development begin

2012: NHAAP website and HydroGIS come online
- Non-powered dam (NPD) resource data released
- First Secure Water Act Section 9505 Assessment released

2013: NSD Final Report released
- 2014 National Hydropower Map released

- National Hydropower Plant Dataset v1 released to public
- 2016 National Hydropower Map released

2015: HydroSource Data Model & Data Dictionary Released
- National Hydropower Plant Dataset v2 released to public
- 2018 National Hydropower Map released

2016: Second Secure Water Act Section 9505 Assessment released
- Project FERC dockets accessible through HydroGIS

2017: U.S. Stream Classification System released

2018: NHAAP: National Hydropower Asset Assessment Project (HydroSource predecessor)
Project Timeline Cont. (Peer Review Period)

FY 2019
- Initial scoping of potential thematic map series
- Updated Existing Hydropower Asset (EHA) dataset
- Initial scoping of HydroSource website redesign

FY 2020
- Redesign of HydroSource Website
- Started development of HydroSource Data Explorer
- Published National Hydropower Map
- Published 5 new datasets and updated the EHA dataset
- License agreement with Hydropower Research Institute (HRI).
- Initial analysis of the impact of expanding wild and scenic rivers on Hydropower
- Developed 3 thematic map series
  - Relicensing
  - Fish Species of Concern
  - Environmental Mitigations

FY 2021
- Completed development and released the HydroSource Data Explorer to the public along with its API
- HydroSource Data Story published at the Basin Scale Data Access workshop
- Added new functionalities to the website
- Published 20 new datasets and updated EHA dataset
- Collaborated with Internet of Water to establish HydroSource as a Water Data Hub
- Completed analysis of the impact of expanding wild and scenic rivers with most recent hydropower infrastructure data
## Project Budget

### Total Project Budget – Award Information

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<th></th>
<th>DOE</th>
<th>Cost-share</th>
<th>Total</th>
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<tr>
<td></td>
<td>$3.148 Million</td>
<td>None</td>
<td>$3.148 Million</td>
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### FY19 FY20 FY21 Total Actual Costs FY19–FY21

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<th>Costed</th>
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<tr>
<td>FY19</td>
<td>$384,000</td>
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<tr>
<td>FY20</td>
<td></td>
<td>$986,000</td>
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<td></td>
</tr>
<tr>
<td>FY21</td>
<td></td>
<td></td>
<td>$1,778,000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>$3,148,000</td>
</tr>
</tbody>
</table>
End-User Engagement and Dissemination

HydroSource strives to engage with end-users through

• Workshops
  – Basin scale data access workshop
• Webinars
  – Industry/commercial engagement through the NHA transparency series
  – Uncommon Dialogue working group meetings
  – Agency and institutional engagement through USFWS & USDOI sponsored “Turbine Talk”
• Web portal: https://hydrosource.ornl.gov
  – “Contact Us” form enables public to provide specific feedback on portal or data
• Conference Presentations
Performance: Accomplishments and Progress

HydroSource Data Explorer

- Estimating hydropower generation and capacity by administrative or hydrologic boundaries or other attributes
- Visualizing hydropower potential of a basin
- Analyzing existing facilities/hydrology around a new development site
- Identifying hydropower plants that are up relicensing in a basin or state
- Recognizing mitigations associated with the hydropower plants that are up for relicensing
Performance: Accomplishments and Progress

The 2020 National Hydropower Map

Thematic Map Series: U.S. Hydropower and Fish Species of Conservation Concern

Downloads
- omil fish alloshad eha (pdf)
- omil fish alloshad exlicense (pdf)
- omil fish alsturgeon eha (pdf)
- omil fish alsturgeon exlicense (pdf)
- omil fish ameel eha (pdf)
- omil fish ameel exlicense (pdf)
- omil fish armshad eha (pdf)
Performance: Accomplishments and Progress

Basin Scale Relicensing Opportunity

- ORNL DAAC
- HydroSource
- ORNL Internal Home
- TimeTracker
- Slack | ORNL-DAAC
- code-int
- Tracking New Data
- New Tab
- HydroSource App

Legend
- Multiple dams on river - Capacity ≤500 MW
  - Difference from average relicensing year in river reach
    - ≥10 years
    - 2.1 to 9.9 years
    - 1 to 1.9 years
    - 0.9 to 1.1 years
    - ≤10 years

- Multiple dams on river - Capacity ≤100 MW
  - Difference from average relicensing year in river reach

- HUC10 Multi-dam Rivers
  - Average FERC relicensing year on river
    - After 2051
    - 2041-2050
    - 2031-2040
    - 2021-2030
    - Before 2021

This hydropower facility on the Red River will be relicensed in 2047. There are 2 dams on the Red River with an average FERC relicensing year of 2047.
Performance: Accomplishments and Progress

Web Analytics

Visit Length

Site: Hydrosource
Period: 1/1/2021 - 6/28/2022
## Performance: Accomplishments and Progress

### Web Analytics

<table>
<thead>
<tr>
<th>Title</th>
<th>URL</th>
<th>Page Views</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td><a href="https://hydrosource.ornl.gov">https://hydrosource.ornl.gov</a></td>
<td>878 (1.9%)</td>
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<tr>
<td>Datasets</td>
<td><a href="https://hydrosource.ornl.gov/datasets">https://hydrosource.ornl.gov/datasets</a></td>
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<tr>
<td>Maps</td>
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<td>744 (1.6%)</td>
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<tr>
<td>Tools</td>
<td><a href="https://hydrosource.ornl.gov/tools">https://hydrosource.ornl.gov/tools</a></td>
<td>681 (1.5%)</td>
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<tr>
<td>Existing Hydropower Assets (EHA), 2021</td>
<td><a href="https://hydrosource.ornl.gov/dataset/EHA2021">https://hydrosource.ornl.gov/dataset/EHA2021</a></td>
<td>672 (1.5%)</td>
</tr>
<tr>
<td>US Hydropower Potential from Existing Non-powered Dams (greater than 1MW)</td>
<td><a href="https://hydrosource.ornl.gov/dataset/us-hydropower-potential-existing-non-powered-dams-greater-than-1mw">https://hydrosource.ornl.gov/dataset/us-hydropower-potential-existing-non-powered-dams-greater-than-1mw</a></td>
<td>672 (1.5%)</td>
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<tr>
<td>Recent Publications</td>
<td><a href="https://hydrosource.ornl.gov/publications">https://hydrosource.ornl.gov/publications</a></td>
<td>604 (4.5%)</td>
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<td>The 2020 National Hydropower Map, Version 1</td>
<td><a href="https://hydrosource.ornl.gov/map/2020-national-hydropower-map-version-1">https://hydrosource.ornl.gov/map/2020-national-hydropower-map-version-1</a></td>
<td>565 (4.2%)</td>
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<tr>
<td>Existing Hydropower Assets Plant Dataset, 2020</td>
<td><a href="https://hydrosource.ornl.gov/dataset/existing-hydropower-assets-plant-dataset-2020">https://hydrosource.ornl.gov/dataset/existing-hydropower-assets-plant-dataset-2020</a></td>
<td>472 (3.5%)</td>
</tr>
</tbody>
</table>
Performance: Accomplishments and Progress

• Redesigned and developed HydroSource Data Portal using the Findable, Accessible, Interoperable, and Resuable (FAIR) principles.
• Developed an Application Programming Interface (API) for the HydroSource Data Explorer.
• Published 30 datasets over the past 3 years.
• Prepare HydroSource Platform for “Big Data”
• Analyzed the potential impacts of expanding the existing 13000+ miles of wild and scenic rivers within US on new and existing hydropower assets.
• Collaborated with Internet of Water (IoW) to enable HydroSource as a water data hub.
• Collaborated with PNNL, Stanford University, U Maine and UNH to investigate water data access at the basin scale.
Performance: Accomplishments and Progress

- Peer Reviewed Journal Articles
  - Debjani Singh, Brennan Smith and Corey Vezina. 2022. HydroSource: A Data Discovery Platform for Hydropower Assets. Accepted in AGU EOS

- Conference Presentation
Future Work

• Improve metadata on the landing page to improve data access.
• Advanced search options that helps users filter down results (e.g. subject, keywords, science themes, map type, file type, year, region).
• Dynamic visualizations to help visualize and analyze complex datasets.
• Collect more user metrics to analyze the impact of HydroSource data across organizations, domains and demographics.
• Integrate and link new and updated datasets into HydroSource Data Explorer and HydroSource Data Model.
• Landing page for associated organizations so users could find related data (e.g. EPA, EIA).
• Form a dedicated user base or a user working group from diverse stakeholder groups who will help define the future direction of HydroSource
Q&A