National Hydropower Asset Assessment Program (NHAAP)
National Hydropower Asset Assessment Program (NHAAP)

The Challenge
Fulfill the hydropower community’s need for a comprehensive U.S. hydropower data set
- Existing asset
- Growth potential
- Environmental concerns

Partners
Bureau of Reclamation (Reclamation), U.S. Army Corps of Engineers (USACE), Federal Regulatory Energy Commission (FERC), and the Energy Information Administration (EIA).
## Next Generation Hydropower (HydroNEXT)

### Optimization
- Optimize technical, environmental, and water-use efficiency of existing fleet
- **Collect and disseminate data on new and existing assets**
- Facilitate interagency collaboration to increase regulatory process efficiency
- Identify revenue streams for ancillary services

### Growth
- Lower costs of hydropower components and civil works
- Increase power train efficiency for low-head, variable flow applications
- Facilitate mechanisms for testing and advancing new hydropower systems and components
- Reduce costs and deployment timelines of new PSH plants
- Prepare the incoming hydropower workforce

### Sustainability
- Design new hydropower systems that minimize or avoid environmental impacts
- Support development of new fish passage technologies and approaches
- **Develop technologies, tools, and strategies to evaluate and address environmental impacts**
- Increase resilience to climate change
Next Generation Hydropower (HydroNEXT)

Optimization

- Optimize technical, environmental, and water-use efficiency of existing fleet.
- Collect and disseminate data on new and existing assets.
- Facilitate interagency collaboration to increase regulatory process efficiency.
- Increase revenue streams for ancillary services.

The Impacts

- Provide best-available baseline U.S. hydropower information to support national R&D:
  - Existing hydropower asset
  - Future potential
  - Environmental characterization
- Help identify potential market opportunities and barriers to stimulate hydropower market acceleration
- Identify data gaps and recommend further collaborative actions to collect and expand U.S. hydropower knowledge base.
Next Generation Hydropower (HydroNEXT)

Sustainability

- Design new hydropower systems that minimize or avoid environmental impacts
- Support development of new fish passage technologies and approaches
- Develop technologies, tools, and strategies of evaluate and address environmental impacts
- Increase resilience to climate change

The Impacts

- Understanding of environmental impacts (e.g. Environmental Considerations in the Hydropower Vision)
- Develop tools to increase the objectiveness, efficiency, and effectiveness of environmental improvement strategies (e.g. environmental metrics and the sustainability of hydropower development)
- Inform the design parameters (e.g. head and flow), co-objectives (e.g. species passage, WQ enhancement, recreation), and market potential that multiple DOE-funded tech developments are targeting.
- Identify environmental and science and knowledge gaps through data exploration and creation, respectively (e.g. Stream Classification and Mitigation Prediction).
## Overview of NHAAP Data Holdings

<table>
<thead>
<tr>
<th>Data Efforts</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline – Baseline Data</strong></td>
<td>A collection of most recent water, energy, infrastructure, and environment data from EIA, FERC, and other sources (<a href="http://nhaap.ornl.gov/content/nhaap-data-sources">http://nhaap.ornl.gov/content/nhaap-data-sources</a>)</td>
</tr>
<tr>
<td><strong>EHA – Existing Hydropower Asset</strong></td>
<td>Location, power plant capacity, historic generation, and other facility information of U.S. existing hydropower fleet and newly licensed projects (updated every quarter)</td>
</tr>
<tr>
<td><strong>NPD – Non-Powered Dams</strong></td>
<td>Undeveloped U.S. hydropower resource potential from over 45000 national non-power dams (DOE 2012 NPD study)</td>
</tr>
<tr>
<td><strong>NSD – New Stream-Reach</strong></td>
<td>Undeveloped U.S. hydropower resource potential from over 2.7 million national new stream-reaches (DOE 2014 NSD study)</td>
</tr>
<tr>
<td><strong>EA – Environmental Attribution</strong></td>
<td>Comprehensive national geospatial polygons summarizing environmental concerns for hydropower development and operation.</td>
</tr>
<tr>
<td><strong>SCT – Stream Classification Tool</strong></td>
<td>A national stream-reach classification system that geospatially characterizes the biophysical settings of stream environments</td>
</tr>
<tr>
<td><strong>MPT – Mitigation Data Set and Prediction Tool</strong></td>
<td>A mitigation prediction model based on mitigation records summarized from over 380 FERC licenses issued within the last 15 years</td>
</tr>
</tbody>
</table>
NHAAP Baseline Services

- Provided fundamental asset, resource, and environmental data to support the DOE Hydropower Vision Study.
- Provided maps, summary tables, and visualizations to support the broader hydropower community.

Historic hydropower Generation
Accomplishments and Progress (II)

Stream Classification Tool

- Completed classification of ~ 1 million stream reaches in Eastern US
- 6 Layers: Hydrology, temperature, size, gradient, confinement, substrate
- Provided 11 different Google Earth layers (.kmz) for each region to be used in licensing/relicensing agreements
Environmental Mitigation Tool

- Developed database of mitigation records for hydropower facilities
- Searched over 380 FERC licenses issued within the last 15 years
- Developed mitigation classification framework
- Developed prediction of mitigation requirements at non-powered dams
## Project Plan and Schedule

<table>
<thead>
<tr>
<th></th>
<th>FY2014</th>
<th>FY2015</th>
<th>FY2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>Released national NPD and NSD maps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>Released final NSD assessment report</td>
<td></td>
<td>Released list of non-federal hydropower on USACE facilities</td>
</tr>
<tr>
<td>Q3</td>
<td></td>
<td>Released 2015 HMR data</td>
<td>Released 2016 updated HMR data</td>
</tr>
<tr>
<td>Q4</td>
<td>Released National Hydropower Map (v2014)</td>
<td>Evaluated NHAAP public outreach efforts</td>
<td>Released National Hydropower Map (v2016)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Released environmental mitigation data</td>
<td>Released Hydropower Plant Data Set</td>
</tr>
</tbody>
</table>

- **Main project components**
  - NHAAP Baseline Services (FY2014 – present)
  - Stream Classification Tool (eastern US, FY2014 – FY2015)
    - New effort in FY2017 on CONUS
  - Mitigation Data Set and Prediction Tool (FY2014 – FY2015)

- **Go/No-Go decision point**
  - FY2015 Q4 evaluation of NHAAP public outreach efforts
    - Accept and proceed
Project Budget

Budget History

<table>
<thead>
<tr>
<th></th>
<th>FY2014</th>
<th>FY2015</th>
<th>FY2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOE</td>
<td>Cost-share</td>
<td>DOE</td>
<td>Cost-share</td>
</tr>
<tr>
<td>$958K</td>
<td>$0K</td>
<td>$858K</td>
<td>$0K</td>
</tr>
</tbody>
</table>

- Cost by main project components:
  - NHAAP Baseline Services: ~$500K/FY (FY2014 – FY2016)
    - Outreach and external data support
    - Visualization and program support
    - Data update and expansion
    - IT operation and maintenance
  - Stream Classification Tool: 200K / FY (FY2014 – FY2015)
  - Mitigation Data Set and Prediction Tool: 200K / FY (FY2014 – FY2015)
Collaborating agencies

- U.S. Bureau of Reclamation (Reclamation), U.S. Army Corps of Engineers (USACE), Federal Energy Regulatory Commission (FERC), and Energy Information Administration (EIA)

Summary of major data support during FY14–16

- Hydropower Vision
  - Provided asset, resource, and environmental data support
    Hydropower Vision modeling and analysis
- Argonne National Laboratory (ANL)
  - Provided mode-of-operation data to support hydropower-storage study
- Congressional Research Service (CRS)
  - Provided NHAAP existing hydropower asset data
- Massachusetts Department of Protection
  - Provided detailed NSD data to support waste-site remediation study
Next Steps

• Continue to maintain NHAAP as ‘a comprehensive data service effort to support the DOE Water Power Program for various U.S. hydropower R&D data needs’

FY17/Current research

• NHAAP Baseline Services
  – Interagency and Hydropower Industry Engagement
    • Coordination with National Park Service, U.S. Forest Service, National Oceanic and Atmospheric Administration, and other broader hydropower industry / stakeholder groups to increase the usefulness of NHAAP data
  – Information Resource Management and User Services
  – Data Update and Expansion

• U.S. Stream Classification System
  – Development of a U.S. Stream Classification System (SCS) for the entire United States at the NHDPlus stream reach level based on hydrology, temperature, gradient, size, and valley confinement.