



OAK RIDGE NATIONAL LABORATORY

# New Tools and Data Support Hydropower Development

As the demand for more renewable energy increases, researchers at the U.S. Department of Energy's Oak Ridge National Laboratory have developed a suite of [online tools and data](#), as well as [publications](#) to support new, low-impact hydropower growth.

## Renewable Energy Growth Potential

According to a [2014 ORNL study](#), nearly 80 GW of additional hydropower could be added along undeveloped U.S. streams. Most of these streams are considered low-head, meaning they are 30 ft or less from the hydraulic head, for which standard modular hydropower, or SMH, technologies are applicable.

A similar [2012 ORNL resource assessment](#) determined that approximately 12 GW of additional hydropower could be added to non-powered dams, or NPDs, across the nation.

Despite these sizable opportunities, hydropower development remains somewhat tempered as cited in [ORNL's 2022 US Hydropower Development Pipeline Data](#), which showed 46 MW of new stream-reach development projects under consideration, and an additional 1,436 MW from NPDs.

## SMH Technology Concept

ORNL's [SMH technology concept](#) provides a standardized, plug-and-play capability that reduces the need for costly custom builds while preserving the ecological and environmental functionality of the waterway.

SMH facilities can be built on site by stacking modular components specific to the stream or waterway that facilitate hydropower generation while enabling safe passage of fish and other aquatic species, as well as maintaining the area for recreational use.

SMH technology can apply to new stream-reach hydropower development and retrofits for NPDs.

## Accelerating Hydropower Development

ORNL's [SMH Technology Acceleration](#) project focuses on SMH module and facility research and development for new stream-reach development and NPD sites. In addition to working with industry partners, ORNL research has yielded multiple data sets and tools to inform stakeholder decision-making.

### CORE TENETS OF SMH



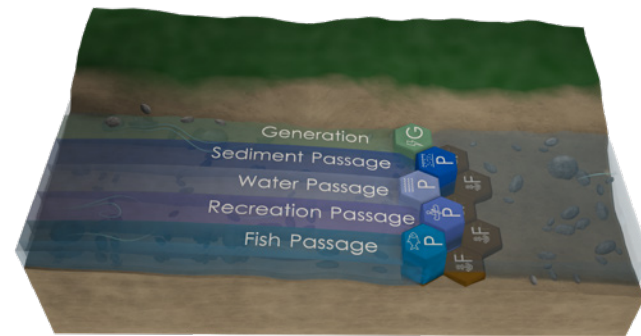
Standardization



Modularity

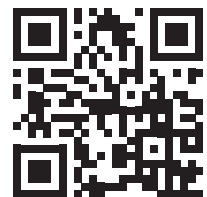


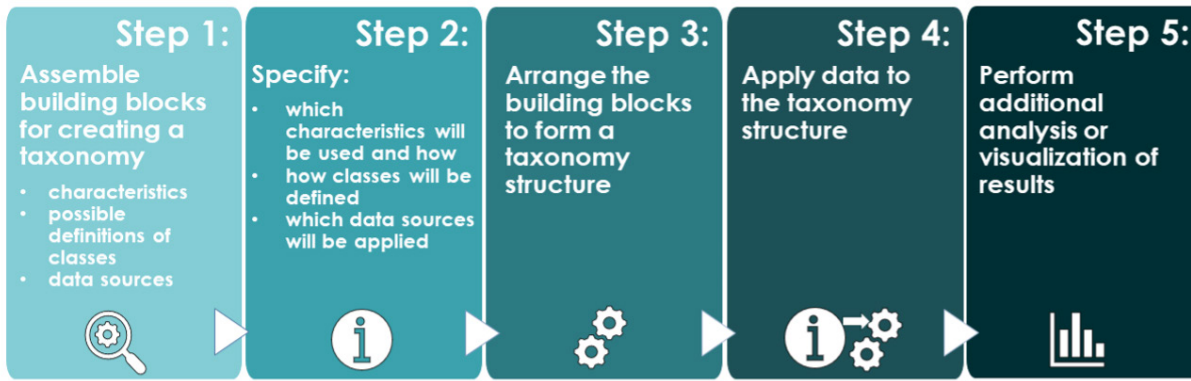
Environmental  
Compatibility



*SMH facility conceptual diagram*

Scan below to  
learn more



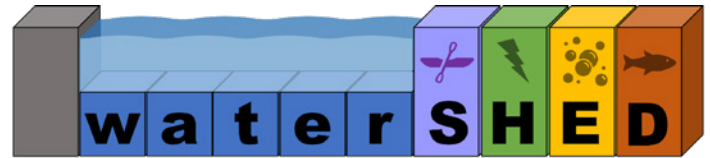


The NPDamCAT framework defines a 5-step framework that can be used to develop customized classes of NPDs based on unique needs of individual stakeholders.

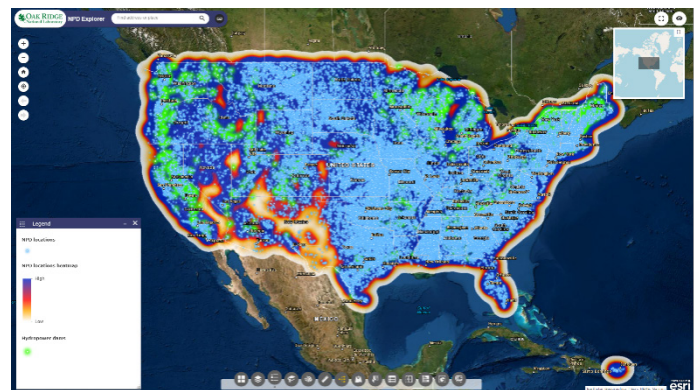
## Online Hydropower Tools

These tools help guide and better inform hydropower infrastructure and policy decision.

- **WaterSHED** – The WaterSHED (water allocation tool enabling rapid small hydropower environmental design) application was developed to virtually demonstrate the design, operation, and feasibility of initiating new, small hydropower projects at sites with existing water infrastructure and new streams. Users can input specific criteria and requirements to begin a simulation of a virtual SMH facility.
- **SMH Explorer App** – This geo-visual analytics platform enables users to secure insights of potential stream-reach hydropower sites by analyzing energy, water, and environmental factors, including foundation, generation, water quality, fish passage, recreation, and sediment types and characteristics.
- **NPD Explorer App** – Functioning as a development sandbox, this application allows users to search specific criteria and download data summaries when researching hydropower viability among NPDs. The application provides geospatial data layers, a common map, and interactive graphics to better visualize search results.
- **NPDamCAT** – From this custom analysis and taxonomy tool, users can group and classify NPDs to review characteristics and data, add preferences and priorities, retrieve data, and download results. The tool enables users to easily select relevant criteria such as environmental conditions, hydropower capacity opportunities, specific regions, and age of streams. Working in connection with the NPD Explorer App, this tool leverages the same data set, the [NPD Characteristics Inventory](#).



The WaterSHED app virtually demonstrates the design, operation, and feasibility of SMH.



The NPD Explorer App enables key stakeholders to research and visualize available hydropower opportunities across the United States.

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