Hydropower Data Access, Analytics, and Workforce Development

Corey Vezina, Hydropower Technology Manager

Allison Johnson, Engagement and Outreach Lead

Outline

Hydropower Data Access and Analytics – Corey Vezina

- Sub-activity Area Overview

- Strategy

- Implementation and Progress

Hydropower Workforce Development – Allison Johnson

- Sub-activity Area Overview

- Strategy

- Implementation and Progress

- Agenda Overview

- Reviewer Introductions

Data Access, Analytics, and Workforce Development Overview

Data Access

Identifying and improving access to valuable hydropower asset data, technology advances, and many other diverse types of dam and river-related information.

Data Analytics

Developing "evergreen" analytical capabilities that can be applied to a diverse range of hydropower-related investigations including basin-scale decisions, energy market applications, and hydropower relicensing processes.

Workforce Development

Supporting the next generation of the hydropower workforce through access to educational materials and workforce development programs.

Lack of Access to Information to Support Decision-Making

- Widely dispersed data on technologies, resources, environmental attributes, markets, etc., which is of differing qualities and difficult to gain access to.

- Costly and time-intensive regulatory processes and poor information and data available/accessible on regulatory process outcomes and drivers.

- Difficulties in analyzing and evaluating tradeoffs due to the many uses of water, as well as changing and sometimes unclear resource management objectives (e.g., environmental, recreational, irrigation, etc.).
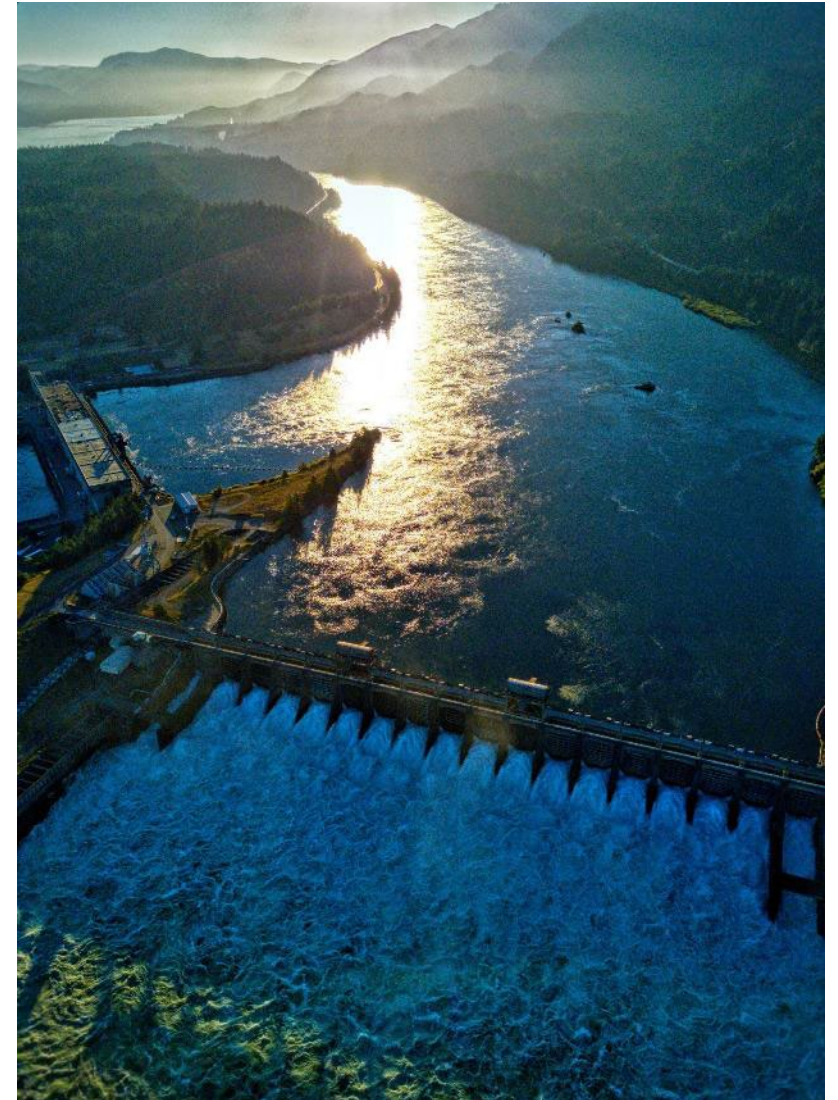
Examples of How Stakeholder Engagement Informed Strategy

WPTO uses its convening role to engage other federal agencies, tribes, the hydropower industry, and nongovernmental organizations to share lessons learned from of the last century of hydropower development.

- Through interviews and analysis, developed, "An Examination of the Hydropower Licensing and Federal Authorization Process".

- Held virtual workshop: "Improving Discovery, Access, and Usability of Data for Basin-Scale River Management".

- WPTO supports and is actively engaged with the Uncommon Dialogue.

- ORNL HydroSource and PNNL River Data projects conducted surveys / interviews on data tool needs.

Data Access and Analytics – Goals

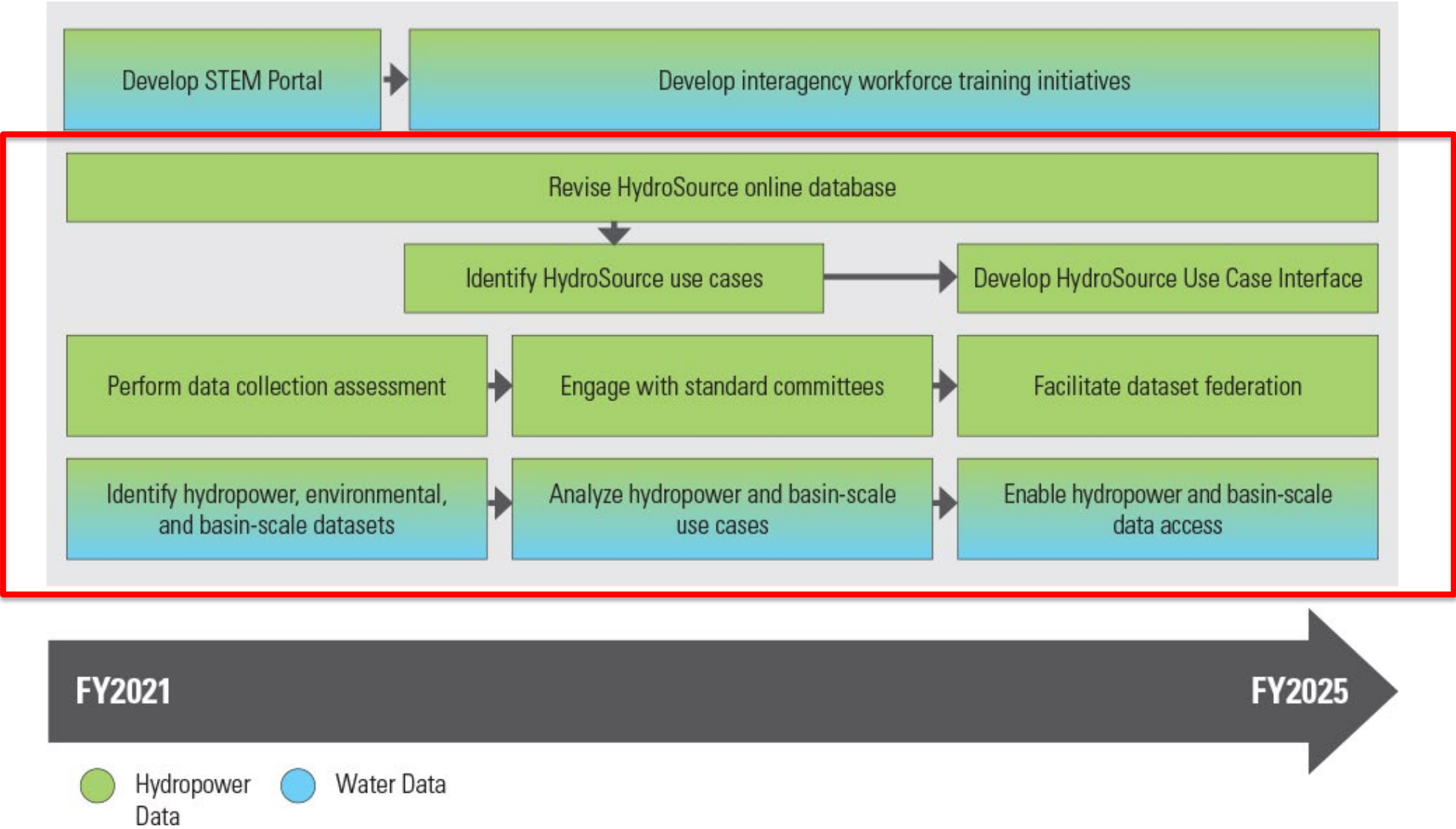## Key Results and Performance Goals (2021–2025)

- ✓ Release a new hydropower-focused STEM/education portal and initiate new partnered efforts to provide data and informational support for high-priority hydropower workforce training needs.
- ✓ Launch DOE's first-ever hydropower collegiate competition and hydropower-focused fellowship program, providing students of diverse backgrounds and disciplines the opportunity to develop key skills for a career in hydropower.
- ✓ Launch and improve the new externally oriented HydroSource online data portal with broad use-case capabilities.
- ✓ Publish a report on the key issues on the time, cost, and uncertainty associated with U.S. hydropower regulatory processes.
- • Leverage machine learning and new big-data access approaches, in collaboration with FERC and other stakeholders, to increase access to information available in FERC's eLibrary.
- • Develop a standard suite of application programming interface (API) capabilities that will provide unprecedented access to power market information for the hydropower community.

Data Access and Analytics – Objectives

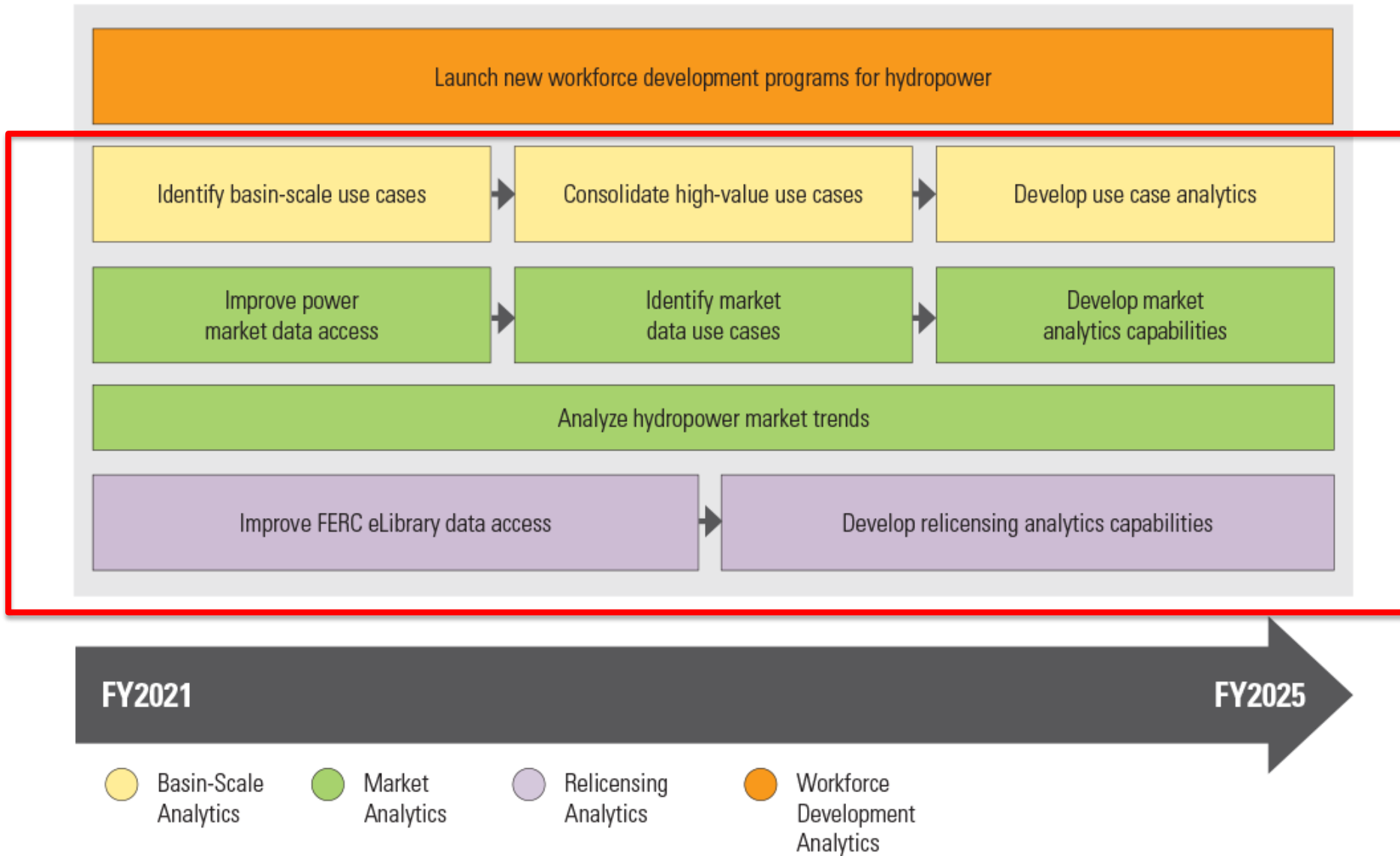## Data Access and Workforce Development Objectives (2026–2030)

- Significantly increased use of the HydroSource portal by a diverse set of stakeholders—beyond the current range of application—along with improved ease-of-use metrics and reviews from users.
- Power market data are utilized by developers of new hydropower technologies to specifically target the greatest opportunities and approaches for growth and are incorporated into future technology development and project planning processes.
- FERC and other stakeholders leverage eLibrary insights along with interdisciplinary big data approaches to improve licensing and relicensing study efforts while maintaining regulatory effectiveness.
- Key issues identified in the U.S. hydropower regulatory process report are utilized by diverse hydropower stakeholders to agree upon and begin to operationalize regulatory process improvements.
- Documented increases in hydropower early-career interest/opportunities and improvements in institutional knowledge-transfer landscape.

Data Access and Analytics – FY21–25 Research Priorities

Data Analytics and Analytics – FY21–25 Research Priorities

Launch new workforce development programs for hydropower

Identify basin-scale use cases → Consolidate high-value use cases → Develop use case analytics

Improve power market data access → Identify market data use cases → Develop market analytics capabilities

Analyze hydropower market trends

Improve FERC eLibrary data access → Develop relicensing analytics capabilities

FY2021 → FY2025

Legend:
- Basin-Scale Analytics
- Market Analytics
- Relicensing Analytics
- Workforce Development Analytics

Key Accomplishments – Data Access and Analytics

Fiscal Year (FY) 2019

Updated Existing Hydropower Asset dataset and scoped redesign of HydroSource website.

Began initial project scoping with universities on Water Data Basin Scale management research.

FY2020

Redesigned and developed HydroSource Data Portal using the Findable, Accessible, Interoperable, and Resuable (FAIR) principles.

Developed initial FERC eLibrary user interface and conducted user research and testing.

Held virtual Federal Roundtable on Water Data Coordination.

Expanded and built out Regulatory and Permitting Information Desktop Toolkit (RAPID) database case studies and capabilities.

FY2021

Published 3rd complete edition of the Hydropower Market Report.

Published ORNL hydropower cost modeling report on cost analysis of baseline and innovation cases for non-powered dam sites.

Completed development and released the HydroSource Data Explorer visualization tool.

Published PNNL report on Improving Discovery, Sharing, and Use of Water Data.

FY2022*

Published report on An Examination of the Hydropower Licensing and Federal Authorization Process.

Conducted workshop on Improving the Discovery, Access, and Use of Water Data for Basin-Scale River Management

Outside of review period for WPTO's 2022 Peer Review

Future Work

- Continue to develop Federal Interagency Data Access workshops.

- Develop and implement HydroSource Climate Visualization tool.

- Continue to build and add new datasets to the HydroSource platform.

- Deploy fully tested and implemented FERC eLibrary tool.

- Continue research and development of future Hydropower Market Report editions.

- Complete analysis of baseline costs for cost modeling of new stream reach development sites.
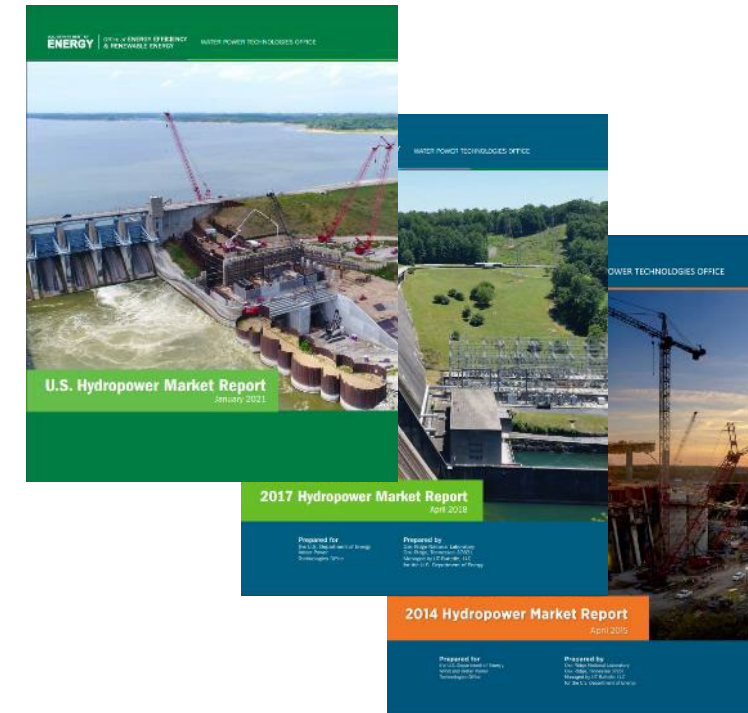
Hydropower Market Report, 2021

Environmental Mitigation Database

Existing Hydropower Assets, 2021

New Stream-reach Development (NSD) Potential

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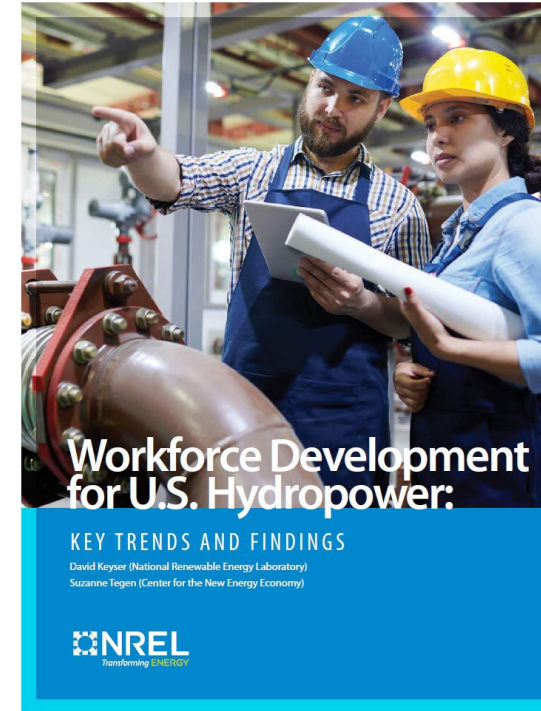
Workforce Development

Supporting the next generation of the hydropower workforce through access to educational materials and workforce development programs.

Challenges the Activity Area Addresses

- Approximately **26% of the hydropower workforce is age 55 and older** and will reach retirement age within the next decade.

- The need to quickly hire large numbers of workers presents recruitment challenges and makes the transfer of knowledge difficult, but it also presents an **opportunity to build the workforce to better reflect the demographics of the United States.**

- An NREL-led curricula assessment and academic survey found **few hydro degree or training programs exist** yet institutions of higher learning reported see **growing demand from employers for students with hydropower education.**

- According to hydropower organizations who employ recent graduates, **new hires have limited to no knowledge of hydro or hands-on experience.**

Workforce Development for U.S. Hydropower (2019)

Q9. How much hands-on experience relevant to hydropower do recent student graduates have before joining your organization?
31 responses

- No hands-on experience
- Limited hands-on experience
- Extensive hands-on experience

51.6%   48.4%

Aging workforce

+

Few hydro degree or training programs

+

Perception among young people that hydro isn't exciting or innovative

=

?

Examples of How Stakeholder Engagement Informed Strategy

Feedback received from the hydropower industry, academia, and students have informed all aspects of WPTO's STEM and workforce development portfolio.

WPTO and NREL have collected feedback through:

- Surveys with industry, academia, and students

- A hydropower workforce and curricula assessment

- Engagement with members of the interagency hydropower workforce committee (under the framework of the Federal Hydropower Memorandum of Understanding)

- Several stakeholder workshops, such as a half day workshop at 2019 Waterpower Week, a workshop with educators and staff from the National Energy Education Development (NEED) Project, and multiple webinars on specific aspects of the water power STEM and workforce portfolio

Curricula Assessment (FY19)

Student Survey (FY20)

Industry Survey (FY21)
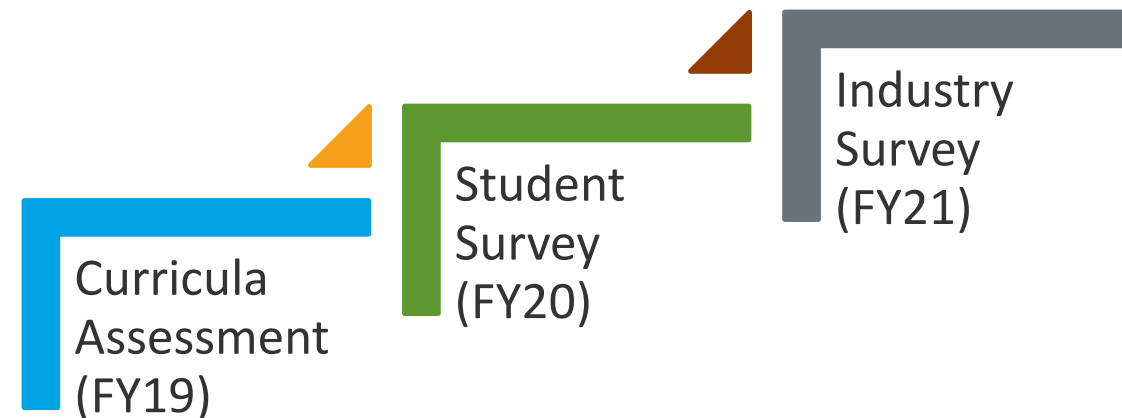
Workforce Development – Goals

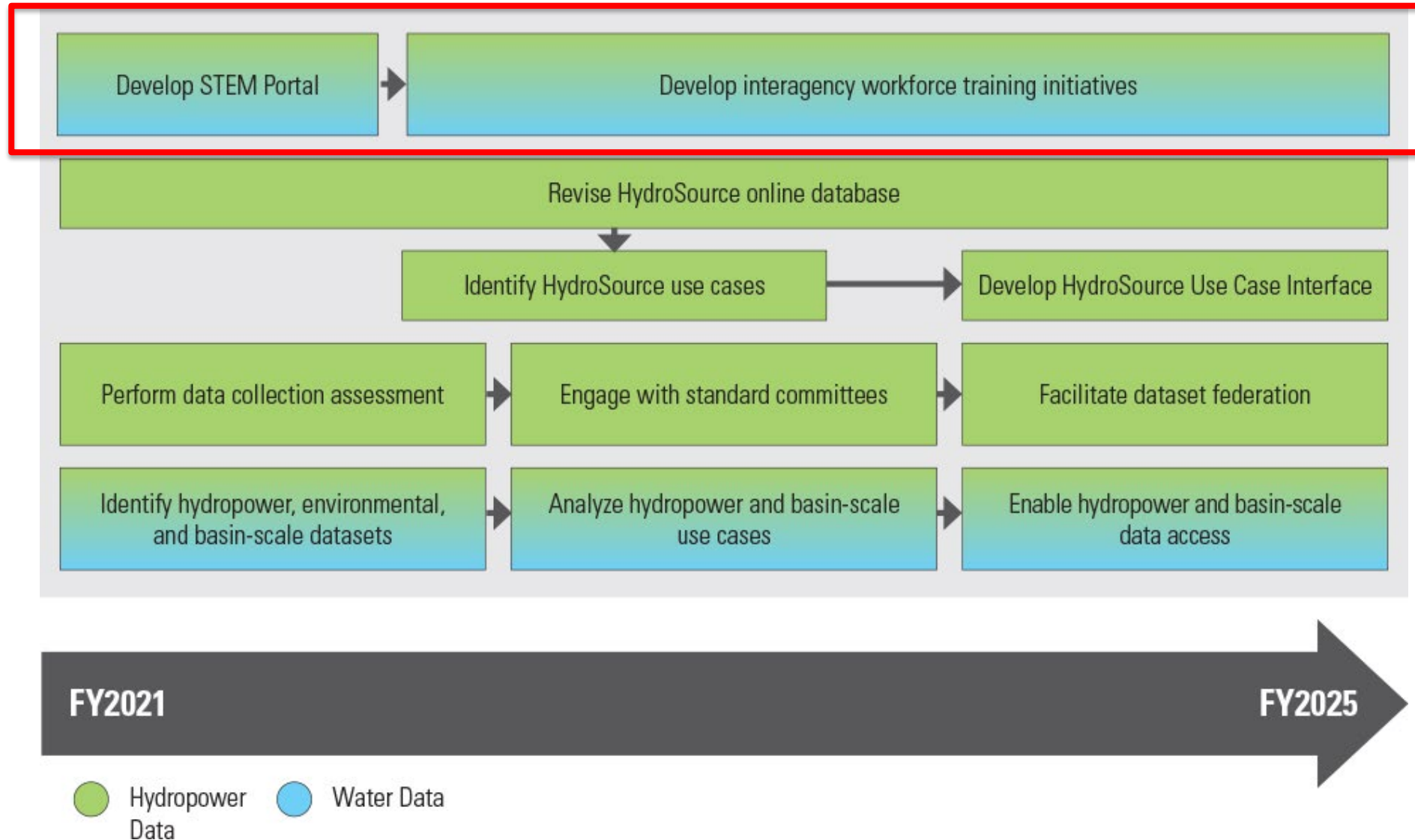## Key Results and Performance Goals (2021–2025)

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Workforce Development Objectives

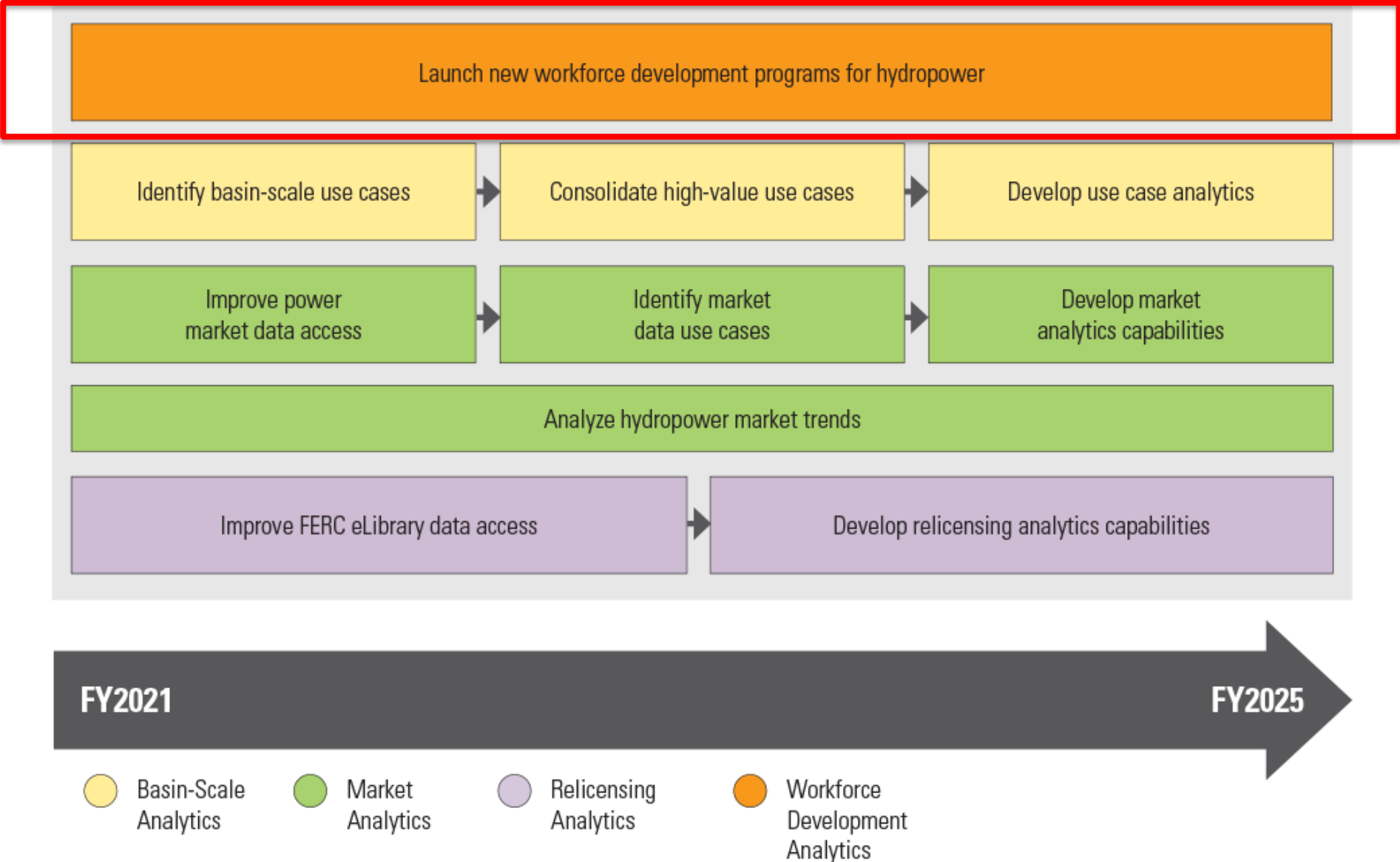## Data Access and Workforce Development Objectives (2026–2030)

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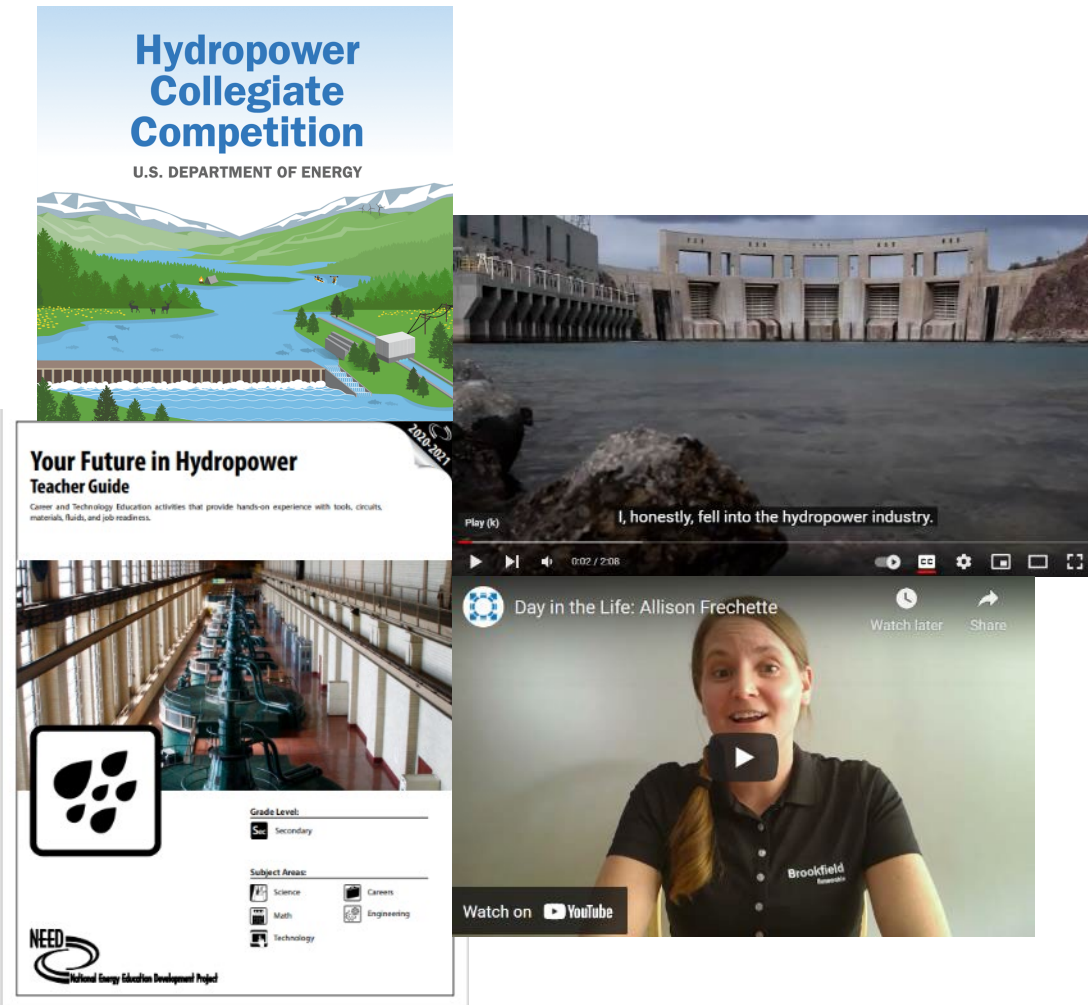# Workforce Development – FY21–25 Research Priorities

Data Analytics

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Improve power market data access	Identify market data use cases	Develop market analytics capabilities

Analyze hydropower market trends

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FY2021 → **FY2025**

- Basin-Scale Analytics
- Market Analytics
- Relicensing Analytics
- Workforce Development Analytics

Implementation and Progress

Mechanism	Target audiences	Reach/impact
MHK Grad Research Fellowship	• Graduate students pursuing marine energy research	A few but deeply
Clean Energy Innovators Fellowship	• Recent graduates (Bachelor's, Master's, and Doctoral graduates) • Early career energy professionals	A few but deeply
Marine Energy and **Hydropower Collegiate Competitions**	• Undergrad students • Community college students • Trade school students • Graduate students • Professors and faculty	100+ students and professors across many disciplines annually
Online STEM Portals for Hydropower and Marine Energy	• K-12 students • K-12 educators • Post-secondary students • Post-secondary educators	Many

Key Accomplishments – Workforce Development

Fiscal Year (FY) 2019

Began scoping the NREL-led workforce project and led an outreach campaign to gather stakeholder input that informed priorities/direction.

Published results from a hydro workforce study which found that expanded training and education programs are needed to meet current and future hydro industry needs.

FY2020

Solidified a 5-year roadmap for the NREL workforce project.

Launched a new Science, Technology, Engineering, and Math (STEM) and workforce development portal for hydropower.
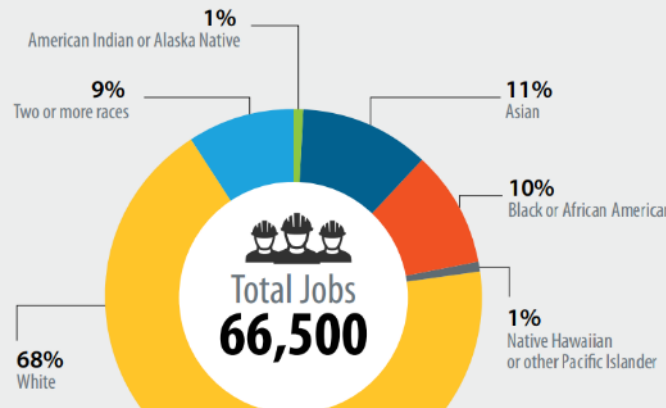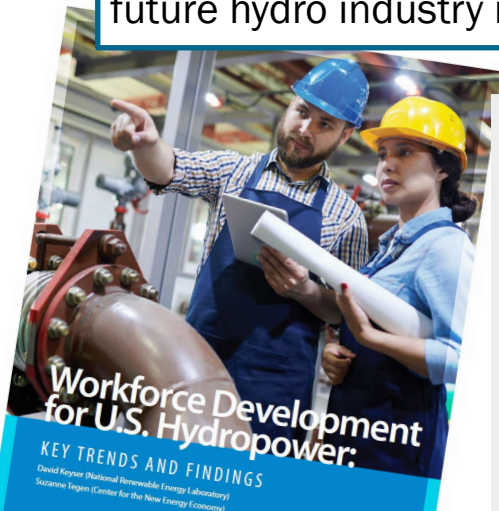
FY2021

Established hydro collegiate competition steering committee with DOE, Hydro Foundation, NHA, and industry.

In partnership with NEED, developed topical and timely hydropower curricula and educational materials (example).

FY2022*

Launched the inaugural Hydropower Collegiate Competition with 11 teams representing various regions of the United States.

Launched the Clean Energy Innovator Fellowship (with EERE partners). **13% of candidates selected water power as one of their top two sectors of interest.**

Workforce Development for U.S. Hydropower:
KEY TRENDS AND FINDINGS
David Keyser (National Renewable Energy Laboratory)
Suzanne Tegen (Center for the New Energy Economy)

Total Jobs
66,500

- American Indian or Alaska Native 1%
- Two or more races 9%
- Asian 11%
- Black or African American 10%
- Native Hawaiian or other Pacific Islander 1%
- White 68%

Outside of review period for WPTO's 2022 Peer Review

Future Work – Workforce Development

Programs
- Manage the inaugural 2023 Hydropower Collegiate Competition
- Co-manage the new Clean Energy Innovators Fellowship
- Starting in FY23, fund the national labs with water power programs to carry out "DEI in STEM" projects

Products
- Develop a hydropower career map showing the skills needed in the hydropower sector
- Release a new educational app and game exploring an island powered by different water power technologies

Analysis & Outreach
- Publish an updated hydropower workforce assessment
- Workshops and presentations at several upcoming water power conferences (such as Hydrovision, Clean Currents, NWHA Fall Regional Meeting)

Scoping New Ideas
- Hydropower-focused fellowship program
- Certification program
- Curricula exchange program
- Collegiate competition supporting entrepreneurship in communities underrepresented in clean energy

Q&A