U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

2019 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
WATER POWER TECHNOLOGIES OFFICE

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INTRODUCTION

Purpose of Peer Review

A peer review is a standard best practice for assessing highly technical, complex projects and programs and is widely used by industry, government, and academia. Peer reviews elicit objective reviews and advice from independent experts to provide the U.S. Department of Energy (DOE) managers, staff, and researchers with a powerful and effective tool for informing the management, relevance, and productivity of government-funded projects. The 2016 Office of Energy Efficiency and Renewable Energy (EERE) Peer Review Guide defines a peer review as:

> A rigorous, formal, and documented evaluation process using objective criteria and qualified and independent reviewers to make a judgment of the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects.

This definition distinguishes in-progress peer review from other types of reviews, such as merit reviews, which are used to evaluate technical proposals for competitive solicitations; "stage gate" or "go/no-go" reviews, which determine whether a project is ready to move to the next phase of development; and other review activities such as quarterly milestone reviews or budget reviews.

A peer review is based on the premise that enlisting third-party experts to objectively evaluate the progress and impact of a technical project and/or program adds a valuable layer to technical program and project management. Peer reviews are essential in providing robust, documented feedback to EERE leadership to inform program planning. They also provide management with independent validation of the effectiveness and impact of its funded projects and program scopes. Knowledge about the quality and effectiveness of current projects and programs is essential in directing (or redirecting) new and existing efforts.

WPTO 2019 Peer Review

EERE's Water Power Technologies Office's (WPTO's) 2019 Peer Review was held on October 8–10, 2019, in Alexandria, Virginia. During the public event, principal investigators (PIs) presented on 77 projects in WPTO's research and development (R&D) portfolio (41 MHK, 36 Hydro), and WPTO staff presented on each program's strategy and key initiatives. These projects and program strategies were systematically reviewed by 24 external subject matter experts from industry, academia, non-governmental organizations (NGOs), and federal agencies. The 2019 Peer Review included tracks across all the Marine and Hydrokinetics (MHK) and Hydropower Programs' activity areas (see Figure 2).

Results of the 2019 Peer Review will be used to help inform programmatic decision making, modify existing projects, guide future funding opportunities, and support other strategic planning objectives. The time period for the 2019 Peer Review included the first three years of WPTO as an independent office.

Figure 2. WPTO program activity areas

MHK Program	Hydropower Program
• Foundational and Crosscutting R&D • Technology-Specific System Design and Validation • Reducing Barriers to Testing • Data Sharing and Analysis	• Technology R&D for Low-Impact Hydropower Growth • R&D to Support Modernization, Upgrades, and Security for Existing Hydropower Fleet • Grid Reliability, Resilience, and Storage • Environmental R&D and Hydrologic Systems Science • Big-Data Access and Management

Peer Review Panels

Review Panels consisted of four to six external experts who were selected based on their technical expertise and high-level qualifications in their designated technology area. WPTO made efforts to ensure there was a balance within each Review Panel by including a mix of reviewers from industry, academia, NGOs, and federal agencies, with a range of expertise. Reviewers were required to sign legal agreements stipulating an absence of a conflict of interest with the projects they reviewed. Each set of reviewers was guided by a Program Review Chair, as well as a Review Panel Lead, whom in most cases had previous experience as a reviewer. Table 1 lists the members and affiliations of the Program Review Chairs and Review Panel Leads. Members of each Review Panel are listed within each individual program sections.

Table 2. Program Review Chairs and Panel Leads

HYDROPOWER PROGRAM			
Name	**Role**	**Review Panel**	**Affiliation**
Greg Lewis	Review Chair and Panel Lead	New Technology and Moderniza-tion	Duke Energy
Scott Flake	Panel Lead	Grid Reliability	Independent Consultant
Tim Brush	Panel Lead	Environmental R&D and Data Management	Inter-Fluve
MHK PROGRAM			
Name	**Role**	**Review Panel**	**Affiliation**
Elaine Buck	Review Chair and Panel Lead	Foundational R&D, Technology Design, and Validation	European Marine Energy Centre
Chris Bassett	Panel Lead	Reducing Barriers to Testing and Data Sharing	University of Washington

Reviewers were responsible for consolidating and summarizing all reviewer comments on assigned projects and submitting draft project evaluation summaries to WPTO and Chairs/Panel Leads. Panel Leads were responsible for drafting activity area evaluation summaries and submitting to WPTO and Review Chairs. Review Chairs were responsible for drafting a program-level evaluation summary, reviewing key parts of the draft report, and submitting to WPTO.

Program Evaluation Criteria

Reviewers were asked to evaluate WPTO's major R&D Programs and significant initiatives at a strategic level, both numerically and with specific, concise comments, to support each evaluation. Reviewers evaluated each program or strategic initiative on the following, equally weighted criteria: (1) program strategy and objectives; (2) program portfolio; (3) program management approach; and (4) stakeholder engagement, outreach, and dissemination. These evaluation criteria, as described below, served as the standard template for the scores and comments provided to each program or strategic initiative. In addition, reviewers were asked to answer unscored, supplemental questions for each program or strategic initiative, which are outlined in Appendix B.

Table 3. Program Evaluation Criteria Weighting

Program Evaluation Criteria	Weights
Program Strategy and Objectives	25%
Program Portfolio	25%
Program Management Approach	25%
Stakeholder Engagement, Outreach, and Dissemination	25%
Recommendations/Supplemental Questions	0%

- **Program Strategy and Objectives**—programs or strategic initiatives were evaluated on the degree to which:
  - The program's long-term strategy, strategic approaches, and future direction were effectively conveyed during the peer review.
  - The program's strategy reflects an understanding of the near and long-term challenges facing industry and other stakeholders.
  - The program invests in early-stage research to accelerate the development of innovative water power technologies, while ensuring that long-term sustainability and environmental issues are addressed.
  - The program supports efforts to validate performance and grid reliability for new technologies, develop and increase accessibility to necessary testing infrastructure, and evaluate systems-level opportunities and risks.
  - The program invests taxpayer funds wisely to drive the greatest impact.

- **Program Portfolio**—programs or strategic initiatives were evaluated on the degree to which:
  - The projects within this program portfolio contribute to meeting the program's strategy and objectives.
  - The projects within this program portfolio are addressing key challenges and reducing barriers to advance water power technologies.
  - The rationale for and organization of the funded projects and program approaches have been effectively conveyed during the peer review.
  - The program portfolio effectively balances research priorities and allocates resources appropriately.
  - The projects within this program portfolio are appropriate for WPTO's role as a public R&D organization.
- **Program Management Approach**—programs or strategic initiatives were evaluated on the degree to which:
  - The program team effectively manages and directs the activities needed to meet its objectives.
  - The program team focuses on priority research areas that create the greatest impact on new technology and industry advancement.
  - The program team effectively communicates priority research areas and the allocation of resources.
  - The program team demonstrates the professional and technical capabilities needed to identify, monitor, and guide its portfolio of projects.
  - The program team has operations and oversight procedures in place to ensure efficient direction of office activities, both internally and with project awardees.
- **Stakeholder Engagement, Outreach, and Dissemination**—programs or strategic initiatives were evaluated on the degree to which:
  - The program demonstrates good stewardship of taxpayer funds by persistently and transparently communicating how WPTO funds are being utilized and evaluates project impacts.
  - The program gathers feedback from stakeholders to inform and improve WPTO projects and strategy.
  - The program maximizes the impact of WPTO-supported research by effectively disseminating results of projects and tracking usage of various products.
  - The program provides access to accurate and objective information and data that can help to accelerate industry development and inform decision makers.

Project Evaluation Criteria

Each project in the WPTO portfolio was categorized based on its start and/or end date. To capture projects that have been active since the last peer review, which took place in 2017, the three project categories are as follows:

- **Sunsetting and Completed Projects** – projects with a planned end date prior to January 1, 2020 and completed projects.
- **Ongoing Projects** – projects with start dates before October 1, 2017 and end dates after January 1, 2020.
- **New Projects** – projects with start dates after October 1, 2017.

Project scoring involved weighting the evaluation criteria based on each project's category. The weighting for project categories and evaluation criteria is illustrated in Table 4.

Table 4. Project Evaluation Criteria Weighting

		Project Categories		
		Sunsetting and Completed Projects	Ongoing Projects	New Projects
Evaluation Criteria Weights	Project Objectives, Impacts, and Programmatic Alignment	20%	20%	20%
	End User Engagement and Dissemination Strategy	20%	20%	20%
	Management and Technical Approach	20%	20%	20%
	Technical Accomplishments and Progress	40%	20%	0%
	Future Work	0%	20%	40%

Reviewers were asked to evaluate each project on specific criteria: (1) project objectives, impacts, and alignment with the program strategy; (2) end user engagement and dissemination strategy; (3) management and technical approach; (4) technical accomplishments and progress; and (5) future work. These evaluation criteria, as described below, served as the standard template for the scores and comments provided to each project.

- **Project Objectives, Impacts, and Alignment with the Program Strategy**—projects were evaluated on the degree to which:
  - The project performers have described how the project contributes to the program's strategy/approaches.
  - The project performers have considered and described the use/applications of their expected products and outputs.
  - The project performers have presented the relevance of this project and how successful completion of the project will advance the state of technology, meaningful impacts, and/or the viability of any commercial applications.
- **End User Engagement and Dissemination Strategy**—projects were evaluated on the degree to which:
  - The project performers have identified who will benefit from this project and how the success of the project will advance the industry or meet the needs of specific stakeholder/end user groups.
  - The project performers have explained whether specific industry or end users were engaged/are planned to be engaged and at which points in the project, (i.e., whether an advisory group was set up, whether end user needs were surveyed/assessed, if and how progress/preliminary results are communicated).
  - The project performers have clearly described the rationale for the stakeholder/end user engagement strategy and how project results and information have been/are planned to be disseminated.
- **Management and Technical Approach**—projects were evaluated on the degree to which:
  - The project performers have implemented technically sound R&D approaches and have demonstrated/validated the results needed to meet their targets.

  - The project performers have identified a project management plan that includes well-defined milestones and adequate methods for addressing potential risks.
  - The project performers have clearly described critical success factors, which will define technical viability, and they have explained and understand the challenges they must overcome to achieve success.
- **Technical Accomplishments and Progress**—projects were evaluated on the degree to which:
  - The project performers have made progress in reaching their objectives based on their project management plan.
  - The project performers have described their most important accomplishments in achieving milestones, reaching technical targets, and overcoming technical barriers.
  - The project performers have clearly described the progress since any last review period.
- **Future Work (New and Ongoing Projects Only)**—projects were evaluated on the degree to which:
  - The project performers have outlined adequate plans for future work, including key milestones and go/no-go decision points.
  - The project performers have communicated key planned milestones and addressed how they plan to deal with upcoming decision points and any remaining issues.

WPTO OVERVIEW

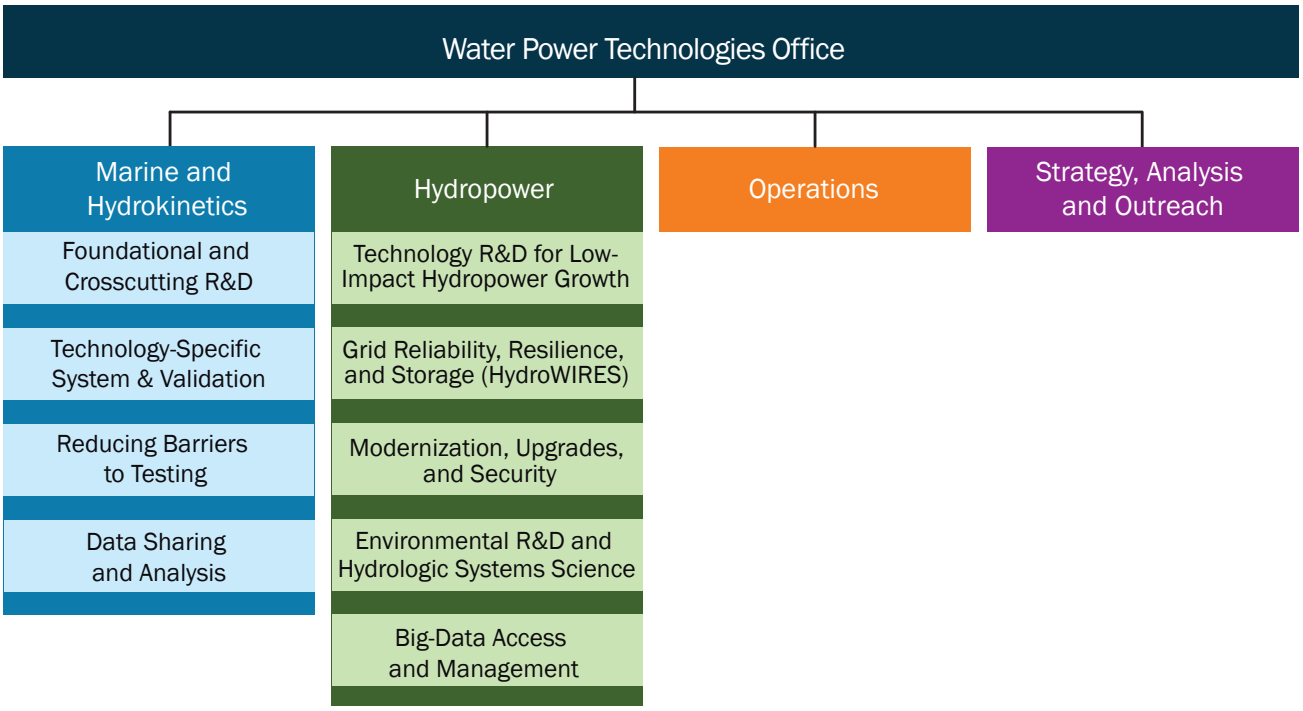
Mission, Values, and Structure

WPTO enables research, development, and testing of emerging technologies to advance marine energy and next-generation hydropower and pumped storage systems for a flexible, reliable grid. WPTO works with national laboratories, industry, universities, and other federal agencies to conduct R&D activities through competitively selected, directly funded, and cost-shared projects. In pursuing these objectives, WPTO always endeavors to:

- Catalyze innovation in technology and science
- Steward natural resources and support the public good
- Expand access to affordable, reliable, and secure energy
- Invest taxpayer funds wisely and to drive the greatest impact
- Collaborate and actively seek input from stakeholders and partners
- Demonstrate transparency and share results widely.

WPTO's work directly supports EERE's strategic objectives of increasing energy affordability, improving grid reliability, and reducing barriers to technology development. This, in turn, supports DOE's mission to ensure U.S. security and prosperity by promoting transformative science and technology solutions to meet the nation's energy and environmental challenges. WPTO consists of two R&D programs: the MHK Program and the Hydropower Program. The office also has two teams who work across the two programs: the Operations team and the Strategy, Analysis, and Outreach team (Figure 3).

Figure 3. WPTO's Organizational Structure



WPTO considers stakeholder engagement a top priority and strives to engage a diverse array of stakeholders, such as researchers, technology developers, regulators, and the public. Active collaboration and communication among key stakeholders enable WPTO to more effectively achieve its mission by identifying critical challenges in water power research, outlining opportunities for accelerating industry development,

and informing the strategy and direction of the office's portfolio. WPTO's Outreach and Engagement Strategy represents values that are essential to WPTO's success, such as appropriately incorporating expert feedback into our R&D and maximizing the impact of DOE's investments.

The WPTO Outreach and Engagement Strategy includes four key goals:

1. **Transparency**: Demonstrate good stewardship of taxpayer funds by persistently and transparently communicating how WPTO funds are utilized and evaluating project impacts.
2. **Feedback**: Gather feedback from stakeholders to inform and improve WPTO projects and strategy.
3. **Dissemination**: Maximize the impact of WPTO-supported research by effectively disseminating results of projects and tracking usage of various products.
4. **Objective and accurate information**: Provide access to accurate and objective information and data that can help to accelerate industry development and inform decision makers.

Outreach and engagement, as well as management and operations, were incorporated into the evaluation criteria for both the program elements and individual projects, as outlined in the previous sections.

Budget

Water power R&D has taken place at DOE consistently since fiscal year (FY) 2008 after the Energy Independence and Security Act of 2007 directed DOE to establish the "Water Power Program." Prior to FY 2016, water power research was conducted in the former Wind and Water Power Technologies Office. In FY 2016, in response to congressional direction, WPTO was established as a standalone office dedicated to marine energy and hydropower R&D. The time period for the 2019 Peer Review included the first three years of WPTO as an independent office.

Funding for DOE's water power R&D has increased considerably since FY 2008, as shown in Figure 4. Congressional appropriations have usually kept the water power portfolio split with roughly two-thirds of the budget focused on marine energy R&D and one-third on hydropower. Figure 5 shows EERE's Office of Renewable Power budget since FY 2008, with WPTO currently representing about 5% of the portfolio.

Figure 4. Water Power Technologies Office budget from FY 2008 to FY 2020

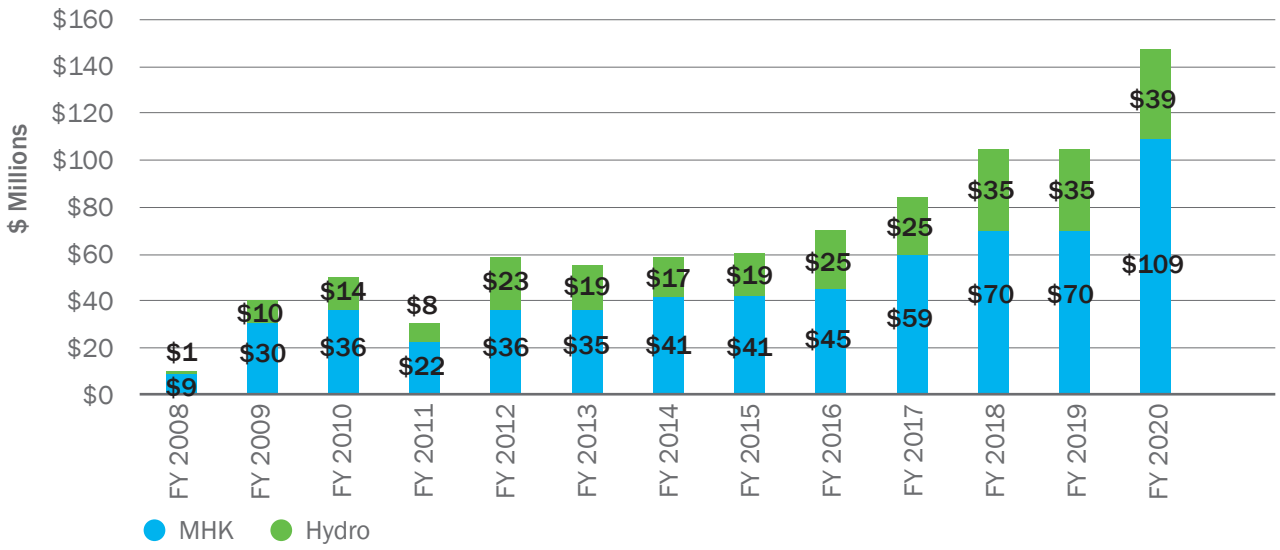
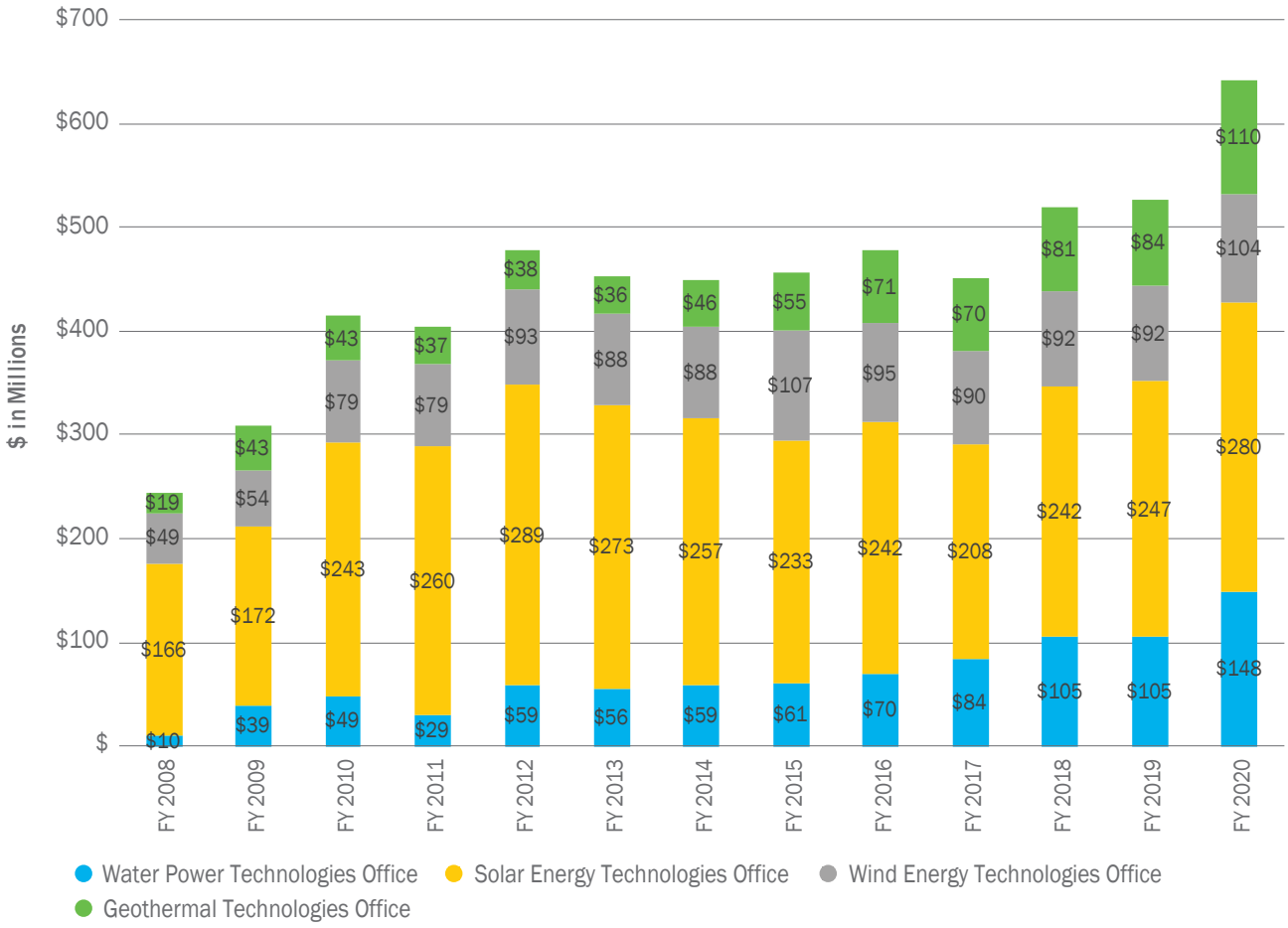


Figure 5. Office of Renewable Power budget from FY 2008 to FY 2020



Funding Mechanisms

WPTO leverages a variety of funding mechanisms and increasingly focuses on developing innovative programs and funding mechanisms to support R&D. The following describes the main mechanisms WPTO leverages to fund R&D. The budget breakdown showing how much the MHK and Hydropower Programs executed in each category for FY 2017–FY 2019 can be found in the Program-specific sections of this report.

- **Financial Assistance (public, competitive funding opportunities**) is a vehicle to fund competitive solicitations that aim to identify and fund solutions or ideas that are developed by private industry or academia.
  - Through a **Funding Opportunity Announcement (FOA)**, WPTO provides notice of available funding for R&D projects that address areas of interest identified by the office. Applications submitted through FOAs are evaluated based on publicly shared criteria. Selected applications result in cooperative agreements through which DOE provides multi-year funding with a cost-share commitment from the awardee (though some applicants are exempt from the EERE cost-share requirement, like academic institutions). Cooperative agreements are similar to grants but provide for more involvement between the federal awarding agency and the awardee.
  - The **Small Business Innovations Research (SBIR) and Small Business Technology Transfer (STTR) Programs** are competitive programs targeted to small businesses to support prototyping and commercialization activities. Both programs offer zero cost-share grants through a three-phased approach focused on products and services with commercial potential.

- **Prizes and competitions** use financial awards and other incentives to tap into the ingenuity and creativity of crowds. Prizes are organized with defined goals and within a defined timeframe. Compared to funding made available through DOE FOAs, prizes usually offer smaller funding awards within a faster timeline.
- **National lab-led R&D funded through Annual Operating Plans (AOPs)** are annual contracts with DOE national labs that define the scope, schedule, milestones, and cost for work. This is how WPTO funds national lab partners to conduct research and analysis, as well as to develop tools and resources for the benefit of the water power field. Ongoing, multi-year efforts require merit review.
- **WPTO-funded lab support to industry** are mechanisms that leverage the expertise and resources of the national laboratories, with the intended recipient being industry or academia.
  - **"FOA support"** occurs when labs receive funds to support a FOA awardee. Labs are currently ineligible to apply for WPTO FOAs, but they may be requested by a FOA recipient (from industry or academia) to partner on an awarded project. In these cases, WPTO pays the lab directly.
  - **Small Business Vouchers (SBV)** has funded national labs' support to small businesses to help test, develop, and validate their innovative products.
  - **The Technology Commercialization Fund (TCF)** enables industry to obtain a license to lab-developed technologies. This is a congressionally mandated program which comprises .9% of annual program budgets and requires cost share.
- **The Energy Policy Act (EPAct) 2005 Section 242 Hydro Incentive Program** provides funding for projects adding hydroelectric power generating capabilities to existing dams throughout the United States. This is a congressionally mandated program appropriated to the Hydropower Program.
- All other funded work that does not fall within one of the categories above and involves additional program-led work, including analysis, communications, stakeholder engagement, and dissemination activities.