INL/EXT-19-56723

FY 2019 Nuclear Energy Infrastructure Database Accomplishments

November 2019

Jonathan Kirkham

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INL/EXT-19-

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Idaho National Laboratory
Nuclear Science User Facilities
Idaho Falls, Idaho 83415

http://www.nsuf.inl.gov

Prepared for the
U.S. Department of Energy
Office of Nuclear Energy
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517

Summary

In 2014, the U.S. Department of Energy (DOE) Deputy Assistant Secretary for Science and Technology Innovation initiated the Nuclear Energy Infrastructure Management Project by tasking the Nuclear Science User Facilities (NSUF) with creating a searchable and interactive database of all pertinent infrastructure supported by, or related to, the DOE Office of Nuclear Energy (DOE-NE). This database is intended to be used for analyses to identify needs, redundancies, efficiencies, distributions, and similar considerations to best understand the utility of DOE-NE's available infrastructure, inform the content of the infrastructure calls, and provide information to NSUF users.

The database, known as the Nuclear Energy Infrastructure Database (NEID), is accessed through a web-based application (at nsuf-infrastructure.inl.gov) and built specifically to track research and development (R&D) facilities and associated equipment throughout the DOE-NE complex. The NEID serves internal users (such as DOE personnel and national laboratory staff and researchers) and potential infrastructure users who will be able to view the inventory of DOE-NE-compatible R&D capabilities potentially available to them. NSUF utilizes the NEID to support the annual nuclear energy gap analysis process. Infrastructure needs are gathered from DOE-NE R&D programs and researchers at U.S. national laboratories, universities, and the U.S. nuclear industry.

The fiscal year (FY) 2019 Nuclear Energy Infrastructure Database (NEID) Accomplishments report captures all the additions and improvements made to the database in FY 2019.

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1. Introduction

The database, known as the Nuclear Energy Infrastructure Database (NEID), located at https://nsuf-infrastructure.inl.gov, can be used for analyses to identify needs, redundancies, efficiencies, distributions, and similar considerations to better understand the utility of DOE-NE's available infrastructure, inform the content of infrastructure calls, and provide information to NSUF users. The NEID stores nuclear energy related institutions, facilities, and capabilities.

This project was built on the NSUF mission of providing access to specialized facilities at no cost to the researchers by:

1. Developing and maintaining the NEID for facilities at national laboratories, universities, industrial R&D sites, and international R&D sites

2. Coordinating the DOE-NE infrastructure awards for university reactor upgrades, university general scientific infrastructure, and NSUF access award locations

3. Coordinating the DOE-NE scientific investments at national laboratories for experiment design and analysis capabilities, irradiation (neutron, ion, and gamma) capabilities, post-irradiation examination (PIE) capabilities, and data analysis and management capabilities.

1.1 Current Data within the NEID

Table 1 shows the current data within the NEID, as of November 2019.

Table 1 Current NEID Data

Institutions	Facilities	Capabilities
147	491	1,013

Table 2 shows how the contents have grown over the years, starting from the initial release in 2015 and up to the current year. Facility numbers dropped due to validating activities that moved the facilities into the capabilities section of the NEID.

Table 2 Additions Over the Years

Year	*Institutions*	*Facilities*	*Capabilities*
2015	84	377	802
2016	127	465	963
2017	145	487	972
2018	146	498	972
2019	147	491	1,013

Figure 1 shows the distribution of institutions within the NEID. It consists of six different types including: Universities, Government Labs, Industry, International Government, International Universities, and International Industry.

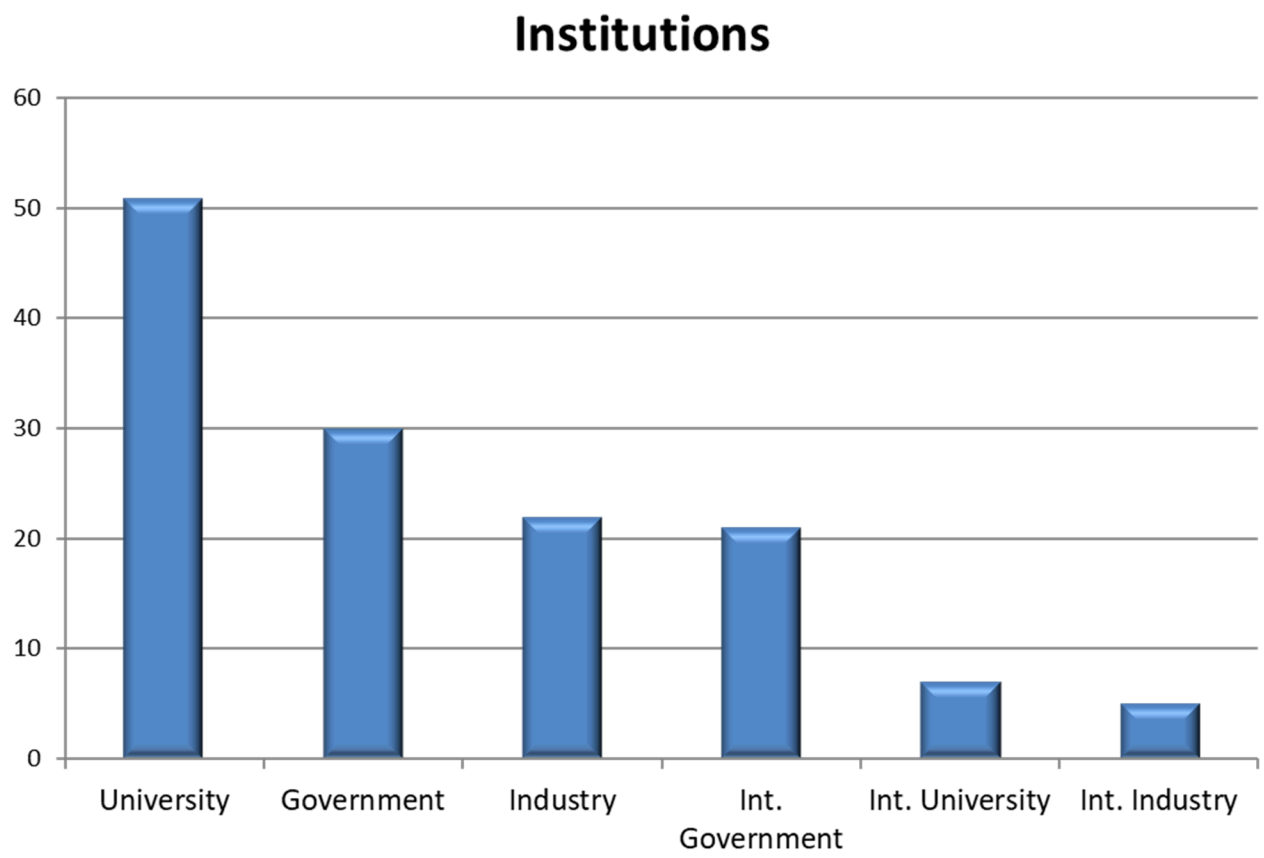

Figure 1 NEID Institutions

1.2 Features and Functionality Additions

We strive to create innovative tools to connect researchers to capabilities. The NEID gives you the ability to find capabilities all around the world. Data and improvements are continuously implemented into the NEID. The NEID gives users the ability to easily locate NSUF facilities by clicking on the facilities tab located on the main page, see figure 2. Users also have an editing feature for facility managers to update their own facilities. We have also added the ability to attach documents to facilities and instruments. The documents can include pictures of the facilities/capabilities, user guides, etc.

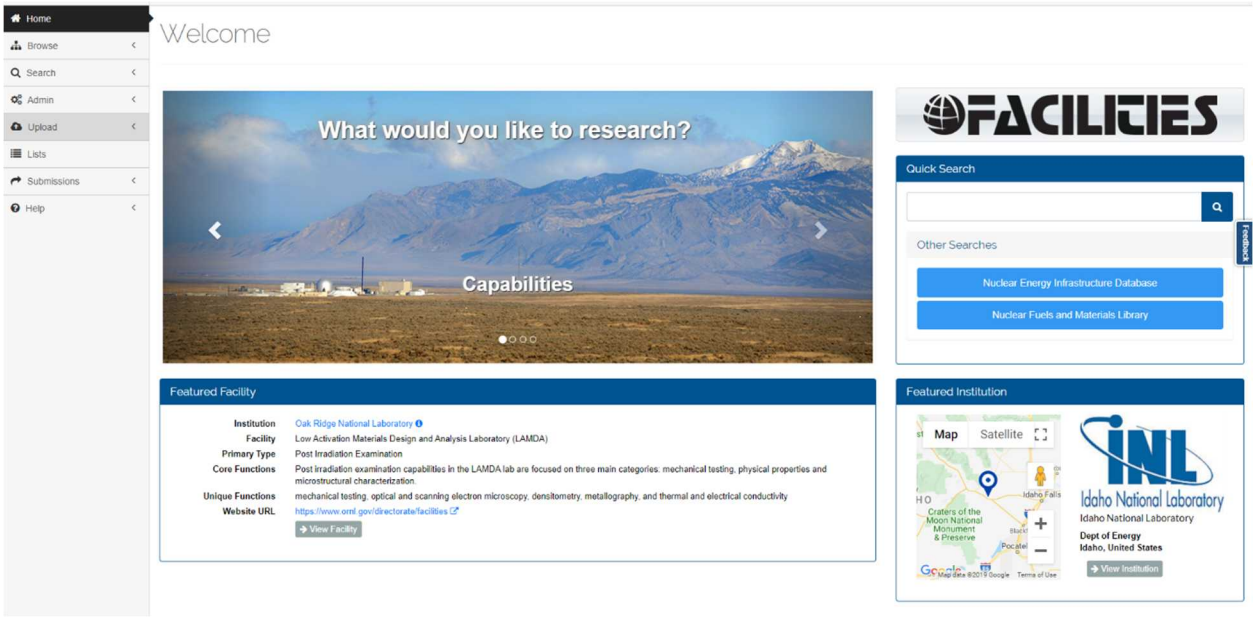

Figure 2 NEID Homepage

Improvements and additions are added to the NEID regularly. The most recent upgrades were the NSUF Point of Contacts (POC) for all NSUF facilities. Some Idaho National Laboratory (INL) facilities got some additional descriptions added to them; along with a few more capabilities. Another accomplishment is that we have finally been given some feedback on the user's side involving the editing feature for the facility managers. These improvements are currently in the works and should be available early February 2020.

Another way to navigate to a specific institution can be done through the globe map section by clicking on maps, under the Browse tab. Figure 3 shows what this mapping feature looks like within the NEID.

Figure 3 Institution Map

2. Data Validation Activity

In 2019, the NSUF developed an activity to verify and validate the current data within the database. Starting with the NSUF facilities, we want to start going out to each facility, in a physical manner, and validate every entry within the NEID. Table 3 lists a drafted schedule that estimates the order and timeframe needed for this activity. This activity has yet to begin but is planned to commence soon. The activity will most likely be spread over at least a 2-year timeframe.

Table 3 Verify and Validate Schedule

Institution	Activity	Weeks
INL	Advanced Test Reactor	1
	Analytical Laboratory	1
	ATR Critical and Gamma Facility	1
	Central Facilities Area	1
	Electron Microscopy Lab	1
	Experimental Fuels Facility	1
	Fuel Conditioning Facility	1
	Fuels and Applied Science Building	1
	High Performance Computing	1
	Hot Fuel Examination Facility	1
	INL Research Center	2
	IMCL	1
	NRAD	1

	TREAT	1
SNL	Review MOU	1
	Verify and Validate Equipment	1
LLNL	Review MOU	1
	Verify and Validate Equipment	1
LANL	Review MOU	1
	Verify and Validate Equipment	1
OSU	Review MOU	1
	Verify and Validate Equipment	1
UF	Review MOU	1
	Verify and Validate Equipment	1
TAMU	Review MOU	1
	Verify and Validate Equipment	1
NSLS-II	Review MOU	1
	Verify and Validate Equipment	1
ORNL	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	2
Westinghouse	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
MIT	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
Michigan	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
NCSU	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
PNNL	Start MOU	2
	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
ANL	Start MOU	2
	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
CAES	Start MOU	2
	Finish MOU	3

	Review MOU	1
	Verify and Validate Equipment	1
Wisconsin	Start MOU	2
	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
IIT	Start MOU	2
	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
Purdue	Start MOU	2
	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
UNLV	Start MOU	2
	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
UCB	Start MOU	2
	Finish MOU	3
	Review MOU	1
	Verify and Validate Equipment	1
	Total Weeks	**111**

3. Utilization of the NEID to Support DOE-NE and NSUF

3.1 NSUF Calls

The NSUF mission is to facilitate the advancement of nuclear science and technology by providing nuclear energy researchers with access to world-class capabilities at no cost to the researcher. This mission is enabled by a consortium of partners that make available state-of-the-art experimental irradiation testing, post irradiation examination, and INL high performance computing as well as technical and scientific assistance for the design and execution of projects. Access to NSUF capabilities is granted through competitive proposal processes.

The Rapid Turnaround Experiment (RTE) award process offers an avenue for researchers to perform irradiation effects studies of limited scope on nuclear fuels and materials of interest utilizing NSUF facilities. Each year, NSUF seeks proposals that will utilize NSUF irradiation, post-irradiation examination and beamline capabilities through the Consolidated Innovative Nuclear Research (CINR) Funding Opportunity Announcement (FOA). Through the NSUF CINR workscopes, NSUF provides no-cost access to world class capabilities to facilitate the advancement of nuclear science and technology.

The NEID supports writing, reviewing, planning, and execution of these proposals and is used by the researchers, NSUF technical leads, reviewers, and program management to support the process.

3.2 Nuclear Energy R&D Capabilities Gap Analysis

The NSUF gap analysis captures infrastructure gaps and identifies investments being made at the national laboratories. The list of recommended projects below has been developed in response to NSUF's request for information (RFI) that was distributed to the national laboratories' DOE-NE points of contact, NSUF users, and Nuclear Energy University Program (NEUP) users. The NSUF developed the NEID by utilizing data from a variety of reports from DOE, the National Research Council, the International Atomic Energy Agency, and various other federal and civilian resources. This basis was built upon specific searches of reference documents, individual institutions' internet sites and written surveys to U.S. institutions. The NEID uses geographical information system technologies to visualize the infrastructure data; these technologies are designed for easy utilization by all levels of users. This tool is used to support processes for this report. The NEID is designed to identify and document all the major capabilities associated with nuclear energy R&D across the DOE complex. This has been expanded to cover similar capabilities at universities and commercial sites, primarily in the United States, but also international facilities of interest. NSUF works with the nuclear community, including NEUP's contact list and NSUF's direct affiliates, to develop a list of scientific infrastructure gaps that need to be filled. A variety of tools and methods (NEID, RFI, and direct email solicitation) were utilized to develop the list of recommended investments. This coordinated effort resulted in the identification of funding to fill many of the gaps identified by this process.

3.2.1 University Scientific Infrastructure

The Department of Energy's (DOE) Office of Nuclear Energy (NE) provides funding to support crosscutting nuclear energy research and development (R&D), and associated infrastructure support activities, to develop innovative technologies that offer the promise of dramatically improved performance for advanced reactors and fuel cycle concepts, while maximizing the use of DOE resources.

The development of nuclear energy-related infrastructure and basic capabilities in the research community is necessary to promote R&D that supports nuclear science and engineering (NS&E), DOE-NE's mission, and the Nation's nuclear energy challenges. Accordingly, DOE intends to enable the education and training of nuclear scientists, engineers, and policymakers, in graduate and undergraduate study, and two-year programs, as well as R&D that is relevant to the Department and the nuclear energy industry in general.

The Nuclear Energy University Program (NEUP), funds Scientific Infrastructure investments at US universities to support the R&D objectives of the DOE-NE. Over 60 million dollars have been invested in these universities over the last ten years within two areas: Research Reactor Upgrades, to upgrade and improve the U.S. university nuclear research and training reactors to contribute to strengthening the academic community's nuclear engineering infrastructure, and General Scientific Infrastructure to develop and maintain a national R&D framework to achieve NE's research missions and/or to support or improve the instructional mission of the university. The NEID is used to verify that the recommended investments are not duplicative of existing capabilities and that the new capabilities can be integrated into the NSUF, as necessary.

3.2.2 NSUF and INL Scientific Infrastructure Investments

Funding for infrastructure investment at national laboratories may be provided by NSUF or through a variety of INL resources for INL-specific investments. Specific recommendations generated through the gap analysis process are listed in FY 2019 NSUF Nuclear Energy Research and Development Capability Gap Analysis (INL/LTD-19-54249) June 2019.

4. Conclusion

Improvements and additions are added to the NEID regularly. The major planned activity for FY2020 is the validation of the NSUF partner facility information, as described in Section 2. The FY2020 Gap Analysis Report will be published on June 30, 2020.