Nuclear Energy Sensors Database

Advanced Sensors and Instrumentation (ASI) Annual Program Webinar
October 24 – 27, 2022

PI: Andrew Casella (Nuclear Engineering SME)
PM: Tim Downing (Software Engineering SME)

Project Overview

- Goal and Objective:
  - Collect, store, and maintain nuclear energy sensor information so that it can be easily accessed on the web. The site is located at https://nes.energy.gov/
    - Expand the number of sensors in the database.
    - Improve, expand or replace existing content.
  - Provide mechanisms for the user community involvement (i.e. sensor suggestions, needs suggestions, etc.)
    - Directly interface with reactor operators and national technical directors.
    - Openly requesting input and feedback from the user community.
  - Adapt to feedback and new data requirements as needed.

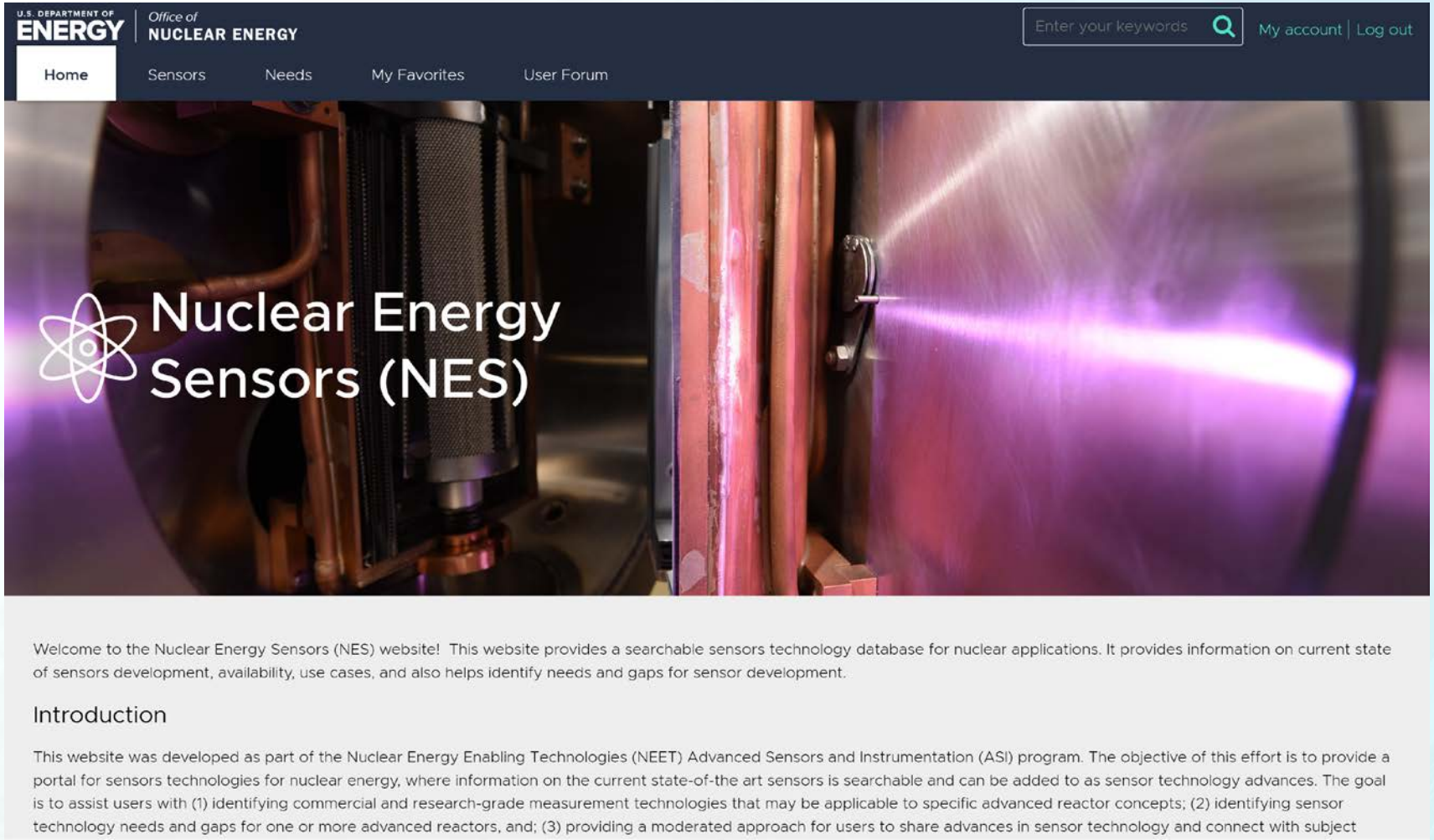
Technology Impact

Nuclear Energy Sensor Website Impacts

- Provides one “go to” searchable database for government, universities, and industry on current sensor technology. The site is maintained and updated at PNNL in Richland, WA.
- Provides a database for sensor gaps that need to be filled, including community voting on priority.
- Potentially build a community of subject matter experts. A forum is included to start the conversation.
- Can be used as a tool for stakeholders in designing and building new nuclear designs and facilities.

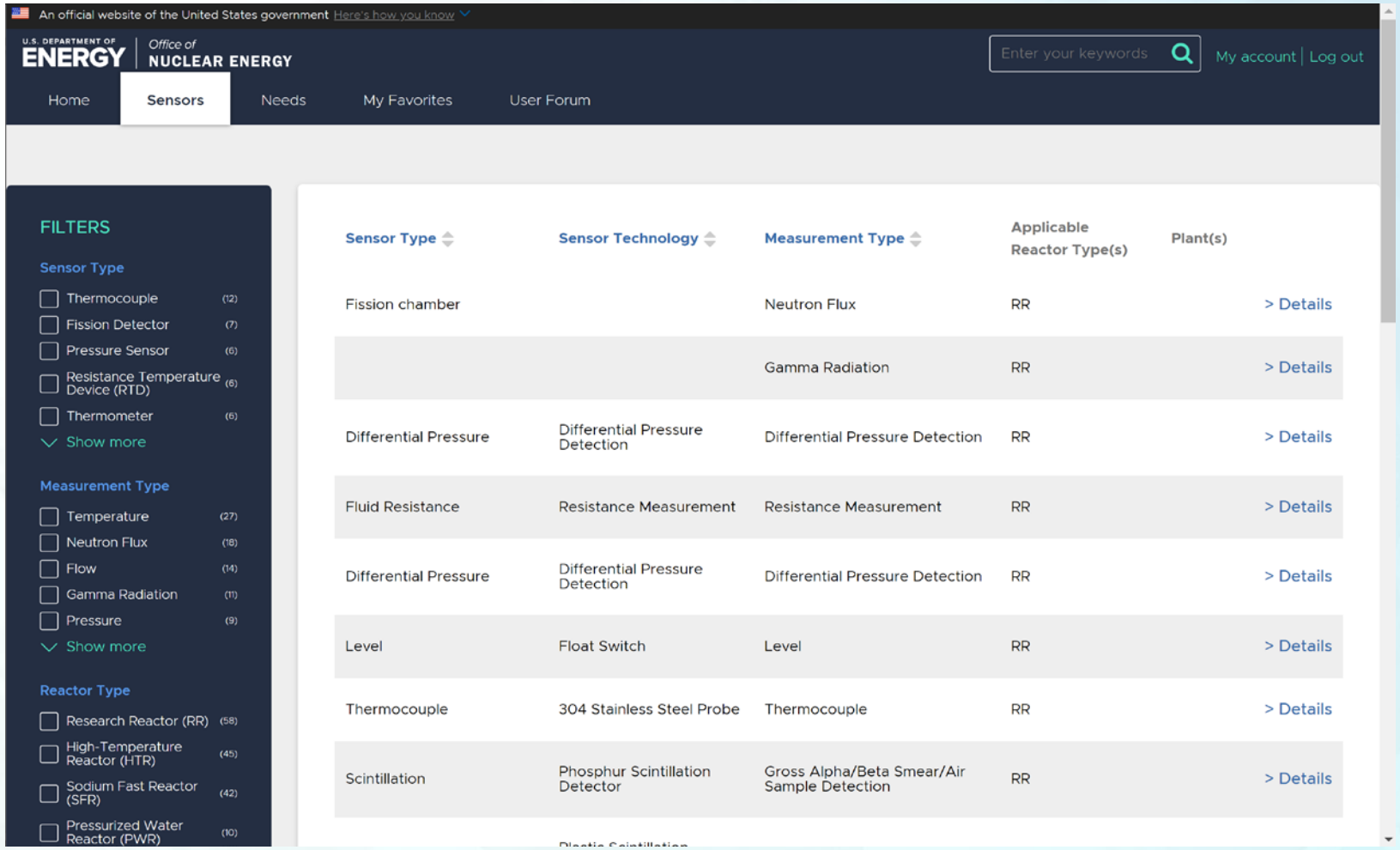
Technology Impact (Continued)

Nuclear Energy Sensors Database Home Page



Technology Impact (Continued)

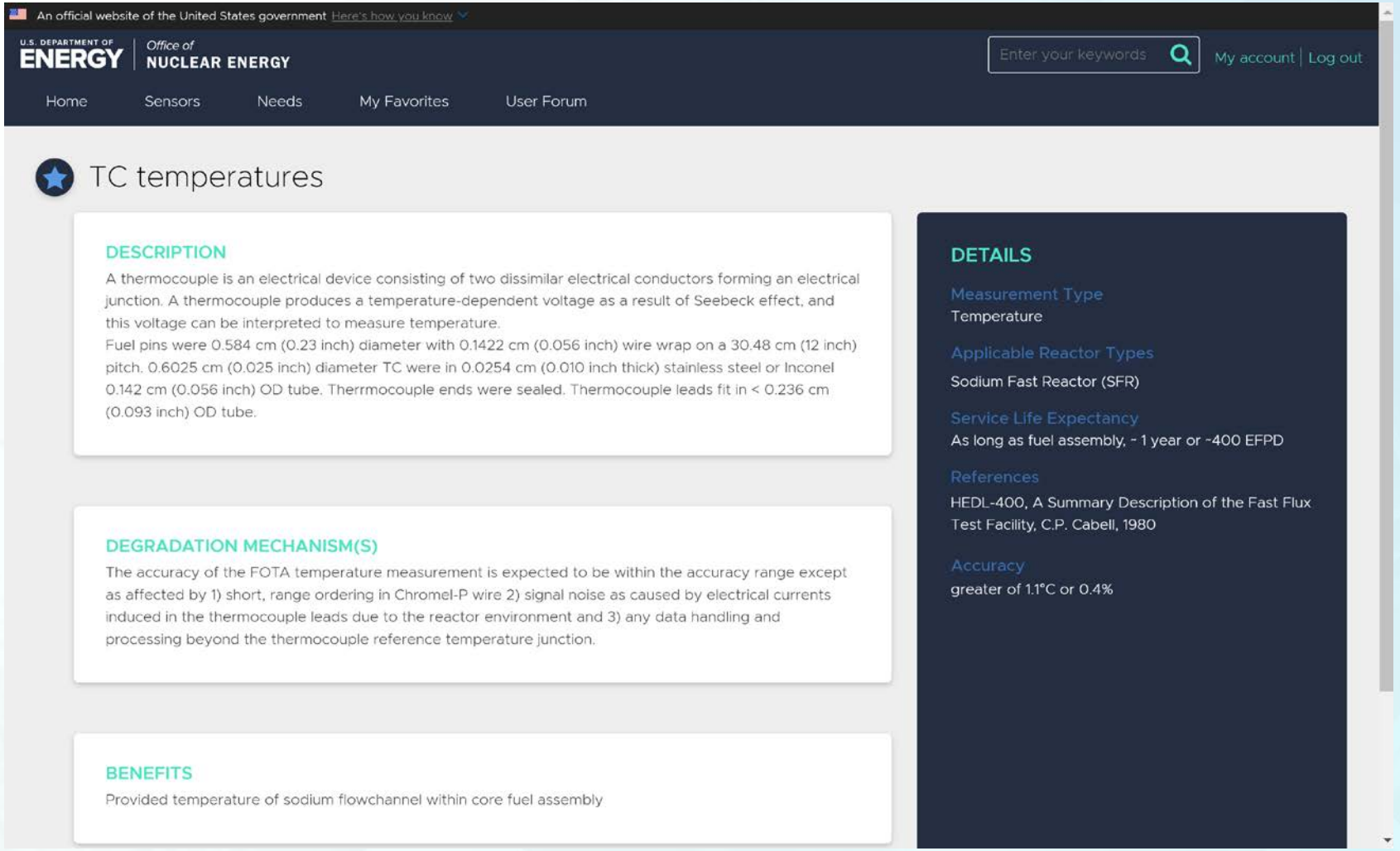
Sensor Listing Page



Sensor Type	Sensor Technology	Measurement Type	Applicable Reactor Type(s)	Plant(s)	
Fission chamber		Neutron Flux	RR		> Details
		Gamma Radiation	RR		> Details
Differential Pressure	Differential Pressure Detection	Differential Pressure Detection	RR		> Details
Fluid Resistance	Resistance Measurement	Resistance Measurement	RR		> Details
Differential Pressure	Differential Pressure Detection	Differential Pressure Detection	RR		> Details
Level	Float Switch	Level	RR		> Details
Thermocouple	304 Stainless Steel Probe	Thermocouple	RR		> Details
Scintillation	Phosphur Scintillation Detector	Gross Alpha/Beta Smear/Air Sample Detection	RR		> Details

Technology Impact (Continued)

Example Sensor Detail Page



Results and Accomplishments

The website has been available for use since the fall of 2020.

- There are currently a total of 146 Sensors
- There were 94 sensors added between FY21/FY22
- Some examples counts below of Measurement Type, Reactor Type and Sensor Type:
  - Measurement Types (Top values with 3 or more entries):

Temperature	27
Neutron Flux	18
Flow	14
Gamma Radiation	11
Pressure	9
Leak Detection	7
Level	7
Moisture	6
Coolant Flow	4
Count rate of pulses	3
Sodium leaks	3

Results and Accomplishments (Continued)

– Sensor Types (Top values with 3 or more entries):

Thermocouple	12
Fission Detector	7
Pressure Sensor	6
Resistance Temperature Device (RTD)	6
Thermometer	6
Flowmeter	5
Fission chamber	4
Scintillation	4
Unknown/Not declared	4
Boron/Neutron Reaction Detectors	3
Fiber optic	3
Hygrometer	3
Pressure Transmitter	3
Sodium Leak Detector	3
Ultrasonic	3

Results and Accomplishments (Continued)

– Reactor Types (Top values with 3 or more entries):

Research Reactor (RR)	58
High-Temperature Reactor (HTR)	45
Sodium Fast Reactor (SFR)	42
Pressurized Water Reactor (PWR)	10
Boiling Water Reactor (BWR)	8
Molten Salt Reactor (MSR)	8
Pressurized water test reactor (ATR)	3

- Software Development: There have been a number of miscellaneous styling improvements and bug fixes.
- The primary challenge with the project has been gathering data content to post on the site. This is partially a staffing availability issue, so PNNL has hired an intern starting in November 2023. Under the mentorship of Ryan Meyer (PNNL), this intern will be focused half time on collecting sensor data. This includes both new sensors and adding additional details to existing sensors already included in the database.

Concluding Remarks

In FY22:

- PNNL increased sensor count captured in the database.
- Made contacts with industry, universities, and national technical directors for further sensor information.

In FY23:

- PNNL has a dedicated resource to continue expanding the data set and contacts. This includes both new sensors and expanding existing sensor information to include more details.
- Adapt to feedback and sponsor requests related to the software.
- Work with other labs on accepting and posting additional sensor information.

Andrew Casella (Nuclear Engineering SME)
andrew.casella@pnnl.gov
Tim Downing (Software Engineering SME)
tim.downing@pnnl.gov

Thank You