

**First-of-Kind Nuclear Demonstration Readiness Project:  
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**Pathway:** First of a Kind Nuclear  
Demonstration Readiness Projects***Abstract***

As an outcome of current market conditions, many nuclear facilities are struggling to remain economically competitive in the regions they serve. Over the past few decades, non-discretionary capital investment to address safety and regulatory issues has resulted in the deferral of needed reinvestment in the plants to address aging plant systems. Now, at a time when available discretionary capital is greatly reduced due to depressed energy prices, nuclear utilities need to both upgrade their aging plant systems and lower their operating costs by investing in transformative business improvement such as centralized plant monitoring. Leveraging the capabilities of the existing platform developed by Luminant POC; advanced monitoring and diagnostic software will be expanded to integrate the technology-driven solutions that will be researched, deployed, evaluated, and demonstrated to support the following pilots:

1. **Operator Rounds:** Advanced cameras (visual and infrared), wireless vibration, and temperature sensors will be considered (Comanche Peak Nuclear Power Plant will lead this effort).
2. **Transformer Health Monitoring and Cycle Isolation Monitoring:** Using online dissolved gas analyzer (DGA) the health of different transformer types and cycle isolation valve leakage will be monitored at the POC and prognosis will be performed using the models developed by Idaho National Laboratory (INL) (Columbia Generating Station will lead this effort).
3. **Process Anomalies Detection:** Automate detection of anomalies across different process parameters and plant asset performance data using data analytics to enable early assessment of plant asset health condition or any potential sensor drift issues (Monticello Nuclear Generating Plant and Prairie Island Nuclear Generating Plant will co-lead this effort).
4. **Thermal Performance:** Consolidate and automate thermal performance data collection to detect sources of thermal performance losses in order to maximize unit generation (Susquehanna Nuclear Power Plant and Columbia Generating Station will lead this effort).
5. **Fire Watch:** Automate the fire watch process by using advanced fire detection sensors and methods (Susquehanna Nuclear Power Plant will lead this effort)

Pilots were selected based on the nuclear industry's Delivering the Nuclear Promise (DNP) initiative for the area of advanced remote monitoring.

The proposal outlines a comprehensive approach for successful execution of the RD&D activities. The pilot demonstration will be conducted at identified plant sites and the results will be shared with other USA Members and with the nuclear industry to emphasize the impact of the outcomes.

**Major Deliverables:**

- Standardized Monitoring and Diagnostics Software Platform
- Statistical Modeling Tool
- Thermal Performance Monitoring and Energy Mass Balance
- Portal Interface
- Improved Data Automation Process and Advanced Remote Monitoring Technologies



**Project Objectives and Scope:**

- Research, Develop and Demonstrate (RD&D) standardized online monitoring approach and advanced diagnostics software platform to enable core business process transformation.
- RD&D integration of advanced platform with automation and advanced remote monitoring technology at participating Utilities Service Alliance (USA) plants.
- Perform advanced data analytics and share project outcomes with the U.S. Department of Energy (DOE) Office of Nuclear Energy and with other domestic fleet, to support adoption throughout the remaining USA plants as well as the rest of U.S. Light Water Reactor (LWR) nuclear fleet.

**Project Tasks:****Operator Rounds**

Task 1- Identify sensor modalities that will be used to collect the desired data

Task 2- Enhance Wi-Fi infrastructure

Task 3- Final Design Authorizations (FDA's).

Task 4- Automate data collection of operator rounds with remote sensors to the control room and POC.

Task 5- Demonstration and evaluation of technologies to automate operator rounds.

**Transformer Health Monitoring**

Task 1- Verify the data collection of the DGA to the plant computer

Task 2- Transfer DGA data to the POC

Task 3- Conduct software quality assurance

Task 4- Develop predictive analysis methods to measure transformer health

Task 5- Demonstration and evaluation of technologies to automate transformer health monitoring.

**Cycle Isolation Monitoring**

Task 1- Define and develop design, scope

Task 2- Develop and install monitoring platform

Task 3- Transfer data to the POC and develop monitoring criteria

**Process Anomalies Detection**

Task 1- Enhance data fidelity in plant computer

Task 2- Create single process parameter deviation detection capability in plant computer

Task 3- Create multi process parameter deviation detection capability in plant computer.

Task 4- Demonstration and evaluation of technologies to automatically detect process anomalies

**Thermal Performance**

Task 1- Upgrade the current PI infrastructure to support online monitoring

Task 2- Install new sensors and expand the existing wireless backbone to accept additional sensors:

Task 3- Develop thermal performance intelligence and assistive tools

Task 4- Demonstration and evaluation of technologies to automate thermal performance monitoring.

**Fire Watch**

Task 1- Fiber backbone.

Task 2- Switch and Access Point Installation.

Task 3- Secure Domain.

Task 4- Sensor Array Development.

Task 5- Sensor Testing

Task 6- Network Backup.

Task 7- Procedures and Training.

Task 8- Demonstration and evaluation of technologies to automate fire watches.

**Benefits to Commercial Nuclear Industry**

At its fullest potential, the technological advancements of this project will result in sustained improved reliability; more resource efficient solutions; improved data analytics; automated repetitive manual tasks; reduced time-based maintenance activities; and increased work management process efficiencies.

