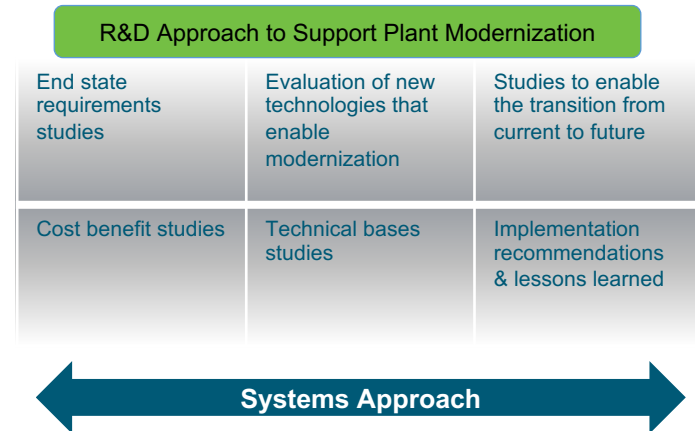
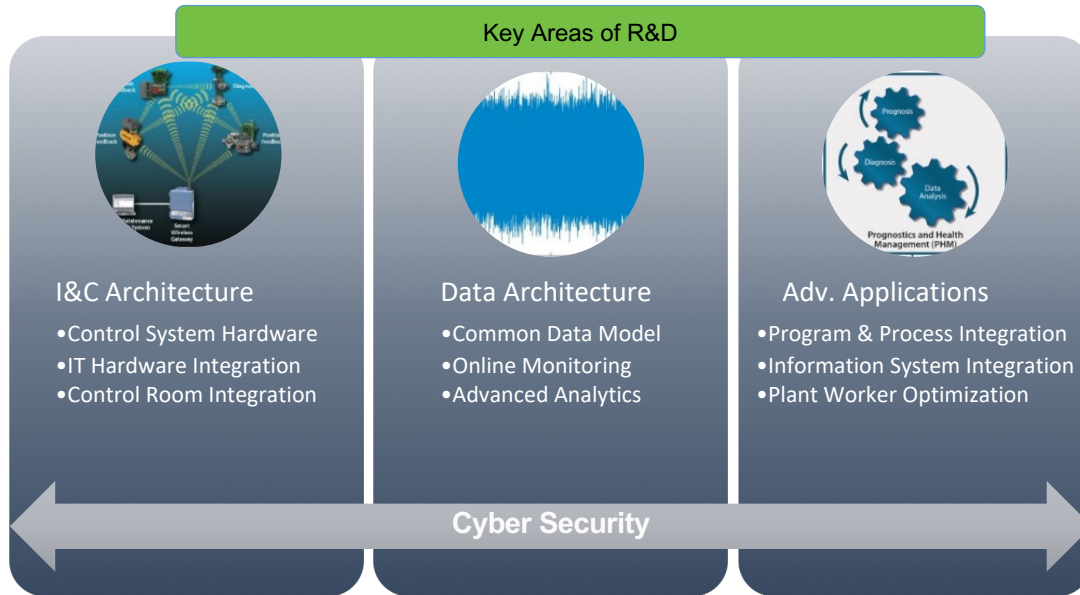




Light Water Reactor Sustainability Program Nuclear Innovation Portal

The LWRs Program **Plant Modernization** pathway is working to **significantly reduce risk of I&C modernization.**



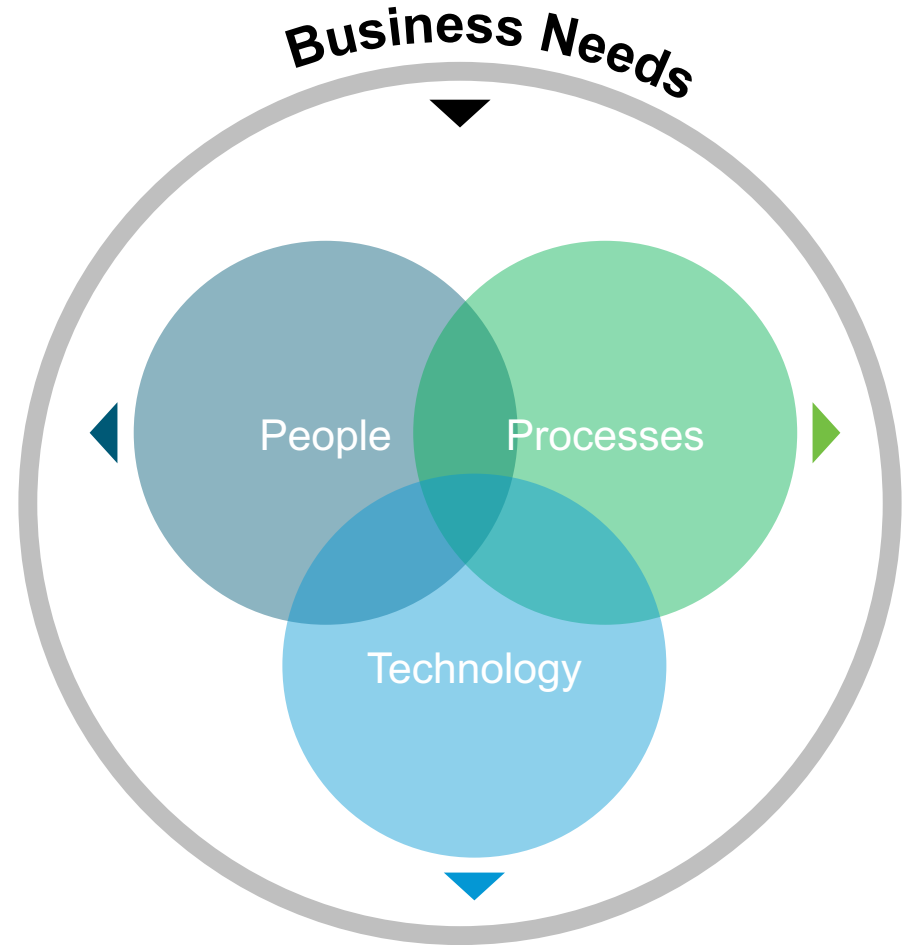
- The LWRs Program **provides guidance for full-scale implementation** and **communicates the results** to other nuclear power stakeholders.



The LWRS program aims to **enable plants to impact the revenue/ cost gap** by **introducing technologies** and **operational efficiencies** that transform the organization.

The LWRS Program Plant Modernization pathway recognizes that both a **top-down and bottom-up approach** is needed for **successful transformation in the industry**.

To this end, the **Nuclear Innovation Workshop** served as an important effort to initiate the development of an **effective and impactful platform for sharing ideas and lessons learned in innovation space** across the nuclear industry.





The objectives of the workshop were supported through **facilitated discussions** and **industry presentations** within the context of a **four-phased approach to nuclear innovation**.

- The objectives of this workshop were to:
 - [1] **promote an innovation ecosystem** that reduces cost and risk through early evaluations,
 - [2] **provide hands-on activities** that demonstrate the value of using the advanced tools, methods, and capabilities offered by LWRS Program,
 - [3] **provide a platform to enable broad innovation** in the nuclear industry,
 - [4] enable industry leaders the **opportunity for networking and sharing of their experiences**, and
 - [5] **take inspiration from other industries** (e.g., offshore oil) to push the envelope for transformation in the nuclear industry.





What is Nuclear Innovation?



Innovation: What & Why

What is Innovation?

Innovation - the introduction of something new

Business landscape is always evolving

- New Competition – Lower Costs
- Changing Demand
- Social Changes
- Changing Technologies

Why Innovate?

Innovation is crucial to enable our business to adapt to the changing landscape

What is **unique** about nuclear innovation?



The nuclear industry has three notable characteristics that influence innovation:

Strong Safety Culture

Innovation must always ensure that change is evaluated to not adversely effect safety

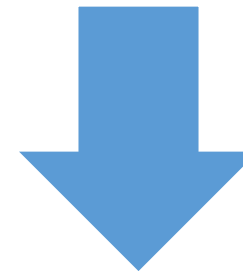
Risk and Change Adverse Culture

Innovation must be introduced in a way that will overcome the strong tendency of nuclear organization to avoid any risk or proposed change

Highly Regulated Industry

Innovation must be evaluated to confirm compliance

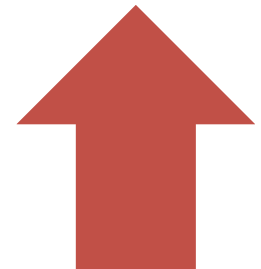
Innovation leaders face two competing forces:



Critical need to change



Strong organizational resistance to change



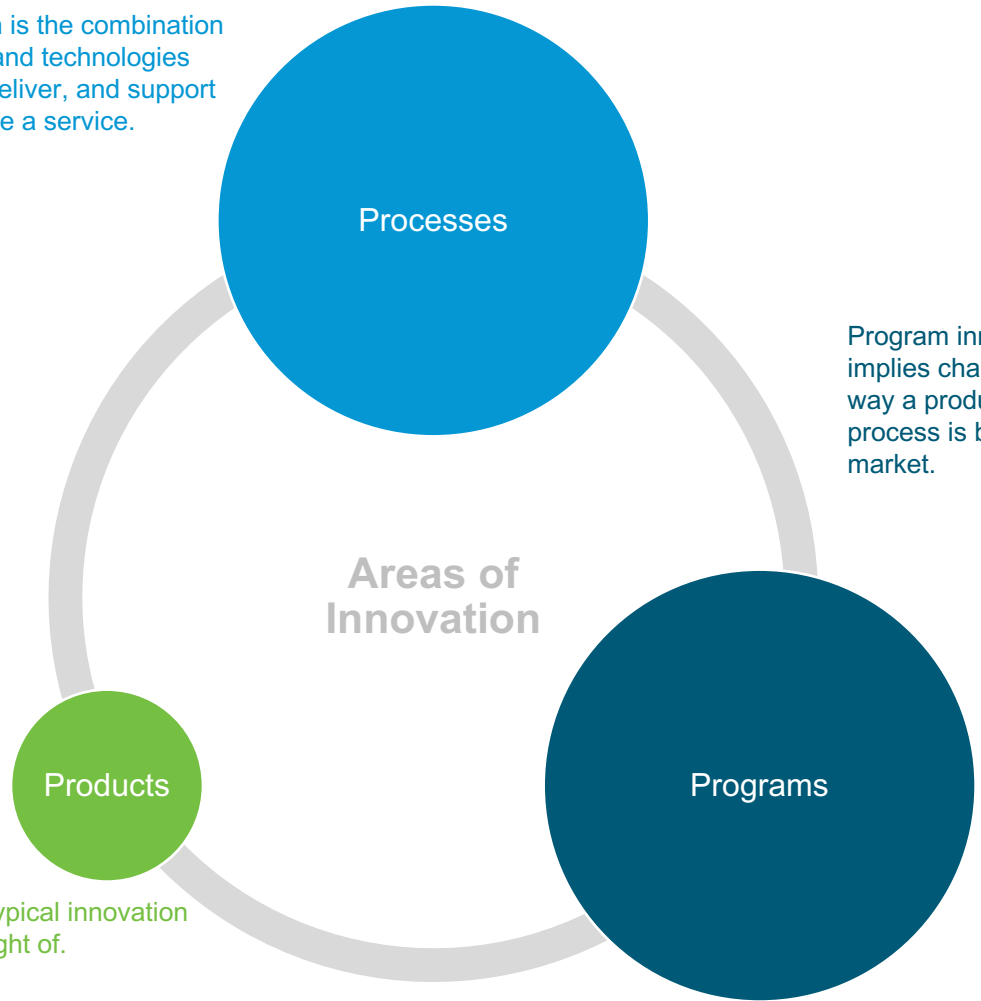


Business needs should drive nuclear innovation.

Process innovation is the combination of facilities, skills, and technologies used to produce, deliver, and support a product or provide a service.

Innovation should focus improving **processes** and **programs**.

And leverage use of **reliable off-the-shelf products** to reduce overall risk.



Program innovation implies changes in the way a product or process is brought to market.

What typical innovation is thought of.



To support nuclear innovation, **three key initiatives** were identified from the workshop and are being actively pursued.

1

Develop an Innovation Portal

to support industry through providing a unified resource for the current technologies available, demonstrating how they interrelate for business-driven innovation that addresses a specific functional area.

2

Establish an innovation group

to routinely convene and discuss lessons learned and any innovation progress for the industry.

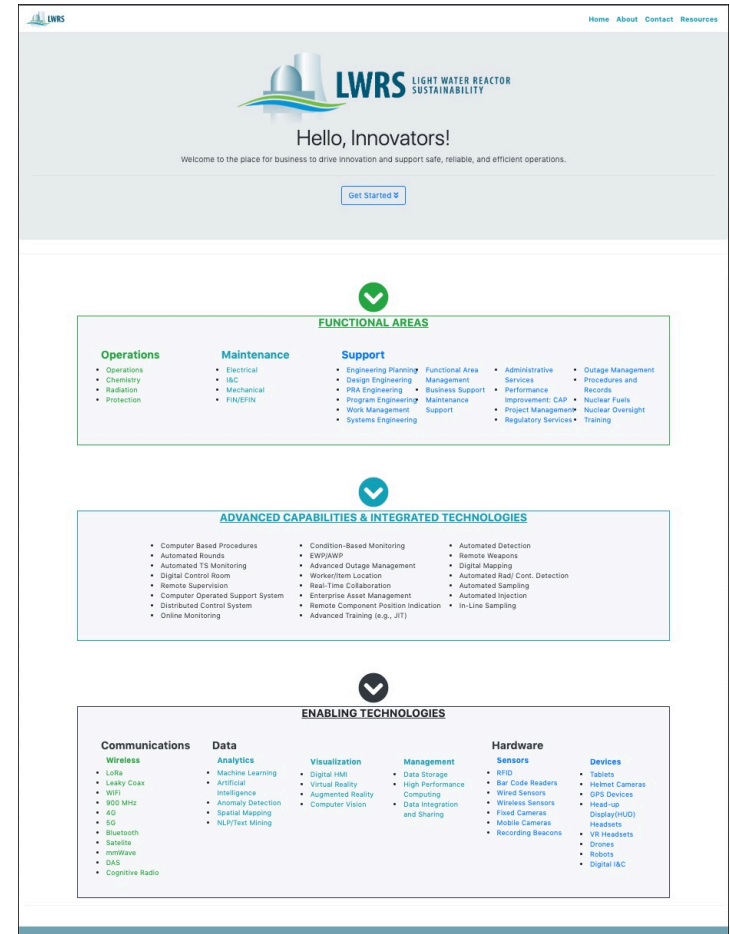
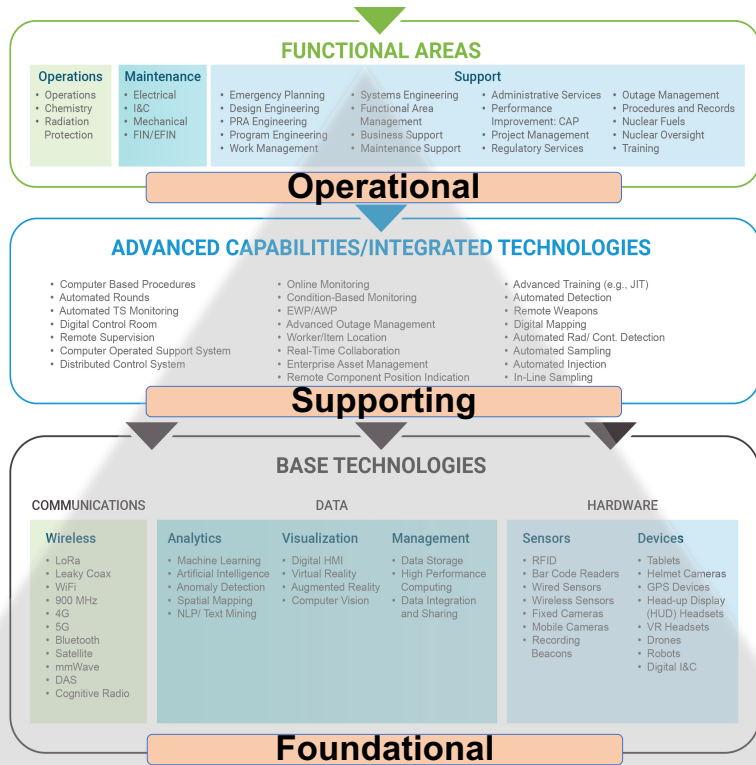
3

Facilitate open discussions with industry

to share lessons learned in nuclear innovation through recurrent meetings with utilities, vendors, and research organizations.



The Innovation Portal will support business-driven innovation through a **top-down** and **bottom-up** approach.



The LWRS Program is **developing key features and functions** to support vendors, utilities, and research organizations alike with innovation in the U.S. nuclear industry.



The innovation portal will **provide information that enables the identification and selection** of enabling technology and capabilities that synergistically support key functional areas.

The user can **enter the portal at a given level** of the innovation map (Functional Area, Advanced Capability, or Enabling Technology).

The user is able to understand **how technology maps** to advanced capabilities and applied functional areas.

Upon selecting a given link, the user will be taken to a **detailed page**.

FUNCTIONAL AREAS

- Operations**
 - Operations
 - Chemistry
 - Radiation
 - Protection
- Maintenance**
 - Electrical
 - ISC
 - Mechanical
 - Flu/ETM
- Support**
 - Engineering Planning
 - Design Engineering
 - PRA Engineering
 - Program Engineering
 - Work Management
 - Systems Engineering
- Functional Area**
 - Management
 - Business Support
 - Maintenance
 - Support
- Administrative Services**
 - Performance Improvement: CAP
 - Project Management
 - Regulatory Services
- Outage Management**
 - Procedures and Records
 - Nuclear Fuels
 - Nuclear Oversight
 - Training

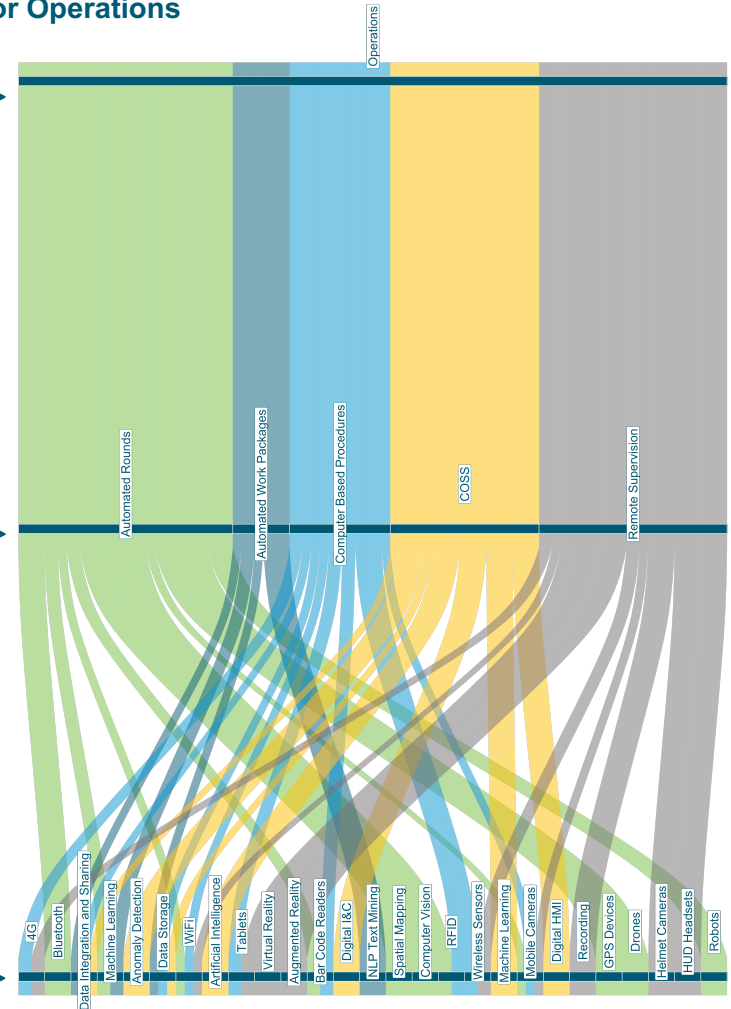
ADVANCED CAPABILITIES & INTEGRATED TECHNOLOGIES

- Computer Based Procedures
- Automated Rounds
- Automated TS Monitoring
- Digital Control Room
- Remote Supervision
- Computer Operated Support System
- Distributed Control System
- Online Monitoring
- Condition-Based Monitoring
- EW/IAWP
- Advanced Outage Management
- Workitem Location
- Real-Time Collaboration
- Enterprise Asset Management
- Remote Component Position Indication
- Advanced Training (e.g., JT)
- Automated Detection
- Remote Weapons
- Digital Mapping
- Automated Red Cont. Detection
- Automated Sampling
- Automated Injection
- In-Line Sampling

ENABLING TECHNOLOGIES

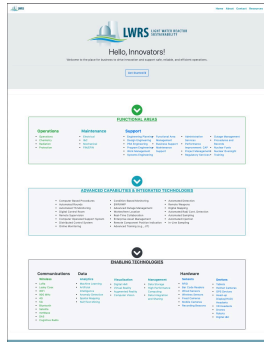
- Communications**
 - Wireless
 - LiFi
 - Leaky Coax
 - WiFi
 - 800 MHz
 - 4G
 - 5G
 - Bluetooth
 - Satellite
 - mesh
 - DAS
 - Cognitive Radio
- Data**
 - Analytics
 - Machine Learning
 - Artificial Intelligence
 - Autonomy Detection
 - Spatial Mapping
 - NLP/Text Mining
- Visualization**
 - Digital HMI
 - Virtual Reality
 - Augmented Reality
 - Computer Vision
- Management**
 - Data Storage
 - High Performance Computing
 - Data Integration and Sharing
- Hardware**
 - Sensors
 - RFID
 - Bar Code Readers
 - Wireless Sensors
 - Fixed Cameras
 - Mobile Cameras
 - Recording Beacons
 - Devices
 - Tablets
 - Helmet Cameras
 - GPS Devices
 - Headup Display(RUD)
 - Headsets
 - VR Headsets
 - Drone
 - Robots
 - Digital I&C

(Example) Business Need: Reduce O&M Costs for Operations



FOR ILLUSTRATIVE PURPOSES ONLY

Detailed information is provided to support the **identification, selection, and implementation** of advanced capabilities and technologies.



A screenshot of the 'Advanced Capabilities | Computer Based Procedures' page. The page has a light blue header with the LWRS logo and the text 'LWRS LIGHT WATER REACTOR SUSTAINABILITY'. Below the header, the title 'Advanced Capabilities | Computer Based Procedures' is displayed in large, bold, blue letters. To the right of the title is a 'Back' button. The main content area is divided into several sections: 'Description:', 'Capability Benefits:', 'Related Functional Areas:', 'Related Base Technologies:', 'Applicable Standards, Guidance, and Reports:', 'Demonstrated Resources:', and 'Deployment Resources:'. Each section contains a list of items with brief descriptions. A 'Point of Contact' section is also present, listing the name 'Katya Le Blanc'.



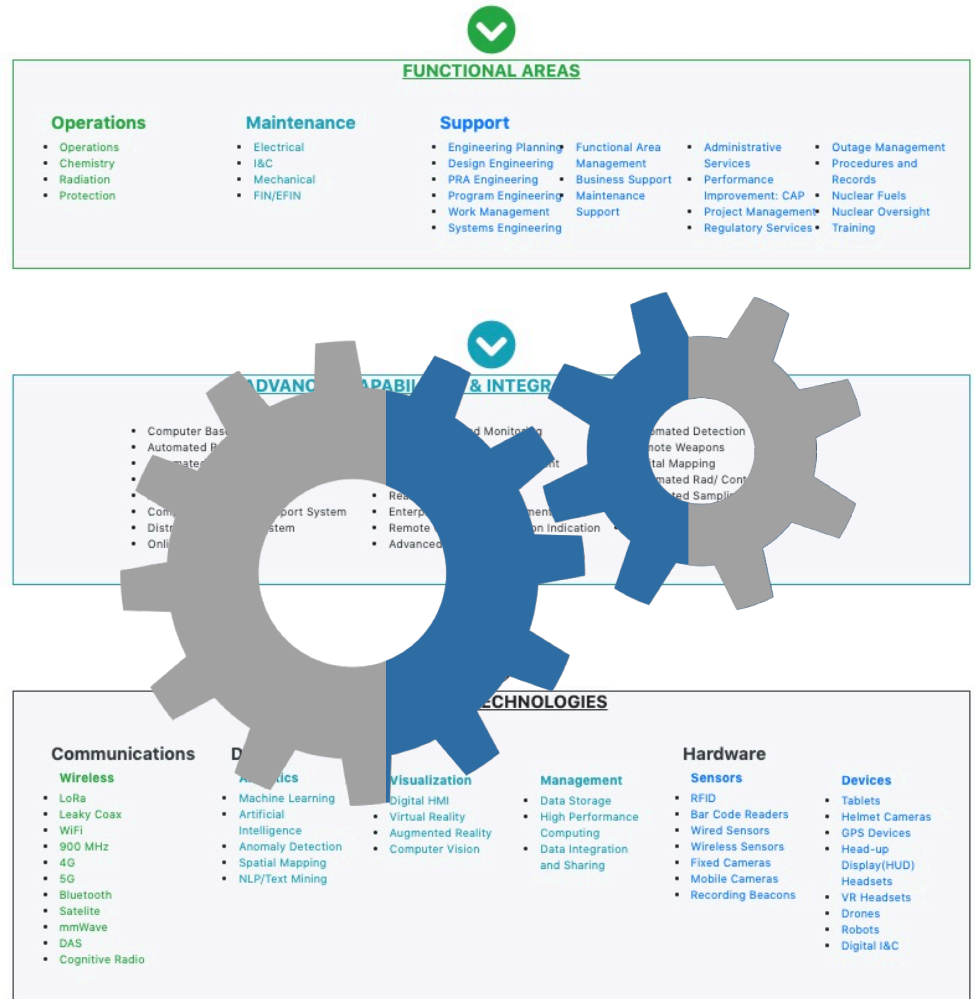
- **Detailed pages provide a summary** of benefits, related functional areas and technologies (inter-linking between the innovation map levels), guidance documents, standards, and related LWRS reports that support identification, selection, and implementation.
- A **point of contact** information is listed for further information.
- Ability to **enter and view lessons learned** will be added.



There will be **access to tools that allow utilities to perform ‘what-if’ evaluations** of using enabling technologies, advanced capabilities, and processes for specific utilities.

The tool will support **cost-benefit analyses** and **work function analyses** for strategic integration of technologies to support capabilities and key work functions.

We are looking at allowing users to enter in their unique information (locally) to perform the evaluations.

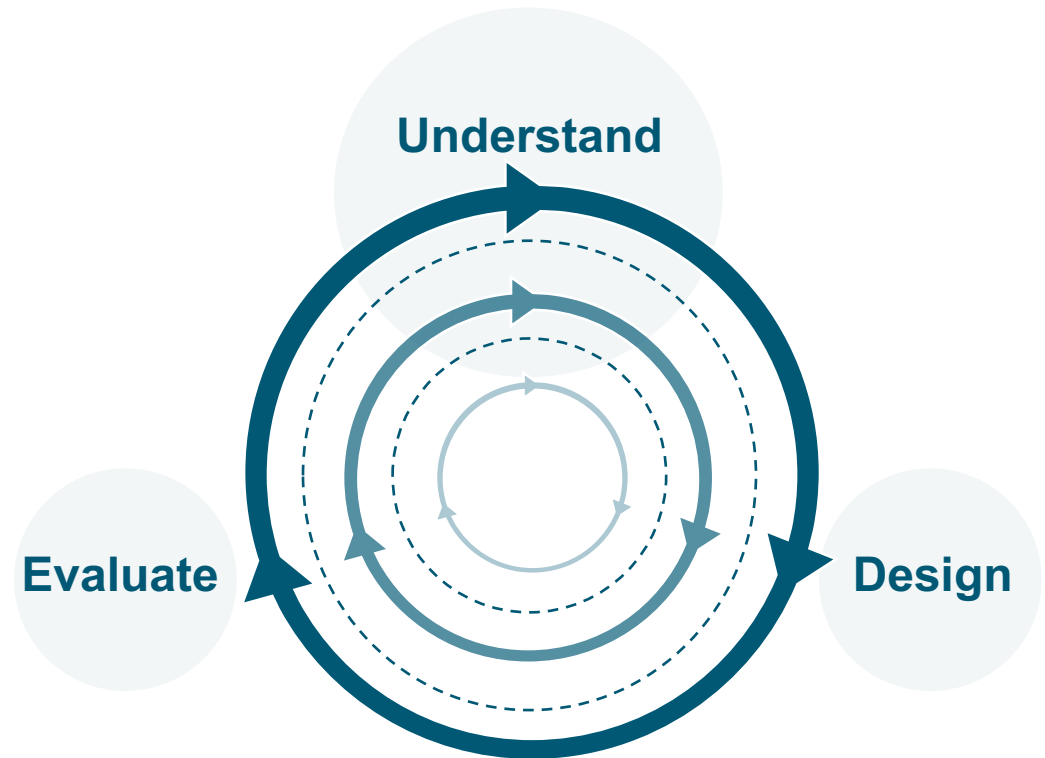


LWRS Program is looking for input from industry, including utilities, vendors, and universities to make the portal most meaningful for you.



We would like your feedback on information that you think is important for the portal.

We also would like to **share our findings** from the Nuclear Innovation Workshop with you through conference calls or on-site meetings.



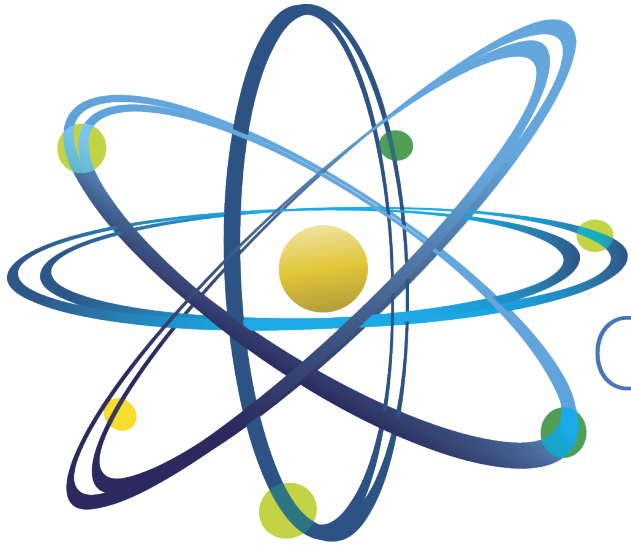
If you or anyone at your organization would benefit from this opportunity, please contact Craig Primer or Casey Kovesdi.

Craig.Primer@inl.gov (Plant Modernization Pathway Lead)

Casey.Kovesdi@inl.gov (Human Factors Scientist)



Questions?



Clean. **Reliable. Nuclear.**