Risk Analysis Methods & Tools for Advanced Reactors

Research Update

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Advanced Reactor Roadmap

A shared strategy to ensure success at scale

Serving government, academic, industrial, and public **stakeholders**

Almost 100 GWe of **new nuclear** will be needed by 2050. This means around **300 ARs** in the next **30 years**

7 Enablers and **46 key actions** chart our path towards a **net-zero future**

Convening the industry for **strategic action**

Industry's roadmap to the future fleet

AR Roadmap: Strategic Elements

Regulatory Efficiency

- **Licensing** — 7 Actions
- **Environmental** — 7 Actions
- **Oversight** — 2 Actions

Technology Readiness

- **Fuel Cycle** — 3 Actions
- **Plant/SSC Design** — 3 Actions
- **Supply Chain** — 7 Actions
- **Nuclear Beyond Electricity** — 3 Actions
- **Codes & Standards** — 2 Actions

Project Execution

- **Project Management** — 4 Actions
- **Engineering & Procurement** — 2 Actions
- **Construction & Commissioning** — 3 Actions
- **Initial Operations & Maintenance** — 1 Actions
- **Workforce Development** — 4 Actions

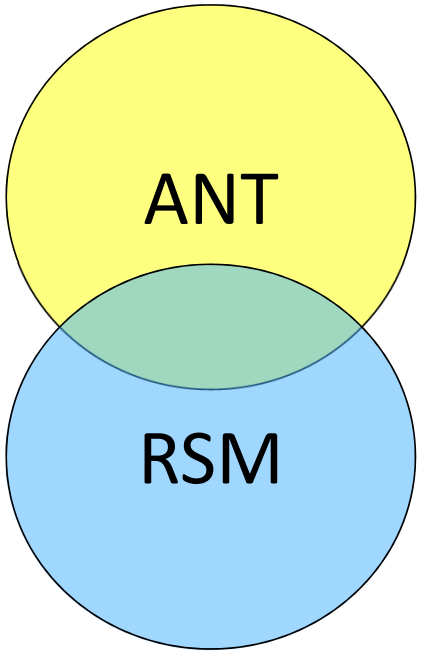
Benefit from Risk Analysis Methods & Tools Research

AR Roadmap: Actions Related to Risk Methods Research

- Technology Readiness
  - Demonstrate risk-informed and performance-based approach
  - Develop and qualify analytical tools for advanced reactor design
  - Develop guide on leveraging legacy reactor experience
  - Establish decoupling framework for Nuclear Beyond Electricity users
- Regulatory Efficiency
  - Develop enhancements to licensing process
  - Develop industry recommendations for regulatory guidance on operator staffing
  - Develop technical input to siting criteria
- Project Execution
  - Reduce operating and maintenance costs to a level similar to other thermal plants

Coordinating the EPRI ANT & RSM Programs

- Risk Analysis Methods and Tools for Advanced Reactors
  - Unique partnership between two EPRI divisions
    - Advanced Nuclear Technology (ANT)
      - EPRI Nuclear Sector
      - Future Fleet division
    - Risk and Safety Management (RSM)
      - EPRI Nuclear Sector
      - Current Fleet / Engineering division
  - Joining forces through a matrixed approach to address common challenges



Advanced Reactors: Gen-III+ LW-SMRs & Gen-IV Non-LWRs

EPRI Research on Risk Analysis Methods & Tools for ARs

OBJECTIVES

- Determine the readiness of current risk methods and tools for use in Advanced Reactors
- Develop and execute a research roadmap to guide EPRI research to address new technology and new decisions
- Support related ANT research
  - DOE sponsored work on advanced reactor design
  - Technical Methodology to Demonstrate the Separation of Nuclear Facilities from Adjacent Facilities

PRODUCTS

- Published EPRI report with identified gaps and a research roadmap (August 2023)
- Stakeholder collaboration group to share common challenges and approaches to solutions

NEXT STEPS

- Continue monitoring & prioritizing the key challenges to assist the development and deployment of Advanced Reactors
- Expanding research activities in 2024…

EPRI Report 3002026495
Evaluation of Risk Analysis Methods & Tools for Advanced Reactors

EPRI Report 3002026499
Technical Methodology to Demonstrate the Separation of Nuclear Facilities from Adjacent Facilities

Risk Analysis Methods and Tools for New Technology

Basis

- Risk analysis is an important input to final designs and initial licensing
- New technologies used in advanced reactor designs present new challenges to the existing risk analysis toolset

Actions

- Develop guidance for collection & analysis of reliability and performance data for new components & systems
- Develop common approaches for passive system reliability analysis
- Develop tools for treating of digital systems in PRA
- Ensure HRA methods capture the impacts of new human interfaces

Value

- Common methods, tools, and data that support realistic risk analysis in support of design and licensing activities

Advanced Risk-Informed Decision-Making Approaches

Basis

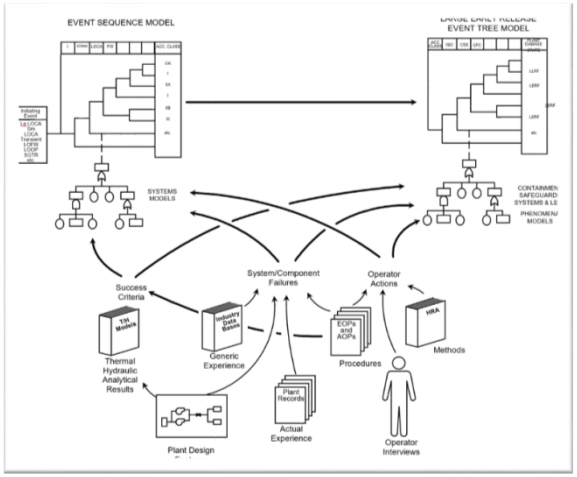
- Risk analysis for advanced reactors is expected to produce different results and insights than the current fleet and regulators are familiar with
- The current risk-informed decision-making approaches may not be the most realistic approach for advanced reactors

Actions

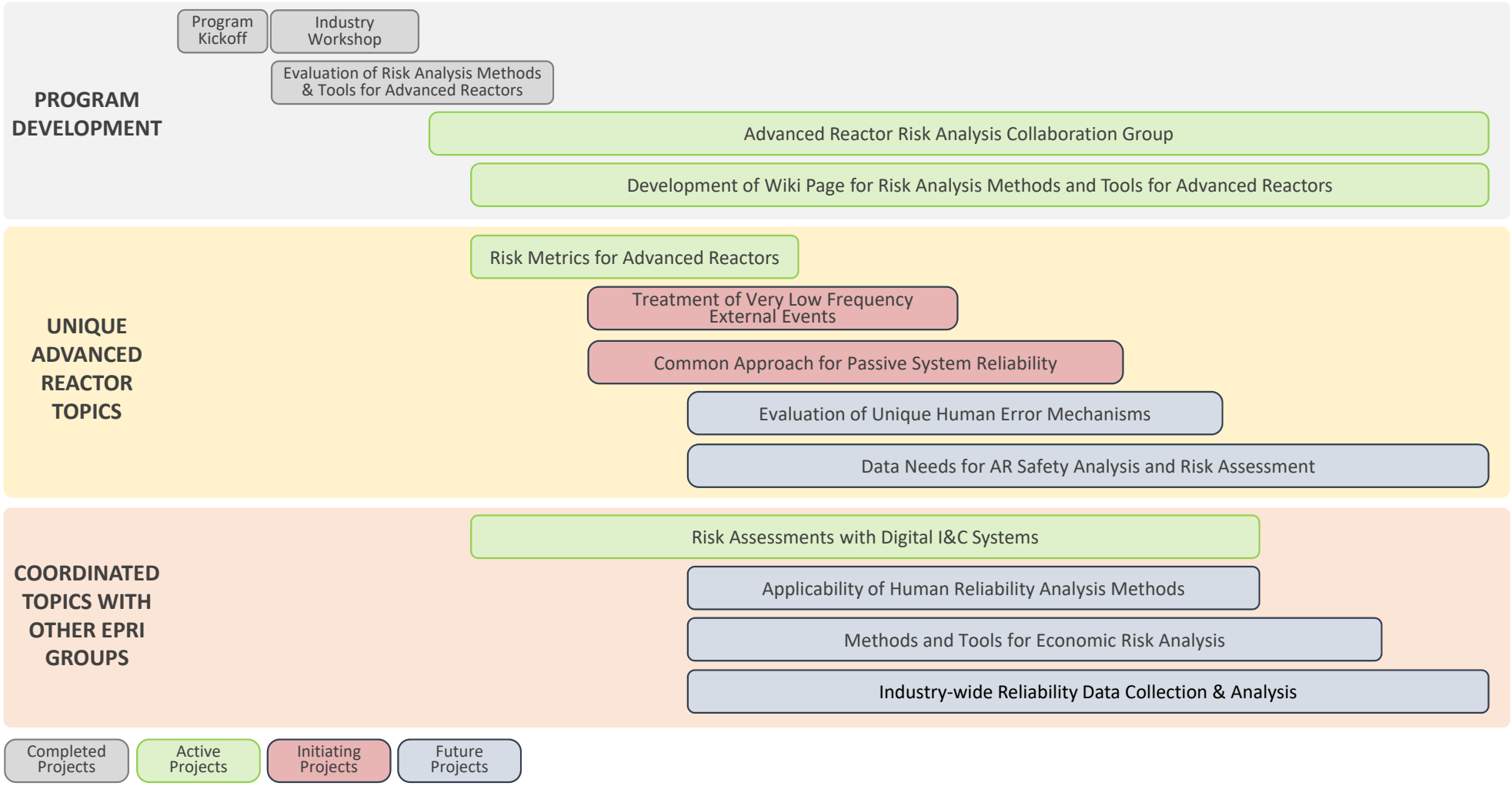
- Develop guidance for selecting appropriate risk metrics for realistic decision making
- Improve the technical basis for the treatment of very low frequency external events
- Expand PRA methods and tools to support broader economic risk analysis

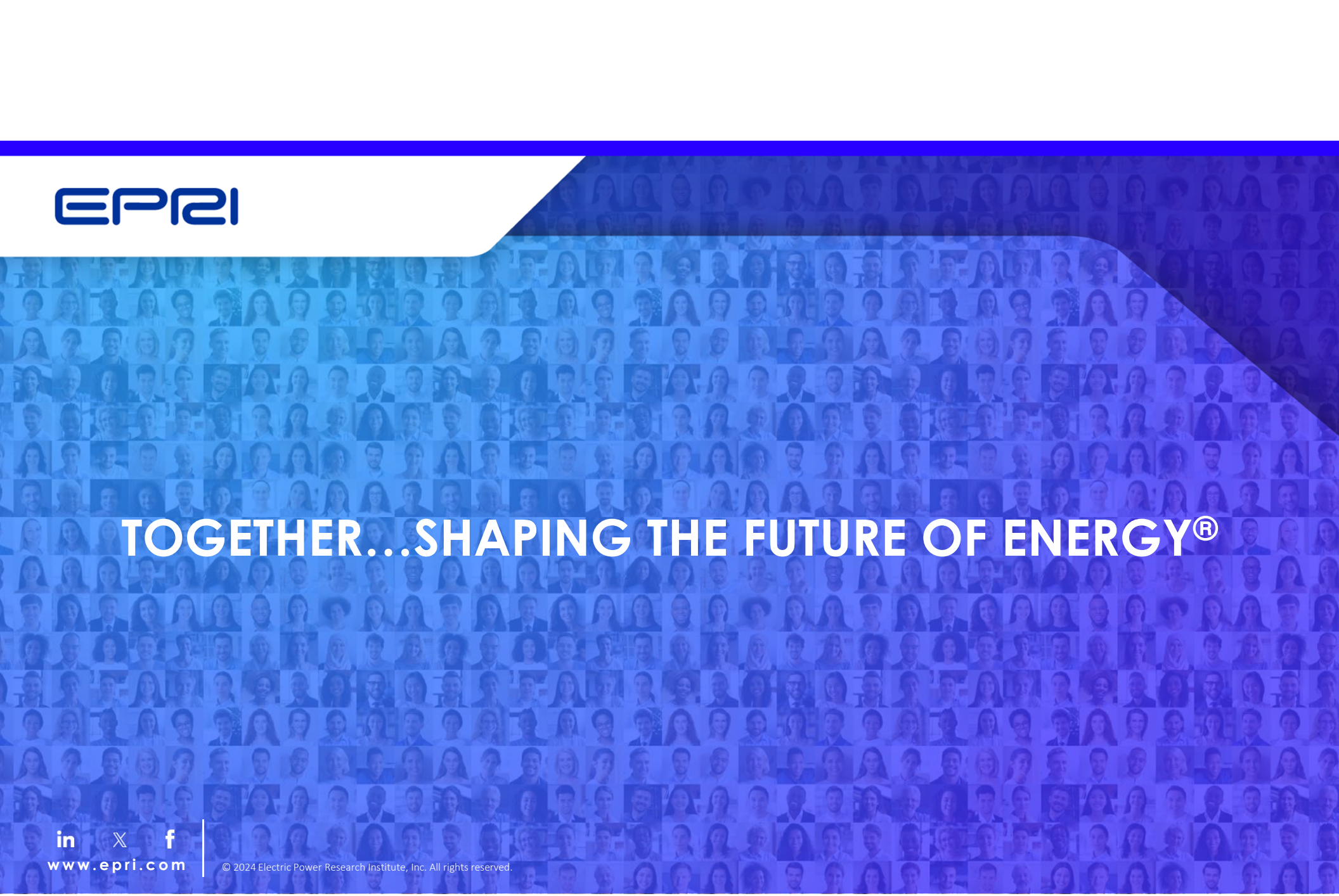
Value

- Streamlined risk analysis approaches, results, and insights that are appropriate for advanced reactors



Roadmap for Risk Analysis Methods & Tools





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