Vision for an EPRI Fusion Program to Support Commercialization of Fusion

Overview of EPRI Fusion Strategic Program

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INFUSE Virtual Mini-Workshop
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Vision

To be a world leader in advancing science and technology solutions for a clean energy future

Mission

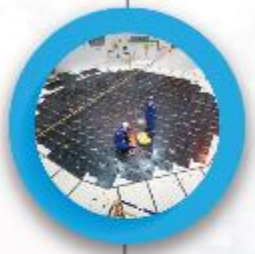
Advancing safe, reliable, affordable, and clean energy for society through global collaboration, science and technology innovation, and applied research.

Together…Shaping the Future of Energy®

EPRI Research & Development

TECHNOLOGY INNOVATION

Driving thought leadership, advanced R&D, and technology scouting and incubation to sustain a full pipeline of solutions



Nuclear Power

Energy Supply and Low-Carbon Resources

Electrification and Sustainable Energy Strategy

Transmission and Distribution Infrastructure

Integrated Grid and Energy Services

STRATEGIC RESEARCH

Low-Carbon Resources

End-Use/ Economy-Wide Carbon Reduction

Electric System Reliability/Resilience

Electric System Flexibility

Market Transformation/ Policy/Regulatory Education

EPRI Accelerates Technology Advancement

LABORATORIES AND UNIVERSITIES

Basic research and development

SUPPLIERS AND VENDORS

Technology commercialization

EPRI

Collaborative technology development, integration, and application

Thought leadership illuminates emerging developments, opportunities, and trends.

Technology Innovation Scouting searches globally for emerging technologies and concepts to provide insights on industry challenges and solutions.

Sector R&D conducts research and demonstrations to address challenges, deploy results, and provide supporting services for existing and emerging technologies.

EPRI stimulates innovation and plays a key role in validating technology across multiple utilities, fostering widespread acceptance, and helping accelerate technology to commercial development and industry adoption

EPRI Perspective on Fusion Commercialization

What is required for commercial adoption…

TECHNOLOGIES THAT ARE:

- mature → *demonstration*
- compelling → *new attributes & capabilities*
- competitive → *cost and value*

CUSTOMERS WHO:

- understand → *information & engagement*
- believe → *evidence of performance*
- need → *business case*

EPRI uniquely positioned to provide…

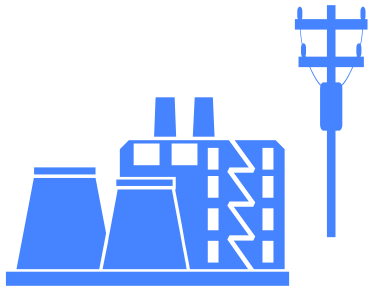
Industry informed and focused R&D that accelerates demonstration and deployment of viable technologies

Access to years of OE each day through engagement with owner-operators globally (including 75% of world's commercial nuclear operators)

End-user requirements that ensure technology attributes are aligned with customer needs

EPRI's collaborative model and tech transfer mission can accelerate fusion's move to market.

Commercialization: Pilot vs. Commercial Plants

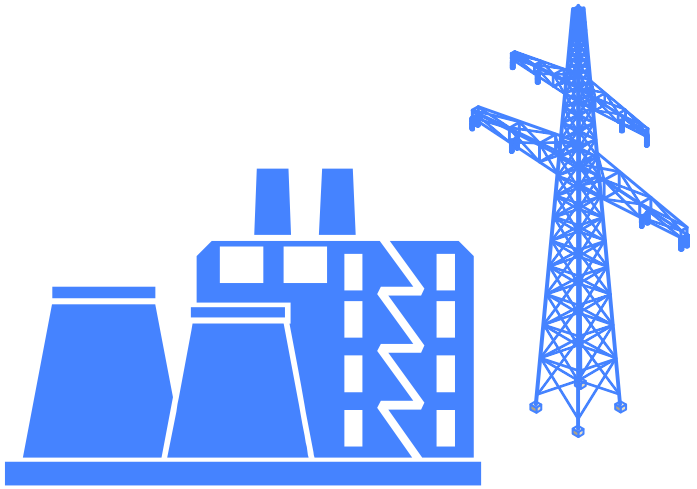


Pilot Plant

Designed, built to:

- understand operation
- identify problems
- allow for reengineering and replacement
- support, enable scale-up

Not focused on reliability, availability, economics; may only operate intermittently

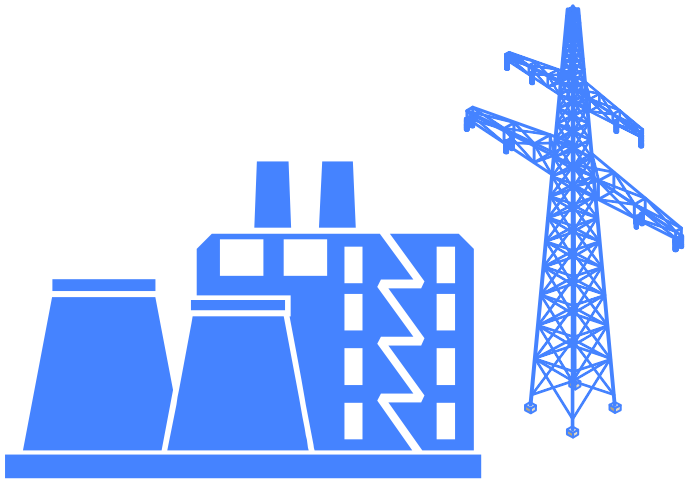


1st Commercial Plant

Designed, built for:

- reliability
- availability
- economics

Project risks for FOAK may preclude standard commercial contractual and procurement conditions



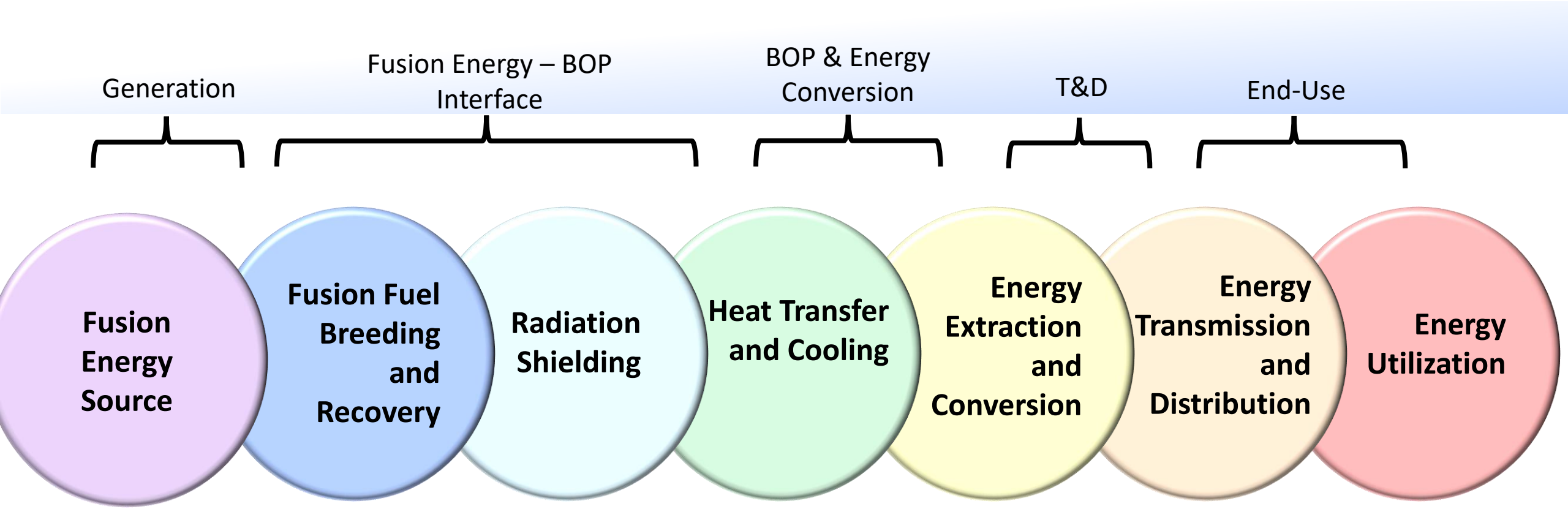
2nd Commercial Plant

Second in series may reduce project risks sufficiently to enable standard commercial contractual and procurement conditions

To fleet deployment

Seven Spheres of Fusion Energy Systems

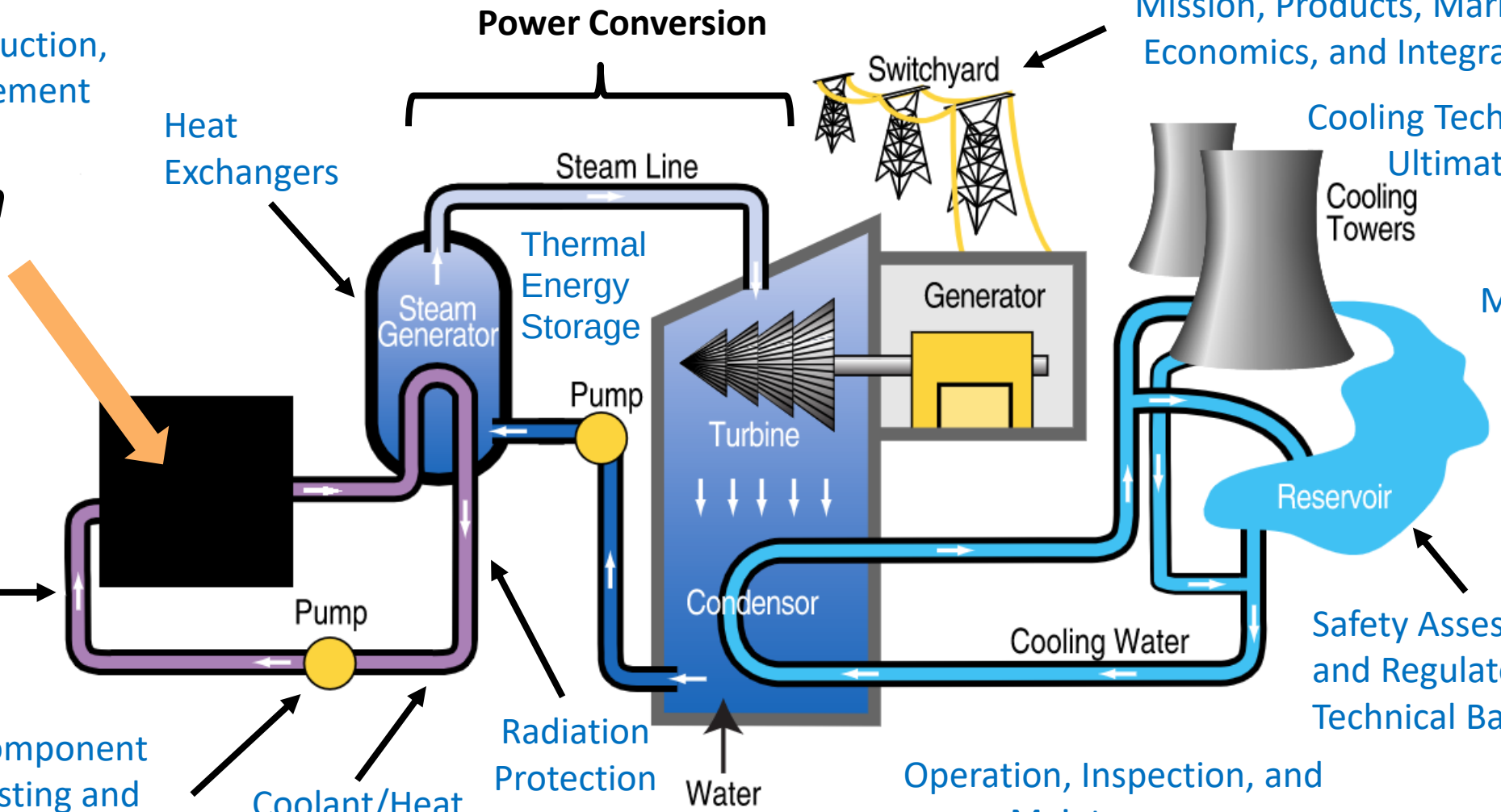
Inspired by J. Kepler, Mysterium Cosmographicum (1596)



Many engineering challenges lie outside of the fusion energy source

Leveraging Existing Industry Experience, Expertise

TRADITIONAL THERMAL POWER PLANT CONFIGURATION



Engineering, Construction, and Project Management

Heat Exchangers

Insert Fusion Heat Source Here

Mission, Products, Markets, Economics, and Integration

Cooling Technology and Ultimate Heat Sink

Waste Management

Materials, Manufacturing, and Code Qualification

Component Testing and Qualification

Coolant/Heat Transfer Chemistry

Radiation Protection

Safety Assessment and Regulatory Technical Basis

Operation, Inspection, and Maintenance

Turnover, Commissioning and Initial Operations

Adapted from image courtesy of TVA; Wikimedia Commons

Establishing EPRI as a Collaborative Resource

Vision: EPRI can support and accelerate commercialization of fusion technology via collaborative R&D to better align technology attributes with end-user and market needs

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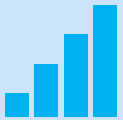

Execution: Focus and alignment with EPRI core strengths

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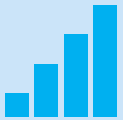

Execution: Focus and alignment with EPRI core strengths

EPRI launched internally funded fusion energy strategic program in 2023.

Fusion Energy Strategic Program: Objectives

- Support and enable fusion commercialization
- Inform EPRI and its members on technology, challenges, opportunities (prepare for the future)
- Generate publicly available products (generally)
- Target broadest benefit for stakeholders, including the fusion community, EPRI members, regulators, and decision-makers
  - **More tailored projects can/will be pursued outside of this internally sponsored program (supplemental projects)**

Collaborative R&D and Technology Transfer for Commercialization of Fusion

EPRI can leverage its unique access to a broad R&D portfolio and the equivalent of years of operating experience every day

REQUIREMENTS	EPRI ROLES
» Economic & reliable energy generation	• Technoeconomic assessments and modeling of energy markets • Advanced power conversion systems
» Path to Licensing, Supply Chain, and Deployment	• Technical basis for safety cases • Project development & execution guidance • Advanced engineering & construction methods • Advanced manufacturing & materials • Material/component testing and qualification
» Practical Operation & Maintenance	• Non-destructive examination & sensors • Collection and sharing of operating experience • State-of-the-art maintenance programs

2023 Activities

Engaging the fusion community and relevant stakeholders

EPRI Fusion Forum • Hosting Industry Workshops • Attending Relevant Conferences

Informing EPRI community about state of fusion technology

Technology Insights Briefs: Quick reads on key fusion topics

Addressing research gaps on pathway to commercialization

Building a Body of Knowledge to Inform a Safety-in-Design Methodology for Fusion Facilities

2024 Project Pipeline (Tentative)

Continuing:

- Fusion Forum (bimonthly webcast)
- Safety-in-Design Methodology to Support Fusion Energy
- Hosting Industry Workshops

New/To Be Scoped:

- Fusion Technology Scouting Portal
- Analyzing Fusion’s Role in Future Energy Market
- Revisiting EPRI's Utility Requirements for Fusion
- Fusion Material and Manufacturing Approaches Gap Analysis
- Operating Experience with Tritium Handling in Commercial and Government Nuclear Facilities
- Investigating Fusion Use Cases for Quantum Sciences