

**DISCUSSION GUIDE: GENERATION SECTOR COUNCIL OBJECTIVES**

The Generation sector leadership team has developed 10 proposed Council Objectives to help ensure alignment of EPRI R&D with key industry priorities. The list spans numerous challenges associated with the full lifecycle of existing and emerging assets, including project development, operation and maintenance, cross-cutting solutions, and post-closure considerations.

While this list is intended to help ensure strategic alignment of EPRI R&D over time, the expectation is that the amount of emphasis placed on achieving specific objectives can – and will – change based on evolving industry needs. Solutions are not exclusive to the category in which they are listed, as advancements to existing assets may also apply to emerging assets, and vice versa.

These proposed objectives are foundational to discussions planned for the February 2025 Generation Council meeting. During our time together in Charlotte, we will address these objectives in the context of broader efforts to fill R&D gaps across the full asset lifecycle.

**R&D to Enable a Customer-Focused Energy Supply Transition**

Energy companies in markets around the world are leading transformational change, while working to maintain affordability and reliability for customers. As an independent R&D organization with a public-purpose mission, EPRI has established Generation sector Council Objectives serving as a North Star in fulfilling its commitment to identify and advance technical solutions benefitting society.

**PROPOSED COUNCIL OBJECTIVES**

*Numbers are included for ease of reference and do not indicate priority order. More detailed descriptions below.*

<p><b>EXISTING ASSETS</b></p> <p><i>Resources Deployed Broadly at Scale Today</i></p>
<p><b>EMERGING ASSETS</b></p> <p><i>Resources Approaching Broad Deployment at Scale</i></p>
<p><b>CROSS-CUTTING</b></p>

1. **Optimize and extract maximum value from the gas fleet**
2. **Minimize the total lifecycle cost and maximize value of renewables assets**
3. **Leverage AI and digital technologies to optimize fleet operations**
4. **Ensure the reliability of the coal fleet**
5. **Minimize post-closure costs for generation assets**
6. **Enable broad deployment of energy storage**
7. **Enable CCS decarbonization pathways for natural gas**
8. **Enable low-carbon fuels decarbonization pathways**
9. **Accelerate deployment timelines from first-of-a-kind to n<sup>th</sup>-of-a-kind**
10. **Develop a risk-informed evaluation methodology for investments and project management**

### 1. Optimize and extract maximum value from the gas fleet

**Current state:** The operation of the gas fleet is evolving over the 30- to 50+-year operating life of the plant, primarily driven by the incorporation of larger shares of variable generation.

**Industry need:** Develop a systematic approach for assessing the evolution of needs and determine optimal operating, maintenance, and investment strategies over the life of the gas assets to deliver value in an environmentally responsible manner.

**EPRI's role:** Develop technical resources supporting design, development, and lifecycle operational decisions that will lead to maximizing the value of the gas assets over the operating lifetime.

### 2. Minimize the total lifecycle cost and maximize value of renewables assets

**Current state:** While the first generation of wind and solar assets have been built in a highly competitive environment that incentivizes capital cost minimization, the next generation will need to operate with higher reliability and performance, while providing more flexibility and grid services. Other renewable assets, such as hydropower, have delivered reliable power for decades and are today candidates for uprates and other enhancements to optimize operation and extend their useful life.

**Industry need:** Drive operational experience into better designs, guidelines, and tools to manage plants more effectively and minimize total lifecycle costs. Integrated life management resources are needed to help with procurement, quality programs, and lifecycle equipment health, while circular economy practices support environmental performance. Finally, there is a need to apply these principles to newer renewable energy technologies such as geothermal, offshore wind, and biomass, where the technologies are finding market potential.

**EPRI's role:** Build a library of technical resources supporting design, development, and lifecycle operational decisions to minimize costs for renewable assets crucial to driving decarbonization. Foster technical exchange among asset owners and operators to ensure sharing of lessons learned and identification of emerging priorities.

### 3. Leverage artificial intelligence and digital technologies to optimize fleet operations

**Current state:** Although the maturity of digitalization initiatives within utilities is highly variable, most organizations agree that there is opportunity to leverage data more effectively in managing asset performance and reliability, implementing automation in support of more dynamic power plant and system operations, and improving security through comprehensive procedures for protection, detection, and recovery.

**Industry need:** Provide comprehensive analysis of artificial intelligence digitalization options, including cost/benefit analysis techniques to assist decision-making and implementation guidelines. Identify opportunities for artificial intelligence tools and technologies to supplement existing staff and systems to improve operational efficiency.

Support the shift towards remote operations for energy supply assets and the growing need to improve alarm notification and management for operators as digitalization initiatives continue to grow. Support the workforce in leveraging digital tools.

**EPRI's role:** Establish a library of technical resources supporting option analysis, economic evaluation, and rigorous implementation of digitalization technologies supported by industry networking to exchange lessons learned and best practices.

#### 4. Ensure the reliability of the coal fleet

**Current state:** Time horizons for coal fleet closure vary and can change. Managing both the asset and the staff through its full lifecycle and into retirement requires understanding of several risks, including managing the potential for a delayed closure and the operational implications of changing the role of an asset.

**Industry need:** Ensure the coal fleet is in a condition to continue to operate reliably, affordably, safely, and environmentally responsibly.

**EPRI's role:** Develop a risk management framework that can be used to allow for optimal operating and maintenance decisions for the coal fleet through its full lifecycle and into retirement.

#### 5. Minimize post-closure costs for generation assets

**Current state:** The buildout of renewables and the continued operation of existing thermal assets are driven by minimizing total installed cost and production cost. This can and historically has increased post-closure costs in the form of remediation, waste disposal, etc. These costs are increasing as new regulations are creating more ongoing requirements.

**Industry need:** Reducing post-closure costs and minimizing potential liabilities require new technologies and methods, including actions that can be taken during operation to prepare for site repurposing or retirement in a cost-effective and environmentally responsible manner. For new renewables, it is important to establish designs that encourage the recycling/reuse of materials to develop circular economy pathways.

**EPRI's role:** Identify and prioritize post-closure cost-reduction opportunities. Develop and test new technologies and methods. Connect with stakeholders to establish a value chain for recycled renewables byproducts. Outline the results through guidelines to facilitate implementation and regulatory acceptance.

#### 6. Enable broad deployment of energy storage

**Current state:** As wind and solar assets continue to deploy and become the predominant source of power generation, energy storage is expected to grow and support demand and grid reliability.

**Industry need:** As the energy system relies increasingly on variable renewables, short-duration batteries, large-scale pumped hydro, and emerging long-duration technologies could all play a role in addressing energy demand, helping ensure resource adequacy, and providing grid services. In a marketplace crowded with emerging technologies, evaluating the roles and deployment of potential industry storage solutions requires specialized expertise in selecting technologies, designing and operating assets, and planning for end-of-use.

**EPRI's role:** Conduct assessments for case studies where broader energy storage deployment may be needed and create technical resources supporting design, development, and lifecycle operational decisions for deployment.

## 7. Enable CCS decarbonization pathways for natural gas

**Current state:** Global deployment of power generation CO<sub>2</sub> capture and storage (CCS) is limited to four coal-fired facilities and one smaller-scale gas turbine application that is no longer operational. CO<sub>2</sub> capture technologies for natural gas units require 10 to 20 commercial-scale deployments to prove market viability, cost trajectory, and risk management.

**Industry need:** The power sector needs to deploy CCS at scale as part of a comprehensive set of solutions to meet net-zero targets, and there have been no deployments of CCS on gas power plants to date. As CCS deploys in the power sector, energy companies need to identify unique considerations for existing site applications vs. new site builds. As incentives drive CCS growth in other industries, it is important that the power sector understand how to best leverage new CO<sub>2</sub> transport and storage infrastructure.

**EPRI's role:** Develop a library of technical resources supporting design, development, and lifecycle operational decisions that will lead to least-cost and timely deployment of CCS for natural gas power generation.

## 8. Enable low-carbon fuels decarbonization pathways

**Current state:** The current gas fleet is projected to play a role in supporting the energy transition but faces pressure to decarbonize. Units with low capacity factors may not be economically suitable for CO<sub>2</sub> capture. Alternative, low-carbon fuels could provide reduced CO<sub>2</sub> emissions while supporting reliability and resilience.

**Industry need:** Transitioning to low-carbon fuels will require new value chains and infrastructure to produce, store, and deliver fuels to power generation facilities. With assets capable of handling 100% hydrogen and ammonia not yet available, today's power plant operators need to understand the quantity of low-carbon fuels existing assets can use without significant modifications.

**EPRI's role:** Build a library of technical resources supporting design, development, and lifecycle operational decisions that could lead to deployment of economic and robust low-carbon fuels supply chains for power generation.

## 9. Accelerate deployment timelines from first-of-a-kind to n<sup>th</sup>-of-a-kind

**Current state:** Many types of power generation technologies are likely needed to support the energy transition. While many of today's commercially available technologies will continue to increase in deployment (e.g., solar, wind, gas), nascent technologies require additional support to achieve commercial scale.

**Industry need:** History has shown that implementing new energy supply technologies takes a thoughtful, phased approach to demonstration and deployment at scale. Accelerating emerging, low-carbon technologies toward the scale and cost required for broad deployment involves conducting several full-scale demonstrations and sharing learnings broadly across the industry.

**EPRI's role:** Develop a prioritized methodology to identify and support activities that can accelerate deployment of emerging energy supply technologies.

## 10. Develop a risk-informed evaluation methodology for investments and project development

**Current state:** Utilities are confronting the multi-pronged challenge of rapidly expanding their energy supply fleet, transitioning from one set of legacy assets to a new set of technologies, and maintaining or increasing reliability in the face of more dynamic system requirements and growing threats to asset resilience. At the same time, the workforce transition continues with the most experienced staff leaving organizations, and supply chains are changing with increased concern over quality and timing of equipment delivery, placing a substantial challenge to utility staff in managing projects from development through commissioning and through operations.

**Industry need:** Develop risk-informed, comprehensive tools and resources to support the project execution side of energy supply investments, including in new generation, upgrades to existing assets, and myriad investments that could achieve increased system flexibility where no clear 'best' answer currently exists. Determine key decision points and actions to help ensure reliability and affordability across the asset lifecycle.

**EPRI's role:** Establish a list of key resources needed by utility staff to improve project execution, including design specifications, commissioning and quality guidelines, and data information cost/benefit analysis and decision-making. Identify opportunities to leverage EPRI's collaborative model to improve information-sharing and support the workforce in leading a successful transition.