

LCRI Decision Support Tool for Assessment of EH&S Impacts along the Low-Carbon Energy Value Chain

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Background/Objectives. Effective resilience to climate change will hinge on fundamental advances in a variety of zero- and low-carbon electric generation technologies and chemical energy carriers. The *Low Carbon Resources Initiative* (LCRI), a five-year joint initiative of the Electric Power Research Institute and the Gas Technology Institute, seeks to identify and accelerate development of promising zero- and low-carbon energy technologies from around the world, demonstrate and assess the performance of key technologies, identify possible improvements in sustainability, and inform stakeholders and the public about the nature of technology options and potential pathways towards a low-carbon future. To support these objectives, LCRI is sponsoring the development of a novel decision support system and related software apps to help identify, quantify, and compare potential environmental, health, and safety impacts along the low- and zero-carbon energy value chain.

Approach/Activities. The *LCRI Decision Support Tool* addresses a critical need for the low- and zero-carbon energy development marketplace. It is designed for engineers, environmental specialists, and other stakeholders to evaluate and compare a variety of key performance indicators (KPIs) related to sustainability across alternative energy development and delivery pathways, e.g., from primary energy production to energy conversion, storage, transport, and end use. To guide effective and timely decision making and accelerate possible technologies towards commercialization, the LCRI tool will enable stakeholders to reliably, yet efficiently, evaluate and compare how alternative technologies and management practices could potentially influence a series of metrics associated with key environmental, natural resource, safety, and socio-economic issues. At its core, the LCRI tool broadly applies many life-cycle assessment (LCA) concepts to enable a practical, yet robust and more cost-effective evaluation, compared to conventional LCAs, to quantify and compare priority KPIs among targeted energy development and delivery pathways. Examples of important sustainability related KPIs include carbon intensity, water intensity, ecological impacts, land use, energy efficiency, worker safety, and community impacts. By comparing KPIs among alternative competing scenarios, users can identify opportunities to minimize negative impacts, address localized and often varied stakeholder concerns, and maximize possible improvements in sustainability.

Results/Lessons Learned. The high level of detail, effort, and cost associated with conventional LCAs is often not needed to effectively screen and compare promising low-carbon technologies. Process characterization, KPI calculation modules, and a prototype software app of the *LCRI Decision Support Tool* are under development, focused primarily on hydrogen production, underground gas storage, and carbon capture and sequestration. More broadly, future applications will enable a variety of KPIs to be compared among a wide range of potential technologies, processes and management scenarios associated with low-carbon fuel alternatives, such as ammonia, synthetic hydrocarbons, renewable natural gas, and biofuels. The authors will describe general and technical approaches to process characterization and KPI calculations in the LCRI tool, present case studies of current applications, and discuss envisioned future applications and capabilities of this unique and novel decision support system.