LCRI LOW-CARBON RESOURCES INITIATIVE

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EXECUTIVE SUMMARY

Clean Hydrogen and Ammonia Costing Study

This report highlights the findings of a study comparing multiple scenarios for fueling two different-sized GE gas turbines, GE 7FA and GE LM6000, with 100% hydrogen or 100% ammonia. The study explored scenarios of either direct fueling of hydrogen or ammonia via interconnecting pipelines or via production of the fuels within 5 miles of the turbine location.
The study assumed clean hydrogen or ammonia production via PEM electrolysis or PEM electrolysis and ammonia synthesis, respectively, powered by a nearby solar array. The gas turbines in this study were assumed to operate daily during 4 pm–8 pm, local time, when typical grid market prices are higher and solar typically decreases.

The study assessed equipment sizing as well as footprint, permitting, utility, capital cost, and operating cost considerations. Key findings are listed below.

- Production of hydrogen and ammonia from electrolyzers coupled with solar PV power is possible, although the low-capacity factor presents some unique and novel challenges with sizing and operating the facilities.
- Similar electrolyzer sizes for the smaller turbine case (GE LM6000) can be used for supplying both 100% hydrogen and 100% ammonia to the turbine. However, as the turbine sizing increased, the hydrogen required for ammonia synthesis, and the downstream 100% ammonia combustion, exceeded the requirements for 100% hydrogen fueling.
- For the hydrogen mass requirements defined in this study, aboveground gaseous storage is not financially or spatially feasible given the alternatives of liquid hydrogen or liquid ammonia storage.
- The high impact equipment items, from a cost perspective, are the electrolyzers, liquefaction system, ammonia synthesis unit, vaporizer systems, gas compressors, and pipelines.

THE LOW-CARBON RESOURCES INITIATIVE

This report was published under the Low-Carbon Resources Initiative (LCRI), a joint effort of EPRI and GTI Energy addressing the need to accelerate development and deployment of low- and zero-carbon energy technologies. The LCRI is targeting advances in the production, distribution, and application of low-carbon energy carriers and the cross-cutting technologies that enable their integration at scale. These energy carriers, which include hydrogen, ammonia, synthetic fuels, and biofuels, are needed to enable affordable pathways to economy-wide decarbonization by mid-century. For more information, visit www.LowCarbonLCRI.com.

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GTI Energy is a leading research and training organization. Our trusted team works to scale impactful solutions that shape energy transitions by leveraging gases, liquids, infrastructure, and efficiency. We embrace systems thinking, open learning, and collaboration to develop, scale, and deploy the technologies needed for low-carbon, low-cost energy systems. www.gti.energy

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