NREL
NATIONAL RENEWABLE ENERGY LABORATORY

ENERGY SYSTEMS INTEGRATION

ESI optimizes the design and performance of electrical, thermal, fuel, and water pathways at all scales.

PARTNERSHIPS

NREL + GINER

Giner, a developer of proton-exchange membrane (PEM) technologies, has contracted with NREL to validate the performance of its large-scale PEM electrolyzer stacks. PEM electrolyzers work much like fuel cells run in reverse: a DC voltage applied to the anode and cathode causes water molecules to dissociate to hydrogen ions (protons) and oxygen molecules at the anode, and the protons pass through the PEM to combine with electrons at the cathode, where the hydrogen gas is formed and collected. PEM stacks from Giner produce hydrogen gas at pressures in the range of 40 bar (600 psig).

R&D STRATEGY

Giner delivered three 150-kilowatt electrolyzer stacks that NREL installed in its electrolyzer stack test bed in the ESIF. The test bed can provide as much as 1 megawatt of AC or DC power to operate such large-scale electrolyzers. NREL validated the performance of the electrolyzers under the full operating range of applied stack currents and hydrogen output pressures.

IMPACT

Utility-scale electrolyzers offer a new approach to energy storage by converting electricity into hydrogen, which can later be fed to a fuel cell to either produce electricity again or to power a vehicle. High-purity hydrogen can also be combined with carbon dioxide to produce natural gas or with nitrogen to create ammonia for fertilizer. This will help utilities handle excess generation from wind and solar energy sources, which sometimes produce more power than the utility grid can handle, often causing these renewable resources to be curtailed. Connecting electrolyzers to the grid would allow utilities to add more renewable energy to their power mix, because the excess generation can be converted and stored as hydrogen.

The Giner PEM electrolyzer installed in the ESIF's electrolyzer stack test bed for performance validation. *Photo by Dennis Schroeder, NREL 32586*

Partner with NREL at the ESIF

User facility access to the ESIF is awarded through the review and approval of user proposals, depending on the scientific merit, suitability of the user facilities, and the appropriateness of the work to DOE objectives, and includes a signed user agreement for the facility.

For more information, please visit:
www.nrel.gov/esi/work-with-us.html
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The Energy Systems Integration Facility (ESIF) at the National Renewable Energy Laboratory (NREL) provides the R&D capabilities needed for private industry, academia, government, and public entities to collaborate on utility-scale solutions for integrating renewable energy and other efficiency technologies into our energy systems.

To learn more about the ESIF, visit: ***www.nrel.gov/esif***.

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NREL/FS-5C00-66575 • March 2017
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