

Inventions & Innovation Project Abstract

High-Efficiency Liquid-Desiccant Regenerator for Air Conditioning and Industrial Drying

Over 2 quads of fossil fuels are used each year for moisture removal. Desiccants—materials that have a high affinity for water vapor—can greatly reduce energy use for both drying and dehumidification. Furthermore, since a desiccant drier or dehumidifier runs primarily on heat, they can run directly on solar thermal energy. They also can become an important part of a Zero Net Energy Building or Distributed Generation facility that provides cooling as well as heating. The contribution that desiccants have made to industrial drying and space conditioning has been limited by their high first cost, large size, and, for liquid-desiccant systems, high maintenance requirements.

However, during the past three years, with funding from DOE, AIL Research has developed a new generation of liquid-desiccant technology that dramatically improves the cost, size and performance characteristics of these systems. In work sponsored by NREL, AIL Research both modeled the performance of a two-stage regenerator and demonstrated its technical feasibility in a small bench-top test rig. This regenerator - referred to as a 1/2-effect regenerator - has the potential to almost double the efficiency of liquid-desiccant systems. AIL is developing and demonstrating the operation of a 1/2-effect regenerator as part of a complete liquid desiccant dehumidifier.

The successful development of the 1/2-effect regenerator will lead to a wide range of economic and environment benefits. Many of these benefits will follow directly from the energy savings. When solar and CHP installations are included, the 1/2-effect regenerator could reduce energy use by close to one-tenth quad. These savings will greatly reduce the country's emissions of greenhouse gases (i.e., CO₂). In HVAC applications, the 1/2-effect regenerator primarily displaces electricity, and in industrial drying, natural gas.



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