

U.S. Department of Energy's

ADVANCED DESICCANT COOLING AND DEHUMIDIFICATION PROGRAM



Buildings for the 21st Century

Buildings that are more energy efficient, comfortable, and affordable . . . that's the goal of DOE's Office of Building Technology, State and Community Programs (BTS). To accelerate the development and wide application of energy efficiency measures, BTS:

- Conducts R&D on technologies and concepts for energy efficiency, working closely with the building industry and with manufacturers of materials, equipment, and appliances
- Promotes energy-/money-saving opportunities to both builders and buyers of homes and commercial buildings
- Works with state and local regulatory groups to improve building codes, appliance standards, and guidelines for efficient energy use
- Provides support and grants to states and communities for deployment of energy-efficient technologies and practices.



NREL/PIX03554



NREL/PIX05634



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Left: NREL assists industry in developing national performance standards for desiccant wheels. Center: The Advanced HVAC Test Facility at NREL provides state-of-the-art test equipment for component benchmarking and prototype development. Right: Research and development have successfully reduced the size and cost of liquid-desiccant systems. (Left-standard industrial system. Right-NREL/AIL prototype.)

IMPROVING AIR QUALITY USING LESS ENERGY

The use of desiccant materials for cooling and dehumidification is an effective, economical, environmentally safe method for meeting indoor air quality standards established by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). Desiccant systems improve indoor air quality in all types of buildings, including schools, theaters, supermarkets, hospitals, and restaurants, by delivering more fresh air. And they can handle the loads without increasing energy use. These systems also displace chlorofluorocarbon-based cooling equipment that contribute to the depletion of the Earth's ozone layer.

To maximize the technology's potential for reducing energy consumption and improving indoor air quality, the U.S. Department of Energy's (DOE's) Office of Building Technology established the Advanced Desiccant Cooling and Dehumidification Program. The program seeks to develop cost-effective desiccant systems that can compete in the broadest markets, enabling them to:

- Capture 20% of air-conditioning sales by 2005 and 35% by 2010

- Reduce energy consumption by 0.1 quad annually by 2005 and 0.4 quad annually by 2010
- Reduce carbon dioxide emissions by 6 million tons annually by 2005 and 24 million tons annually by 2010.

PARTNERING WITH INDUSTRY

The National Renewable Energy Laboratory (NREL) and Oak Ridge National Laboratory (ORNL) manage DOE's Desiccant Cooling and Dehumidification Program and offer technical support to industry.

The laboratories collaborate with the U.S. Air Quality (USAQ) consortium and industry to:

- Benchmark current performance
- Develop generic design tools
- Support technology transfer
- Develop and demonstrate new hardware
- Support industry efforts in developing and implementing rating and certification methods
- Educate industry users

In addition, DOE supported industry efforts that established two national standards for testing and rating desiccant wheels; the heart of the system. The standards are:

- American Society of Heating, Refrigerating and Air-Conditioning Engineers MOT Standard 139 –



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"Method of Testing for Rating Desiccant Dehumidifiers Utilizing Heat for the Regeneration Process."

- Air-Conditioning and Refrigeration Institute (ARI) Rating Standard 940 – "Desiccant Dehumidification Components."

To facilitate the execution of these standards by certification laboratories and manufacturers, NREL hosted a Desiccant Dehumidification Wheel Test Method and Rating Workshop. Co-sponsored by ARI, the Gas Research Institute (GRI), and DOE's Office of Building Technology, the workshop provided industry participants with an in-depth look at the standards and a chance to experience NREL's state-of-the-art test equipment.

NREL also developed a *Desiccant Wheel Test Guide* to assist industry in developing testing expertise quickly and cost effectively. The *Test Guide*, a product of more than 20 years of experience gained at the Laboratory's desiccant research facilities, details practical experimental experience with rotary mass exchangers in relation to the standards.

EXPANDING THE MARKET

Although advances have improved the technology's performance, reliability, and

cost-effectiveness, further cost reductions and improvements are needed before desiccant systems can compete successfully in broader residential and commercial buildings markets.

One area in which researchers are working to reduce costs and enhance energy efficiency, is that of liquid desiccants. Liquid-desiccant systems can cost much less than today's state-of-the-art systems used to cool and dehumidify ventilation air. With the development of critical components, applications in which solid-desiccant systems are already successful can also be served by liquid-desiccant systems. Research is focussed on three technology improvements that will enable liquid systems to serve expanded markets at lower costs and greater energy savings — zero carryover, internal cooling, and double-effect regeneration.

Another opportunity for expanding the desiccant market may lie with the increasing use of combined cooling, heating, and power (BCHP) systems for buildings. Facilities with BCHP systems recover waste heat from generators, turbines, or engines and utilize it for heating and cooling to maximize overall facility efficiency. Desiccant systems can use these large quantities of low-temperature heat to provide dry, cool, comfortable fresh air to building occupants. DOE's Office of Building Technology is developing an initiative to accelerate the development and integration of BCHP systems and compatible technologies.

EDUCATING INDUSTRY USERS

The information and data generated by the collaboration between DOE and industry will be disseminated to the HVAC industry, the desiccant community, architects, engineers, builders, utilities, and other end users through industry and professional society meetings, conferences, and workshops. For information about current research and developments, meetings, conferences, workshops, and publications, visit NREL's Desiccantcool web site at www.nrel.gov/desiccantcool/



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NREL hosts a Desiccant Dehumidification Wheel Test Method and Rating Workshop to support technology transfer, demonstrate new hardware, and educate industry users.



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