Liquid Desiccant Cooling System

The Technology

A seven year, $5 million program co-funded by the *National Renewable Energy Labs* (NREL) and the *US Department of Energy* has developed a liquid-desiccant air conditioner that efficiently converts thermal energy into cooling and dehumidification. The energy required to run the unit can be provided by a number of sources including:

- ◊ **Solar Thermal Collectors**
- ◊ **Recovered Heat from CHP Systems**
- ◊ **Gas-Fired Water Heaters**
- ◊ **Steam Distribution Loops**

AILR LD Model SOA-6000
w/ Cooling Tower and Auxiliary Hot-Water Boiler

Applications

AILR's Liquid-Desiccant Air Conditioner addresses several problems that now face the HVAC and other energy-intensive industries.

- ◊ Liquid-desiccant air conditioners more effectively dehumidify air than conventional electric air conditioners. *During the summer, they will insure that buildings can meet current ventilation requirements while avoiding indoor humidity problems.* Nursing homes, healthcare facilities and auditoriums, which need large amounts of ventilation—supermarkets, which must keep indoor humidity very low—and natatoriums, which internally generate large amounts of humidity, are all excellent candidates for this technology. Mold problems, poor indoor air quality, high maintenance for wet cooling coils and frost build up on refrigeration systems can all be avoided by the proper application of the liquid-desiccant air conditioner.
- ◊ *Implementation of this technology will provide many societal benefits while also improving building efficiency.* The fans and pumps within the liquid-desiccant air conditioner draw a fraction of the power required for an electric air conditioner of comparable cooling capacity. Reducing the electric demand for air conditioning will lower the cost of peak power, help defer transmission/distribution costs and improve air quality.
- ◊ Liquid desiccant systems are well suited to non-tracking solar thermal collectors with operating temperatures of 180 ^{0}F. When powered by solar thermal energy, the liquid desiccant air conditioner greatly reduces primary energy needs for cooling and dehumidification of buildings. *This reduction in primary energy use produces an equally great reduction in carbon emissions.*

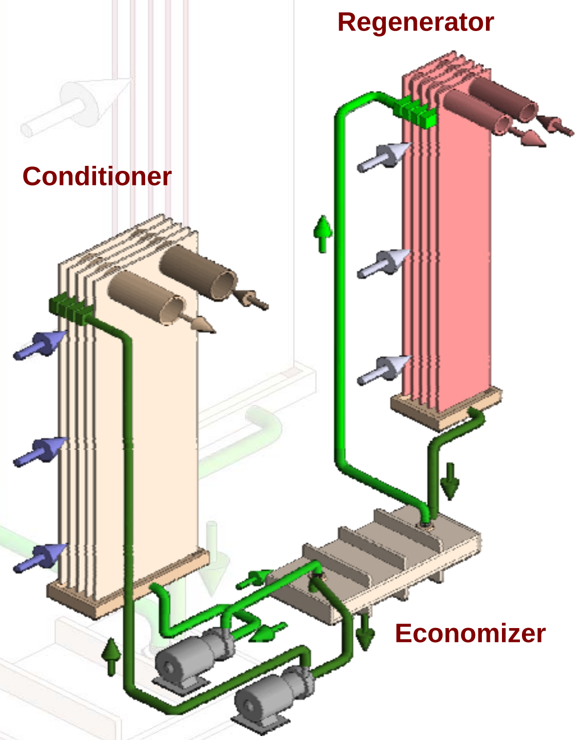
The Company

AILR is a New Jersey company with facilities in Princeton. Over the past 15 years, AILR has conducted over $10 million of R&D for the U.S. Department of Energy, NASA, gas and electric utilities and technology companies. AILR plans to expand its facilities in New Jersey to manufacture liquid-desiccant air conditioners, creating a new industry for sustainable energy technology within the state.

Status

Three tests of AILR's OA-3000 and OA-6000 (process 3,000 and 6,000 CFM, respectively) will be conducted during the summer of 2006. Each test site is configured to run from a different thermal source. One uses a gas-fired water heater, one is steam driven, and one recovers heat from an engine-generator. The LDAC will be manufactured in limited quantities for commercial applications in 2007 and will thereafter be available for worldwide distribution.

How It Works



The Liquid Desiccant Air Conditioner has three main components: the conditioner, regenerator and interchange heat exchanger or economizer.

The conditioner and regenerator are parallel-plate liquid-to-air heat exchangers. In the conditioner thin wicks on the plate surfaces create uniform desiccant films and the air to be processed flows horizontally through the gaps between the plates. As this humid air comes in contact with the desiccant, water vapor is absorbed. The air leaves the conditioner drier and at a much lower wet-bulb temperature. The heat released by this absorption process is transferred to the cooling tower or other heat sink such as a swimming pool or pre-heating fresh water.

The diluted desiccant then leaves the conditioner and is pumped to the regenerator where hot heat transfer fluid flows within the plates. As the temperature of the dilute desiccant increases, the absorption process is reversed and the entrained water vapor is discharged which re-concentrates the desiccant.

The hot, concentrated desiccant that leaves the regenerator and the cool, dilute desiccant that flows to the regenerator exchange thermal energy in the interchange heat exchanger. This exchange increases the efficiency of the regenerator and decreases the cooling load on the conditioner.