



# Inventions and Innovation

## *Success Story*

## Low Humidity to Yield Sweet Rewards

MELBOURNE, FL – According to eccentric chocolate-maker Willy Wonka in “Charlie and the Chocolate Factory,” the key to producing perfect chocolate is a giant waterfall that churns the ingredients flawlessly. Dr. Michael West, building-systems scientist for Advantek Consulting, Inc., has another idea: humidity control on-demand.

Although it may not be as flashy as a waterfall, humidity control is a critical element during chocolate ‘tempering,’ the process of heating and cooling at specific temperatures. Maintaining low humidity during this process allows ingredients to mix completely and reach precise temperatures, ensuring a glossy look, smooth texture, and pleasing taste.

If humidity is not controlled properly during storage, cocoa butter solids may not crystallize properly, causing ‘blooms,’ white hazy splotches that appear on the surface. Blooms make chocolate cracked and brittle, and cause it to lose much of its rich flavor.

“Chocolate manufacturers and retailers are concerned with chocolate blooms caused by humidity, especially during these hot summer months,” Dr. West explains.

### Conditioning a New Technology

Dr. West has been working at Advantek, based in Melbourne, Florida, to develop humidity control technology for over five years. Advantek is a consulting and technical support company providing businesses with methods for improving productivity and becoming more energy-efficient. Advantek quickly realized that clientele in various industries from hotel chains, to paper processing plants, to pharmaceutical laboratories were all experiencing the same dilemma.

“Our customers were unable to control humidity cost-effectively, and so their customers were unhappy, and product quality was suffering,” says Dr. West. “Some tried to control humidity by running the air conditioner and the heat at the same time. This wastes an enormous amount of energy and is costly. There just wasn’t a readily available, affordable product solution for our clients.”

Realizing the need for on-demand humidity control in a wide range

of markets, Advantek began to develop its own solution. Dr. West’s background in HVAC (heating, ventilation and air conditioning) and desiccant cooling technologies, including research at the University of Florida and a doctorate in Thermal Science, gave him the experience he needed to become the project’s director.

Advantek wanted to develop a product that could perform better than competing products, cost less, and use less energy. Meeting all three goals proved to be quite a challenge, particularly in a market skeptical of new air conditioning technologies.

*“Before ClimaStat™, there just wasn’t a readily available, affordable product solution.”*



“The target market perceives new technologies as being impractical, difficult to manufacture and install, and prone to breakdown. We had to avoid those pitfalls by developing an effective, yet simple design. We had to create a system that wasn’t too different from conventional air conditioning units, but with enhanced energy efficiency and lowered costs. Simplicity and low cost were critical.”

Dr. West and the Advantek team designed ClimaStat™ with readily available components that can be easily applied to existing units without much added cost. They also strived to overcome some of the barriers presented by conventional air conditioners. Instead of moving the entire airflow through coils like other systems, this technology allows some air to bypass the cooling coil, concentrating the cooling effect and allowing for increased dehumidification when needed and increased energy efficiency when maximum sensible cooling is needed.

ClimaStat™ was also designed with a coil sensor to detect freezing early and optimize coil temperature, and a liquid-suction heat exchanger-accumulator that subcools refrigerant before reaching the cooling coil, and superheats it before reaching the compressor, allowing a flooded coil while preventing compressor slugging.

Advantek was awarded grant funding from the U.S. Department of Energy's Inventions and Innovation to continue development and testing of ClimaStat™. Since then, laboratory test-runs have revealed impressive results. Of seven widely used industry applications, ClimaStat™ maintains the highest humidity removal rate,

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removing 58 lbs of water per hour, compared to just 30 lbs per hour with standard 5-ton systems.

## Validating Cooling Claims

Advantek's next hurdle is proving their claims and lab results to manufacturers. They are now independent testing with the Florida Energy Center to assess ClimaStat's™ abilities under standardized ARI conditions. A 5-ton prototype rooftop unit is under a field test evaluation during summer's peak temperatures and humidity at Kilwin's Chocolates, a chocolate and ice cream retail store in hot and humid Stuart, Florida.

Because of Stuart's high humidity, Kilwin's is troubled by chocolate blooms. Improved dehumidification at Kilwin's will prevent chocolate produced and stored on-site from developing blooms by keeping the humidity level below 55 percent. It will also increase shelf life, and enhance the appearance and flavor of the chocolate.

As beneficial as this technology could be for their chocolate, humidity control may also improve the quality of other Kilwin's products.

“High humidity is causing frost build-up in their ice cream refrigeration cases, which causes frozen products to become hard and develop frost,” says Dr. West. Maintaining low humidity levels will keep ice cream and other frozen products soft, smooth, and frost-free. It will also reduce the need for tedious case defrosting that has to be done by hand with all of the ice cream removed.

If ClimaStat™ proves effective in controlling humidity at Kilwin's, it could become a valuable tool for the food industry, particularly in frozen and cold-based foods. The technology also has the potential to benefit a variety of other industries, according to Dr. West.

“Because of its variability, our product presents large potential for almost any application in a wide range of climates. This technology will benefit retail stores, office buildings, supermarkets, hotels, schools, laboratories, and processing plants, among others.”

ClimaStat™ has a variable coil-face velocity, so the speed at which air flows through the coils can be increased or decreased depending on the customer's needs for dehumidification, cost-savings, and quality control.

ClimaStat™ automatically adapts to the amount of dehumidification needed, minimizing energy use, “whether the primary concern is dehumidification, frost control, or simply reducing electricity bills,” says Dr. West.

## Boosting Summer Business

Advantek is preparing to commercialize their product once testing is complete in October, the end of the summer cooling season. A major U.S. air conditioning manufacturer signed a first right of refusal licensing agreement for the patented<sup>1</sup> ClimaStat™ system. Advantek has also met with six other interested companies in recent months. Three have indicated extreme interest in this innovative technology. The technology may apply to future production of units as well as retrofit to existing lines.

Along with enhancing the flavor, shelf life and appearance of chocolate and reducing frost on ice cream, Dr. West hopes that widespread commercialization will boost overall summer business in the years to come.

“We hope that by keeping the humidity low and product quality high, particularly during the summer, business will flourish, even during the hottest, high-humidity temperatures.”

<sup>1</sup> U.S. Patent Number 6427454 and other U.S. and international pending.

On the Web:

<http://www.advantekinc.com>

<http://www.eere.energy.gov/inventions/pdfs/advantek.pdf>

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