

Summary of Advanced WICF Control Technologies

U.S. Department of Energy Better Buildings Alliance
Food Service Technology Team



Background

- **Objective:**

- Several Better Buildings Alliance Food Service Technology Team members requested a summary of advanced Walk-in Cooler/ Freezer (WICF) control technologies currently available on the market (as of publication – February 2015)
- The purpose of this summary is to make food service organizations aware of the range of advanced WICF controls in use

- **Scope:**

- Add-on controls for *existing* walk-ins

- **Disclaimers:**

- Information provided is for educational purposes only. Inclusion here does not constitute endorsement from the U.S. Department of Energy, the Better Buildings Alliance, or the Food Service Technology Team.
- Estimated savings are *manufacturer-reported* figures; DOE has not verified manufacturer claims.

Note: Unless otherwise indicated, photos are from the product website listed.

Control Technologies Summarized in this Report

- **CoolTrol Cooler Control** by National Resource Management
- **Model 2100 Cooler Controller** by FreeAire
- **Cool Expert Adaptive Refrigeration Controls** by National Energy & Conservation Inc.
- **KE2Evap and Condenser Fan Control** by KE2 Therm Solutions
- **Frigitek Fan Motor Controls** by Energy Control Equipment, Inc.
- **Model FC and FCX Fan Motor Controls** by Greenwise Energy Solutions
- **COOLControl MFRC Multi-function Refrigeration Controller** by Greenwise Energy Solutions

Matrix Mapping Controls to Functions

Manufacturer	Controller	Total # Features	Evaporator Fan Control During Refrigeration Off-cycle	"Smart Defrost" (Initiation when Needed)	Door Heater Controls Based on Humidity	Economizer Cooling: Using Outdoor Air for Cooling when Conditions Allow	Other
National Resource Management (NRM)	CoolTrol Cooler Control Systems	5	Yes	Yes	Yes	Yes	Shuts off non-perishable coolers when store is closed
Freeaire	Model 2100 Cooler Controller	4	Yes	Yes	Yes	Yes	
National Energy & Conservation Inc.	Cool Expert MIC QKL e3 Electronic Refrigeration Control System	4	Yes	Yes			Compressor management, fault management
Dixell	XR__CX Electronic Controls (Several Variations Available)	2	Yes	Yes			
KE2 Therm Solutions	KE2Evap (Evaporator Efficiency Controller)	3	Yes	Yes			Superheat controls
	Condenser Fan Motor Control	1					VFD control on condenser fans
Energy Control Equipment, Inc.	Frigitek ECMotor Controller	1	Yes				
Greenwise Energy Solutions	EC Evaporator Fan Motor Controls: Model FC and Model FCX	1	Yes				
	COOLControl MFRC	4	Yes	Yes			Adaptive compressor control, VFD control on evaporator fans

National Resource Management



Product Name	CoolTrol Cooler Control
Function(s)	<ul style="list-style-type: none">• Reduces evaporator fan run time• Controls door and frame heaters based on store dew point• In cold regions: uses outdoor air for cooling when conditions allow• Shuts off non-perishable coolers when store is closed• Defrost cycles based on coil temperature and run time• Optional feature: Remote visibility and control
Estimated Savings*	<ul style="list-style-type: none">• 10-20% reduction in energy bills in case studies of convenience stores, groceries, and restaurants• 20-55% energy savings for large compressor and fan coil units in an independent case study of a refrigerated warehouse in California
Product Website	http://www.nrminc.com/national_resource_management_products_cooltrol.html

* Manufacturer-reported savings estimate

FreeAire

Product Name	Model 2100 Cooler Controller
Function(s)	<p><u>Included:</u></p> <ul style="list-style-type: none">• Controls compressor run time• Controls evaporator fan run time (uses separate, smaller circulating fans to maintain air circulation)• Defrost cycle management <p><u>Optional features:</u></p> <ul style="list-style-type: none">• Door heater control• Humidity monitoring• CO₂ Monitoring• “Polar Power” (uses outside air for cooling when conditions allow)
Estimated Savings*	25-55% cooling energy reduction reported in case studies of refrigerated warehouses and conveniences stores in the Northeast
Product Website	http://freeaire.com/model-2100-cooler-controller/



* Manufacturer-reported savings estimate

National Energy & Conservation Inc.



Product Name	Cool Expert Adaptive Refrigeration Controls
Function(s)	<ul style="list-style-type: none">• Defrost detection• Defrost management• Compressor management• Evaporator fan management• Fault management• Optional feature: network module for two-way data transmission
Estimated Savings*	Up to 40% reduction in refrigeration energy consumption
Product Website	http://neconservers.com/Product%20Data%20Sheets/MIC_QKL_e3_%20Data_Sheet.pdf

* Manufacturer-reported savings estimate



Product Name	XR__CX Electronic Controls (several variations available)
Function(s)	<ul style="list-style-type: none">• Demand defrost (controls interval between defrosts)• Cycles evaporator fans when the compressor is off
Estimated Savings	Not specified by manufacturer
Product Website	http://www.emersonclimate.com/europe/en-eu/Products/Electronics/Dixell_Electronic_Controls/Refrigeration/General_Purpose/Pages/E_CLASS_CX.aspx

KE2 Therm Solutions

Product Name	KE2 Evaporator Efficiency
Function(s)	<ul style="list-style-type: none">• Superheat controls• Demand defrost• Defrost termination – cycles heaters to control the rate the coil approaches termination temperature• Cycles evaporator fans when the compressor is off• Optional feature: Electronic expansion valve
Estimated Savings*	20-50% refrigeration system energy savings
Other Info	Southern California Edison is doing a pre- and post-installation performance test on this controller
Product Website	http://ke2therm.com/productsevap.html



* Manufacturer-reported savings estimate

KE2 Therm Solutions

Product Name	KE2 Fan Control
Function(s)	Variable speed control that matches condenser fan speed with load and ambient conditions
Estimated Savings*	50-70% condenser energy savings (Does not include compressor savings)
Other Info	<ul style="list-style-type: none">• Designed for use with inverter-driven fan motors• Applicable to multi-fan condensers only
Product Website	http://ke2therm.com/files/Features and Benefits - Fan Control.pdf



* Manufacturer-reported savings estimate

Energy Control Equipment, Inc.



Product Name	Frigitek ECMotor Controller
Function(s)	Reduces evaporator fan speed from normal full-speed operation during refrigeration off-cycle
Estimated Savings*	Evaporator fan energy savings of 83% (Savings estimate includes retrofitting from shaded pole to EC motors)
Other Info	Designed for use with EC motors
Product Website	http://www.themadisonenergygroup.com/frigitek.html

* Manufacturer-reported savings estimate

GreenWize Energy Solutions



Model FC



Model FCX

Product Name	ECM Fan Motor Control Model FC and FCX
Function(s)	Reduces evaporator fan speed from normal full-speed operation during refrigeration off-cycle (Model FC uses thermistors to determine if refrigeration cycle is on; Model FCX wires into the unit's thermostat)
Estimated Savings*	Evaporator fan energy reduced 90% when operating fans at low speed (Estimate includes retrofitting from shaded pole to EC motors)
Other Info	<ul style="list-style-type: none"> • Can control multiple evaporator coils that share a common solenoid • Designed for use with EC motors
Product Website	http://www.greenwizeems.com/

* Manufacturer-reported savings estimate

GreenWize Energy Solutions

Product Name	COOLControl MFRC
Function(s)	<ul style="list-style-type: none">• Adaptive compressor control• On-demand defrost initiation (based on refrigerant conditions)• Evaporator fan speed control (designed for use with fully-variable EC motors)• Web-based user interface for monitoring and control
Estimated Savings	Not specified by manufacturer
Other Info	Product release in Spring 2015
Product Website	http://www.greenwizeems.com/



Manufacturer prototype

Control Technologies Not Considered

The following control technologies were not included because they do not appear to be available as an add-on features. That is, they can only be built into the unit by the manufacturer.

- **Beacon II and Smart Defrost Kit** by Heatcraft
- **Super Controller and Master Controller** by Master-Bilt

For Further Information

- Contact BBA@ee.doe.gov and reference the Better Buildings Alliance Food Service Team WICF Controls Summary
- Better Buildings Alliance Food Service Team website: <https://www4.eere.energy.gov/alliance/activities/technology-solutions-teams/food-service>