ATMOsphere AMERICA

the Business Case

natural refrigerants


EcoThermics CORPORATION

Natural Refrigerant Heat Pump Technologies

# Carbon Dioxide Heat Pump

# Field Study

**Washington, DC**

**June 18, 2013**

# Agenda

1. Introduction – Merle Rocke, CEO, EcoThermics
2. Case Study – Darin Massner, CEO, Country Maid
3. Q&A

# EcoThermics Mission

**Building a sustainable business --**

**providing high value compressors**

**for $CO_2$ heat pumps.**

# EcoThermics AT54M

EcoThermics AT54M
Compressor


w/ 10hp
Motor

# Semi-hermetic Compressor (AT80SH)


# $Eco_2Boost^{®}$ Heat Pump (concept)



**L = 28 in.  D = 19 in.  H = 30 in.**

# $Eco_2Boost^{®}$ Installed at Country Maid


*DOUBLE-CLICK IN BOX*

Eco 2Boost Clip(1).wmv

16" x 24" footprint

40" Tall

# Country Maid – West Bend, IA
## (Darin Massner, CEO)



Manufacturer of Butter Braid® brand products
West Bend, IA

# Country Maid Introduction

- Founded in 1991
- 55,000 sq. ft.
- 80 employees
- 100% employee owned
- Frozen pastry dough products
- Sell products to dealer network in 46 states

# Field Study at Country Maid

*Dedicated CO2 Heat Recovery Heat Pump*
*"The Eco$_2$Boost®"*

- **Hot Water for Sanitation** ***and***
- **Supplemental A/C & Dehumidification**

***Serving Plant Production Areas***

# Base Conditions

## PRE-EXISTING HOT WATER COST ESTIMATES

| | |
|---|---|
| Cost of Hot Water Energy Per Day - | $43 |
| Per Year - | $10,000 |

***Consumption volume is expected to increase by and estimated 1200 gal./day (20%) in 2013…***

| | |
|---|---|
| 2013-14 Forecast Cost of Hot Water Energy Per Day - | $51 |
| 2013-14 Forecast Cost of Hot Water Energy Per Year - | $12,000 |

# Retrofit Goals

- Demonstrate the capability for simultaneous water heating and space conditioning with a CO2 heat pump
- Quantify energy and cost reductions

# Significant Hot Water Requirements

# Need for Production Area Space Conditioning

Simultaneous Space Conditioning

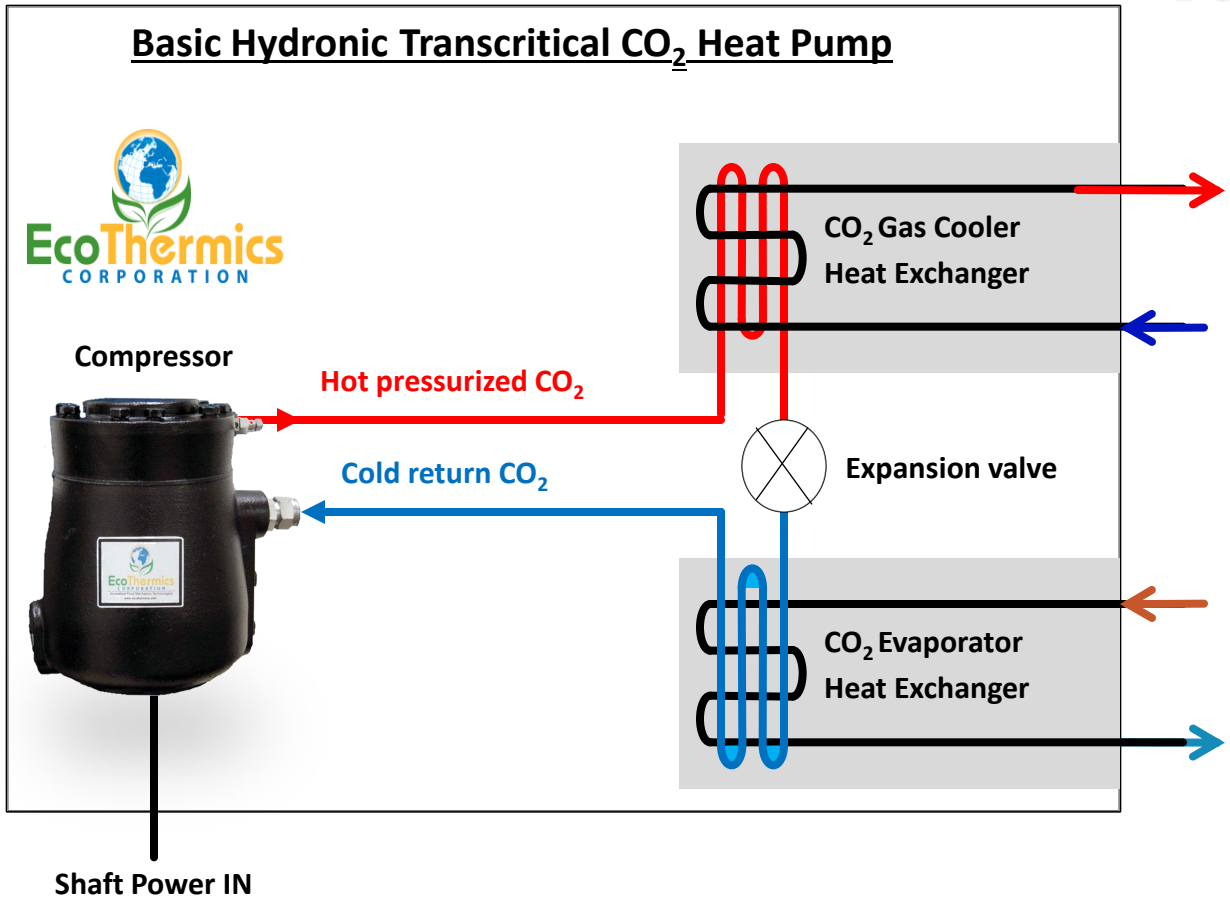
- Air Conditioning
- Dehumidification

# System Model Advance Projections

- Heating COP = 3.8
- Cooling COP = 2.9
- Combined COP = 6.7
- NG Energy cost savings = $3300/year
- Energy cost savings w/o electric = $8000/year

* Using summer 2012 conditions and energy rates @ 2200 gal/day

# Eco$_2$Boost System Schematic




*DOUBLE-CLICK IN BOX*

DiagramAnimation_h264Hi.wmv

# System Operation “Before”

4kW Electric
Heat element

6gpm
~145 ˚F

6 gpm
~120 ˚F

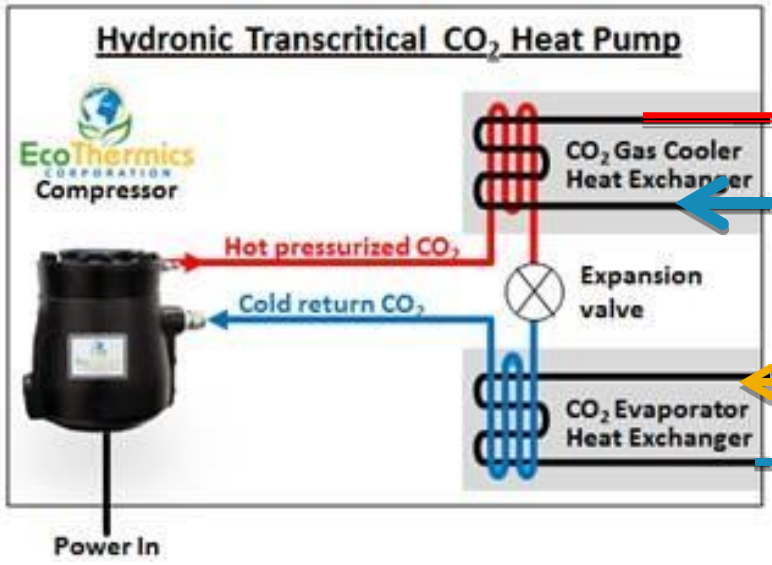
~145 ˚F

(3) Rinnai®
Natural Gas
$H_2O$ Heaters

**Average Total Water Consumption:**
~6000 gallons / day - *No space conditioning

Sanitation &
Process Use

# Retrofit Summary "After"




145˚F $H_2O$

55˚F City $H_2O$

750 gal tank

45˚F $H_2O$

65˚F $H_2O$

**DEDICATED HEAT RECOVERY SYSTEM**

**6 TON OF COOLING**

Sanitation & Process Use

# RESULTS - Data

| | | |
|---|---|---|
| Volume target: 2000-2200 gallon per day | | ***Achieved*** |
| Target = >140°F - 145°F | **145°F** | ***Achieved*** |
| Target Heating COP = 3.8 | **4.2** | ***Achieved*** |
| Target Cooling COP = 2.9 | **3.0** | ***Achieved*** |
| Target Combined COP = 6.7 | **7.2** | ***Achieved*** |

# RESULTS – Calculated Savings/Year

- A/C ONLY * - NEGLIGIBLE SAVINGS/YEAR -
- HEATING ONLY - Eco HPWH vs NATURAL GAS ~$1355/Yr
- HEATING ONLY - Eco HPWH vs ELECTRIC ~$6428/Yr
- HEATING ONLY - Eco HPWH vs NG / Elec BASELINE ~$2292/Yr
- SIMULTANEOUS - HEAT/COOL vs NATURAL GAS ~$3340/Yr
- SIMULTANEOUS - HEAT/COOL vs ELECTRIC ~$8412/Yr
- SIMULTANEOUS - vs BASELINE (NG + ELECTRIC) ~$4276/Yr

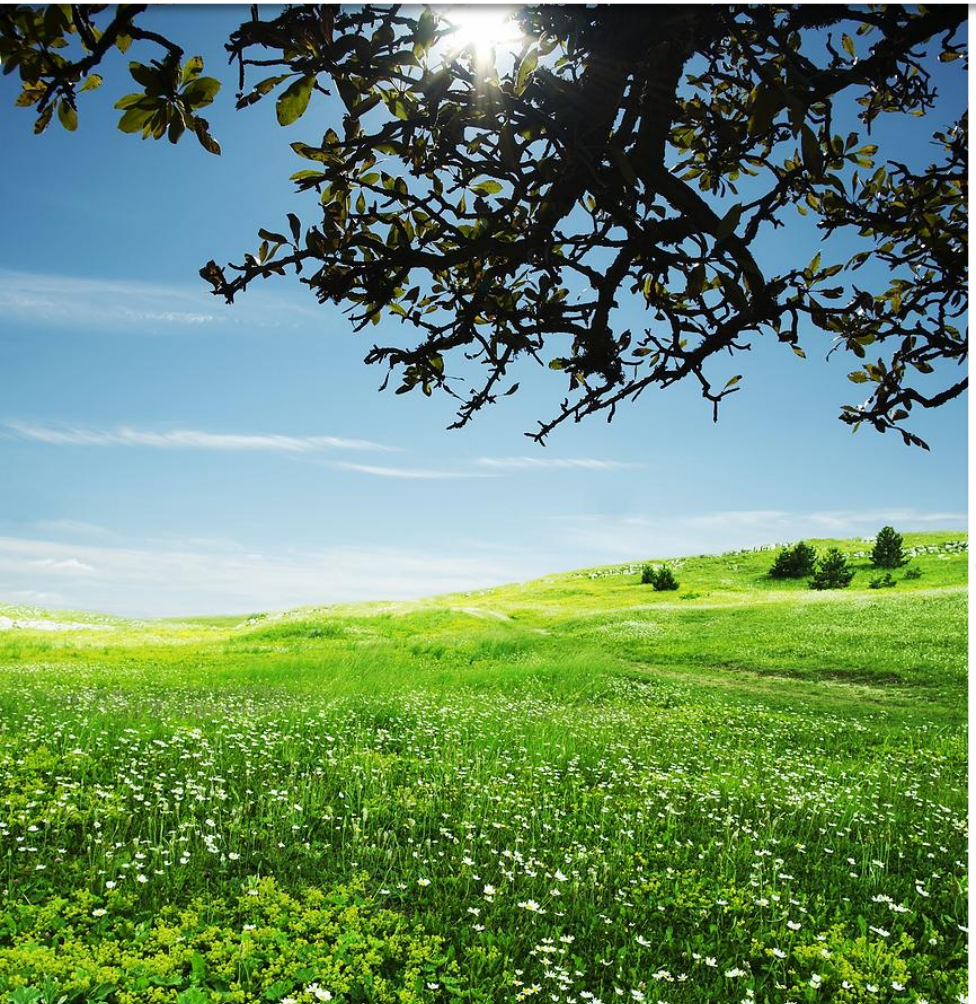
*A/C Cost/year (EST. Country Maid Baseline) ~$2184

# Summary

**Transcritical CO2 Dedicated Heat Recovery for Primary Sanitation Hot Water & Simultaneous Supplemental A/C for Food Production & Packaging Areas with estimated BET < 4.0 years.**

**Note:** **Due to time limitations, this summary was very brief; Much more detailed data available upon request.**

# Thank You



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