



ATMO
sphere
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 CO₂ heat pumps.**



CONFIDENTIAL

EcoThermics AT54M



**EcoThermics AT54M
Compressor**



**w/ 10hp
Motor**



Semi-hermetic Compressor (AT80SH)



Eco₂Boost[®] Heat Pump (concept)



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

Eco₂Boost[®] Installed at Country Maid



DOUBLE-CLICK IN BOX



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 Eco₂Boost[®]"

- **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
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2013-14 Forecast Cost of Hot Water Energy Per Year -	\$12,000
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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



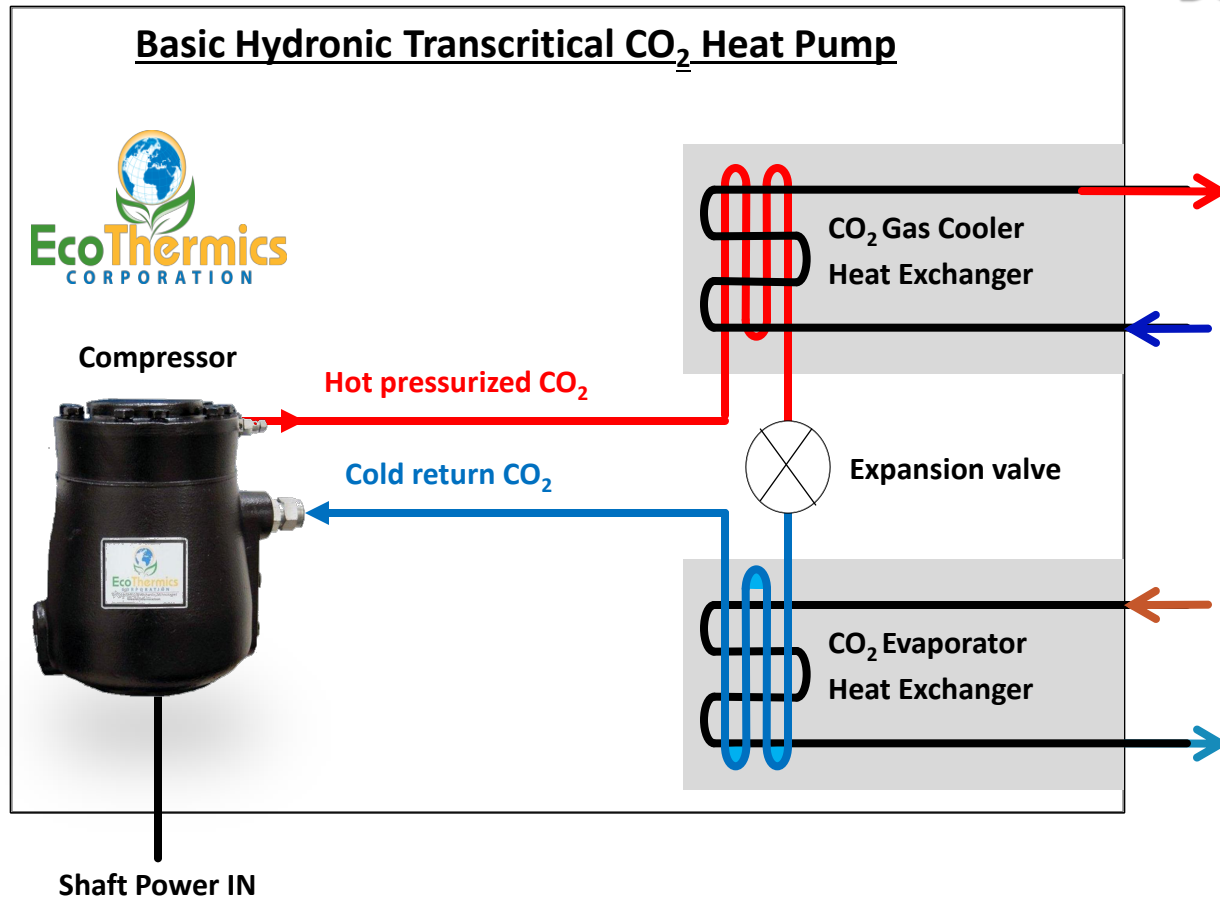
- Heating COP = 3.8
- Cooling COP = 2.9
- Combined COP = 6.7
- NG Energy cost savings = \$3300/year
- Energy cost savings w/o electric = \$8000/year

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

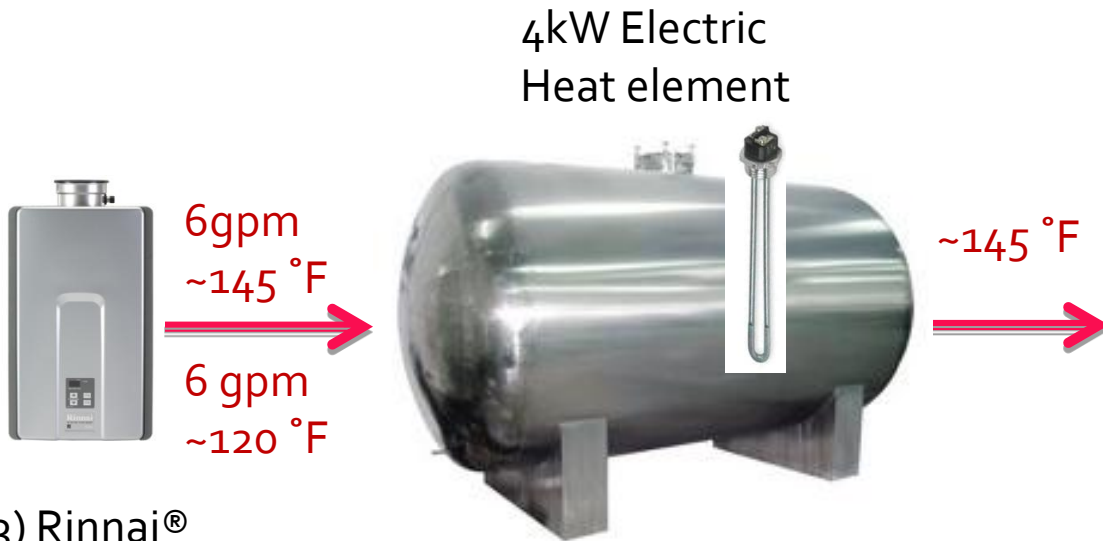
Eco₂Boost System Schematic



DOUBLE-CLICK IN BOX



System Operation "Before"



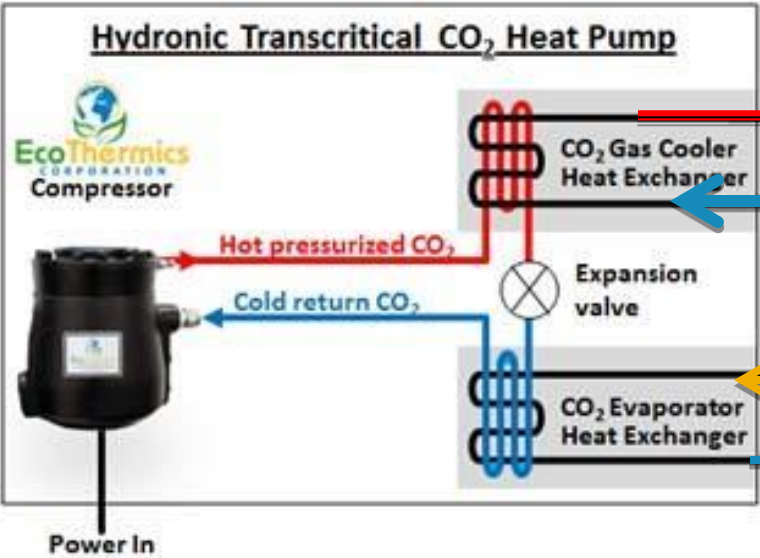
(3) Rinnai®
Natural Gas
H₂O Heaters



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

Sanitation &
Process Use

Retrofit Summary "After"



145°F H₂O

55°F City H₂O

750 gal tank



**DEDICATED
HEAT
RECOVERY
SYSTEM**



45°F H₂O

65°F H₂O

6 TON OF COOLING

Sanitation &
Process Use



RESULTS - Data



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

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

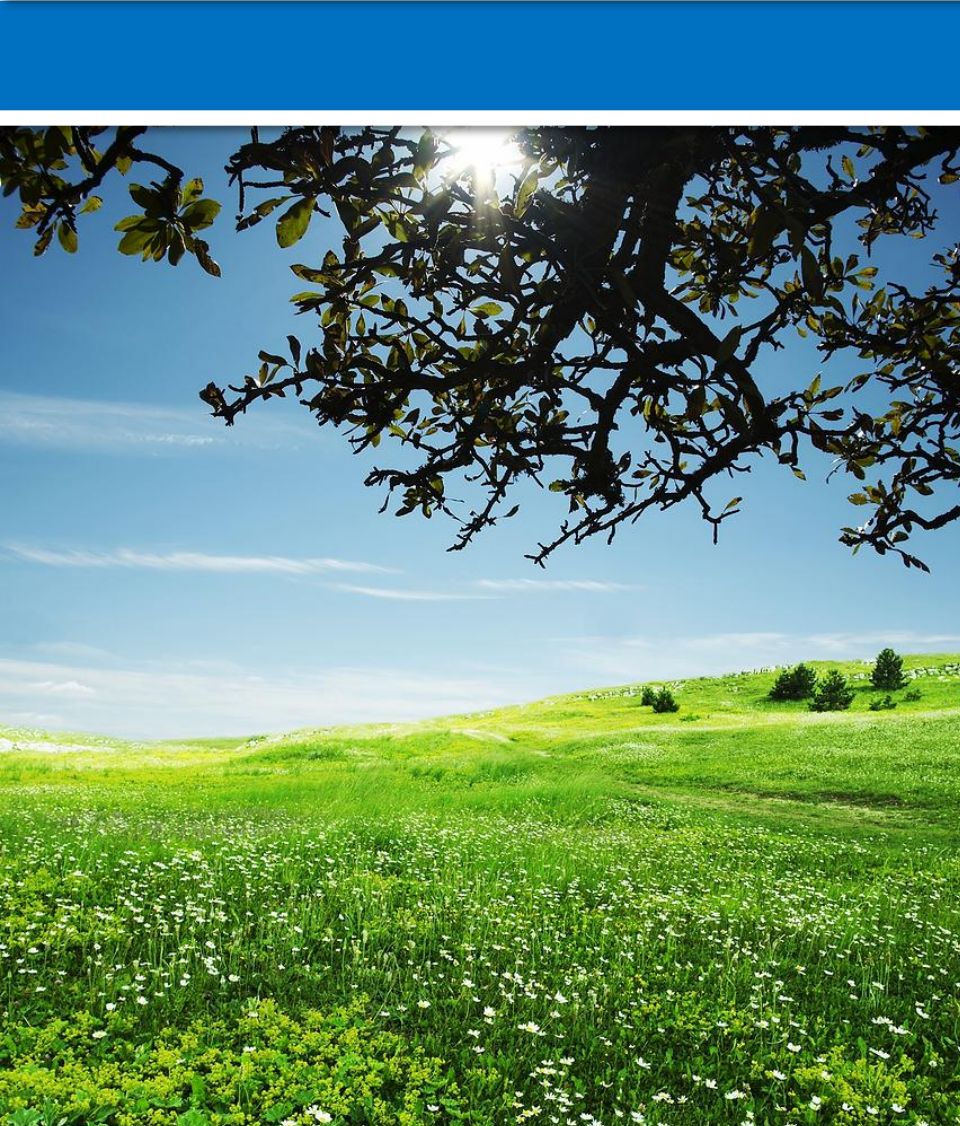


**Transcritical CO₂ Dedicated Heat Recovery for Primary Sanitation
Hot Water & Simultaneous Supplemental A/C for Food
Production & Packaging Areas
with estimated BET < 4.0 years.**

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



Thank You



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