



EcoThermics
CORPORATION

Innovative Fluid Mechanics Technologies

R744

**CO₂ Compressor & System Technology:
Sustainable Heating & Cooling**

September 2010

ATMOsphere 2010



Shared Mission

- Promote natural refrigerants
- Reduce energy consumption & GHG
- Shorten time to market
- Accelerate market adoption

EcoThermics Solution

- Natural refrigerant compressor
- Significantly improves performance of heat pumps
- Environmentally sustainable

Overview



Speed to Market - 7 Key Elements:

1. Proven technology & integrated system solutions
2. Critical alliances and partnerships
3. Highly leveraged supply chain
4. Unquestionably convincing value proposition
5. Market ripe for new paradigms
6. Supportive governmental policies and practices
7. Education of distribution channel and end users



EcoThermics CO₂ Compressor



*“EcoThermics
Inside”*

Manufacturing
compressor solutions for
next generation
heat pumps*

* via contract mfg. partner



Proven Technology



EcoThermics AT54 Compressor

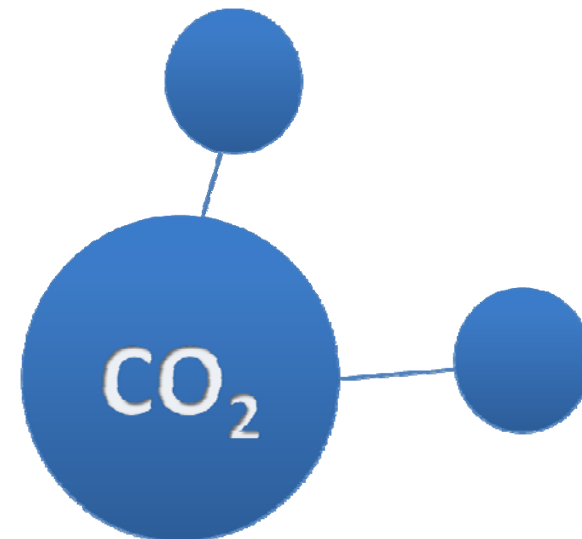
- Superior axial CO₂ compressor
- Compact; high power density
- Cost driven core design
- Competitive performance
- Right size for commercial HW heating
- OEM application flexibility
 - scalable
 - modular
 - configurable
 - manufacturable



AT54 Product Specs



Configuration	– Axial piston
Heat pump cycle	– Transcritical, single stage
Drive	– Mechanical shaft, bi-directional
Mounting orientation	– Vertical axis
Weight (without motor)	– 30 kg (65 lb.)
Physical dimensions	– 200mm (8 in.) dia. 250mm (10 in.) long
Displacement	– 54.2 cc/rev (3.31 cubic inches/rev)
Rated motor speed	– 1750 rpm
Swept displacement	– 5.7 cubic meter/hr. (195 cubic feet/hr.)
Rated pressure	– 124 bar (1820 psi)



Performance Forecast	
Overall Isentropic efficiency	– 65% to 70%
Volumetric efficiency	– 75% to 80%
Low OCR	– <3%

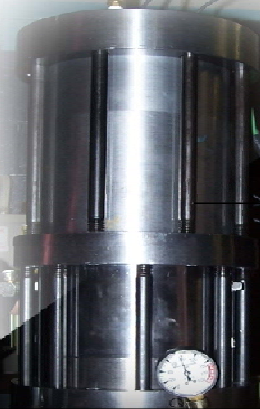
Product Evolution



AT54 (2011)



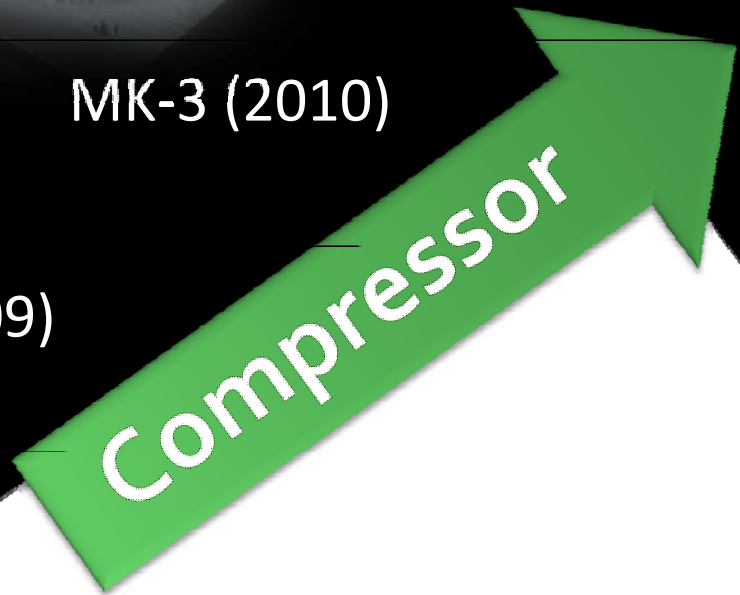
MK-3 (2010)



MK-2 (2009)



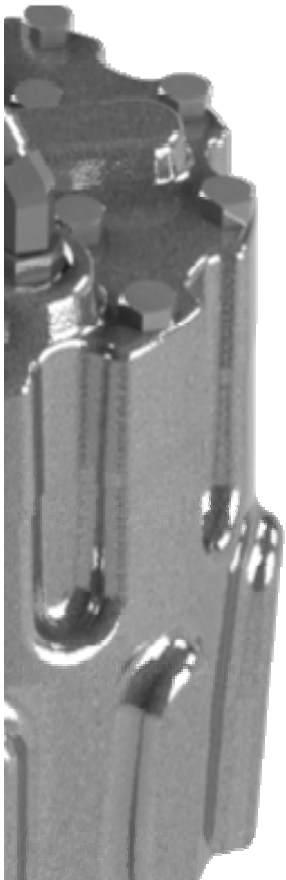
MK-1 (2008)



Development Status



- Extensive testing in three lab test facilities; competitive performance targets achieved
- Field testing underway in two locations
- Limited quantities of compressors available now to select OEM's for system design and testing
- On target for pilot production (2Q 2011)



Prototype goals achieved
On target for pilot phase



Merle Rocke

Chairman & CEO

- Founder & former GM, Caterpillar Logistics
- Manufacturing, technology, supply chain



Travis Horton, PhD

Chief Technology Officer

- Expert in transcritical CO₂ compression
- Purdue University faculty



Rodney Hugelman, PhD

Chief Scientist

- Rocket engine, Mars, Atlas Missile projects
- Professor Emeritus, University of Illinois



Thomas Lewicki

Chief Financial Officer

- Commercialization (MS Internet Explorer)
- IPO's, strategic investments, spin-outs



Tammie Leichtenberg

Director of Corporate Services

- Marketing, communications, administration
- Strategic analysis & business development



Marc Albertin

Director of Innovation

- Founder, inventor, applications engineer
- Prototype development and fabrication



Daniel Sherman

Director of Engineering

- Design engineering, system integration
- Electronic/hydraulic system design expertise



Craig Riediger

Product Consultant

- Strategic product development, Caterpillar
- Component development; holds 12 patents



Al Sabin

Manufacturing Consultant

- High velocity manufacturing champion
- Est. Caterpillar engine business in China



Tom Dennison

Product Consultant

- Component & complex system development
- New product intro & machine validation



Building Value



Core Values

- Focus
- Innovation
- Relentless
- Speed
- Trust
- Passion
- Integrity
- Collaboration
- Keep it Fun
- Show Results

Core Values

- Focus
- Innovation
- Relentless Execution
- Speed
- Trust



Leverage Partners & Supply Chain

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Leveraging Partnerships

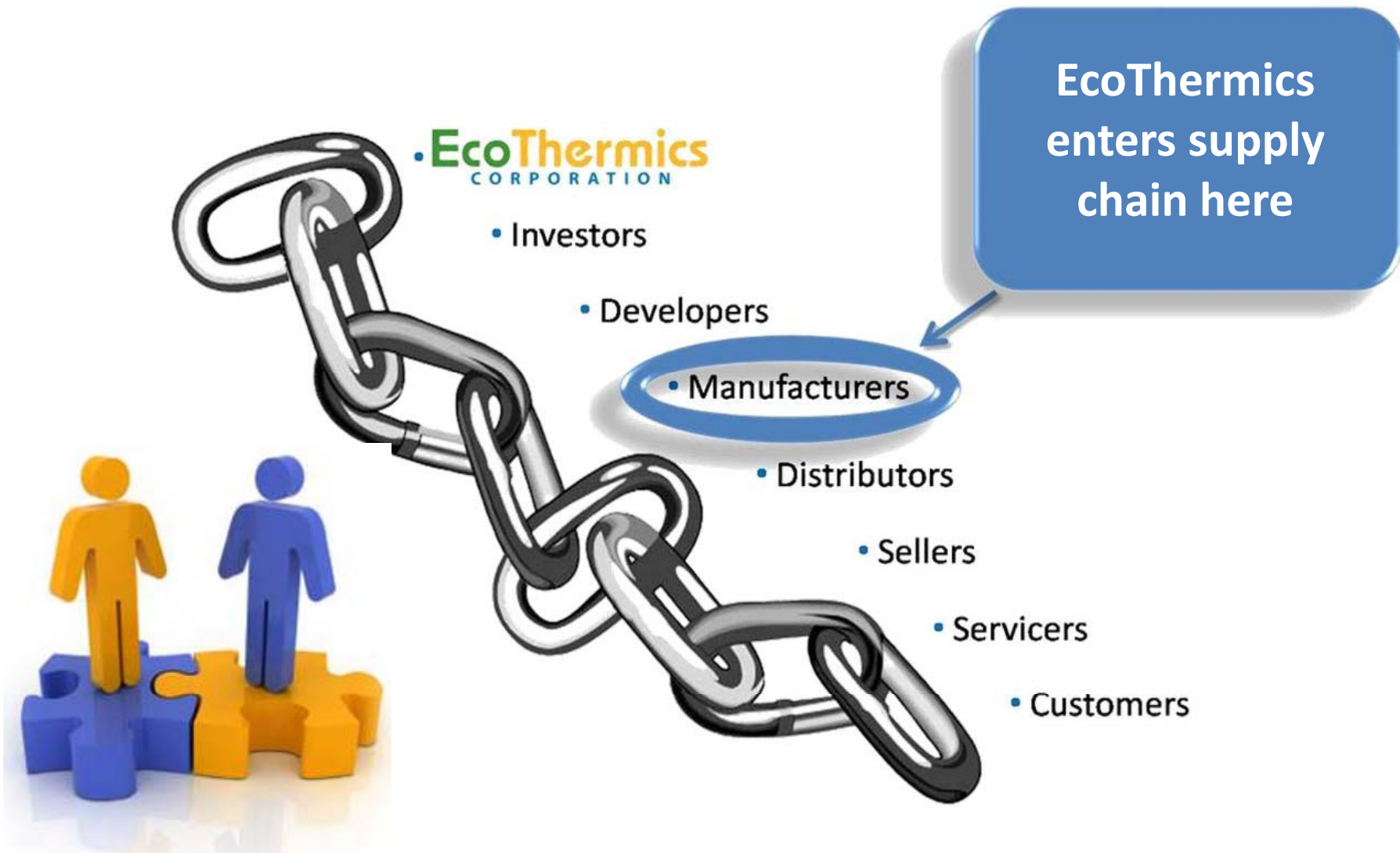


...to enhance speed, precision and value

- WaterFurance Renewable Energy - system integration
- Festec Automation - prototype development
- Mennie Machine Company - production manufacturing
- Shecco - market research
- Purdue University - lab testing
- Indiana Tech & StollPak Inc. - field testing
- Subject Matter Experts - design,
production & manufacturing expertise



Leveraging Supply Chain



Value Proposition



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End User Payback Analysis



Hot Water Heater	Electric	CO ₂
Total installed cost	\$ 4,200	\$ 19,400
Cost Premium		\$ 15,200
Net annual energy costs	\$ 7,010	\$ 1,800
Energy cost reduction , \$		\$ 5,210
Energy cost reduction, %		74%
Payback, years		2.9

- (1) This analysis is illustrative: actual costs, savings and payback will depend upon equipment, application and other factors.
- (2) 1,000 gallon per day usage, average electricity cost, \$0.09 kwh.
- (3) Net energy costs are net of cooling benefit.

The Market



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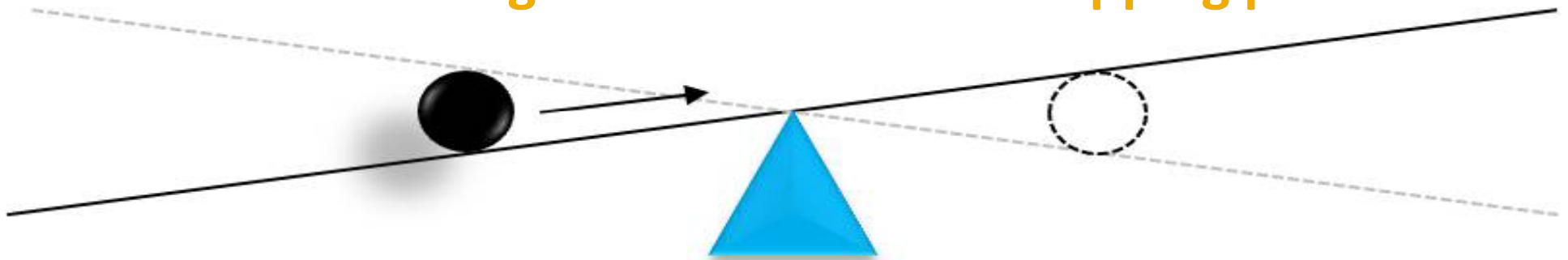


Market Drivers

Performance
& efficiency

- High cost of energy - money & environmental impact
- Global effort to reduce climate change
 - Increasing governmental involvement & regulation
 - Consumer demand for greener products
 - Availability of natural refrigerant components
 - Japan & Europe - encouraging examples
 - The U.S. remains a viable, new open market

Factors driving toward an eventual tipping point...



Entry Level Market Opportunity



Commercial heat pump water heater

- Reduces energy cost up to 80%
- Provides “free cooling” as well
- Payback in 2-4 years
- High heating temperatures
- Wide range of ambient conditions
- Precise zone temperature control
- Easy to install and service
- No GHG emissions

Broad Market Applications



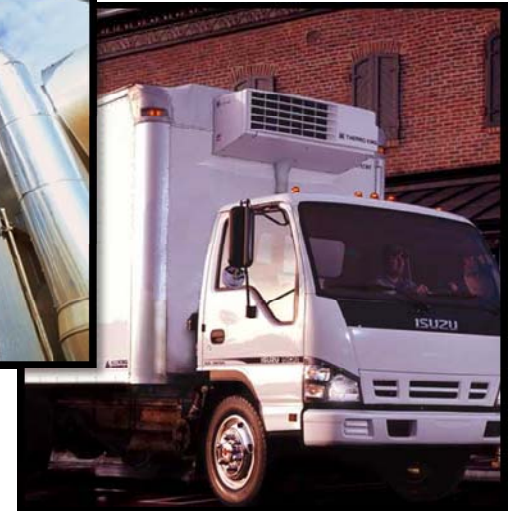
Residential



Commercial




Industrial



Mobile/Portable

Barriers to Adoption



- 
- A hurdle with a white top bar and red and black legs. The top bar has the brand name "BLAZER" in a stylized font. The hurdle is positioned behind a list of barriers to adoption.
- U.S. governmental legislation still several years behind Europe/Japan
 - New technology costs more initially
 - Lack of knowledge by customers and distribution channel
 - Inertia of current technologies & widespread resistance to change
 - CO₂ slightly less efficient at cooling

...simply hurdles to be overcome

Prompting Change...



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Action Opens Doors



1. Governmental interest & involvement

- Incentives (tax credits)
- Penalties – targeting applications using HFCs where alternatives are available
- Fund R & D

2. Competitive pressures

- Educate OEM system builders & end-users
- Elicit support from industry thought leaders
- Communications – spread the word

3. Profit motive

- Demonstrate convincing value proposition - payback
- Form alliances with partners willing to take early financial and market risk
- Continued focus on superior durability, performance and lower cost of ownership



Thank You



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