



Precision Combustion, Inc.

Fuel Reformer & Fuel Processing Systems

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Precision Combustion, Inc.

- Established in 1986
- Develop advanced catalytic reactors & systems technology & manufacture limited-volume catalytic products
- Two major platform technologies under development
 - *Microlith[®] catalytic reactors for multiple markets*
 - *RCL[®] catalytic combustors for gas turbines and downhole applications*
- 30 employees
- Over 65 patents
- \$5 million revenues



Technologies and Applications

Microlith[®] Catalytic Reactors

Technology

- Ultra-Compact
- High Efficiency
- Lightweight
- Rapid thermal response
- Multiple system efficiencies

Applications

- Fuel Processing
- Compact burners
- Air Cleaners/TCCS
- Chemical Manufacturing
- Fast lightoff converter



RCL[®] Catalytic Combustors

Technology

- Improved combustion stability
- Ultra-low NO_x and CO
- Compact/robust
- Fuel flexible: natural gas, low BTU gas, refinery fuel gas, syngas, hydrogen

Applications

- Power Generation turbines
- Downhole heat generation
 - Heavy oil
 - Methane hydrates
 - Shale oil
 - EOR



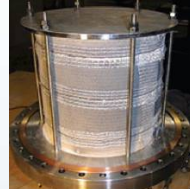
Fuel reformers/
Fuel processors



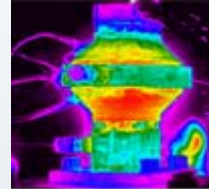
Stirling
burners



Ultra-
compact
burners



Air
cleaners



Fast lightoff
converters



Chemical
Manf.



Gas turbine
combustors



Downhole
heaters

Compact Fuel Reformers for Fuel Cell Systems & Industry



- **Smaller, quieter, faster transient response, more efficient**
- **Fuel-flexible: JP8, JetA, diesel, biofuel, gasoline, E85, natural gas, paint fumes**
- **Sulfur-tolerant, coke-resistant, robust**
- **Enables fuel cells to use conventional liquid fuels**
- **Enables new industrial applications**

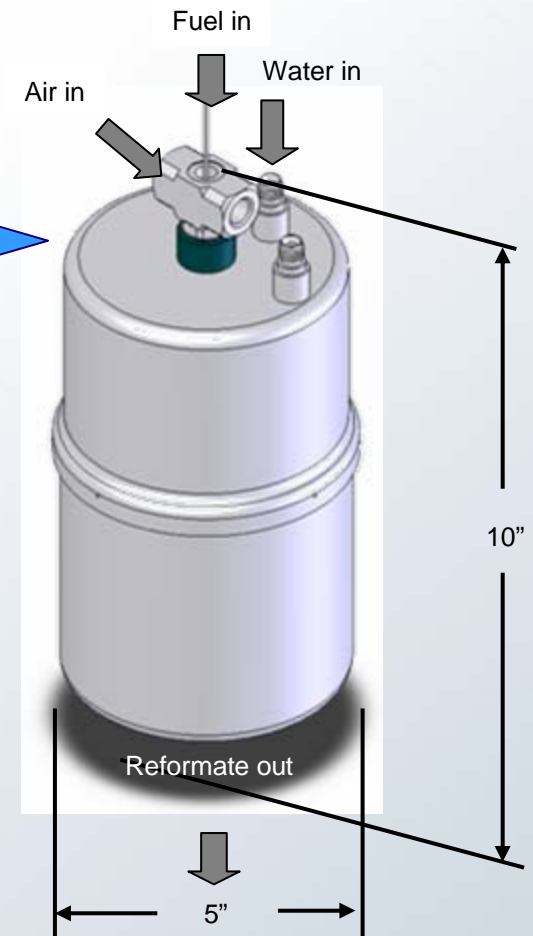


JP-8/Diesel Reformer with Sulfur Trap

Fuel to Reformate System



- Injection
- Mixing
- Ignition
- ATR
- Steam generation
- Sulfur cleanup
- External controls
- H₂/CO reformate



DoD Organizations with Applications



UAV



Vehicle APU



Shipboard Power



UGV



Portable Power



Tactical Generator Sets



Fuel Reformer & Fuel Processor Examples



5 kWt SOFC JP-8 Fuel Processor for CERDEC



26 kWt JP-8 Fuel Processor for Army PEM fuel cell



Natural Gas CPOX

Water neutral reformer
Navy steam reformer



Army ethanol reformer
Paint Solvent Reformer

5-15 kWt JP8/Diesel Fuel Processor Meets/Exceeds CERDEC 2009

Feature	Army CERDEC req 2009	PCI 2009
Start-up	< 30 minutes	<30 seconds
Efficiency	70%	80%
Power Density (W/L)	150	>600
Specific Power (W/kg)	170	>1000
Fuel-sulfur in/out	1500/5 ppm	400/1 ppm
Lifetime	2000 hours	2000 hours → 8000-16000 hrs
Cost (\$/kw at volume)	\$800	\$800 → \$400

Current State of Development-Mil

Navy

- PEM fuel processor prototype delivered to NAVSEA – Philadelphia 9/07 (TRL 5)
- Steam Reformer SBIR PH II entering 2nd year
- 250 kWe Advanced Demonstration desulfurized logistics fuel processor for high temperature PEM
 - under development for 2012 delivery
 - cost savings >\$1Mil/yr per ship

Army

- Demonstrated with two companies' SOFC stacks
 - one for 1,000 hrs
- 1 kWe low sulfur JP-8 fuel processor delivered to ARL 3/09
- A second unit will be delivered to Army CERDEC 7/09
- PH III effort starting 7/09



Current State of Development-Com

DOE

- Water Neutral Diesel Reforming SBIR PH II in 2nd year
- Hydrogen turbine Program-Catalytic Combustor

Industrial Solvent Reformer

- ~1 MWthermal Paint Solvent Reformer delivered 2008
- Ford/FuelCell Energy/Arencibia Associates
- Avoids cost of haz waste disposal plus electricity
- Start-up summer 2009

Thank You for Your Time & Attention!

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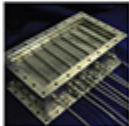


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PRECISION COMBUSTION, INC.

COMPANY CAPABILITIES



Advanced Catalytic Reactors and Systems for the Energy Sector



Clean Power Solutions for the 21st Century®

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