

Methane Recovery from Hog Waste CHP Workshop

Sioux City & Cedar Rapids IA

November 3rd and 4th, 2004



UNISON

SOLUTIONS

Unison Solutions Overview

Turnkey waste-to-energy systems

Multiple awards for Biogas systems (EPA project of the year 2003)

Capstone MicroTurbine ASP and distributor (thru Alliant Energy)

STM Power Stirling Engine Generator Distributor

Kohler Power Systems Distributor

Design/General Contracting/Maintenance

Gas compression/treatment system design and fabrication

Feasibility Studies

Electrical System Interconnection

Communications/Automation

Utility metering

Unison Solutions Biogas Projects

Landfills

1. Antioch IL-12 Turbine CHP
 2. Sauk Co. WI-12 Turbines
 3. Glacier Ridge WI-10 Turbines
- ## WWTF/Industrial Digesters
1. Sun Prairie WI-1 Turbine CHP
 2. Kaukauna WI-1 Turbine CHP
 3. Chippewa Falls WI-2 Turbine CHP
 4. Albert Lea MN-4 Turbine CHP
 5. Northern Star Co. MN-4 Turbines
 6. Top Deck Farms IA-1 Turbine and 100 kW engine CHP (being modified to 4 turbines)

Key Gas Constituent Issues

Anaerobic Digester 60% to 65 %
Methane

Lagoon 50% to 55% Methane

Landfill 35% to 55% Methane

Moisture-100% Saturated

H₂S-1500 to 3500 ppm

Key Components of an Installation

Gas production/collection/digester

Gas conditioning equipment (H₂S, Siloxanes, Moisture)

Gas compression system

Generation System

Heat recovery system

Electrical System Interconnection

Communications/Automation

Utility metering

Gas Compression and Cleaning Skid



Complete Gas Management System



Suction Scrubber



Scroll Gas Compressors



After Cooler and Refrigerated Dryer



Carbon Vessels for Siloxane Removal



Capstone MicroTurbine Biogas Projects

Capstone has 220 units running on biogas

5 Systems on Hog Waste

10 Systems on Dairy Waste

95% of Micro-Turbine Market

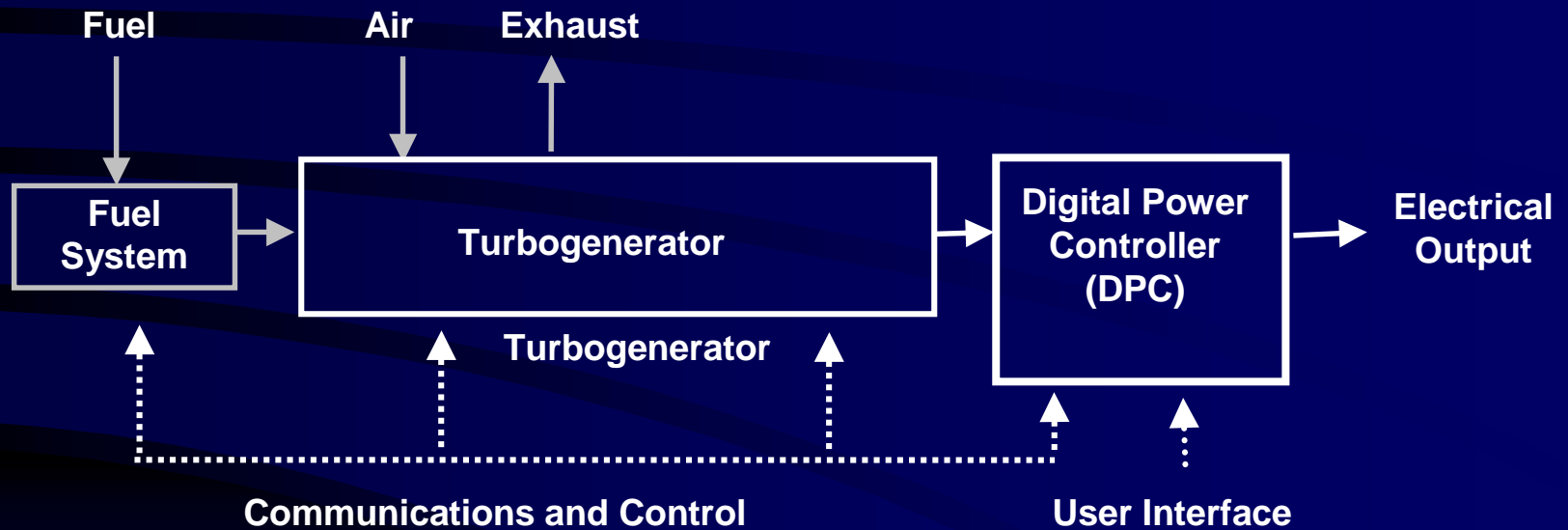
1/3 Energy Conversion is Electrical

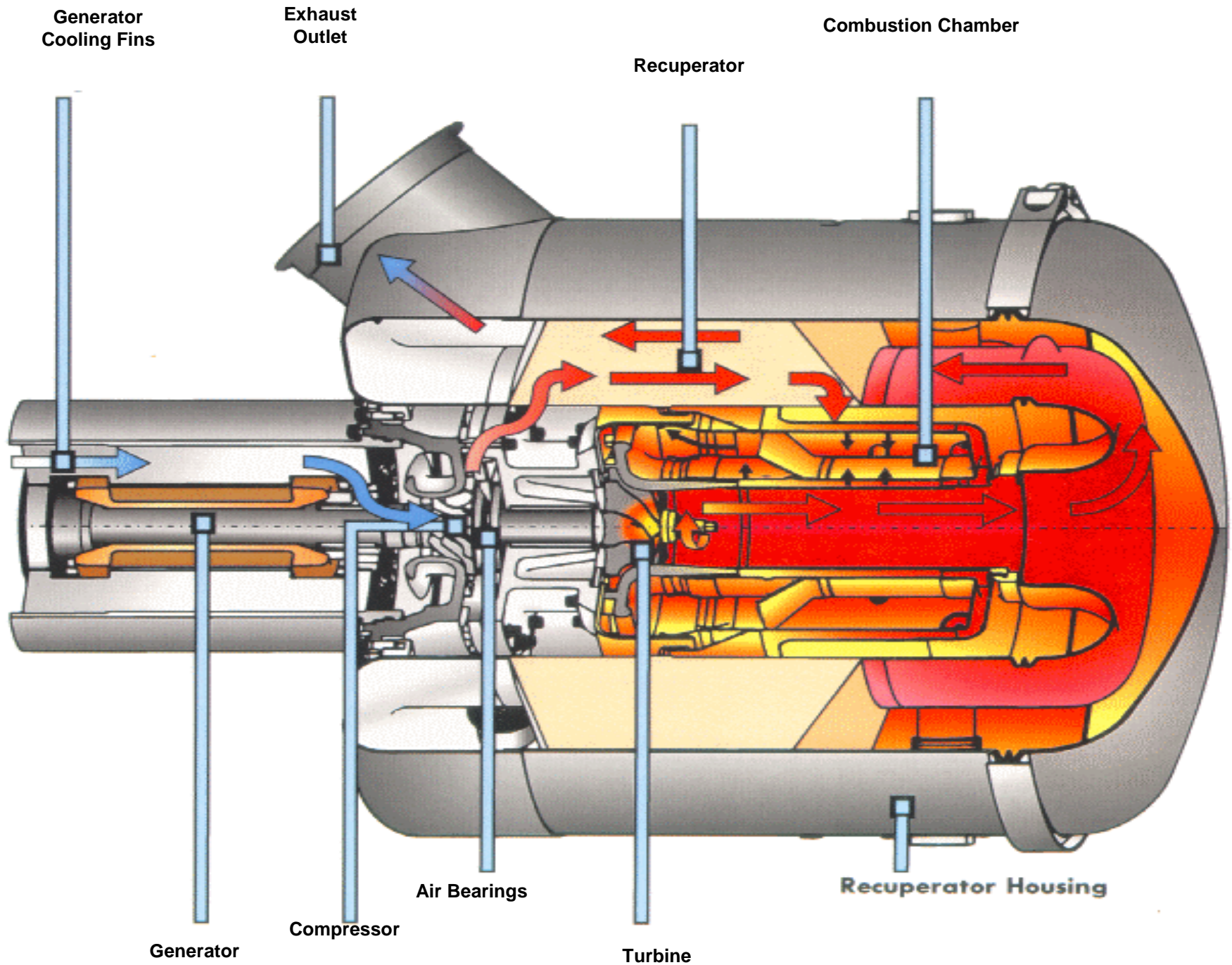
2/3 Energy Conversion is Thermal

Capstone 30 kW Micro-Turbines



System Block Diagram





Exhaust Manifold and Gas Header



Exhaust Heat Exchanger



The Value of MicroCHP

✓ Clean
Emissions

→ Install Anywhere

✓ Onsite
Generation

→ Secure Power

✓ High Efficiency

→ Payback on
Biogas

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