

Unison Solutions, Inc.

Biogas Quality and Conditioning



CHP Operators Workshop

University of Iowa

November 6, 2014

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Unison Solutions, Inc. Overview

- Company founded on January 1, 2000
- Located in Dubuque, Iowa
- 40 Employees (10 Engineers)
- 45,000 sq. ft. Manufacturing Facility
- 205 systems sold worldwide, 170+ in Operation
- Biogas Conditioning System Design and Fabrication
- Custom System Design and Fabrication

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Unison Solutions, Inc. Overview

SALES &
MARKETING

ENGINEERING
& DESIGN

AUTOMATION
& CONTROLS

FABRICATION
& ASSEMBLY

FACTORY
TESTING

STARTUP &
COMMISSIONING



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Biogas Conditioning Systems

What is driving the need for increased gas treatment on biogas fueled generation and direct use projects?

Equipment Damage & Performance Issues

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Getting Started on a Biogas to Energy Project

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System Design Checklist

- Site Conditions
- Inlet Gas Conditions (gas testing)
- Discharge Gas Conditions
- End-use Technology



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Gas Quality Limits To Need Treatment

Equipment	H ₂ S	Siloxanes
MicroTurbine	<5,000 ppmv	<100 ppbv
IC Engine	<100 - 500 ppmv	<100 - 1,000 ppbv
Boiler	<100 - 500 ppmv	<500 - 2,000 ppbv
Vehicle Fuel	Non-Detect	<100 ppbv

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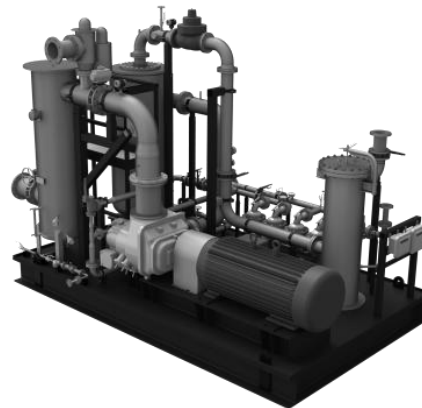
Hydrogen Sulfide Removal Systems



Digester or Landfill



Hydrogen Sulfide Removal



Gas Compression/
Moisture Removal



Siloxane/VOC
Removal



MicroTurbines



IC Engines



Boilers



Hydrogen Sulfide Removal Systems

Why Hydrogen Sulfide Removal?

- Equipment Damage from Corrosion (Hydrosulfuric Acid)
- SO_x Emissions
- Health and Safety Issues (1000ppm will cause an individual to lose consciousness)
- Odor Control
- Causes fouling of Siloxane Removal Media

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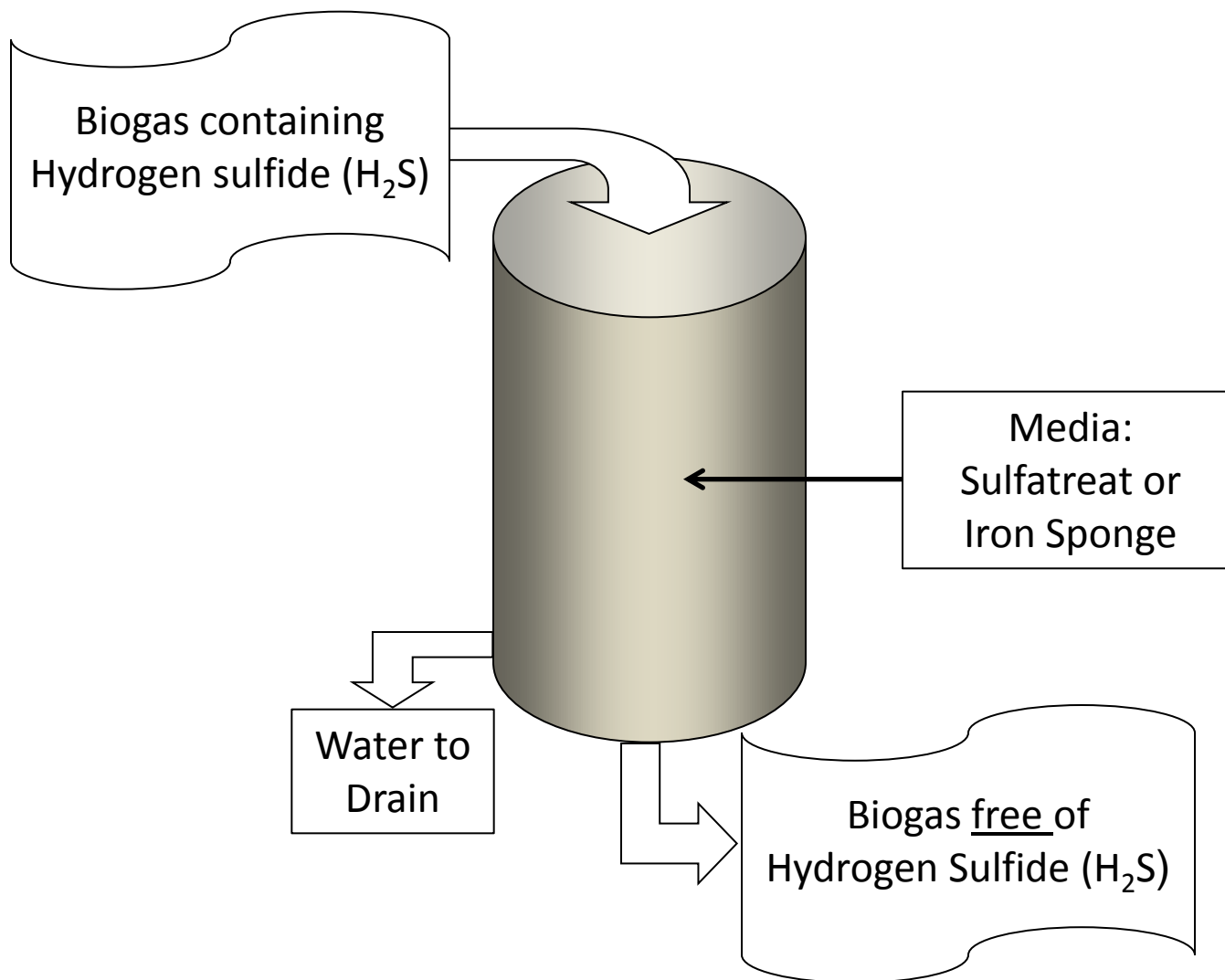
Hydrogen Sulfide Removal Systems Technologies

- SulfaTreat Systems
- Iron Sponge Systems
- Biological/Iron Sponge Systems
- Biological Systems

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Hydrogen Sulfide Removal Systems

SulfaTreat/Iron Sponge Process



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Hydrogen Sulfide Removal Systems Biological/Iron Sponge Systems

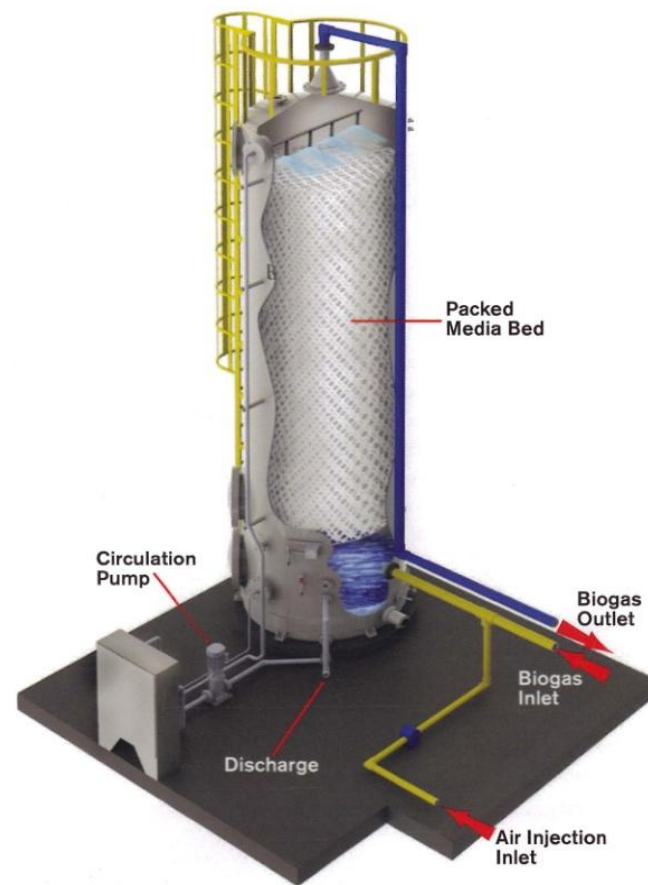
- Features
 - Hydrated iron oxide on a wood shavings and chips carrier.
 - Water is re-circulated through the system.
 - Oxygen is injected into the system.



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Hydrogen Sulfide Removal Systems Biological Systems

Typically used on applications with high H_2S levels



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Gas Blower and Compressor Systems Skid Mounted Equipment



Digester or Landfill



Hydrogen Sulfide Removal



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Boilers

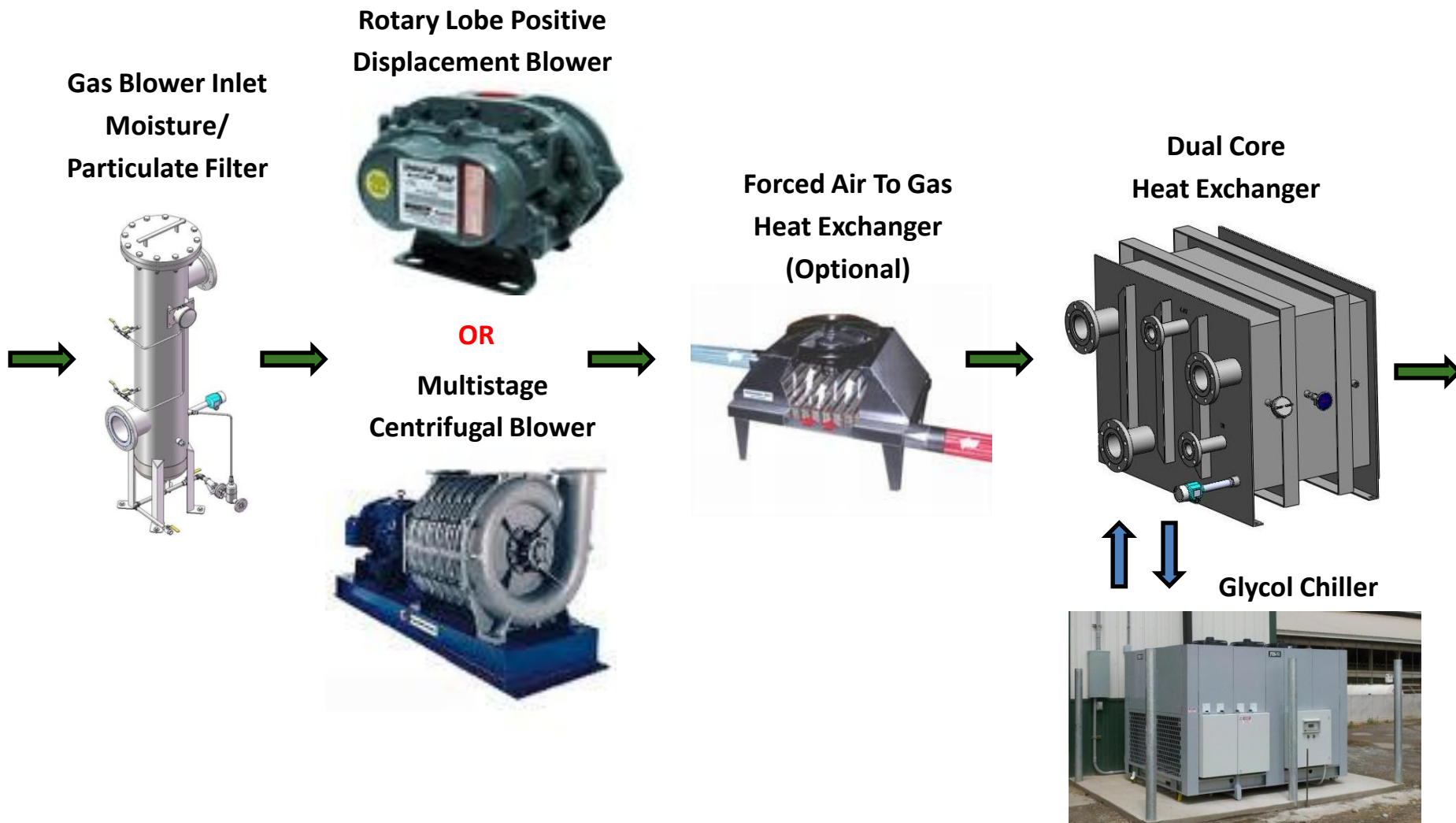


Gas Blower Systems Generation Supported

- Internal Combustion Engines
 - Caterpillar
 - GE Jenbacher
 - GE Waukesha
 - Cummins
 - MWM
 - Liebherr
 - MAN
 - Tech 3
- Direct Use Boiler
- Fuel Cells

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Gas Blower Systems Major Components



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Gas Blower Systems Skid Mounted Equipment

**Rotary Lobe Positive Displacement
Blower System**



**Multistage Centrifugal
Blower System**



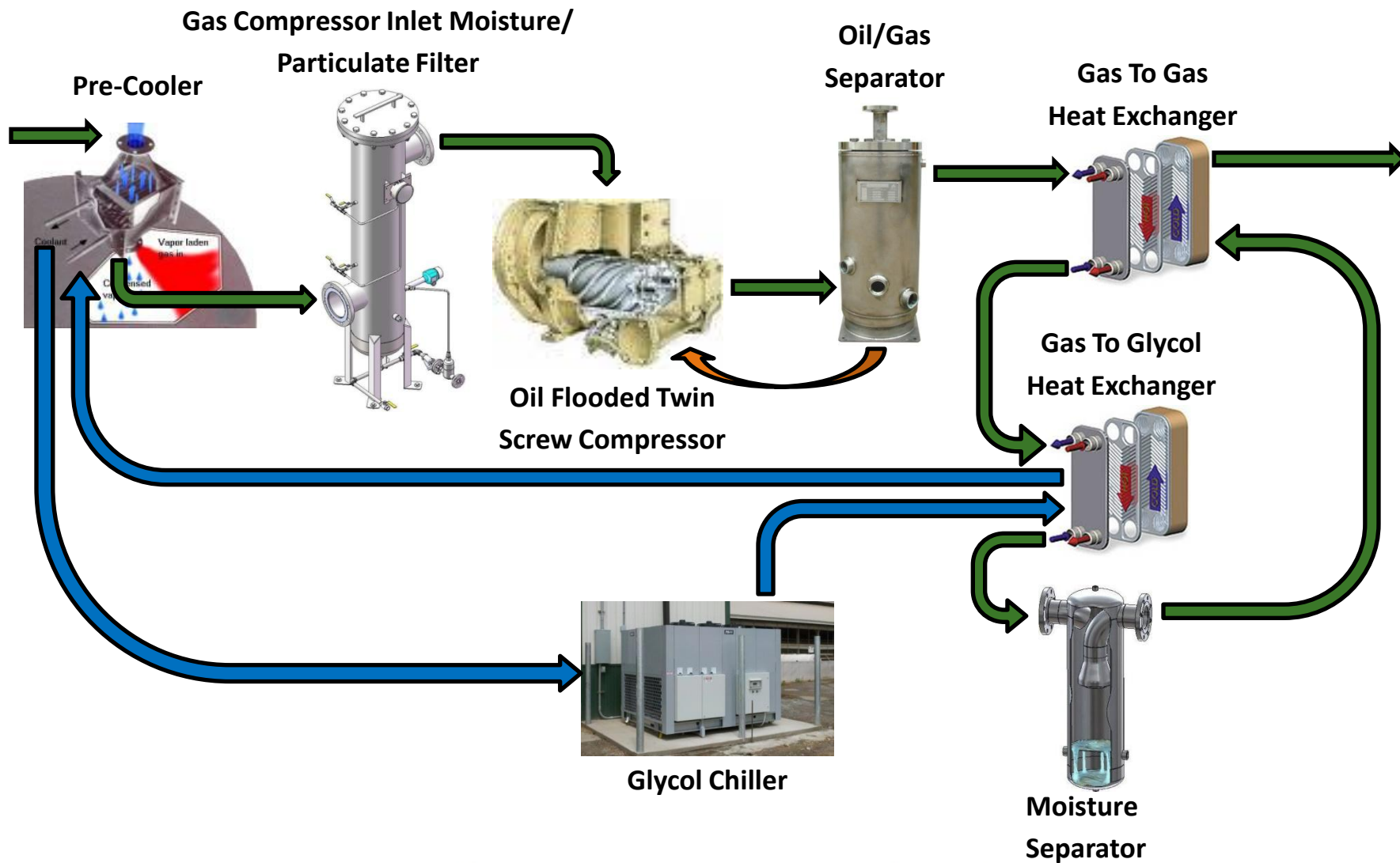
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Gas Compressor Systems Generation Supported

- Turbines
 - Capstone
 - Solar
- Direct Use Boiler
- Direct Use Pipeline
- Fuel Cells

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Gas Compressor Systems Major Components



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Gas Compressor Systems Skid Mounted Equipment

Oil Flooded Twin Screw
Compressor System



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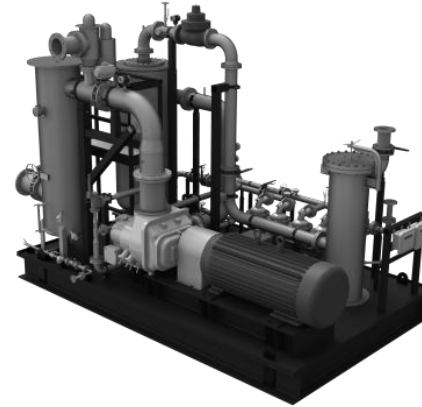
Siloxane Removal Systems



Digester or Landfill



Hydrogen Sulfide Removal



Gas Compression/
Moisture Removal



Siloxane/VOC
Removal



MicroTurbines



IC Engines



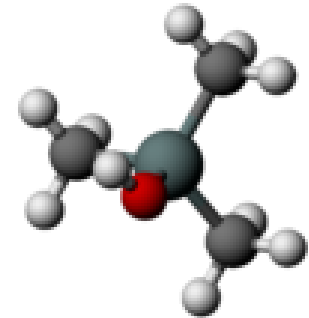
Boilers



Siloxane Removal Systems

What Are Siloxanes?

- What is a Siloxane?
- Silica and organic compounds are combined (Organosilicon)
- Used in many consumer and *industrial products (*Listed as Silicones as the ingredient on products*)
 - Shampoo
 - Conditioner
 - Deodorant
 - * Dry Cleaning Solutions
 - * Windshield Cleaning Products
 - * RTV Silicone Cleaner
- Siloxanes break down in landfills and digesters, and combine with the methane gas



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Siloxane Removal Systems

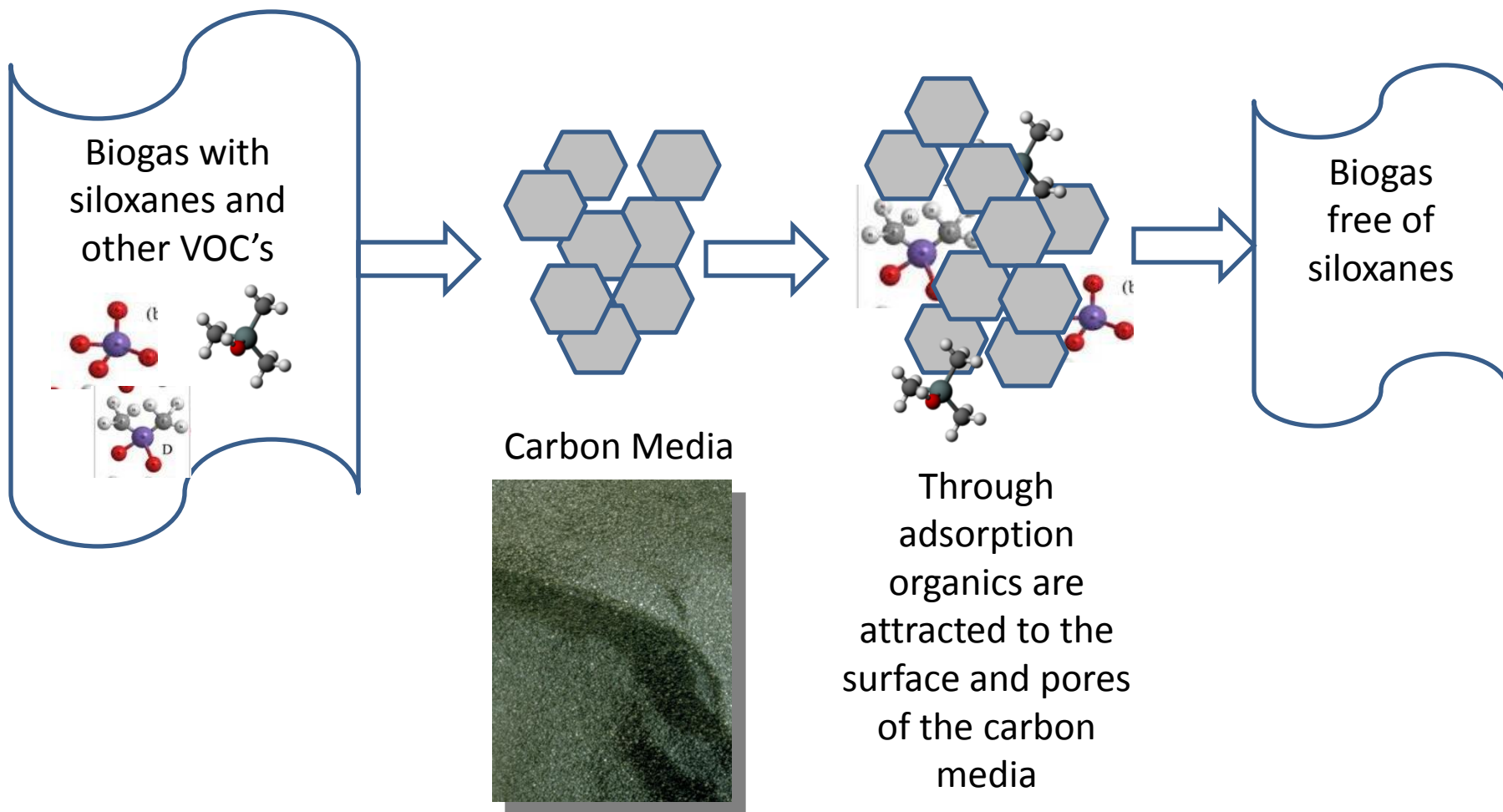
Siloxane Impact on Engines



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Siloxane Removal Systems

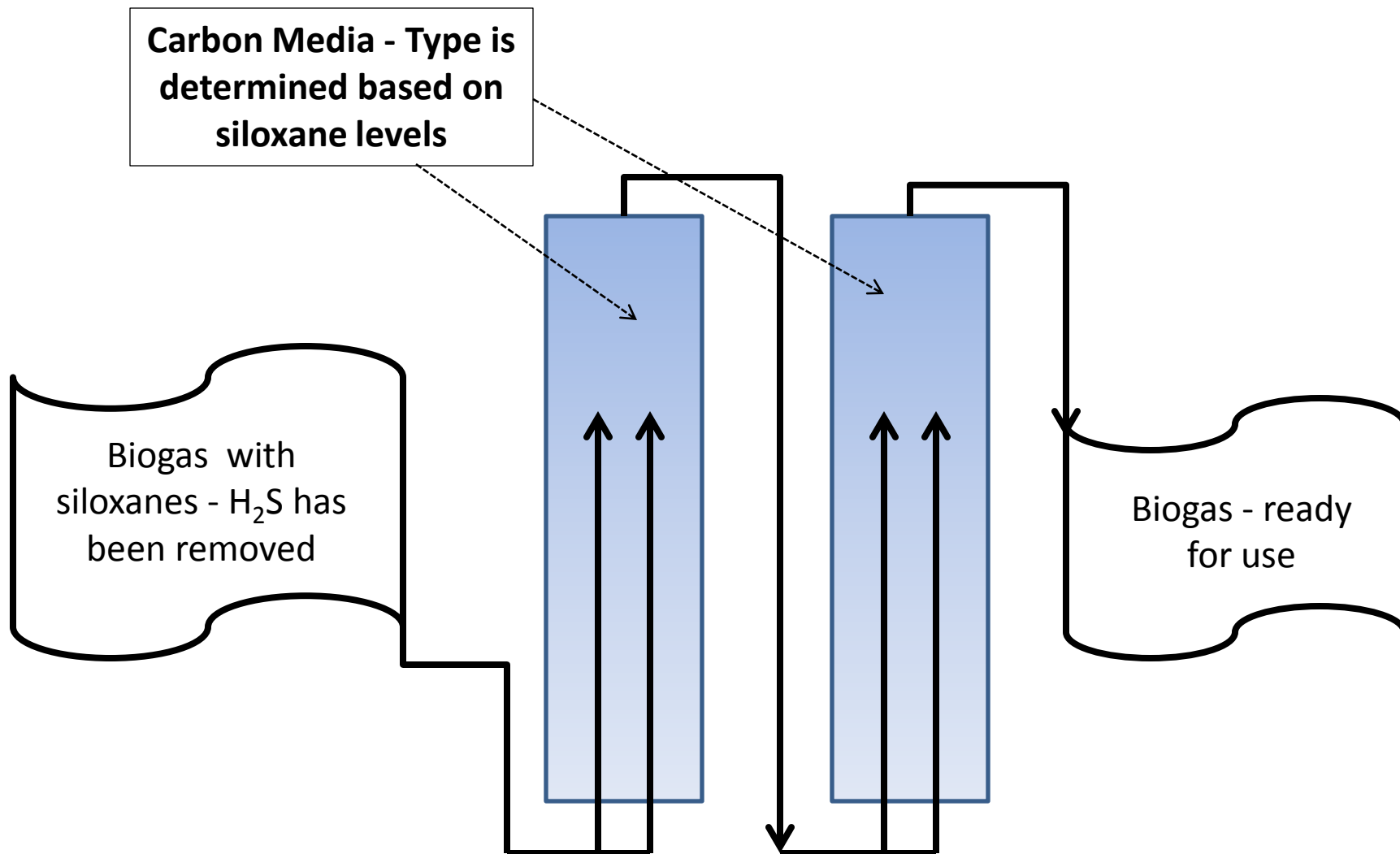
Siloxane and VOC Removal



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Siloxane Removal Systems

Siloxane and VOC Removal



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Gas Testing/Sampling Sampling and Shipping Supplies

Box with
Limited
Quantity
Label

Hose
Barb
Fitting

Tedlar
Bag with
Valve

Metal Can, Lid
and Sealing
Ring

Flexible
Tubing

Chain of
Custody



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Budgetary Biogas System Costs

- 50scfm Systems
 - Low Pressure Ranges From: \$200,000 to \$325,000
 - High Pressure Ranges From: \$230,000 to \$340,000
- 100scfm Systems
 - Low Pressure Ranges From: \$230,000 to \$400,000
 - High Pressure Ranges From: \$240,000 to \$380,000
- 300scfm Systems
 - Low Pressure Ranges From: \$270,000 to \$580,000
 - High Pressure Ranges From: \$310,000 to \$600,000

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BioCNG™ Vehicle Fueling System

Process Flow Diagram

Addition of Proprietary
CO₂ Removal System



Digester or Landfill

BioCNG™ Gas Conditioning
System

CNG Vehicle
Fueling Station

CNG Vehicles

MicroTurbines

IC Engines

Boilers



Potential Energy Produced

Vehicle Fuel

Electricity

Heat



Contact Information

Thank You!

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