

*the Energy to Lead*

# Renewable Bio-Gas an Opportunity for the Nation

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## Gas Technology Institute

### Addressing Key Issues for the Energy Industry

- > Contract Research
- > Program Management
- > Technical Services
- > Education and Training

- > Over 1,000 patents
- > Nearly 500 products commercialized

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## GTI Overview

- > Not-for-Profit Research, with 60+ Year History
- > Over \$60MM/yr energy R&D
- > Facilities
  - 18 acre campus near Chicago
  - 200,000 ft<sup>2</sup>, 28 specialized labs
  - Other R&D sites in Oklahoma and Alabama
  - DC, CA and MA offices
- > Staff of 260



Flex-Fuel Test Facility



Headquarters Offices & Labs



Energy & Environmental Technology Center

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## Renewable Bio-gas is...

- > Methane produced from digesters
  - Animal manure (dairy cows, swine)
  - Waste water treatment facilities
  - Food processing
- > Methane from Landfills and large composting facilities
- > Bio-gas produced from thermal chemical processes like gasification utilizing renewable feed-stocks including forest residues and agricultural wastes.

**RENEWABLE BIO-GAS CAN BE CLEANED-UP AND PLACED IN THE NATURAL GAS PIPELINE SYSTEM**

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## Renewable Bio-gas Rationale

### > Renewable Gas

- Using Natural Gas Infrastructure - Natural gas is 23% of US primary energy, has an extensive and very efficient energy distribution infrastructure.

### > Value

- Very high life cycle efficiency numbers – maybe the highest of any renewable product (70% conversion efficiency or higher)
- Helps to reduce nutrient run-off issues surrounding manure management
- Renewable option for end-use natural gas applications
- Renewable low carbon fuel for transportation, combustion and power generation
- Enhances value of forest and agricultural by-products by providing additional markets

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## Potential Renewable Bio-gas Vision for 2025

### > 516,000 jobs created over the last 10 years

- Substantial rural economic development (most jobs located in rural areas)
- Cleaner rivers, streams, and ground water (due to better management of livestock waste streams)
- Extensive new pipeline system developed to capture bio-gas
  - > Tying farms, landfills and woody bio-mass gasification facilities together to place high quality bio-gas into natural gas pipeline system
  - > 8% - 10% of all natural gas is now renewable

### > Carbon emissions reduced between 2015 – 2025 **1.27 Billion Metric tons of CO<sub>2</sub> (245 million cars off the road)**

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## How do we get to 2025?

- > Policy Parity – A Renewable methane molecule is valued as much as a renewable electron or gallon of liquid transportation fuel
- > Policies to allow virtual movement of a renewable bio-gas molecule through our nation’s pipeline infrastructure to meet any goals or mandates (RES – RFS – national carbon regime)

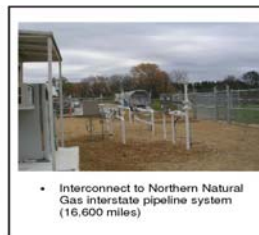
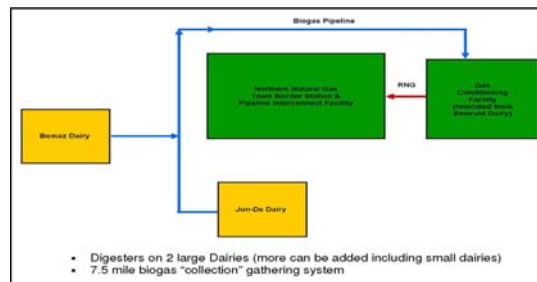
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## WESTERN WISCONSIN RENEWABLE NATURAL GAS DAIRY BASIN PROJECT

### Project Milestones

- Proof of concept and gas cleaning technology validated by Gas Technology Institute report
- Permitting completed
- Pipeline Interconnect with Northern Natural Gas operational
- Support from state and local funding agencies in place
- Industrial Revenue Bond (IRB) allocation approved and required “conduit resolutions” by municipalities approved



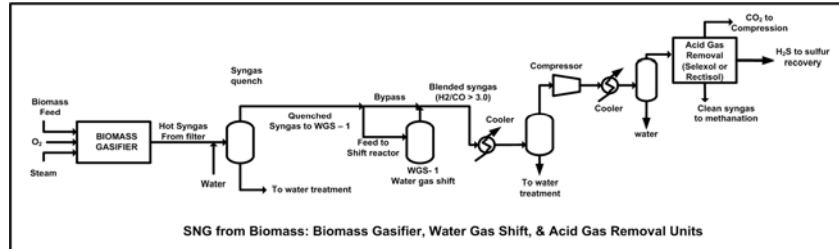
- Interconnect to Northern Natural Gas interstate pipeline system (16,600 miles)

Agri-Waste Energy, Inc.

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## Biomass to SNG Process Simulation



### Commercial Systems Basis

- Oxygen-blown, pressurized fluidized bed gasifier (10 bar<sub>a</sub>)
- Hydrocarbon reforming (including inherent CH<sub>4</sub>)
- Sour water-gas shift to achieve H<sub>2</sub>:CO >3
- Compression for commercial acid gas removal for CO<sub>2</sub> and S
- USDOE simulation for AGR used in process
- Two stage + trim methanation reactor
- Dehydration to achieve gas pipeline specifications
- All facilities will be carbon sequestration ready

~ 70% conversion efficiency

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## Pipeline Quality Bio-methane from Livestock Manure

### Pipeline Quality Biomethane: North American Guidance Document for Interchangeability of Dairy Waste Derived Biomethane

This effort provides guidance needed for the introduction of biomethane from dairy waste into existing pipelines. To support this effort, three areas of focus have been captured, with independent reports: [Executive Summary and Acknowledgments](#) – (GTI-09/0011)

[Task 1 Final Report: Technology Investigation, Assessment, and Analysis](#) – (GTI-09/0012)

[Task 2 Final Report: Laboratory Testing and Analysis](#) – (GTI-09/0013)

[Task 3 Final Report: Guidance Document for Introduction of Dairy Waste Biomethane](#) – (GTI-09/0014)



GTI is also implementing a similar gas testing and quality program for biogas/biomethane derived from landfills and waste water treatment plants to provide guidance for a growing green energy market from these biomass sources. Results from this project are anticipated in 2010.

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## Renewable Bio-gas Market Growth strategy

- > Generate reduced carbon, pipeline-quality renewable natural gas by
  - Creating incentives for early market entrants
  - Developing projects using repeatable designs
  - Providing product to traditional natural gas users through pipeline system
    - > Existing centralized power generation
    - > Homes, businesses, industry
    - > Natural Gas Vehicles
- > Potential to displace 10 -15 percent of natural gas use by 2025 - 2035
  - Depends on resource allocations and public policy
  - GTI informational one-pagers available on every state's resource base, revenues, GHG reductions and job creation

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## Current Renewable Bio-gas activity

- > Renewable Bio-gas Coalition in support of S 306 and HR 1158
  - Over 85 companies in support of production tax credits
  - Support letter provided to Congress and key committee staff
  - Goal to get legislative language attached to an energy bill in 2010
  - Attempting to get language to allow moving renewable bio-gas through pipeline system virtually for national RES and/or Cap
- > California low-carbon fuel standard
  - Has identified compressed bio-methane as the lowest carbon transportation fuel
- > NARUC resolution in support of Bio-gas tax incentives
- > Efforts underway in Texas and Wisconsin to allow renewable bio-gas to be moved delivered virtually to electricity producers to help meet State RPS
  - Already allowed in CA

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## Today's Speakers

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- **Christopher Voell**, AgStar Program, U.S. Environmental Protection Agency
- **Marisa Uchin**, Manager, Federal Government Relations, Pacific Gas and Electric Company
- **Wayne Davis**, Vice President, Incentives and Regulatory Affairs, Harvest Power, Inc.
- **Arne Jungjohann**, Program Director Environment, Heinrich Boell Stiftung

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## GTI contact information

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