

# SW CERT Biogas Digester Meeting

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May 12, 2011



# Project Components

- Digesters at two dairies:
  - Jon-De Farm
  - Bomaz Farms
- 9.5 miles of Biogas “gathering” pipeline
- Gas Conditioning Facility
- Pipeline Interconnect

# Gas Conditioning Facility

UPGRADING IBR DIGESTER "RAW BIOGAS" INTO PIPELINE QUALITY GAS



**IBR**  
Gas  
Conditioning  
Facility



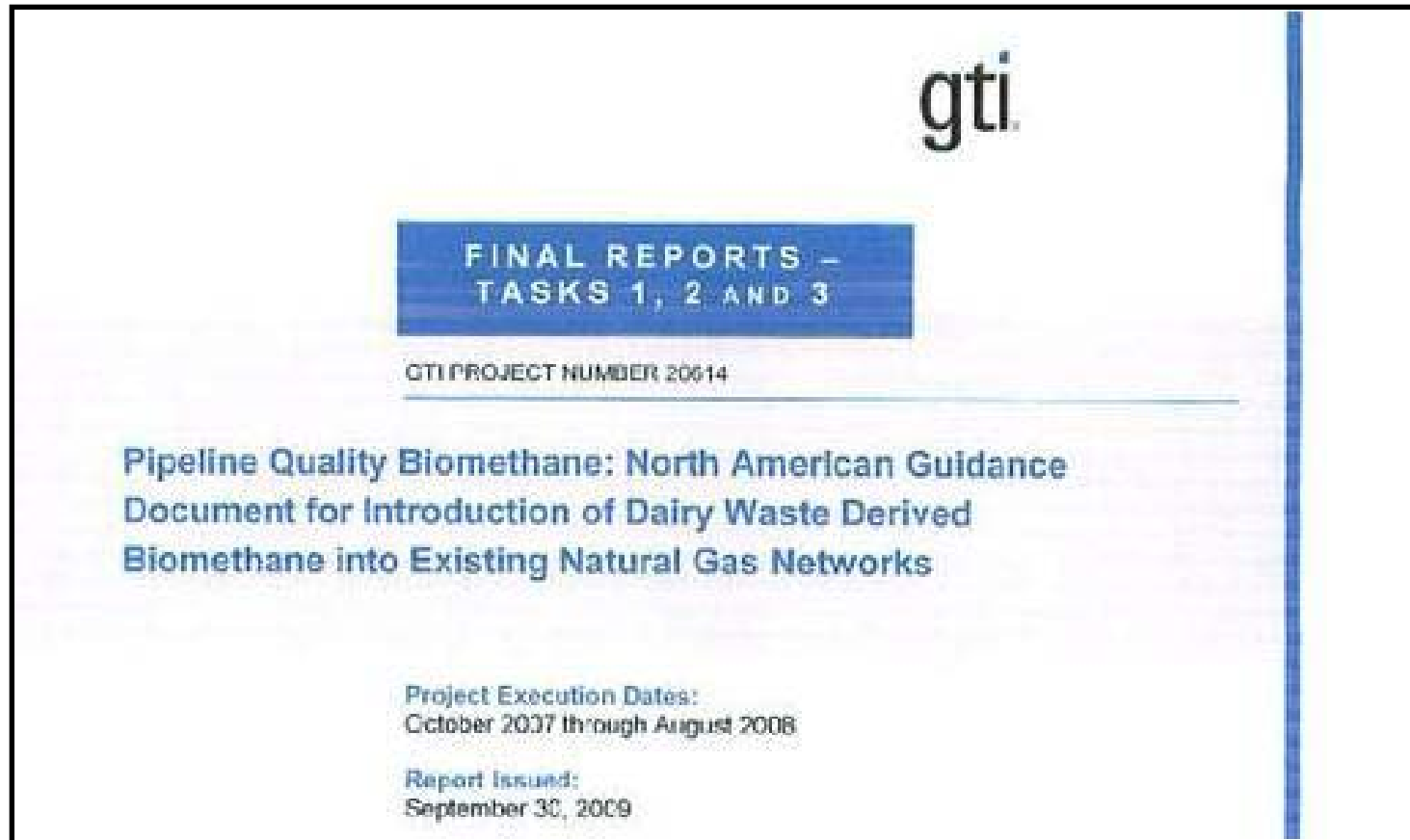
Inside  
Biogas  
Processing  
Facility



Tube  
Tanker  
Truck at  
Injection  
Point

Graphics Layout By: John Graham, Chief Knowledge Officer, Environmental Products & Technologies Corporation, ©Copyright 2010. Photos By: AgriWaste Energy, Inc.

# GTI Study Executive Summary



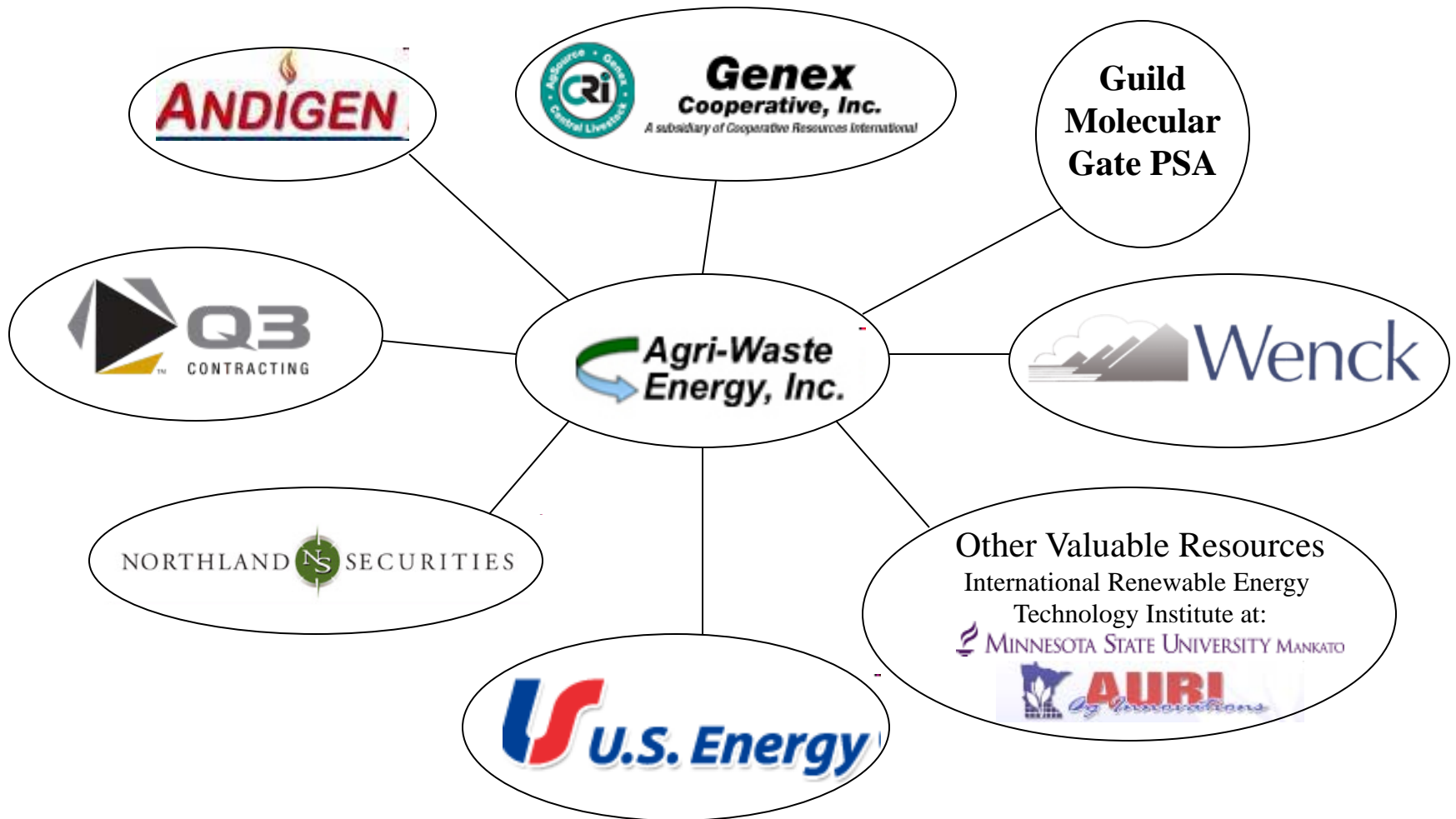
# NNG Tariff Baldwin, WI

Component /Property	Units of Measure	Pipeline Spec <sup>1</sup>	CNG Spec per DOT <sup>2</sup>
Water vapor	Lbs per mmscf (million std cu ft)	Less than 6	Less than 0.5
Hydrogen sulfide	Grains per Ccf	Less than or equal to 0.25	Less than or equal to 0.10
Total sulfur	Grains per Ccf	Less than or equal to 20	Less than 0.1
Heating value	Btu per Cubic Foot	Greater than or equal to 950	
Temperature	Degrees Fahrenheit	Less than or equal to 120 F.	
Oxygen	Per cent by volume	Less than or equal to 0.2	Less than 1.0
Carbon dioxide	Per cent by volume	Less than or equal to 2.0	Less than 3.0
Non-hydrocarbon gases	Per cent by volume		Less than 4.0

<sup>1</sup> Issued May 1, 2003 Northern Natural Gas Company FERC Tariff - fourth revised sheet 281

<sup>2</sup> DOT regulations DOT-E-8009 13<sup>th</sup> revision

# Strategic Partners





# Dairy Management, Inc. (DMI) and its Innovation Center for U.S. Dairy.



**DMI working with:**

- **Wal Mart**
- **Waste Management**
- **USDA**
- **Major Financial Institutions.**

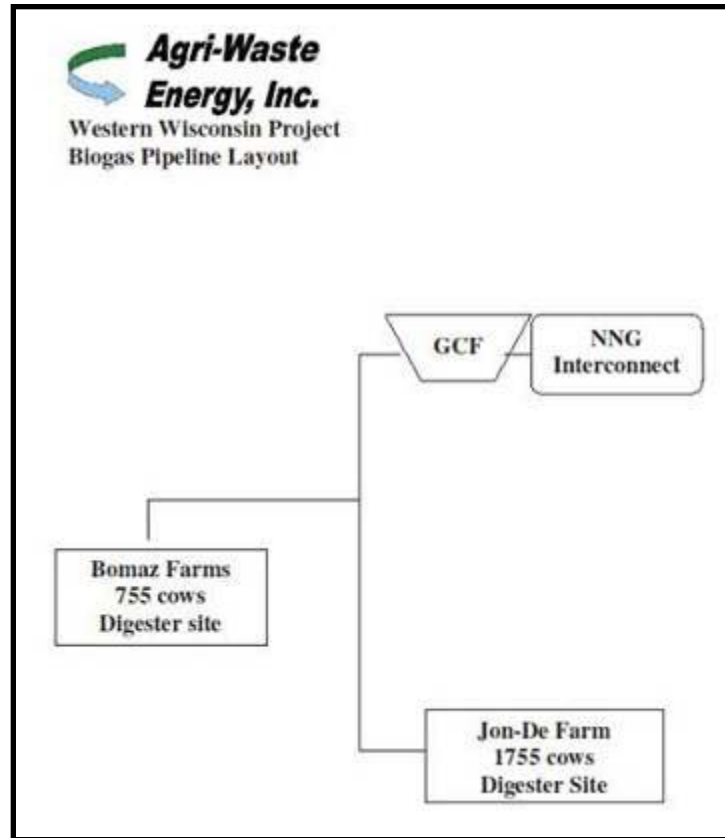
# US Dairy Sustainability Commitment Progress Report

***“The energy source for our society is currently based on fossil fuel, which causes GHG emissions to be released into the atmosphere. Fuel efficiency can offer dairy businesses (large and small) the opportunity to reduce costs and GHG emissions. What’s more, converting manure and processing byproducts into renewable energy could provide new sources of revenue for farms and processors.”***

**DMI Goal: 1300 Digester / Renewable Energy  
Projects on U.S. Dairies by 2020**

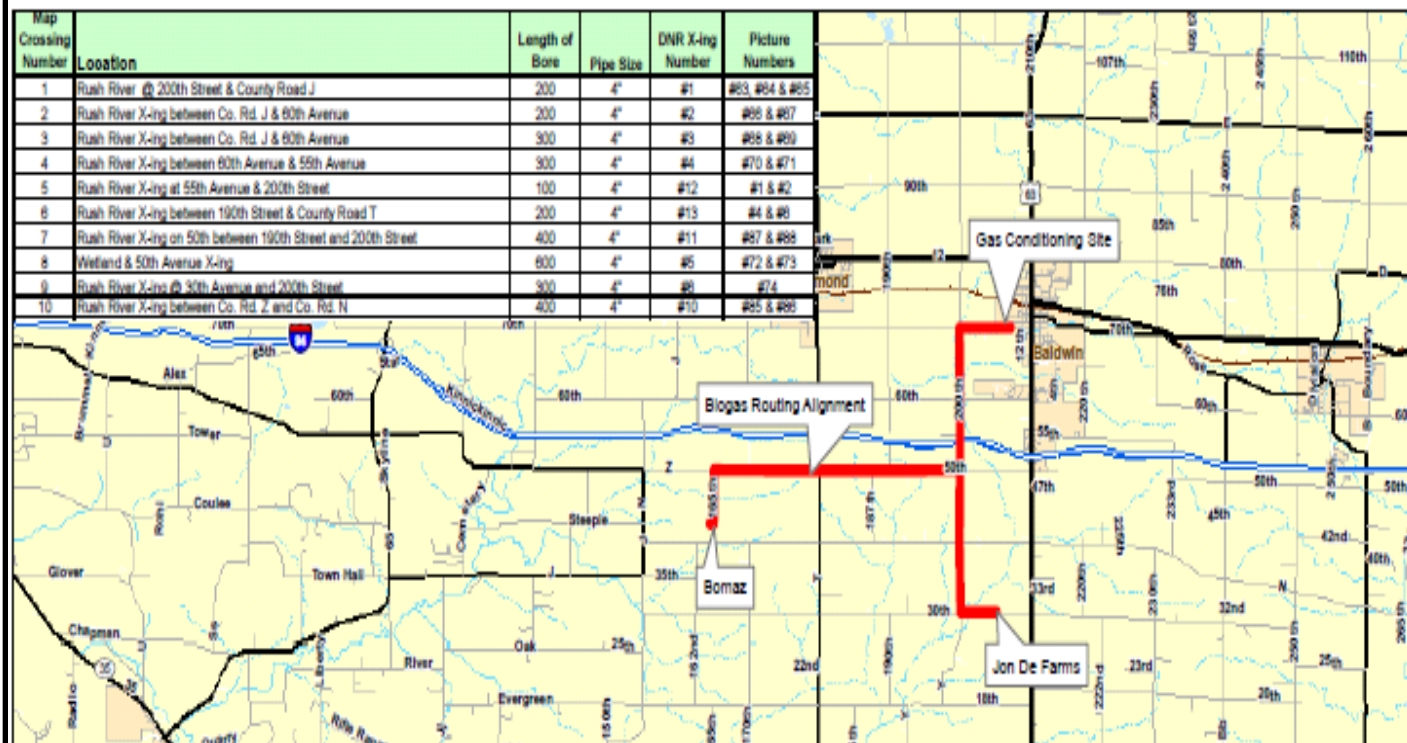
**Developers needed for DMI's "1300 by 2020  
Goal"**

# Biogas Pipeline Layout



The project includes digesters at two dairies, Jon-De and Bomaz, 9.5 miles of biogas gathering pipeline, a Gas Conditioning Facility (GCF), and connection into an existing Interconnect into the Northern Natural Gas pipeline in Baldwin, WI.

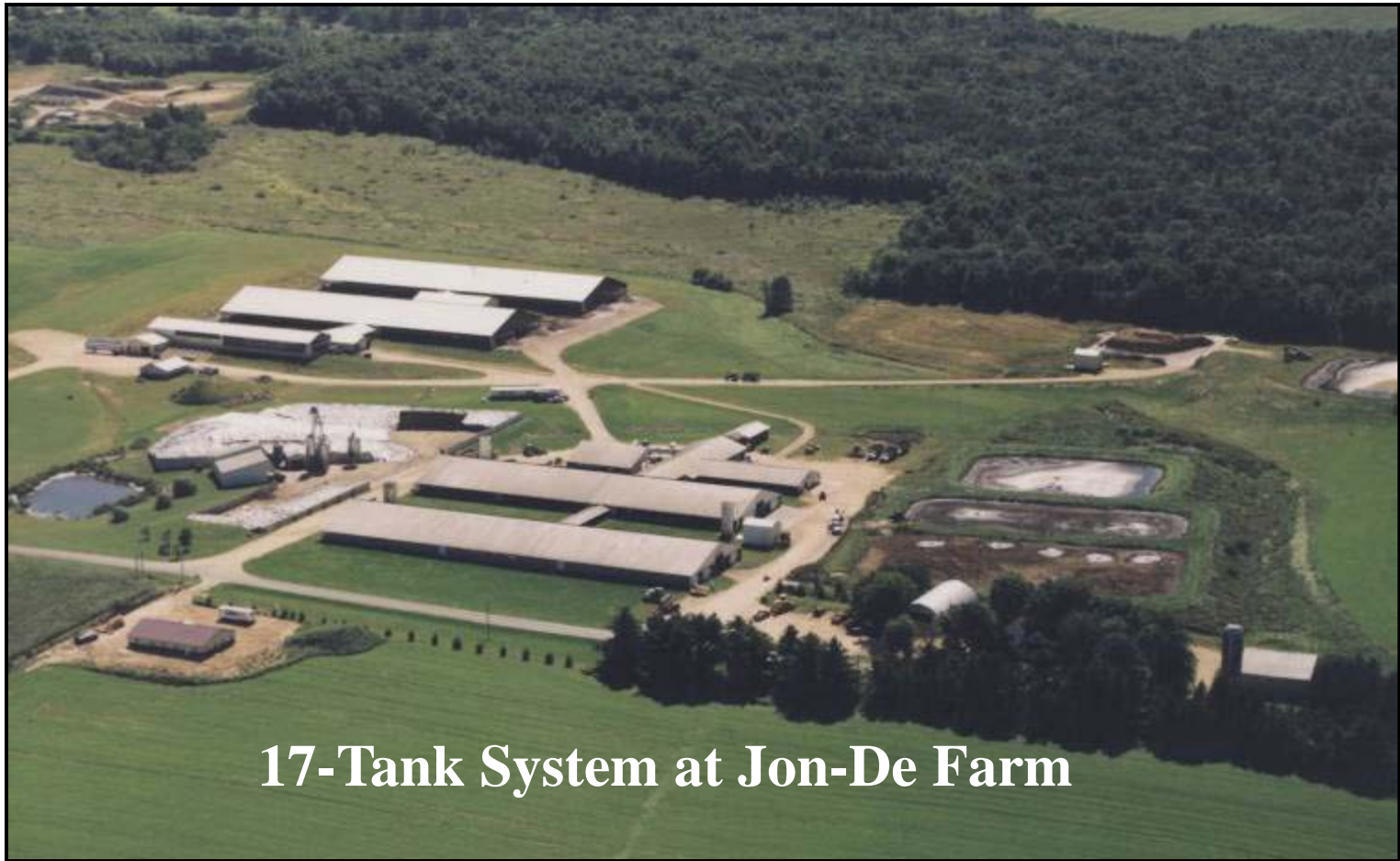
# AGRI-WASTE ENERGY LOW PRESSURE BIOGAS ROUTING BALDWIN, WISCONSIN



**Page Index**

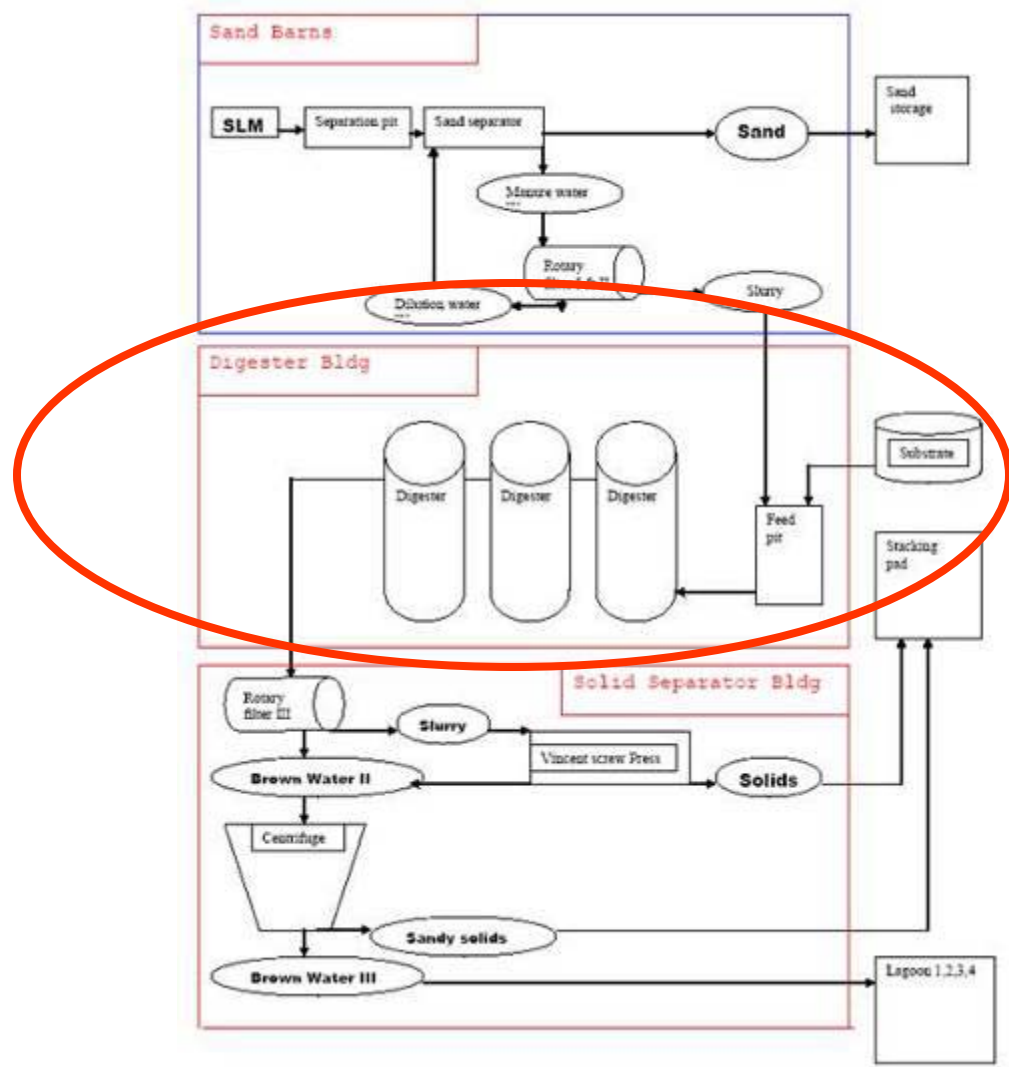
- G1 - Cover Sheet
- C1 - Site Plan and Details
- C2 - Biorefinery to 200th St
- C3 - Co Rd J to 60th Ave
- C4 - 60th Ave to 50th Ave
- C5 - 50th Ave to Co Rd N
- C6 - Co Rd N to 30th Ave
- C7 - 200th St to 190th St
- C8 - 190th St to Co Rd T
- C9 - Co Rd T to 165th St
- C10 - Co Rd Z to Co Rd N
- C11 Gas Well Detail

# How is the Andigen System integrated into a large dairy?



**17-Tank System at Jon-De Farm**

# Manure Flow Diagram



# 6-Tank System at Bomaz Farms



# Andigen Anaerobic Digestion

With the Andigen system (Induced Blanket Reactor or IBR), the conversion process is optimized by creating a controlled environment designed to increase the concentration of bacteria in order to accelerate the rate of digestion.

# IBR Featured Technology

Microbe, Volume 5, Number 4, 2010

## Utah State University

- Developed for cash strapped dairy farms.
- *Needed to be simple to operate, with little labor.*
- Needed to protect the ground water
- Needed to reduce or eliminate vectors and odors.
- Needed to produce a high value digestate that could be used for cow bedding/compost
- Needed to produce energy.



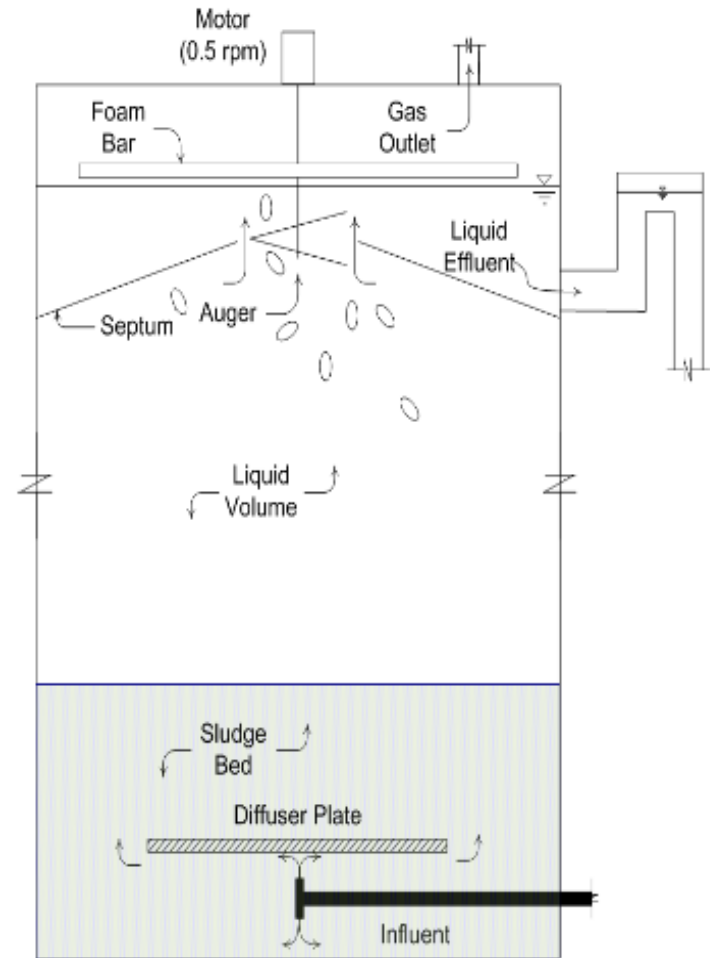
# Digestion Technologies

## TECHNOLOGY COMPARISON

Key Evaluation Criteria	Typical IBR Performance	Plug Flow	Complete Mix	Lagoon
Retention Time	5-6 Days	25-30 Days	20-25 Days	60-90 Days
Fiber Quality	Very Good/Excellent	Good	Very Good	Poor
Gas Quality % Methane	65-70% Typ.	55-60% Typ.	60-65% Typ.	50% Typ.
Footprint (10,000 dairy cows)	.8 Acres	2.25 Acres	1.4 Acres	7 Acres
Temperature Range	Mesophilic/Thermophilic	Mesophilic/Thermophilic?	Mesophilic/Thermophilic	Ambient
Addition of Substrate	Very Good	Good	Very Good	Very Poor
Parasitic Load	Very Low	Low	High	Very Low
Sand Removal	Little to No Disruption	Major Shut Down	Shut Down/Major Shut Down	Major Shut Down
Maintenance	Little to No Disruption	Shut Down	Shut Down	Little to Major Shut Down
Modularity/Expandability	Excellent	Poor	Poor	Poor
Preferred Solids	6-9%	11-14%	6-9%	1-5%

# IBR Process

- Works like a large clarifier
- Separates the SRT from the HRT
- Produced Methane is quickly removed.
- 5 day HRT with high solids
- 8% to 12% Solids
- Can be easily cleaned from accumulated sand
- Modular – easy to expand/remove



# Andigen Anaerobic Digestion

- The Induced Blanket Reactor (IBR) system falls under the NRCS classification of a UASB Controlled Temperature digester (code 366) and meets all applicable requirements.
- Both Farm's Manure Management Plans have been approved by WIDNR with the Andigen system

# IBR Benefits (continued)

Other advantages include:

- Scalable Facility Compared to Fixed Capacity
  - Can be easily expanded to accommodate growing needs
- Easy To Maintain
  - Sand and grit removal

# Whitesides Dairy

## Rupert, ID

- **Facility: Dairy – Approximately 3,000 Cows Serviced**
- First Started (2 tanks): Spring 2005
- Expansion (10 tanks): Fall 2006
- Input Material: Manure slurry
- Collection: Scrape and vacuum
- Substrates Added: None
- Typical Solids Content: 6%
- Hydraulic Retention Time: Approx. 4 days
- Throughput During Operation: Approx. 80,000 gallons/day
- Gas Production: 105 CFM
- Gas Usage: Gas conditioning and sale
- Liquid Effluent: To lagoon for irrigation
- Solids: Post digestion separation and sale
- Typical Operating Temperature: 100 deg. F



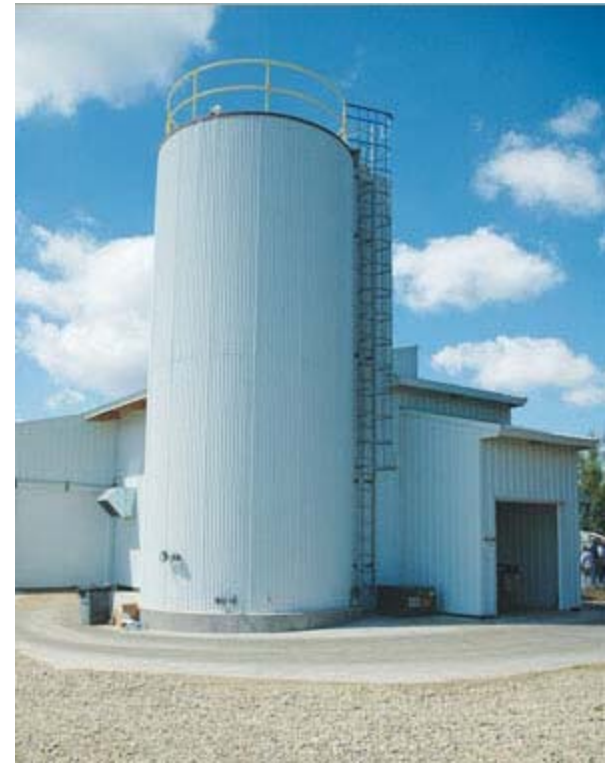
# Wadeland Dairy Ogden, UT

- **Facility: Dairy – Approximately 1,000 Cows Serviced**
- First Started (4 tanks – one developmental):
- Fall, 2004
- Expansion: In progress
- Input Material: Manure slurry
- Collection: Scrape/flush
- Substrates Added: Various
- Typical Solids Content: 6%
- Hydraulic Retention Time: Approx. 6 days
- Throughput During Operation: Approx. 19,600 gallons/day
- Gas Production (manure only): 32 CFM without substrate
- Gas Usage: Electrical Generation
- Liquid Effluent: To lagoon for irrigation
- Solids: Post digestion separation for bedding
- Typical Operating Temperature: 98 deg. F



# Jer-Lindy Farm Brooten, MN

- **Facility: Dairy – Approximately 135 Cows Serviced**
- Started (one tank): June, 2008
- Input Material: Manure slurry
- Collection: Scrape/flush
- **Substrates Added: Cheese Whey**
- Typical Manure Solids Content: 6%
- Hydraulic Retention Time: Approximately 4.5 days
- Throughput During Operation: Approx. 7,100 gallons/day
- Gas Production (manure only): 7-8 CFM without substrate
- Gas Usage: Electrical Generation
- Liquid Effluent: To lagoon for irrigation
- Solids: Post digestion separation for bedding
- Typical Operating Temperature: 103 deg. F



# Westpoint Dairy

## Jerome, ID

- **Facility: Dairy – Approximately 4,500 Cows**
- **First Started (15 tanks): Spring 2009**
- Input Material: Manure slurry
- Collection: Scrape and vacuum
- Substrates Added: None
- Typical Solids Content: 6.5%
- Hydraulic Retention Time: Approximately 4 days
- Gas Production: 150 CFM (Est.)
- Gas Usage: Gas conditioning and sale
- Liquid Effluent: To lagoon for irrigation
- Solids: Post digestion separation and sale



# Andigen Digester Systems to be built by Genex Farm Systems



# Tank Erection



# Completed Building



# AURI Research & Testing

Agricultural Utilization and Research Institute  
(AURI) collaboration with Utah State University  
to develop scale model Andigen Digester System  
at AURI - Waseca

# **Pipeline Interconnect with Northern Natural Gas**

# Relocation of Gas Conditioning Facility to site adjacent to Northern Natural Gas Pipeline Interconnect

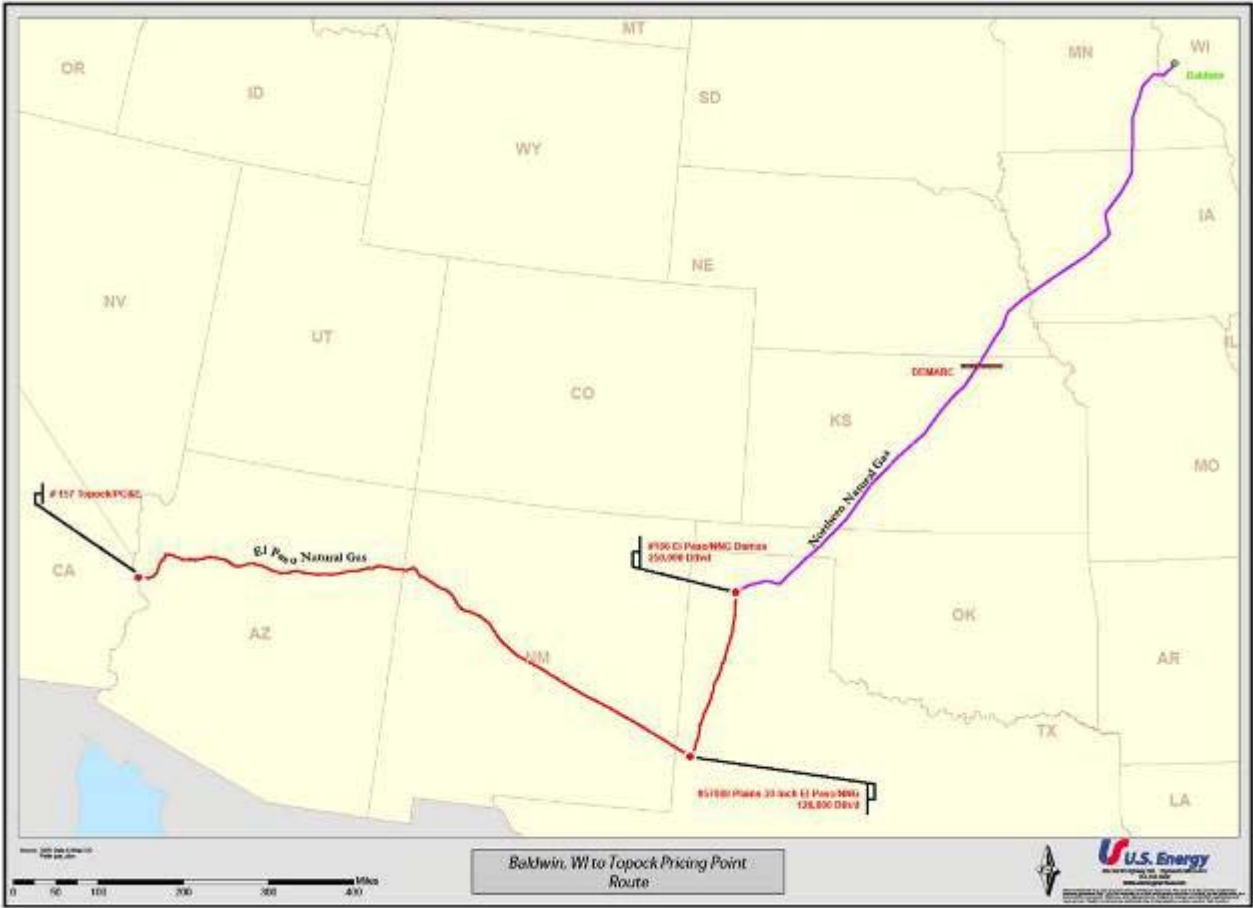


# First Phase (cont.)

Interconnect to Northern Natural Gas  
16,000 mil. pipeline



# Delivery through NNG and El Paso Pipeline Systems



# Interconnect & Operating Agreements

- Northern Natural Gas
- El Paso Pipeline  
(managed by U.S. Energy Systems)

# Economics

- Total Number of Animal Units: 3400
- Biogas Production: 810 MMBTU/day
- Feedstock – Cheese whey & food waste
- Offtake Agreement : 15 year term

# Questions / Discussion