



presents

Genifuel Corporation

Overview

The Future Farm Institute has the exclusive, international rights to market and use the Genifuel System when it is combined with any type of vertical farming system

Hydrothermal Processing

- **Advanced process efficiently converts wet wastes to clean biofuels**
 - Can produce oil, gas, or both
 - 99.5% complete—almost no sludge
- **Process perfected by US Department of Energy at Pacific Northwest National Laboratory (PNNL) over 35-year period with extensive testing**
- **“Solving Two Problems at Once”™**
 - Solves wet waste disposal problems
 - Profitably produces renewable energy

Genifuel

Summary Statement

- **Genifuel's technology converts wet waste streams to advanced biofuels and recovers clean water and nutrients as co-products**
- **US Department of Energy studies, three US National Laboratories, top universities, and a major oil company have concluded Genifuel's technology outperforms competitors**
- **The Genifuel system is small, fast, highly automated, and scalable**

Genifuel

Introduction

- **Genifuel formed by James Oyler in 2006**
- **100% funded to date from personal resources, US National Lab, US DOE, and a major oil company**
- **Protected by Genifuel exclusive patents and licenses**
- **Tested on over 100 feedstocks**
- **Scale-up completed at lab, bench, and skid scale**
- **Target market sectors are industries with reliable wet waste streams**
- **World system market more than \$1,500 billion**

Genifuel

Genifuel Partners



Genifuel

The Problem and the Opportunity

- **Wet waste materials are everywhere, with huge quantities worldwide**
- **Wet waste treatment has often meant large-scale dumping into watersheds or oceans, squandering fresh water, energy and nutrients**
- **Government regulations are increasingly requiring difficult and expensive treatment and will continue to trend in this direction**
- **Demand and value for renewable energy and biofuels are expanding rapidly**

The Genifuel Process

- **Technology is called Hydrothermal Processing—pressurized hot water, with or without catalyst**
- **Wet waste is made into water slurry with 15% to 35% dry solids; no solvents or other additives**
- **Feedstock is heated and pressurized to just below the supercritical point of water, making water a powerful solvent for waste solids in the slurry**
- **Continuous process converts more than 99% of the feedstock organic content in 30 minutes**

Genifuel

Hydrothermal Process Technology

- **Process uses superheated liquid water—below the supercritical point of water**
 - 350°C (662°F) and 200 bar (3,000 psi)
- **Process is stable and thermodynamically neutral**
- **Heat is recovered to heat incoming feedstock**
 - Reduces process energy to app. 12% of energy produced
- **Fuel products are well understood**
 - Oil is biocrude—similar to Fuel Oil #6 or Bunker Oil
 - Gas is medium-heat mix of methane and CO₂
- **Standard stainless steel construction (SS 316L)**

Genifuel

Hydrothermal physical chemistry

- **At room temperature water is a polar molecule, but near the supercritical point molecular bonding changes and water becomes highly non-polar**
 - Shifts from non-miscible with oil to solvent for oil
 - Becomes powerful solvent for organic substances
- **Many inorganic solids which are soluble or bound in feedstock at room temperature become insoluble, and precipitate rapidly and completely**
 - Sulphates, phosphates, and carbonates drop out
 - Sand and grit also precipitate rapidly and completely
 - Precipitate is dense and easy to remove and transport

Genifuel

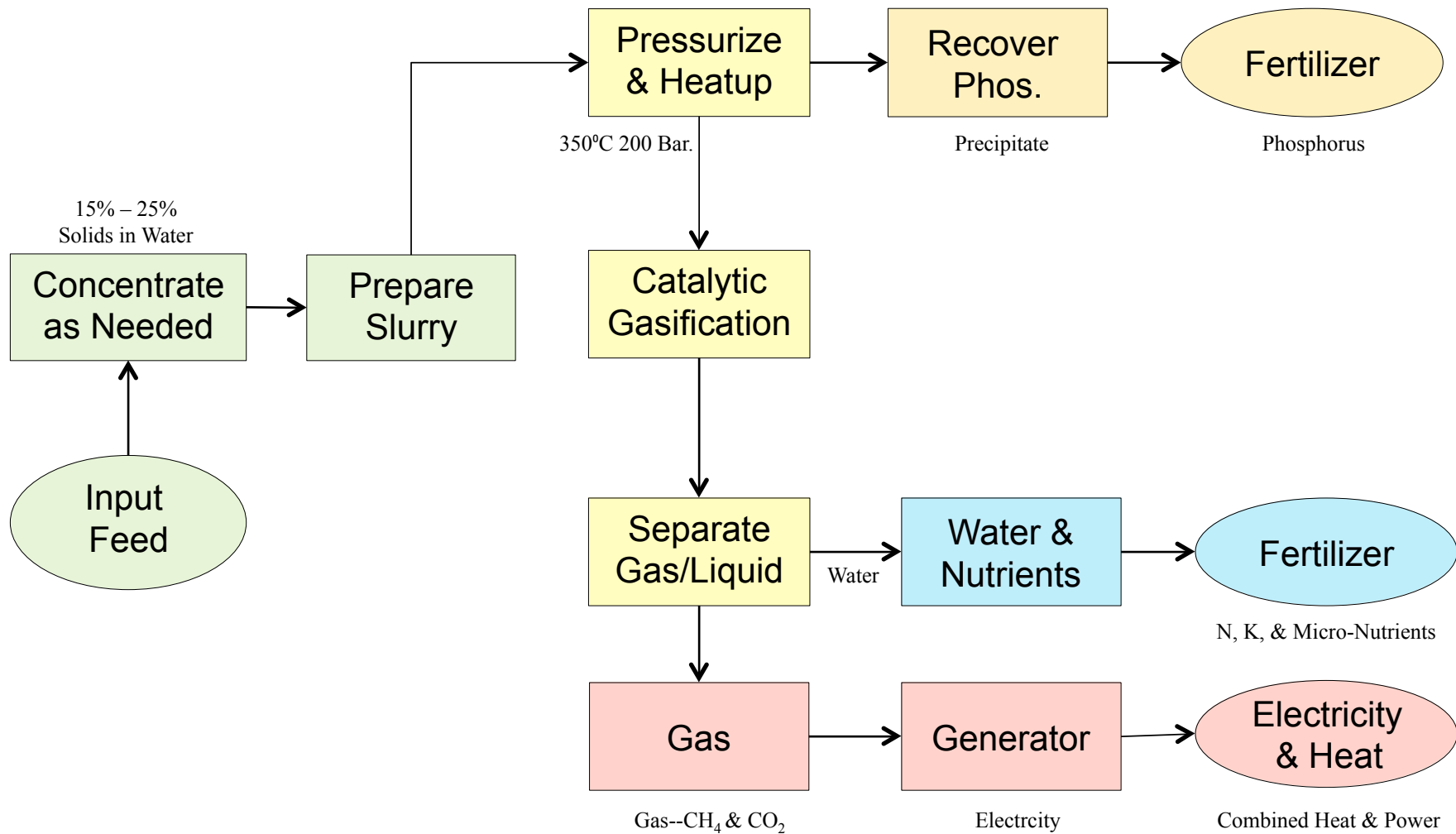
Recovery of Plant Nutrients

- **Primary nutrients N, P, and K are fully recovered**
 - Phosphorus is sent to fertilizer manufacturer and made bio-available with simple acid treatment
 - Nitrogen is in effluent water as ammonium carbonate, a common fertilizer
 - Potassium is in effluent water in bio-available form
- **All micro-nutrients are also recovered in the water**
 - Iron, boron, magnesium, copper, zinc, etc.
- **Water can be spread on land or added to irrigation lines**

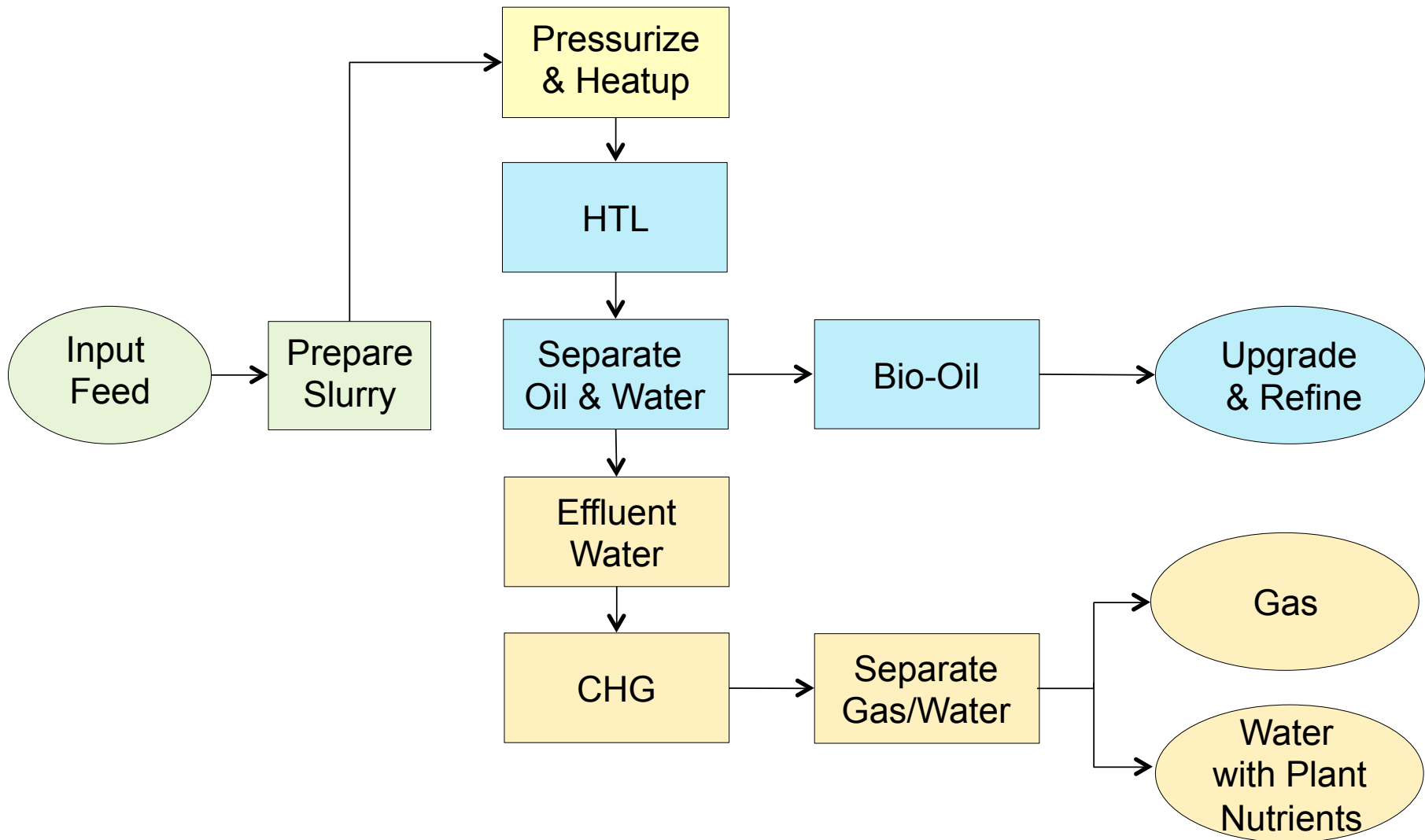
Products Are Oil, Gas, or Both

- **Presence of catalyst determines whether oil or gas**
 - Bio-oil produced when no catalyst present
 - Renewable natural gas produced when catalyst present
- **Both oil and gas can be produced in one continuous process**
 - Two-stage process produces oil first, capturing 50% of the feedstock, with remainder in the effluent water
 - Effluent water is then passed over catalyst, producing renewable natural gas, leaving only clean, sterile water

Hydrothermal Gasification Process Flow

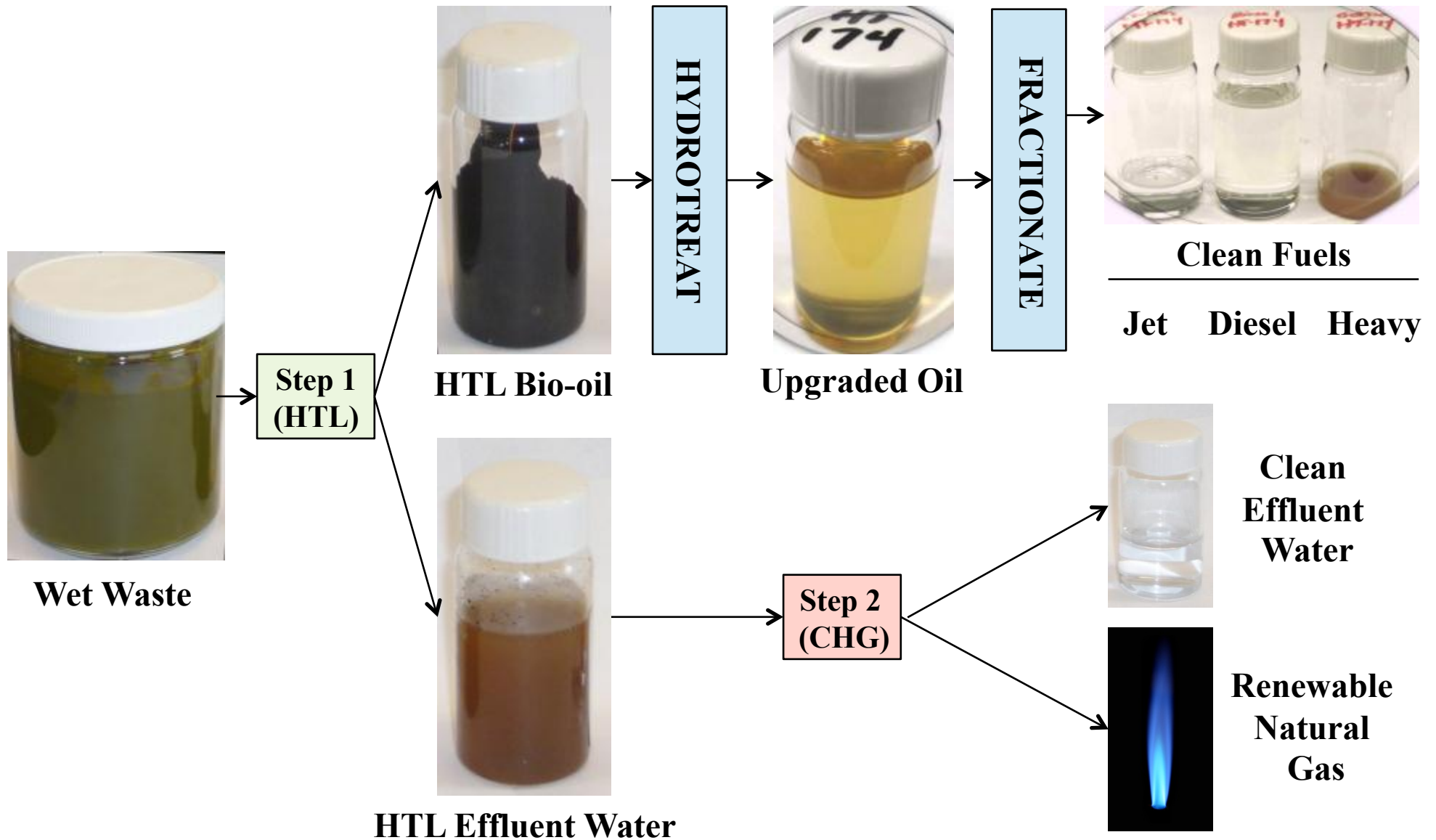


Combined Oil-Gas Hydrothermal Process Flow



Genifuel: Solving Two Problems at Once™

Wet Waste to Clean Fuels



Products

- **Bio-oil can be used as is, or upgraded to refined fuels in a conventional refinery**
- **Renewable natural gas can be used three ways**
 - Use as fuel for generator to make electricity and heat
 - Remove CO₂, then inject into pipeline or use as CNG
- **Most feedstocks produce fuels and power which are eligible for renewable incentives internationally**
 - These credits can be very attractive financially

Feedstocks Available for Hydrothermal Processing

| Feedstock | World Million t/y | USA Million t/y |
|--------------------------------------------|------------------------------|----------------------------|
| Non-Dairy Cattle Manure | 2,510 | 396 |
| Food Processing Waste | 2,397 | 422 |
| Pig Manure | 2,154 | 340 |
| Algae | 1,260 | 270 |
| Cellulosic Ethanol Bottoms | 1,260 | 270 |
| Muni Solid Waste (paper and organics only) | 819 | 225 |
| Dairy Cow Manure | 747 | 53 |
| Wastewater Treatment Solids | 66 | 24 |
| Beer Production | 27 | 5 |
| All Other | 1,686 | 301 |
| TOTAL | 12,926 | 2,305 |

1. All amounts shown as metric tons of wet slurry @ 20% solids.
2. All amounts are actual amounts for 2010 except algae and cellulosic ethanol, which are estimated at 5% of transportation fuel supply.
3. Assumes 54% of available feedstocks are ultimately recovered worldwide.
4. "All Other" includes waste from pulp and paper processing, water and landfill remediation, organic chemical waste, poultry manure, etc.

Genifuel

Potential Hydrothermal Energy Production

| Measure | World | USA |
|-----------------------------------------------|-------|-------|
| HTL Oil from Combined HTL-CHG as % Fossil Oil | 33.8% | 27.8% |
| CHG Gas from Combined HTL-CHG as % Fossil Gas | 15.7% | 15.0% |
| CHG-Only Electricity as % Current Generation | 28.2% | 23.9% |

Competitive Analysis

- **Incumbent technology is Anaerobic Digestion (AD)**
 - Biological process, more than 2,000 years old
 - Difficult and messy to operate properly
 - Inefficient, with hard-to-handle remainder waste
- **A more modern competitor--high-temperature pyrolysis--is not feasible for wet materials**
 - App. 40% of the energy is lost drying the material
 - The product gas is syngas (mix of carbon monoxide and hydrogen), not natural gas

Competitive Analysis (cont.)

- **Compared to Anaerobic Digestion, Genifuel Process has many advantages**
 - Easier to operate—continuous and stable
 - Smaller (trailer size vs. huge tanks)
 - Faster (30 minutes vs. 30 days)
 - More complete (99% vs. 50%)
 - Clean sterile water vs. tons of wet sludge residue
 - Environmentally superior (no sludge)
 - Clean gas (no sulfur or siloxanes in gas)
- **Plant nutrients are recovered as liquid fertilizer in clear sterile water**

Genifuel