PHENIX GROUP
Product sheet summary

Renewable Natural Gas and Green Hydrogen from Waste

New Hydrogen Reduction Technology brings wastes into the circular economy

I. A Global Problem – Waste is Poorly Managed

Our current technologies are ***inefficient***, ***costly*** and ***incomplete:***

Land filling	Incineration	Anaerobic Digestion (AD)
• Large Footprint –Waste of Land Resources, siting concerns • Legacy Issues: Leachate, Toxic Landfill Gas, GHG Emissions, Closure costs • Long distances from source of waste, trucking concerns	• Ash Management, 30%- bottom and toxic fly ash • Major Emitter of GHGs • Expensive Capital and Operational Costs, siting concerns	• Only addresses Source Separated Organics • Management of Digestate, 40% of volume is problematic • Water, Odours and GHG Emissions are major concerns

II. A Local Solution –Hydrogen Reduction Technology

Complete and Cost-Effective Waste Management

- A chemical process – organic molecules reacting with a “reducing agent”
- Hydrogen vaporizes or “reduces” waste into elemental compounds, primarily methane gas, carbon and silica
- Converts ANY organic waste material, including Municipal Solid Waste (MSW), Auto Shredder Residue (ASR), Sewage Waste (SW) and hazardous wastes into RNG
- RNG can be purified to pipeline grade, offsetting demand for NG from fossil fuels
- Significant diversion from land filling, incineration and anaerobic digestion
- Upwards of 95% solid reductions, leaving 5-10% residual (carbon and silica)
- Recovery of metals in waste (ferrous, aluminum, etc.) for recycling
- RNG is produced near to the source of waste to be used locally
- Hydrogen can be economically stripped from the process for ZERO CARBON industrial, transportation, electrical generation and heating

III. Environmental Benefits –Circular Economy in Action

Management of GHGs

- Eliminates all GHGs associated with the management of municipal/industrial wastes.
- No fugitive emissions (CO_2 or Methane) from the process
- No smoke stacks, flaring or methane leakage from system
  Reduced GHGs from not transporting wastes long-distances for processing
- Non-incineration technology – no formation of dioxins, furans or other toxic matter

Offsets/Reduction of GHGs

- RNG produced can be used to off-set fossil fuels
- Source of clean electrical generation
- Displaces fossil Natural Gas in the pipeline –greening the pipeline
- RNG can be used onsite in processes, such as blast furnaces, instead of NG or coal
- Can be converted to CNG and/or Hydrogen to be used as transportation fuel

Water Management

- Source of clean water
- Avoids and treats leachate and toxic water discharge (Landfills and AD)

IV. General Benefits of Hydrogen Reduction Technology

Better Management of ALL Wastes

- Municipalities, Commercial and Industrial Waste Producers
- Diversion of waste from landfills, Incineration and AD
- Better land management and reduced community opposition

Greenhouse Gas Reductions

- Local source of green fuels and energy
- Makes 5 to 10 Million m^3 more gas than consumes
- Helps governments and industry meet GHG targets
- Increased efficiency and energy production
- Reduced environmental impacts (CO_2, CH_4)
- Circular Economy Principles inaction

Economic Returns

- Reduced capital and waste management operating costs
- Job creation – construction (20 + workers) and operation (12 full time operators)

V. TARGETED WASTES

- Municipal Solid Waste
- Sewage Sludge, Septage and Digestate
- Household Source Separated Organic Wastes
- Agricultural Organic and Intensive Farming Wastes
- Restaurant and Food Processing Waste, Off Spec Foods
- All Mixed Plastics – Including Auto Shredder Residue
- Landfill leachate and gas purification
- Hazardous Household Wastes, such as paint and pesticides
- Electronic Wastes, circuit boards, cables, and casings
- And much, much more!

VI. PRODUCT OUTPUTS

Renewable Natural Gas

- Pipeline grade quality to displace fossil fuels
- Suitable for clean LOW CARBON electricity generation

LOW CARBON electricity generation

- Steam Reformed Renewable Hydrogen
- For zero carbon industrial, transportation and heating
- Captured Carbon Monoxide and Dioxide
- No toxic emissions, gases managed for industrial use
- Recoverable Metals, as Present in Waste Streams
- Ferrous, non-ferrous, including copper, aluminum, silver and gold
- Solid Chemical Elements, such as carbon, silica and more
- Waste Water Cleaned to Sanitary Discharge Standards