WASTE REDUCTION AND ENERGY PRODUCTION USING GAS PHASE REDUCTION (GPR)

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WHO ARE WE? - The CRE/NES Team

• **Natural Energy Systems, Inc. (NES)**
  – Based in Ontario, Canada
  – Holds patents for Gas Phase Reduction (GPR) technology
• **Cedar Run Energy, Inc. (CRE)**
  – Based in Warrenton, Virginia
  – Teamed with NES in 2011 to market GPR in U.S.
• Five principal officers with decades of diverse experience
WHO ARE WE? - The CRE/NES Team

PERRY CASTO
CRE Chairman
Chairman and CEO of Allied Associates International, former executive director of DOD BMD Agency.

Dr. DOUG HALLETT
NES Chairman & CEO
Noted toxicologist, former Chair of Great Lakes Toxic Program, developed and patented GPR process.

Dr. NICK TRENTACOSTE
NES Executive VP
Former Sr. VP of SAIC, executive and program management in Alion Corp., Bell Aerospace, and GASL.

CLIFF McLAIN
CRE Chief Engineer
Former executive with FEMA, DOD BMD Agency, ARPA, ARES Corp., SAIC, and SPC Venture Corp.
WHAT DO WE DO? - OVERVIEW

- **Objective**: Convert organic feedstocks to energy and/or other commodities.

- **Market**:
  - Municipal government operators of landfills and waste water treatment plants
  - Coal producers and users
  - Industrial/commercial waste generators

- **Technology**: Gas Phase Reduction (GPR) is NOT a new technology.
Vaporizer
- Add steam and $H_2$ at 500°C
- Vaporize organic materials
  Non-organic materials ejected

GPR Tubular Reactor
- Add $H_2$ at 850°C and 1 ATM Pressure
- Scrubbers eliminate all volatile metals
- Produces a gas with 92% energy of natural gas

Pre Processing
(Commercial Technologies)
- Separate non-organics from feedstock
- Size organic materials

Post Processing
(Commercial Technologies)
- Direct pipeline injection
- Combust in gas turbine
- Reform for use in fuel cell
- Fischer-Tropsch > liquid fuels
- Convert into chemicals

Advantages of GPR Technology
- No SOx, NOx, particulates or tars produced
- No high temperature/pressure vessels or gas cleanup equipment required
- Fewer process steps and reduced down time
- THEREFORE: LOWER CAPITAL AND OPERATING COSTS
WHO IS THE COMPETITION?

• Incineration
• Thermal conversion systems:
  • Gasification, pyrolysis, plasma arc
• Non-thermal systems:
  • Anaerobic digestion, fermentation, biologic
• Emerging market -- fierce competition, great uncertainty, many failures
**BUSINESS MODEL**

**Phase I**

- Laboratory bench-scale testing in cooperation with Virginia Tech & Hampton University
- Fully instrumented tests using a variety of feedstocks
- Measure product gas composition, and calculate mass and energy balances
- Analyze residue from the GPR reactor
- **COST: $320K**
BUSINESS MODEL  
Phase II

- Demonstration scale testing in cooperation with Virginia Tech & Hampton University
- Use existing 0.5 ton per day transportable unit
- Will demonstrate feedstock processing, continuous operation, advanced component designs, and interface of system components
- Cost: $2 Million
BUSINESS MODEL
Phase III – Municipal Landfill Market

- First commercial scale plant at Fauquier County, Virginia
- 200 ton per day capacity using four 50 ton per day reactors
- Use municipal solid waste as feedstock
- Product gas will be converted to diesel fuel
- COST: $147.5 Million capex
Fauquier County WTE CONCEPTUAL DESIGN
ECONOMICS OF FAUQUIER WTE PLANT

• Assumptions:
  – First commercial plant capital cost: $147.5M
  – Input: 200 tons/day of MSW
  – Output: 10M gallons/year of diesel fuel ($3.23/gal)
• Loan repayment in 15 years.
• EBITDA $25M per year
SUMMARY

- GPR has clear economic, operational, and environmental advantages over its competitors
- GPR does not produce toxic byproducts and reduces the requirements for landfilling
- The Hydrogen Enriched Methane gas can be used to produce liquid fuels and other commodities

Currently seeking equity investors for Phase I testing: $320,000