Advanced Gasification Solutions

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Business Structure

Aeronautics

Information Systems & Global Solutions

Missiles and Fire Control

Mission Systems and Training

Space Systems

Aircraft Energy Technology

Efficiency Business

Microgrid

Energy Generation

Carbon Monitoring Exploration

Energy Efficiency

Smart Grid

Nuclear Controls

Ocean Energy

Climate Control

FEMP contract

Energy Storage

Tidal/Wave Energy

BioEnergy

Advanced Materials

Energy Technology

Fuel Efficiency

International
What We’re Working On

BioEnergy

• Waste-to-Energy
  – Using gasification processes to convert waste products to synthetic gas to be used for electricity, hydrogen, specialty chemicals and transportation fuels

• Milestones:
  – Signed a teaming agreement with Concord Blue to deploy technology globally to transform waste into clean, renewable energy
  – Signed an EPC contract to build a 5MW plant in Germany
  – Building a 250kW plant at Lockheed Martin Owego, NY Facility
Concord Blue Technology Discriminators

- Environmentally Friendly: Green recycling technology
- No incineration: Clean conversion of waste
- High input to output ratio: 1 ton per hour ≈ 1.4 MW electricity
- Product: Hydrogen rich, high quality product gas (synthesis gas)
- Emissions: Meets or exceeds all global pollution standards
- Modular/scalable: 250kW to 5MW modules
- Low space requirements
- Secure, Base load power
- Fully automated
Waste and Biomass Feedstocks and Output

Conversion Facility

Cellulosic/Agricultural
- Wood Chips
- Agriculture Waste
- Sewage Sludge

Waste
- Plastics
- Municipal Solid Waste
- Hospital Waste

Waste Disposal

Electricity

or Biofuels/H2/Chemicals
Environmental Benefits

**Green Technology:**
Solution offers a clean and environmentally friendly waste disposal and renewable energy Reformer.
Emissions are from internal combustion engine and char burner.

**High Efficiency:**
Unique use of patented heat carriers allows system to achieve complete heat transfer without requiring additional fuel or power for operation.
Staged reforming (oxygen free steam thermolysis) produces a clean H2 rich syngas which can be used in high efficiency gas engines.

*Exceeds EPA and European Emission Standards*
Modular / Scalable

• The Concord Blue Reformer is scalable (utility and municipal applications)
• Small micro systems are perfectly suited for military bases or hospitals
• Scales between 250 kW and 5 MW modules

Ideal for Industrial and Municipal Sized Applications
Concord Blue Operational Experience
Concord Blue Reformer Pilot Scale Testing Facilities

First Demonstration Plant
Location: Herten, Germany
Operated: 2002 – 2005
Scale: 1 MWth, 0.35 Mwe
Feedstock: various types
Flowrate: 0.35 t/hr

First Commercial Plant
Location: Izumo, Japan
Operating: 2005 – present
Scale: 1 MWth, 0.3 Mwe
Feedstock: wood chips
Flowrate: 1 t/hr

Demonstration Plant for World Hydrogen Conference 2010
Location: Herten, Germany
Operated: 2010 - 2012
Scale: 0.06 MWth, 0.02 MWe
Feedstock: biomass
Flowrate: 0.01 t/hr

4th Generation Concord BlueR I
Location: Mumbai, India
Operating: 2009 - present
Scale: 0.18 MWth, 0.063 Mwe
Feedstock: various
Flowrate: 0.04 t/hr

Commercial operating plant
Location: Mahad, India
Operating: since September 2011
Scale: 3 MWth
Produces 1,200 m3 of syngas/hr for industrial use; replacement for natural gas
Feedstock: Toxic waste effluent

Commercial operating Plant
Location: Pune, India
Operating: since March 2012
Scale (current): 10 MWth, 2.7 MWe
Scale (future): 25 MWth, 10 MWe
Feedstock: MSW
Flowrate (current / future): 300/700 t/d

Pune Plant is Largest MSW Steam Thermolysis-Gasification Plant in the World
Lockheed Martin – Concord Blue Strategic Partnership

• **Background**
  – Four year relationship
  – Significant due diligence performed prior to Lockheed Martin commitment

• **Lockheed Martin & Concord Blue signed partnership agreement in July, 2013**

• **Lockheed Martin Scope**
  – Manufacturing
    • Concord Blue Reformer – Major Components
      – Vessels
      – Separators
      – Conveyors
    • Modular Assemblies
  – Engineering / Procurement / Construction (EPC)
    • Terms and Conditions / Performance Guarantees
    • Warranties
  – System Integration
  – Technology Development / Standardization

Lockheed Martin Reaches Agreement with Concord Blue to Deploy Advanced Gasification Technology Globally

Baltimore, Oct. 1, 2013 — Lockheed Martin (NYSE: LMT) and Concord Blue USA, Inc., have reached an agreement to offer an advanced waste conversion system to address waste disposal, energy security and climate control issues. Advanced waste conversion is an emerging technology that uses gasification processes to convert waste products to electricity, heat and synthetic fuels. This solution addresses the current burden on landfills, conventional incineration and fossil fuels, as well as the desire for green baseload energy.

Lockheed Martin will provide its engineering, program management, procurement, manufacturing and integration experience to deploy Concord Blue’s patented technology globally in the expanding waste-to-energy arena.

“This agreement enables Lockheed Martin to combine our proven ability to meet complex project requirements and access to a broader, global market with Concord Blue’s demonstrated technology, experience and global facilities,” said Paul Krammer, director of bio energy programs at Lockheed Martin’s Mission Systems and Training business. “With more than 7 billion people on the planet, sustainable waste disposal and a need for energy that is both secure and clean are quality of life issues. Leveraging Concord Blue’s feedstock flexibility, combined with their ability to scale for smaller applications, uniquely positions us to solve waste disposal challenges, including those challenges industrial customers face.”

Concord Blue has developed a closed-loop, commercially-proven, non-polluting process that recycles waste into energy at virtually any scale. By working closely with leading businesses, governments and communities around the globe, Concord Blue creates tailored solutions that safely and effectively dispose of waste while producing clean energy through advanced waste conversion.

“This alliance with Lockheed Martin will allow Concord Blue’s innovative waste recycling technology to positively impact more communities around the world,” said Charlie Thannhauser, chairman and chief executive officer of Concord Blue. “This collaboration will enable us to deploy a compelling solution to a significant environmental, social and safety issue that affects every region of the world.”

Lockheed Martin takes a comprehensive approach to solving global energy and...
Lockheed Martin Owego, NY
Advanced Gasification Plant
Lockheed Martin is building an AGP at a Lockheed Martin plant to support multiple priorities:

1. Demonstration facility for customers
2. Operate to offset facility electricity costs
3. Engineering facility to test feedstocks and product improvements
4. Develop complete modular product offering

Lockheed Martin selected its Owego, NY plant location to leverage existing biomass facility team experience, equipment, feedstock and permitting experience.

Expect to Have Plant On-Line Q4 2015
Rendering of Advanced Gasification Plant

- Feedstock Containers
- Concord Blue Reformer Tower
- Syngas Storage Tank
- Waste Water Treatment
- Clean-up System
- Power Distribution Enclosure
- I/C Engine Generator
Market Applications

• **Industrial**
  – Cost savings transportation and disposal
  – Sustainability Initiatives
    • Reduction of carbon footprint
    • Overall emission reduction
    • Self generating power

• **Military**
  – Off-grid installation energy security
  – Meets US Army’s NET ZERO goals and objectives
  – Landfill cost savings
  – Atoll and other island energy solutions – reduce diesel fuel usage
  – Potential FOB applications

• **Commercial/Institutional such as hospitals**
  – On site disposal – less opportunities for contamination
  – Transportation cost savings
  – Disposal avoidance cost savings
  – Sustainability Initiatives

• **Municipal**
  – Solve expensive or undependable energy supply problems
  – Solution offsets large diesel fuel costs
  – Avoid expansion/construction of new landfills

**Scalable Solution Has Significant Market Demand**
Opportunity Pipeline

Lockheed Martin is partnering with Developers around the world
Summary

- Strong Partnership with Concord Blue
- Building 250 kW Plant at Lockheed Martin’s Owego, NY Plant
- Signed 5 MW EPC contract using Concord Blue technology in Germany
- Strong Pipeline of projects
- Lockheed Martin will be looking into other applications and partners for syngas
  - H2 Generation
  - Transportation Fuel
  - Specialty Chemicals