The Sustainable Solution
January 2013
adaptiveARC provides a sustainable foundation
For our communities, industry and academia

Proprietary Cool Plasma® Technology
- Converts waste into clean energy and commercial materials
- Converts a broad range of feedstocks: industrial - medical - toxic and municipal solid waste

We are the low cost leader
- 40 - 70% more economical than competitors through technology

Flexible modern design
- Portable, modular and scalable

High-Energy output

Demonstrated at commercial scale

Easy to permit

Easy to finance
Proven success at commercial scale
25 tons per day

Operating Since July 2010 in Mexico City

- Provides power to entire facility approximately 420kW continuous
- 8 to 14 hours per day of operation
- 21-23 days per month
- Over 670 kg/hr dry material throughput
- Over 115 MW/hr per month
- Operational costs less than $500 per day, including consumables
- Over 130 design improvements have been made based on results from prototype
- 100 tpd @ $18M proposed for 2013
- Waste types processed:
  - Biomass, manure, hazardous waste, industrial waste, MSW residuals, plastic packaging, cardboard, paper pulp, sludge, carpet backing and construction debris
adaptiveARC turns the business model on its head

Liabilities are now assets

Tip fee revenue rather than expense

Energy revenue “inside the fence” exceeds revenue “on the grid”

Recycled materials revenue
- Metals
- Glass
- Ash

Transportation costs nearly eliminated

Incentives
- Diversion credits
- Carbon credits
- Tax incentive
- Renewable energy
Strategic partners in innovation
Environmentalism consists of aspirations:
- Setting the course
- Zero waste, zero impact
- Lifecycle product planning
- Environmental justice

Sustainability consists of realistic and pragmatic policies
- Making the plan
- Our office uses 100kW of power continuously. There’s only 30kW on the roof.

100% of the post-recycled waste of any community can provide 25% of the power
- If landfilled 1 ton produces 1.5 tons of greenhouse gasses
- This figure does not include transportation and other logistics
Sustainable solutions are holistic
Social and Economic factors drive environmental choices

- Environmental
  - Pollution Prevention
  - Environmental Management

- Social-Environmental
  - Environmental Justice
  - Natural Resource Stewardship
  - Inter-Generational Equity

- Social
  - Standard of Living
  - Education
  - Community

- Economic
  - Growth
  - Profit / Cost Savings
  - Research and Development

- Environmental-Economic
  - Environmental Justice
  - Environmental Refugees
  - Inter-Generational Equity

- Social-Economic
  - Business Ethics
  - Fair Trade
  - Human Rights

Sustainability

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The Sustainable Foundation™ Program
Rapidly sharing sustainability best practices

In 2012 adaptiveARC established a program to rapidly share international best practices between
• Industry
• Government
• Institutions including Universities, Military based, Hospital and Health Care

Meaningful sustainability statements
• Produce effective policies
• Engage the community
• Promote public-private partnerships enabling projects that otherwise could not exist

SustainableFoundationsProgram.com
Waste is Pollution
Even costly modern landfills are a leading source of pollution

- Landfills produce more than 180 VOCS, HAPs and other gases — proven harmful to human health
- Landfills and unmanaged biomass produce abundant methane — a greenhouse gas 21 times more potent than CO₂
- Landfills catch on fire daily. The uncontrolled burning of waste is the leading manmade source of dioxins and furans — some of the most harmful toxins known to exist
- Liquid emissions The EPA concedes that all landfills leak potentially contaminating local water sources
After recycling there are only 2 paths
Only gasification offers complete diversion

Recycling is not a complete solution
- Clean MRFs can recover more than 90% from the waste stream
- Up to 80% from unsorted waste

California has the highest recycling rate in the nation: 58 percent
- Yet still disposes over 43 million tons per year into landfills per year
We have proven 100% recovery is possible!
In action at our Mexico City site since July 2010

adaptiveARC integrates with all sustainability technologies

MUNICIPAL SOLID WASTE
ORGANICS
INORGANICS
NONRECYCLABLE
RECYCLABLE
ADAPTIVEARC
NATURABONO

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Energy that cleans
The transition from mainframe to PCs was unexpected
Just as today’s transition from PC to mobile

Then

Now
Centralized waste management is obsolete
Like the mainframe computer it is the end of an era

A single ce25 at each of Mexico City’s 13 Transfer Stations reduces transportation costs and air emissions by 7%
Centralized waste management is obsolete
Like the mainframe computer it is the end of an era

A single ce25 at each of Mexico City’s 13 Transfer Stations reduces transportation costs and air emissions by 7%

Systems pay for themselves in < 3 years providing a tax-free source of revenue
Centralized waste management is obsolete
Like the mainframe computer it is the end of an era

A single ce25 at each of Mexico City’s 13 Transfer Stations reduces transportation costs and air emissions by 7%

Systems pay for themselves in < 3 years providing a tax-free source of revenue

50% of waste is water

Transporting water uses more energy than any other single activity

Nearly 20% of California’s energy use relates to water collection, transportation and treatment.

- adaptiveARC recovers up to half of the water in waste
- adaptiveARC eliminates the needless cost of transporting water in waste
Distributed power is the future of energy
High energy consumers are high waste producers

Hospitals
- The average hospital in the United States has 188 beds and produces 33.8 pounds of waste per day, per staffed bed.

Industrial Parks / Transfer Stations
- A 20,000 sq. ft. colocation facility requires 4 MW

College Campuses
- The average college student produces 640 pounds of solid waste each year

Military Bases
- And Forward Base Operations

Waste Water Processors
- The average WWTP facility processes 1M gallons per day of wastewater for every 10,000 in population. Every 1M gallons produces 1 ton of solid waste

Stadiums / Amusement Parks
- In 2010, Disney Parks sent 121,060 tons of waste to landfill, and consumed 1,877 million kilowatt hours of electricity.
Gasification is very different from incineration. In many ways, it is the complete opposite.

**Cool Plasma Gasification**
- +1300°C
- Oxygen starved
- Negative pressure
- Solids are recyclable
- Creates clean fuel

**Inert Sulfides**

**Incineration**
- 600°C - 800°C
- Oxygen required
- Atmospheric pressure
- Solids are toxic
- Creates dirty exhaust
Why plasma arc?

Plasma arc safely processes any kind of material

- Hazardous and medical can be very attractive due to high processing fees
- Very few restrictions

Legislation prohibits incineration

Lowest air emissions

Lowest residual solids

- Inert and commercial
- < 3% for biomass
- 5% average for MSW

The only traditional barrier has been cost

Medical
Toxic
Biomass

Petroleum Sludge
MSW
Custom Solutions
Key Benefits of Plasma Gasification

- Safely dispose of virtually any waste
  - Including MSW, commercial and industrial wastes, medical waste, hazardous wastes, biomass, tires and coal ash

- Converts over 75% of the energy contained within the waste into useable syngas

- One ton of MSW can produce approximately 500 to 1,000 KWh of electric power

- Air emissions are comparable to those from a natural gas power plant

- Produces clean, reusable by-products

- Plasma gasification is not incineration

- Clean, efficient and with adaptiveARC – cost effective
adaptiveARC breakthrough innovation
Energy that cleans® (cont.)
The evolution of energy from waste.
Mass burn incineration: pre-1960

Popular in Europe.
Dirty: most regulations grandfathered.
New plants require extensive scrubbing.
Large / rigid design.
Land permitting requires acres.
Tons of concrete and steel.
Obsolete before lifespan ends.
The evolution of energy from waste.
Pyrolysis / Gasification: 1960

A cleaner approach.
Limited to homogeneous feedstocks.
Requires extensive scrubbing.

<table>
<thead>
<tr>
<th>Pyrolysis / Gasification</th>
<th>Clean / limited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass burn incineration</td>
<td>Dirty / proven</td>
</tr>
</tbody>
</table>

Cleaning the planet one landfill at a time
The evolution of energy from waste.
Plasma arc gasification: 1990

Cleanest to date.
Expensive.
Thermal-only process.

<table>
<thead>
<tr>
<th>Process</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma arc gasification</td>
<td>Clean / expensive</td>
</tr>
<tr>
<td>Pyrolysis / Gasification</td>
<td>Clean / limited</td>
</tr>
<tr>
<td>Mass burn incineration</td>
<td>Dirty / proven</td>
</tr>
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Cleaning the planet one landfill at a time
The evolution of energy from waste.
Cool plasma gasification / 2009 and beyond

- **Plasma field**
  - Dissolution directly in plasma field occurs at atomic level at temperature too cool to vaporize heavy metals.

- **Plasma pulses**
  - Pulsed energy accelerates dissolution process, eliminates sour gasses and toxic salts.

- **UV detoxification**
  - Accelerates breakdown of ash and residual gas toxins with little energy loss.

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<table>
<thead>
<tr>
<th>Technology</th>
<th>Cleanliness</th>
<th>Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool plasma gasification</td>
<td>Clean</td>
<td>Profitable</td>
</tr>
<tr>
<td>Plasma arc gasification</td>
<td>Clean</td>
<td>Expensive</td>
</tr>
<tr>
<td>Pyrolysis / Gasification</td>
<td>Clean</td>
<td>Limited</td>
</tr>
<tr>
<td>Mass burn incineration</td>
<td>Dirty</td>
<td>Proven</td>
</tr>
</tbody>
</table>

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**AdaptiveARC**

Cleaning the planet one landfill at a time
Evolution: From waste management to sustainability

Only Cool Plasma uses all 3 aspects of plasma

**Plasma field**

Dissolution directly in plasma field occurs at atomic level at temperatures too cool to vaporize heavy metals.

**Plasma pulses**

Pulsed energy accelerates dissolution process, eliminates sour gasses and toxic salts.

**UV light detoxification**

Accelerates breakdown of ash and residual gas toxins with little energy loss.

- **Cool plasma gasification**: Clean / profitable
- **Plasma arc gasification**: Clean / expensive
- **Pyrolysis / Gasification**: Clean / limited
- **Mass burn incineration**: Dirty / proven

*adaptiveARC*
The adaptiveARC torch
Cool Plasma® Technology

Breakthrough plasma arc technology
- Leading plasma physicist and adaptiveARC founder, Christian Juvan, discovered the potential of plasma pulses while developing torches for NASA in the early 1970s
- Tunable heating zone that is molded to avoid contact with long-term components
- Pulsed energy is virtually unused in other plasma arc gasifiers

Price point is 40%-70% more economical than other competing technologies
- Extended service life - more than 5 years
- Easy to use, replace and upgrade
- Operates on multiple gas medias including: landfill gas, CO₂, methane, syngas, etc.
- Low power requirement - less than 5% overall consumption for gasifier

35°C 1300°C
The adaptiveARC torch
In action
Cool Plasma® Gasification
The combination of our unique torch and gasifier

25 TPD RESIDUAL WASTE

HEAT FLUE

DRYING CHAMBER

25 TPD RESIDUAL WASTE

COOL PLASMA CHAMBER

1,000°C

CLEAN SYNGAS

INERT SOLIDS

WASTE WATER

1,000°C

QUENCH

80°C

LIME

EXHAUST < 400°C

GAS CLEANUP

WASTE OIL OR DIESEL

500KW TO 2 MW

GEN-SET

Energy that cleans
Cool Plasma® Gasification
Regenerative Cleaning® clarifies syngas and renders solids inert

Pyrolysis Zone
Torches
Syngas Clarification
Cool Plasma is more effective, smaller and costs less
Cool plasma makes plasma gasification affordable

Molecular bonds are broken with powerful shock waves in a plasma state
• Lower temperatures enable commercial recovery of valuable metals
• Cool plasma torches consume only 2kW continuously but do the work of torches many times more demanding

adaptiveARC torches last more than 5 years
• Typical plasma arc electrodes burn out in 6 weeks

Typical plasma arc gasifiers do not use pulses or UV light in their processes.

All components and the plasma island itself is modular
• Easy to replace, upgrade and scale any component or the entire plant
Cool Plasma integrates over 15 maximum available control technologies dramatically reducing capital and operating cost.
From emissions reduction to remediation

Complete elimination of water waste

Volatile Organic Compounds (VOCs)

Methane (per ton over 30 years)

Combustion Emissions (CAT 3512)

Results from Monterrey, MX pilot plant
Energy balance

**MSW (DRY)**

1.82 METRIC TONS PER HOUR

**INPUT FUEL**

34.2M BTU / hr

**SYNGAS OUTPUT**

23.4M BTU / hr

**GEN OUTPUT**

8.9M BTU / hr

**GRID POWER**

7.6M = 2.43MW BTU / hr

**PROCESSING LOSS**

10.8M BTU / hr

**GENERATOR LOSS**

14.5M BTU / hr

**TRANSFORMATION + PARASITIC LOSS**

1.3M BTU / hr

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<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Input Fuel Energy (BTU/hr)</th>
<th>Processing Loss (BTU/hr)</th>
<th>Generator Loss (BTU/hr)</th>
<th>Transformation (BTU/hr)</th>
<th>Parasitic Power (BTU/hr)</th>
<th>Net Grid Power (BTU/hr)</th>
<th>Net Grid Power (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW</td>
<td>34,247,756</td>
<td>10,959,282</td>
<td>14,671,739</td>
<td>273,982</td>
<td>1,005,440</td>
<td>7,337,313</td>
<td>2.42</td>
</tr>
<tr>
<td>Refinery Sludge</td>
<td>19,836,000</td>
<td>6,347,520</td>
<td>8,497,742</td>
<td>158,688</td>
<td>1,005,440</td>
<td>3,826,610</td>
<td>1.26</td>
</tr>
<tr>
<td>Sewage Sludge</td>
<td>29,573,673</td>
<td>9,463,575</td>
<td>12,669,362</td>
<td>236,589</td>
<td>1,005,440</td>
<td>6,198,707</td>
<td>2.05</td>
</tr>
</tbody>
</table>

Cleaning the planet one landfill at a time
Unique Mobility & Footprint

- ce25 can be transported using a standard flat bed trailer (CONEX format)
- Allows for rapid installation and easy maintenance
- A ce25 system footprint including all shredders, conveyors and storage can be sited in as little as 5000 sq.ft.
- Why transport waste to the system when the system can transport to the waste?
Technical Differences

**adaptiveARC is the technology leader**

<table>
<thead>
<tr>
<th>Feature</th>
<th>adaptiveARC</th>
<th>alterNRG</th>
<th>Europlasma</th>
<th>Plasco</th>
<th>InEnTec</th>
<th>Pyromex</th>
<th>Outotec-EPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long plasma torch lifespan ( &gt; 5 years )</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Pulsed plasma</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Tunable / moldable plasma field</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Use of UV light to control reactions</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Integrated syngas cleanup</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Portable / 1-week setup</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Modular at small scale</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Low O&amp;M 1-man operation</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>6-Month Fabrication Period</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Easy retrofitting of existing diesel gen-sets</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Zero water waste</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>No power outage with short-term feedstock interruption</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Handles toxic sludges, hazardous, and medical waste</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Need to refresh firebrick</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Switch between feedstocks with minimal configuration</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Components replace easily</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

*Fulcrum Bioenergy, Coskata, Enerchem, InEnTec and others are not in commercial production at scale*
<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (HxWxL)</td>
<td>33’5” x 8’ x 40’</td>
</tr>
<tr>
<td>Height (transport position)</td>
<td>11’</td>
</tr>
<tr>
<td>Weight (including mounting platform)</td>
<td>52,000 lb.</td>
</tr>
<tr>
<td>Electric output</td>
<td>500 kW*</td>
</tr>
<tr>
<td>Output voltage</td>
<td>480 volts 3-phase**</td>
</tr>
<tr>
<td>Line synchronization</td>
<td>Automatic or Manual</td>
</tr>
<tr>
<td>Startup power demand</td>
<td>50 kW max</td>
</tr>
<tr>
<td>Startup time cold to full output</td>
<td>15 - 30 min</td>
</tr>
<tr>
<td>Water demand</td>
<td>35 ft³/day ± 50%</td>
</tr>
<tr>
<td>Lime powder demand</td>
<td>330 lb./day</td>
</tr>
<tr>
<td>Reactor pressure at outlet flange</td>
<td>-2 ATM in H₂O</td>
</tr>
<tr>
<td>Syngas caloric output</td>
<td>12.5 MM BTU/hr.</td>
</tr>
<tr>
<td>Syngas caloric value</td>
<td>140 BTU/ft³</td>
</tr>
<tr>
<td>Syngas flow, nominal power</td>
<td>4,857 ft³/day</td>
</tr>
<tr>
<td>Minimum site space requirement</td>
<td>10,000 sq. ft.</td>
</tr>
</tbody>
</table>

*All values given for feedstock @ 3,400 BTU/lb. @ 50% moisture, **Geography specific
adaptiveARC R&D Facility: Riverside, California
Making Cool Plasma even better

ce25 installed August 2012
- Testing ground for new ce25 enhancements
- Fine-tune operational procedures
- Provides additional certification of waste throughput, energy output and emissions

Test plan with Entec / UC-R
- Most comprehensive in the industry
- Pre-test customer feedstock (fee-based)
  - Validating feedstocks from CA and NJ
    - Biomass, MSW, RDF
International footprint
adaptiveARC has more than 160 sites in negotiation

- Hannibal, Missouri: 350 tpd / Hazardous, Syngas for kiln operations
- Derry, Northern Ireland: 25 tpd / Medical, Electricity
- Ishinomaki, Japan: 100 tpd / C&D, Electricity
- Atlantic County, NJ: 100 tpd / RDF, Electricity
- Belgrade, Serbia: 100 tpd / Medical, Electricity
- São Paulo, Brazil: 25 tpd / MSW, Electricity
- Kona, Hawaii: 350 tpd / Process-Derived Fuel, Electricity / Jet Fuel
- Tula, Mexico: 25 tpd / Petro Sludge, Electricity

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Energy that cleans