Commercialization of the FastOx™ Gasification Technology
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sierraenergy.com
Daniel Dodd, VP Engineering
dmdodd@sierraenergy.com
An Integrated Solution
Limitations of Conventional Gasification

- **Fluidized Bed**
  - No In-situ Slagging
  - Feedstock Constraints

- **Plasma**
  - High Parasitic Loads
  - Expensive Carbon Rods

- **Downdraft**
  - Low Conversion
  - Limited Scalability

**Limitations of Conventional Gasification**
The Universal Gasifier

- FastOx™
- Sierra Energy
- Slagging
- Low Parasitic Load
- Minimal Preprocessing

The Universal Gasifier
The FastOx® Gasifier

- Derived from steel-making blast furnace
- Converts nearly any waste to renewable energy
  - Scalable in a single unit
  - Robust: recovers glass & metals
  - Produces energy-dense syngas
  - Minimal Emissions
  - Competitive Economics
  - Can retrofit existing blast furnaces
How It Works

- Waste: Fed into the Top
- Oxygen & Steam: Injected at Bottom
- Waste Descends through Gasifier
- Inorganics Melt, Recovered as Inert Stone & Metal
- Organics Vaporize, Recovered as Energy-Dense Syngas
Renewable Energy Testing Center
McClellan Business Park, Sacramento CA

5-year successful testing & research demonstrated:
- Can handle wide variety of waste feedstocks
- Resulting syngas has high energy density
- Vitrified rock is non-leaching, non-hazardous with potential use as building product.
FastOx Gasification  |  Cold Gas Efficiency: 66–79%

**Inputs/Outputs**

**Inputs**
Oxygen into gasifier: 233 kg
Steam into gasifier: 96 kg
Oxygen into syngas refiner: 205 kg

**Outputs**
Dry syngas energy from syngas refiner: up to 11,139 MJ
Molten metal from gasifier: 34 kg
Molten slag from gasifier: 67 kg

**Yields**
Electricity (genset): 1,083 kWh (gross)**
Electricity (combined cycle): 1,392 kWh (gross)**
FT Products: 148 liters
Hydrogen: 78 kg

**Net Calorific Value**
8.26 - 8.87 MJ/kg (dry syngas)

**Composition**
- Carbon Monoxide: 48–66%
- Carbon Dioxide: 5–15%
- Hydrogen: 18–32%
- Methane: 0.5–12%
- Ethane: < 2%
- Propane: < 2%
- Nitrogen: 0.5–3%
- Oxygen: < 1%
- Argon: 0.5–2.5%

*Key Assumptions: Values calculated for FastOx Gasifier and syngas refiner
Feedstock Amount: 1,000 kg and 13,961 MJ
Feedstock Material: Post-MRF California MSW, 10%wt. total moisture content.

**Electrical Efficiency:**
- Genset: 35%
- Combined Cycle Power Plant: 45%
Project: US Army FHL Installation
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Since GSTC2015

- USACE completed field utilities and site prep
- Permit for Solid Waste
- PG&E interconnect initiated
  - (30, then 80-day review)
Project: US Army FHL Installation

Since GSTC2015 (continued):
- Rockwell Automation
- ASME-coded design and fab
- Value engineering and OEM relationships
Project: US Army FHL Installation
Project: FTL Demonstration

- 1BPD demonstration
- Q1 2017 commissioning
Project: DLA SBIR

1. Clean Syngas
2. H₂ Separation
3. H₂FCEV
4. CO, CO₂
5. Electricity Generation
6. Cotting
7. Element 1
8. Sierra Energy
Creating transparency with our online FastOx™ gasification calculator tool

sierraenergy.com/calculator

Location
State: California
County: Fresno
City by County (population over 25,000): Clovis
Population of County (2010): 920,623
Projected Waste Potential [MT/day]: 1,841

International (Optional)
Country
Est. Population
City/Province

Feedstock
Percent
Tipping Fee [$/MT]

Municipal Solid Waste: 75% $49
Biomass: 25% $2

Energy Product

Electricity $0.11 [$/kWh]

Local Utilities
Local Natural Gas Price $0.75 [$/MMBTU]

Annual Revenues
Primary Tipping Fee: $3,356,000
Secondary Tipping Fee: $46,000
Total Tipping Fee: $3,401,000
Sale of Electricity: $6,758,000
Sale of Recovered Materials: $564,000
Estimated Revenue: $10,723,000

Annual Expenses
Labor and Benefits: $1,172,000
System Maint: $625,000
Supplies and Materials: $260,000
Estimated Expenses: $2,057,000
Operating Income
Annual Revenue: $10,723,000
Annual Expenses: $2,057,000
Projected Income: $8,666,000

Capital Investment
Waste PreProcessing $3,319,000
Oxygen Production $4,710,000
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