

## Using Landfill Gas as a Continuous Clean Renewable Power Source for Cities

Ener-Core manufactures power generation products which enable cities and companies to cleanly generate power from gases that previously were wasted or had no economically viable use. Ener-Core's systems leverage an anticipated worldwide trend towards increasing biogas collection and utilization. Ener-Core Powerstations utilize a greater percentage of landfill gas including low-quality gas for:

- Avoiding flaring and venting
- Transforming a source of unwanted emissions and pollution into renewable power
- Complementing intermittent renewable sources, such as solar and wind power, with continuous clean renewable power for local 24/7 use.

### Ener-Core's Solution to Convert Air Pollution into Clean Power

Ener-Core's Gradual Oxidation technology can effectively convert impure gases with low energy densities into a form which can be processed by gas turbines to produce electricity and heat. Effectively, Ener-Core is in the business of manufacturing and commercializing technology which produces cost-effective, renewable power while lowering air emissions.

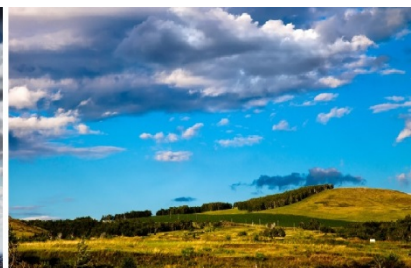
We believe that our customers can greatly reduce the cost of compliance with air quality regulations by avoiding the chemicals, catalysts, and complex permitting required by competing systems. Our products are specifically engineered for fuel flexibility and modularity, so that low-quality fuels can be used as an energy resource instead of being a waste and emissions source from venting and flaring.

### Technology

Gradual Oxidation works by replacing a combustion reaction with a chemically similar, but slower chemical oxidation reaction which occurs at lower temperatures than combustion. Our technology extends a historical trend in engine technology seeking to improve emissions and expand the fuel operating range. Our systems are designed to allow for the extraction of energy from previously unusable fuels, reduce harmful pollutants, and create useful energy products such as heat and electricity. We have completed a number of development and deployment milestones in the last five years. In 2012, our technology successfully underwent testing and verification completed by an independent third party as part of U.S. Department of Defense ("DoD") demonstration program.

### Sustainability Benefits of an Ener-Core Powerstation

- Unprecedented capability to use weaker fuels like waste gas from landfills and biogas operations
- No need for chemicals, catalysts, or Siloxane removal
- Tolerant of changes to gas composition while operating
- Achieve ultra-low emissions (Less than 1ppm NOx is achievable)
- Capability of generating more electricity (MWh's) per year than comparable intermittent renewable sources (~3x over wind and ~5x over solar PV)
  - FP250: up to 1700 MWh per year from a 250 kW system
  - KG2-3GO: up to 13000 MWh per year from a 1850 kW system



TURN POLLUTION INTO A RESOURCE THAT PAYS FOR ITSELF

# ENER-CORE

**Is your landfill Ideal for an Ener-Core Powerstation?** *It may be if it has several of the following...*

- ☑ **Low Quality Gas.** Typically, this can be found in:
  - **Active Landfills with Diversion Programs**
    - Green waste and other carbon based waste in landfills provide the majority of the organic matter for high quality landfill gas generation. Recycling and diversion programs avoid the landfilling of this waste, resulting in decreased methane content in the landfill gas.
    - At a typical active landfill, at least 500,000 tons of waste in place may produce enough methane gas to operate one Ener-Core FP250. At least 3 million tons of waste in place is typically needed for the Ener-Core KG2-3GO.
  - **Old or Closed Landfill with Decaying Methane Production**
    - Depending on the age of a typical closed landfill, between 1 and 2 million tons of waste is needed for the FP250. At least 6 million tons of waste is needed for the KG2-3GO.
  - **Reciprocating Engine or Flare can no longer operate, or needs supplemental fuel.**
    - Gas quality may be too low for an engine to easily operate on, and it may require supplemental natural gas. The Ener-Core Powerstations can generate power from fuel gas with as little as 5% methane. (As a reference, gas typically needs 25% methane to be flared, engines require 40-45% methane, and pipeline natural gas is over 98% methane)
  - **Tail Gas from Landfill-Gas-to-Pipeline Processing Plants or Biogas Conditioning**
    - Tail gas is usually below 20% methane, often requiring supplemental fuel to be flared.
- ☑ **Emissions Concerns or Emissions in Non-attainment.** You may need to mitigate existing air pollution, such as high oxides of nitrogen (which leads to ozone) and carbon monoxide emission levels, have a goal to generate power cleanly, or face difficulty getting permitted within a non-attainment region.
- ☑ **Landfill Gas Collection with Continuous Supply of Gas.** Flares are currently in place, and gas is being flared or vented continuously.
- ☑ **Demand for Power or Access or Utility Grid to Sell Power.** If the site has onsite energy needs and/or access to the grid, the Ener-Core Powerstation can offset high retail electricity prices.

## Products



**FP250**



**KG2-3GO**

**250 kW Product:** The Ener-Core Powerstation FP250 combines Gradual Oxidization with a 250 kW gas turbine, developed by Ingersoll-Rand plc and FlexEnergy, Inc. Ener-Core's Gradual Oxidizer replaces the turbine's standard combustor, resulting in a generation system with a wide fuel operating range and ultra-low emissions.

**2 MW Product:** Our next product, the Ener-Core Powerstation KG2-3GO, combines our Gradual Oxidizer technology with a two megawatt gas turbine, developed by Dresser-Rand Group Inc. Ener-Core is accepting orders for this unit now.