

## Using Digester Gas as a Clean Renewable Power Source for Local Communities

Ener-Core manufactures power generation products which enable communities and regions to cleanly generate power from gases that were previously difficult to use due to the gas not always maintaining a stable or minimal energy density required for combustion or energy production. Ener-Core's systems leverage an anticipated worldwide trend towards increasing the production of energy from biogas, derived from a variety of agricultural, waste and biomass sources. Ener-Core Powerstations make feasible the production of energy from a much wider range of gas qualities (including low-quality gases that have historically been deemed useless), enabling operators to:

- Generating continuous clean renewable power without most of the fuel quality and clean up requirements that are typically associated with traditional forms of biogas-to-energy plants.
- Transforming a source of methane emissions and pollution for local electricity generation
- Opening the possibility of using simpler (and lower cost) biogas digesters as renewable gas resource

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

Ener-Core's Gradual Oxidation technology can effectively convert impure gases with low and inconsistent energy densities into a form which can be processed by gas turbines to produce electricity and heat.

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.

### Local Renewable Power Benefits of an Ener-Core Powerstation

- Unprecedented capability to use weaker digester gas from different feedstock sources
- Tolerant of H<sub>2</sub>S, CO<sub>2</sub> and 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 for local use 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**

## Is your digester gas Ideal for an Ener-Core Powerstation?

It may be if it has one or two of the following...

- Low Quality Gas.** Typically, this may be found in:
  - Agricultural Digester Gas**
    - The organic matter from the agricultural feedstock determines the energy density or methane content in the digester gas. Depending on the location, the season and type of feedstock, the gas energy density may change or decrease.
  - Reduced Process Gas**
    - The regulation of the gas methane content may be dependent on the precise control and complex operation of digestion system. Opening up the allowable gas quality envelope could simplify digester operation and may improve the gas production reliability.
  - Reciprocating Engine or Flare operates intermittently or needs supplemental fuel.**
    - Gas quality may change too frequently and sporadically for reliable reciprocating engine operation, hence requiring the addition of supplemental natural gas to stabilize and increase the energy density of the biogas, such that it is kept above minimal limits required by reciprocating engines. The Ener-Core Powerstations can generate power from fuel gas with as little as 5% methane and accepts changes in fuel quality while operating.
  - Tail Gas from Digester-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.** Any requirements to mitigate existing air pollution, such as high oxides of nitrogen (which leads to ozone) and carbon monoxide emission levels. Alternatively, any regions where the objective of generating power is obstructed by difficulties with gaining permits.
- Digester 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 provide prime power for communities or offset high retail electricity prices from the grid.

## Products



**FP250**

**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.



**KG2-3GO**

**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 closing orders on this unit now, and anticipates commissioning of the first KG2-3GO units in 2014.