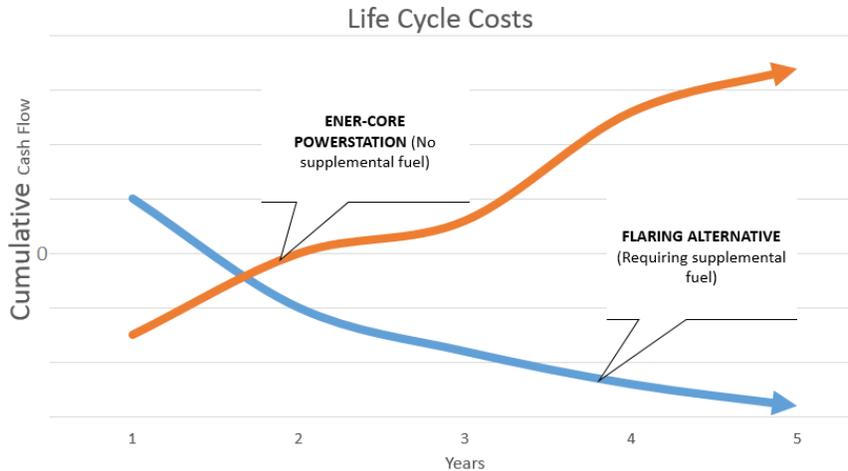


## Using Methane Slippage as a Continuous Clean Renewable Power Source

Renewable natural gas facilities look to upgrade biogas by removing its impurities through upgrading technology and increasing the methane levels from roughly 60% to 95%. Unfortunately methane slips from the upgrading process and creates a tail gas that must be dealt with in order to comply with air quality requirements. In an effort to control emissions tail gas is destroyed by flaring or burning; these processes waste a potentially useful source of energy that can be harnessed to create electricity and hot water.



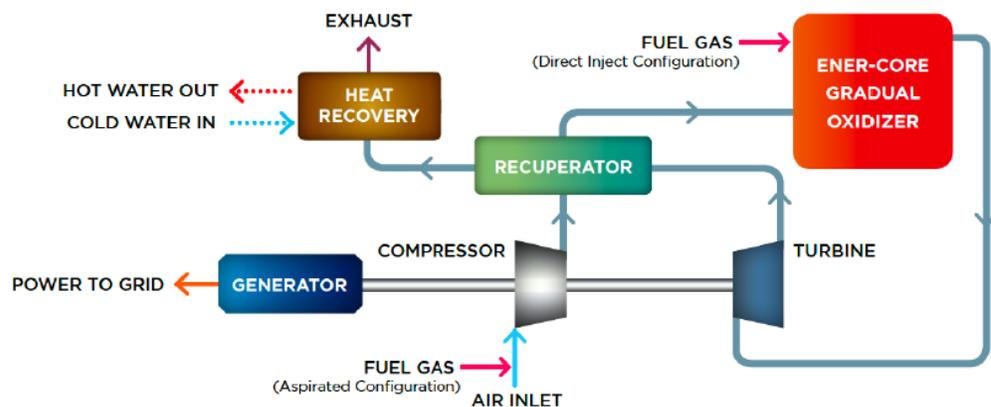
### Benefits of an Ener-Core Powerstation

What makes the Ener-Core Powerstation so innovative and appealing is that it can create a positive cash flow from incombustible gases in comparison to flaring alternatives that may require supplemental fuel. Instead of expending capital to destroy waste gases, the gradual oxidizer can operate on a wide range of energy density fuels **15-2600 Btu/scf (0.55-97 MJ/m<sup>3</sup>)** in order to produce power that can flow to

the grid or to onsite upgrading equipment. Furthermore, while the gradual oxidizer generates electricity, it simultaneously is able to achieve ultra-low emissions (less than 1 parts per million NO<sub>x</sub>). Gradual oxidation is an innovative alternative to flaring and venting that overcomes the minimum energy density requirement; in other words it's intended to create clean electrical power and heat from gases with as low as 2% methane content (depending on O<sub>2</sub> content).

### Technology and How It Works

Gradual oxidation relies on a flameless chemical reaction that avoids the high peak temperatures of traditional combustion, allowing it to bring NO<sub>x</sub> emission to less than 1ppm and volatile organic compounds (VOC) destruction to a 99% efficiency. The system replaces

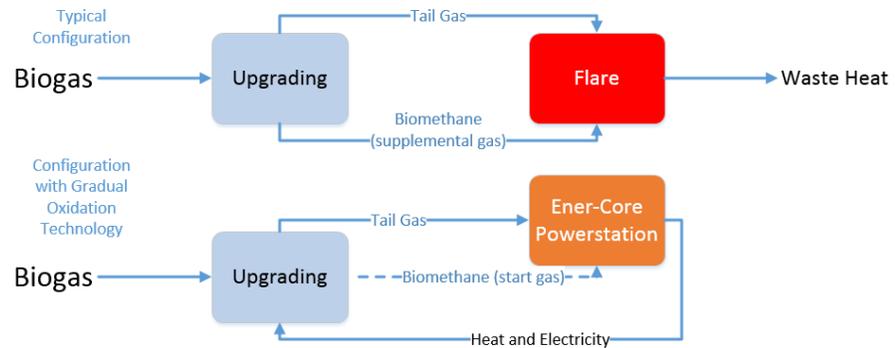


the combustor in a standard turbine configuration with Ener-Core's gradual oxidation vessel. The vessel harnesses the gradual oxidation reaction to simultaneously destroy contaminated gases (VOCs) and generate power. The system can be configured to aspirate the waste gas through the compressor inlet or directly inject the gas into the oxidizer depending on destruction and air quality requirements.

**ENER-CORE: CONVERTING AIR POLLUTION TO CLEAN ENERGY, PROFITABLY**

## How will the Ener-Core Powerstation be integrated?

The Ener-Core Powerstation acts in the place of a thermal oxidizer or flare to dispose of the lean methane “tail gas” produced during the upgrading of biogas to biomethane. The advantage of the Powerstation is that in addition to its ability to meet air pollution control criteria, it can produce power to operate onsite equipment.



The powerstation is skid mounted and can be easily installed on any project site. Because the PowerStation contains a gas turbine it benefits from continuous operation with minimal shutdown (preferably only for scheduled maintenance); should adequate flow not be available from the tail gas of the upgrading technology, supplemental gas can be blended from other sources to achieve the necessary energy input.

For example, the Powerstation can operate on multiple fuel sources without special blending and is capable of alternating between fuel streams without modifications to the

### FUEL FLOW REQUIRED

Methane Percentage	FP250 Fuel Consumption*	KG2-3GO Fuel Consumption*
5%	1904	10906
10%	952	5453
15%	635	3635
20%	476	2726
25%	381	2181

\* ISO Conditions 15°C

system so long as the energy input of the machine is maintained. The table above outlines the fuel flow required to maintain a sufficient energy input for operation on various methane content fuels.

## Products



**FP250**

**250 kW Product:** The Ener-Core Powerstation FP250 combines Gradual Oxidization with a 250 kW gas turbine from 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.



**KG2-3G w/GO**

**1.8 MW Product:** The Ener-Core Powerstation KG2-3G w/GO, combines our Gradual Oxidizer technology with a two megawatt Dresser-Rand Group, Inc. gas turbine.