ENER-CORE

March 23, 2015

Productive Use of Waste Gases to provide on-site Power and Steam:

reducing costs, improving profits and establishing a new environmental standard for ethanol production

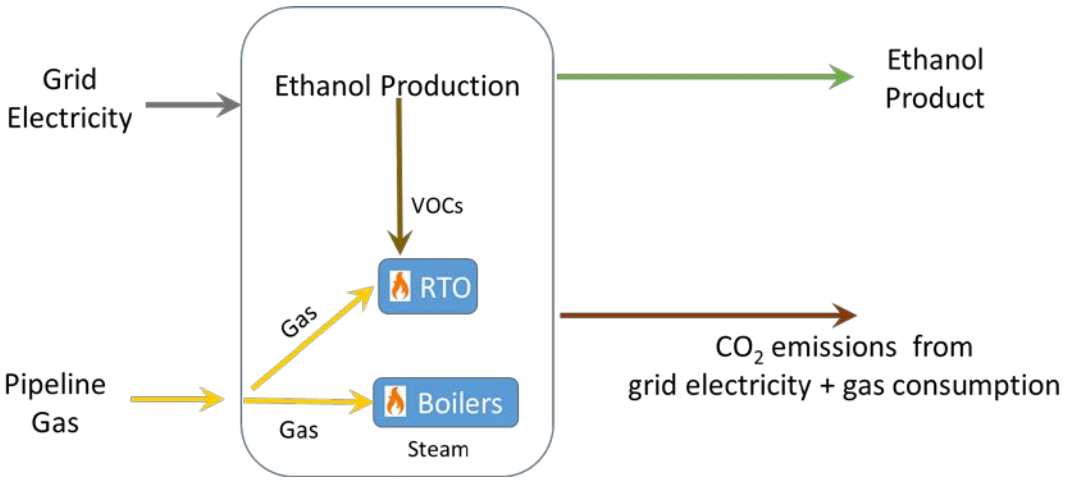
---

The ethanol industry is pushing to reduce its environmental footprint. The industry is being driven to minimize both air and carbon emissions through regulations and fuel standards.

The ethanol production process is energy intensive, using large amounts of electricity and steam. This is reflected in the facility's carbon emissions with the CO_2 emissions from the local utilities being included in the ethanol facility product's carbon score.

The ethanol production process also generates a waste gas composed of volatile organic compounds ("VOCs") that requires destruction. Most ethanol plants elect to use thermal oxidizers to destroy these VOCs. However, these gas waste streams are extremely low in energy density, making it necessary to purchase pipeline-quality natural gas, to mix with the VOCs, in order to destroy these gases.

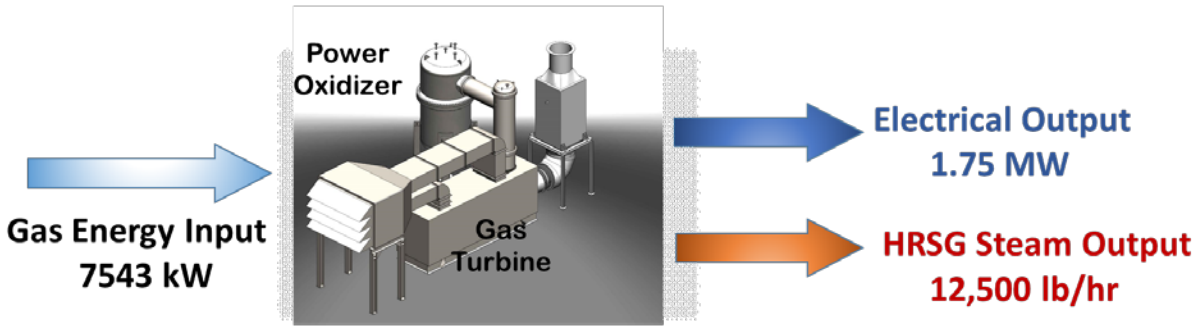
The costs of this extra natural gas, along with maintenance and compliance costs to operate the thermal oxidizers within the environmental standards can be as much as $500,000 or more each year. This adds to the facility's carbon emissions, since any gas burnt in the thermal oxidizer produces additional CO_2 emissions.



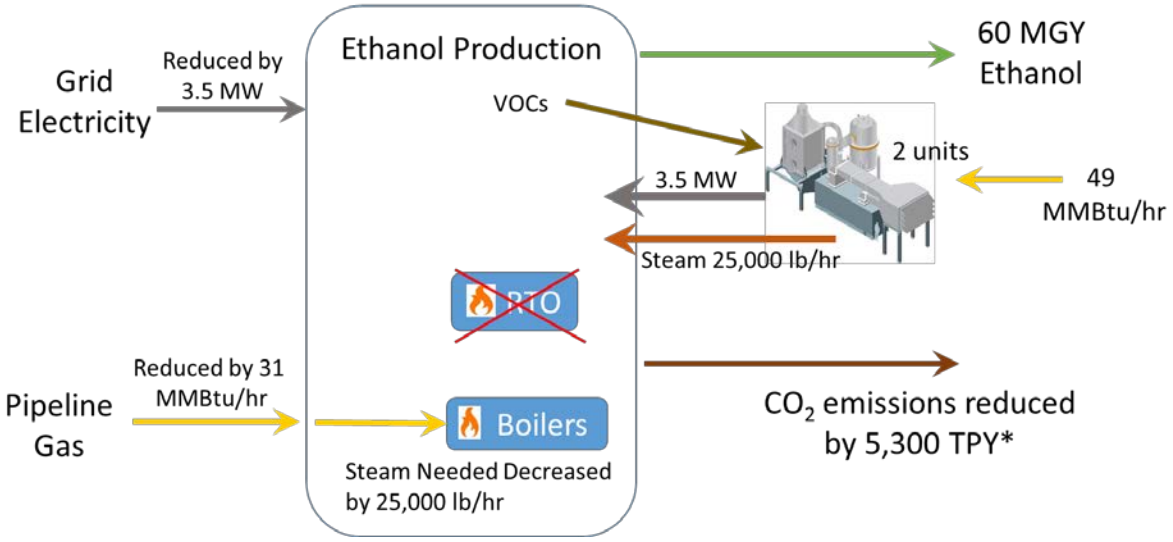
Pacific Ethanol, Inc. the leading producer and marketer of low-carbon renewable fuels in the Western United States decided that, rather than incur these ongoing costs to destroy these waste gases, it could deploy a new technology to re-use its gas waste streams productively. The company has chosen to deploy an advanced cogeneration system from Dresser-Rand that utilizes the Ener-Core Power Oxidizer system. The Power Oxidizer system offers a revolutionary

alternative to the flaring (burning) of low quality waste gases, ensuring compliance with costly environmental regulations while at the same time generating on-site power and steam from the low-quality waste gases, thereby offsetting the ethanol plant's purchases of electricity and natural gas.

The cogeneration facility will use two (2) 1.75 MW Dresser-Rand KG2-3GEF gas turbines with matching Ener-Core Power Oxidizers ("KG2-3GEF/PO"). Each unit outputs 1.75 MW of electricity and 12,500 lb/hr of steam from a heat recovery steam generator.



The diagram below shows the calculated* net CO_2 emissions benefit to Pacific Ethanol of avoiding grid electricity purchases, using the cogeneration facility's steam to offset pipeline gas purchases and destroying the process by-product VOCs in the Ener-Core oxidizer. The VOC destruction avoids 2 MMBtu/hr or almost 17,000 MMBtu of gas purchases each year.



*Calculated using EPA CHP calculator and CO_2 emissions for California grid (average)
http://www.epa.gov/chp/basic/calculator.html

The CO_2 emissions reduction is dependent on the amount of avoided natural gas CO_2/MWh emissions for the displaced grid electricity. The grid CO_2 emissions are influenced by the predominant fuel source for central plant generation. The table below shows the avoided CO_2 from using all of the electricity and steam from the two (2) KG2-3GEF/POs. The CO_2 emissions

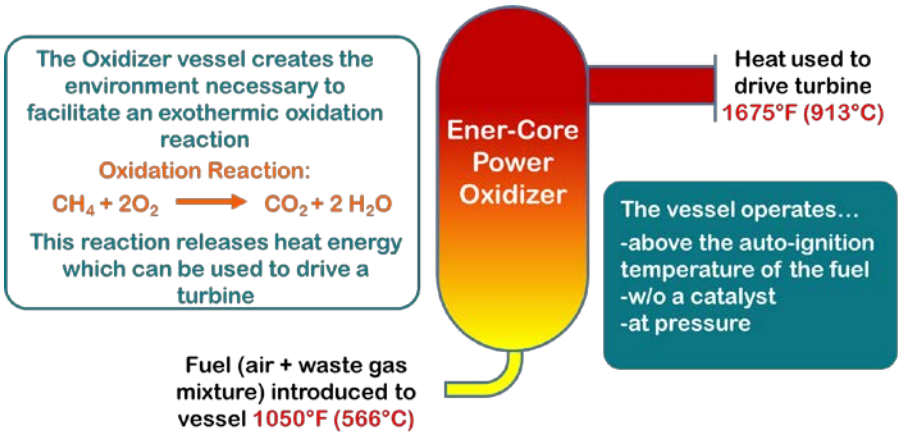
reductions in different U.S. states is compared to California which uses very little coal generation with the ethanol producing Midwest states which use more coal generated power.

	Avoided CO_2 by Displaced Energy from Utilities	CO_2 from Ener-Core Cogeneration Using 96% NG	Total Avoided CO_2 Emissions from Ener-Core System Energy Offsetting Utility Energy**	CO_2 Percent Reduction from Ener-Core System
California	29,507	24,211	5,297	18%
Iowa	39,912	24,211	15,702	39%
Illinois	48,124	24,211	23,914	50%
Indiana	32,634	24,211	8,423	26%
Minnesota	34,657	24,211	10,446	30%
Nebraska	36,389	24,211	12,178	33%

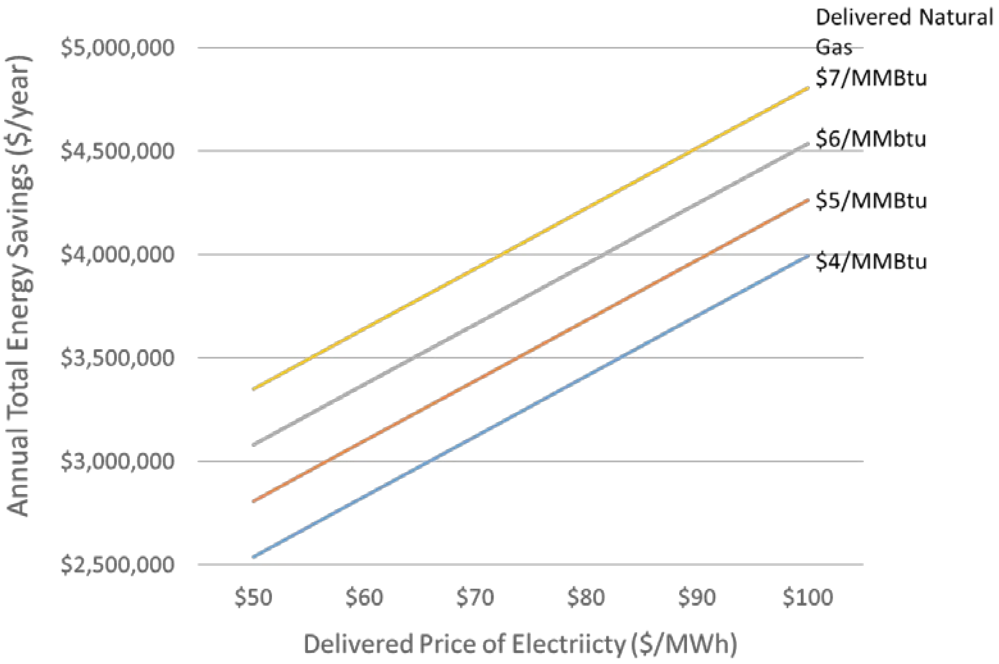
**Includes annual avoided natural gas from shutting down thermal oxidizer.

The preceding table assumes an efficient regenerative thermal oxidizer is being replaced with the Ener-Core cogeneration project. The unique Ener-Core Power Oxidizer can operate on much higher VOC quantities, thus enabling the Dresser-Rand gas turbine run on less supplemental natural gas. Higher VOC quantities used in the Power Oxidizer would increase the CO2 reduction supplied by the unique Dresser-Rand gas turbine with Ener-Core Power Oxidizer cogeneration system. The further reductions in CO2 benefit the ethanol plant by lowering the carbon intensity (CI) of its product.

The Ener-Core Power Oxidizer controls the concentrations and conditions within the oxidizer vessel to release the chemical heat energy from VOCs and fuel gases. It completely destroys the VOCs while keeping NOx emissions below even the strictest environmental regulations, producing emissions free heat at the correct temperature and pressure to drive a gas turbine.



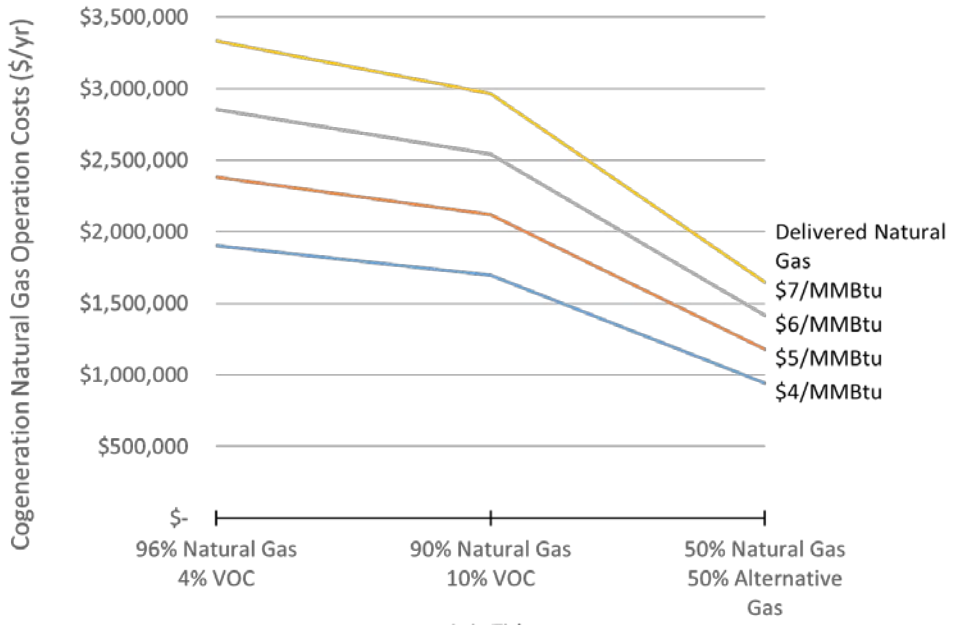
At Pacific Ethanol, the 3.5 megawatt cogeneration system with Power Oxidizer will replace most of the electricity currently purchased from the grid and supply a significant portion of its steam needs. The project is expected to reduce the facility's energy costs by an estimated $3M to $4M dollars per year from 29,000 MWh of electricity and 208 million lbs of steam. Installing the same system at other ethanol plants will result in different levels of savings, depending on the local utility's delivered electricity and gas prices. The figure below provides the range of energy savings a facility can realize from using its VOCs for energy



Through the deployment of this innovative system, Pacific Ethanol becomes a pioneer in the productive use of its gas waste streams, which in turn generates a significant cost reduction in its operations, while at the same time reducing its emissions.

As the Stockton plant will be generating on-site power and steam from its waste gases, it will substantially reduce its purchases of electricity and natural gas. This will result an immediate reduction in operating expenditures from eliminating both the fuel costs and maintenance costs for running the thermal oxidizer, reducing the environmental costs for its operating permits through lower air emissions.

The advanced cogeneration system from Dresser-Rand and Ener-Core will enable the Stockton plant to be less exposed to future volatilities in the prices of electricity and natural gas, even more so if higher quantities of VOCs or alternative gas sources were to be used in place of natural gas. The larger amounts of VOCs or alternative gas sources, effectively provide a zero cost or low price supplemental fuel option. The operating cost impact of using additional zero cost VOCs or low price alternative gas is shown in the figure below.



Lastly, the Pacific Ethanol Stockton facility must comply with one of the most stringent NOx emissions regulations worldwide. Once the new cogeneration system is operational, the NOx emissions from the Stockton ethanol plant will likely by the lowest in the U.S. Pacific Ethanol, along with Dresser-Rand and Ener-Core, expect for this solution to set a new standard in air emissions and operational efficiencies of ethanol production. Other ethanol producers can also take advantage of this environmental and energy breakthrough to reduce their operating costs or expand their operations if they are limited by the local environmental regulations.