

## **Title Page**

### **Improved Natural Gas Combustion for Heating Processes**

#### **Abstract**

Natural gas is used as a fuel in industry to produce heat for a variety of processes. This project will show how every cubic foot of natural gas can produce 7% more energy and reduce the by-products of combustion by 7% for the same heat requirements. This device is useful in increasing the efficiency with which fuel is combusted by treating the raw fuel with a unique magnetic field. When used in heating and energy conversion plants, this treatment process will result in greater thermal output for a given quantity of fuel.

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#### **OIT Focus Industry For Technology**

Aluminum, Brass, Copper, Metal Casting and Steel Industries (Metal Industry)

#### **Other Applicable Industries**

Agriculture-(for drying grain), Chemicals-(processing), Forest Products-(Steaming), Glass-(melting), Mining-(melting), Petroleum-(cracking), etc.

### **Technology Feasibility/Process Description**

#### **Need Exists**

The steel industry uses large quantities of natural gas to produce every ton of steel. From the melting of iron ore in blast furnaces and the making of steel in BOF's (basic oxygen furnace), to the use of slab casters, hot strip mills, pickle lines, portable anneal furnaces and continuous anneal lines, the process continues on and on to produce a finished product. According to The Statistical Abstract of the United States, 1998 edition, eight hundred and eleven trillion BTU's of natural gas were used in the primary metal industry in 1994.

#### **Technically Viable**

From the research data collected by LTV personnel on the #5 portable anneal furnace at LTV Steel before technology was installed (from 5/27/97 through 2/25/98-**control**) and after technology was installed (from 2/28/98 through 2/8/99-**treatment**), a 7% reduction in natural gas use was calculated. With improved efficiency of combustion, emissions were also reduced. A statistical analysis was done on the data by Joseph W. Camp, Jr., Ph.D., Purdue University North Central. For cycle 33 the treatment was statistically significant as follows:  $t = 2.92$ ;  $p < 0.0024$

#### **Technology Description Theory**

Superior Manufacturing Division, Magnatech Corporation has been able to produce encouraging results with gasoline and diesel fuel by merely exposing the molecules of the liquid to an unique field produced by an external magnetic force, the Kinetic Energizer®.

The theoretical basis of this effect is not well understood, but one theory is set forth in the following paragraphs and described as "The Kinetic Theory".

Each electron has two motions: a rotational, or spin motion, and a revolving, or orbital motion. Likewise, each electron develops two magnetic fields: one perpendicular to the direction of travel; the other, a circular field following the direction traveled. The intensity of these fields is proportional to the mass and speed of the electrons. It is these magnetic fields or links which hold the electrons in a fixed relation to each other.

Chemical reactions take place through a modification in the cohesion of the electrons revolving in the outer rings or orbits of the atoms. Specifically, if the magnetic fields of these outer electrons are disturbed, a reaction will result. The magnetic fields of the outer ring electrons can be crossed by magnetic links produced from an external force. The resultant change in the direction of the fields will cause sufficient modification in the cohesive force within the atoms and molecules to alter the molecular structure.

By altering the outer rings of the electron and causing a molecular dialysis of the fuel, a better mixture is obtained, thus increasing the Kinetic Energy of the hydrocarbon molecule. Kinetic Energy causes the speed of the molecules to increase, colliding with one another and against the walls of the fuel line that contains them.

The turbulence caused by the agitation of each molecule modifies the cohesion of the liquid and acts as a catalyst in the combustion area which, in turn, produces a better burning mixture, leaving fewer hydrocarbons and carbon monoxide. Several benefits are derived from this. First, the more uniform mixture utilizes more of the energy contained in the fuel, resulting in increased efficiency. Secondly, better distribution of the various compounds results in a more even flame front, as one molecule ignites the next molecule, and so on, producing more complete combustion.

The Kinetic Theory assumes that all gases are made up of molecules, as are all liquids. The molecules are assumed to be so perfectly elastic that when they collide, they rebound without any loss of energy.

### **Process Description**

A section of natural gas supply line on the furnace is cut out and flanges installed. The special treatment equipment with the multiple pole alternating polarity permanent magnets is then installed.

### **Data**

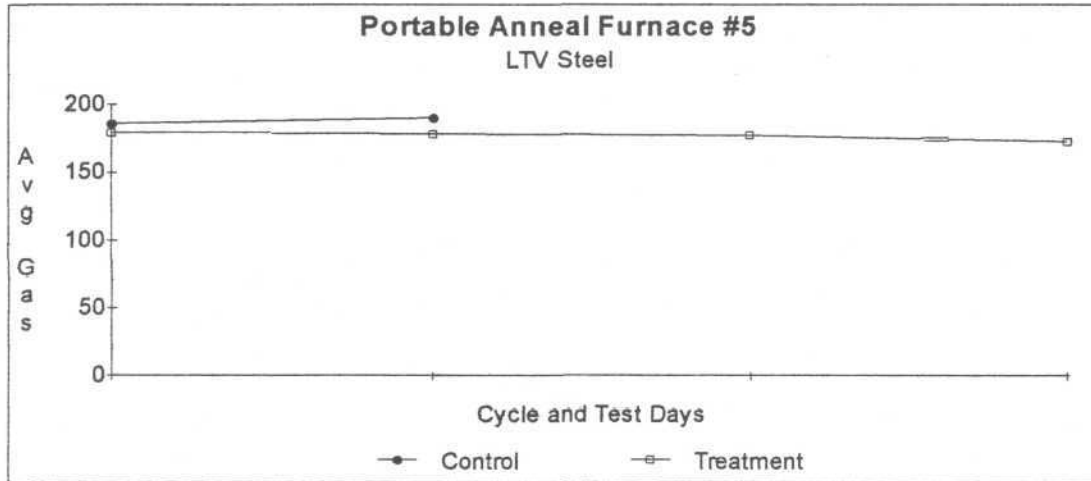
In order to investigate the effect of magnetic treatment on a stream of natural gas in a combustion setting, on 5/25/97 a test unit was installed on the LTV #5 Portable Anneal Furnace, and the fuel usage was monitored and compared against a control period where no magnetic treatment was used. In the control period, gas usage was monitored for a period of nine months. During the control period, 23 production runs were made of the 32 cycle, and 36 production runs were made of the 33 cycle.

On 2/28/98, the test unit was installed and gas usage was monitored for a period of 11 months. During the test period, 16 production runs were made of the 32 cycle, and 43 production runs were made of the 33 cycle. Upon installation of the unit, gas usage dropped significantly, and continued to drop throughout the test period until a plateau was reached demonstrating savings in the range of 7%.

The time and temperature of the furnace were controlled, and remained constant during the control and test periods for cycles.

### LTV #5 Portable Anneal Furnace Data Points for Line Graph

5/25/97 through 2/25/98		2/28/98 through 2/8/99		
Control	X1000=cu ft/hr	Treatment	X1000=cu ft/hr	%Change
Total Avg. Gas Usage for 32 Cycle:	186	Total Avg. Gas Usage for 32 Cycle:	179.4	-3.5
Total Avg. Gas Usage for 33 Cycle:	190	Total Avg. Gas Usage for 33 Cycle:	178.11	-6.2
		Total Avg. Gas Usage for 33 Cycle:	177.2	-6.7
		Total Avg. Gas Usage for 32 Cycle:	172.3	-7.3



### **Innovative and Novel to Industry**

The Perm-a-Core™ used in the Kinetic Energizer® for treatment of natural gas is truly unique. It uses multiple pole alternating polarity permanent magnets that direct the lines of confined magnetic forces in vertical and horizontal planes, thereby greatly enhancing the shear factor. The permanent magnet is so unique it took four years for the U.S. patent office to issue the patent; they kept saying, "a magnet can not have more than two poles". Magnatech Corporation is the only manufacturer in the world that has the technology to make these magnets. The Kinetic Energizer® requires no external energy, needs no chemicals or additives, has no moving parts, and requires very little maintenance, if any. At this period there are no installations of the Kinetic Energizer® in the steel industry.

### **Commercialization/Market Potential**

Magnatech Corporation, (the manufacturer of the Kinetic Energizer®), will actively promote and commercialize the energy saving system to the industry throughout the United States. Molden Associates Inc., serving the steel industry for over 25 years, has agreed to represent this product to their 17 customers in Illinois, Indiana, Michigan, Missouri, Ohio and Pennsylvania, who are among the largest consumers of natural gas. Molden Associates, Inc. specializes in the metal industry, and already sells other product lines to the aluminum, brass, copper, metal casting and steel industries. This energy saving system will be a natural fit with their present line.

A network of manufacturer's sales representatives will also be established to market this innovative technology to other large consumers of natural gas such as agriculture, chemicals, forest products, glass, mining, petroleum, etc.

Manufacturing facilities are already in place to produce this product, which can be ready for market within 30 days. The steel industry and other related industries would be the first industries approached, since the sales agency to sell this product (Molden Associates, Inc.) is already in place.

The steel industry is looking for ways to reduce energy costs to put them in a competitive position with foreign steel that is being "dumped" in the USA. A successful demonstration at LTV Steel Company will justify installation of the technology throughout the entire industry.

Presentations have been made in the past to the industrial consumer; however, the manufacturer has not been successful in convincing the large companies of this technology's value. With the help of the DOE and the technology's successful demonstration, the credibility that is required by major industry when making a purchase of this size can be achieved through a project NICE<sub>3</sub> field demonstration.

Engineers who are skeptical of the new technology are the biggest obstacles to commercializing the product. This hurdle can be cleared with the successful demonstration. The second barrier is expected to be cost justification, which can also be overcome with the demonstration documentation.

The segment size of the primary target consists of over 100 steel mills and related industries throughout the United States, which consume trillions of cubic feet of natural gas each year. At least 50% of the market will be covered within the first two years, with an expected installation rate of 35-40% within a period of five years after the completion of the demonstration period.

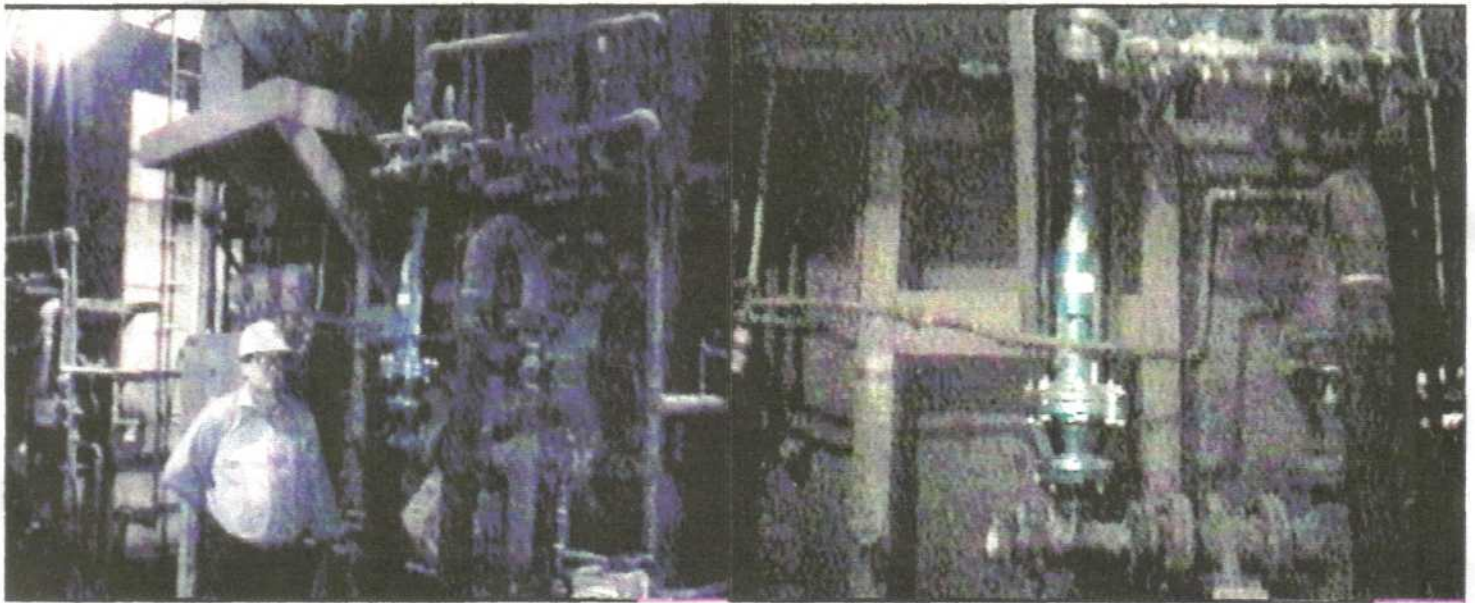
#### **Energy Savings, Environmental and Economic Benefits**

Industry throughout the United States consumes a tremendous amount of energy to produce everything from raw material to the finished product. Additional energy is used to properly dispose of the product when it has completed its life cycle.

Magnetic treatment offers a number of tangible environmental benefits, the first being the reduction of fossil fuel consumption. This has a number of positive effects on our nation and its economy; protecting our valuable natural resources and reducing fuel usage means fewer pollutants released and lower manufacturing cost. The process will also play a part in protecting the environment by reducing emissions through more efficient combustion.

Kinetic Energizer installed on #5 Portable Anneal Furnace at LTV Steel Company, East Chicago, Indiana. Research data was collected by LTV Steel personnel from 5/25/97 through 2/8/99. The average gas usage during treatment was 3,373 Cubic Feet Per Hour.

Back of #5 Furnace, Kinetic Energizer Model # KE-3000-A installed in 3-inch gas supply line.



Front of #5 Furnace

Burners on right side of #5 Furnace

