

# Industrial Furnace and Oven Design Featuring Flameless Combustion and Impingement Flow to Provide Increased Efficiency, Reduced Emissions and Intensified Heat Transfer

## Market and Background

The global industrial furnace and oven market was valued at more than \$8 billion in 2016 and is projected to reach almost \$13 billion in 2023, growing at a rate of 6.2%. The primary driver of this is the metal and steel processing industry, which is experiencing growing demand for automobiles, increased infrastructure activity in developing countries, and overall global economic recovery. Regulatory factors, such as the increasing focus on environmental footprint, are also projected to positively impact the market. Other notable industrial furnace applications include the glass industry, power generation, crude oil processing and coal pyrolysis. Currently, Europe represents the largest market worldwide while the Asia-Pacific has the fastest growth rate.

In traditional industrial furnaces and ovens, combustion is used to generate heat, which is indirectly transferred to the material being processed. This pathway requires convection heating of the oven walls and subsequent radiative heating of the product. Inefficiencies, and corresponding monetary costs, occur at each step in the heat transfer. To improve combustion efficiency, air preheating is commonly used. However, this increases emissions of polluting nitrogen oxides (NOx). In addition, the average life of industrial furnaces is significantly high at 10 to 15 years, which can delay replacement to obtain improvements created by advancements in technology.

## Research and Development Status:

An assistant professor of mechanical engineering technology and inventor from the University of Wisconsin Oshkosh has developed an industrial natural gas furnace and oven design that combines flameless combustion with high velocity impingement gas and air jets directed toward the product being heated. This novel combination has the potential to provide advantages over conventional technology that include higher energy efficiency, uniform temperature distribution, reduced NOx emissions, and intensified convection heat transfer. The design also has the potential to increase productivity by allowing more material to be processed within the same combustion area. This innovative system can be used for production of new furnaces as well as retrofitting existing installations. A small-scale prototype of this design has been constructed and is currently being tested. Further refinement may be needed prior to manufacturing.

## Applications:

- A flameless impingement industrial oven that provides improved energy efficiency, reduced emissions and intensified heat transfer
- Compatible with both, continuous and batch processes
- Applicable to both, furnaces and ovens
- Potential end user industries: metallurgy melting, reheating furnaces, glass, power generation, crude oil processing, coal pyrolysis, food production & processing, chemical processing, electricals & electronics, automotive & aerospace, pharmaceuticals

## Key Benefits:

- Increased productivity

- Reduced fuel consumption per unit of production
- Increased energy efficiency
- Reduced emissions (oxides of nitrogen; NOx)
- Uniform temperature distribution
- Intensified heat transfer
- Can be retrofitted to existing furnaces

### **Intellectual Property:**

A U.S. Patent Application has been filed for this technology. For more information, please contact Jennifer Cook at [jennifer@wisys.org](mailto:jennifer@wisys.org) or by phone at 608-316-4131.

### **Development and Commercialization Needs:**

WiSys is currently seeking a strategic partner interested in further developing and scaling this innovative furnace system, ultimately providing a route to market for its commercialization.