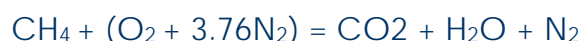


## Reduction in Carbon Dioxide Emissions

The selection of the high technology Weishaupt burner significantly reduces the carbon dioxide emissions of a plant thereby protecting our environment. Here is how using natural gas as an example based upon one of our client's boilers.

Natural gas is comprised of almost 100 % methane. The chemical reaction for burning methane is



The affect of excess air used by the burner and the boiler design affect the combustion efficiency and the amount of fuel used to perform a given duty, but for each unit of fuel, the amount of CO<sub>2</sub> is fixed by the above equation. For natural gas, the volume of CO<sub>2</sub> is 11.7 % of the total volume of combustion by-products when there is no excess air. With excess air added, the percentage of CO<sub>2</sub> will change downward, but the mass flow per unit of fuel cannot change.

Since the Weishaupt burner operates at low excess air and high turndown, the combustion efficiency is higher than a standard burner and the cycling losses are reduced. Therefore using the Weishaupt burner increases the overall efficiency of a given boiler. Since that is true, there is a significant decrease in the fuel usage. It follows then, that the mass of greenhouse gases produced, CO<sub>2</sub> is decreased.

For each mole of fuel there is .117 mole of CO<sub>2</sub> \* 28 #/mole = 3.276 # CO<sub>2</sub> / mole of fuel

Per mole of fuel there is 16 #'s.

Therefore there is .205 # CO<sub>2</sub> for each pound of fuel burned.

For a particular project, we found that the load at the plant is 8000 MBH on average throughout the year. The boiler with a Weishaupt burner operates at 86.4% efficiency while a standard burner on the same boiler runs at 81% efficiency. Assuming that natural gas contains 1000 BTU's per cubic feet, the plant needs an average of 9,259 cubic feet of gas per hour. If a standard burner would have been used, there would be 9,877 cubic feet of gas per hour used. Taking the efficiency of the equipment into account on a yearly basis and converting to mass:

Boiler with Weishaupt burner:

$8000 * 24 * 360 * .6 * .075 / .864 = 369$  tons of CO<sub>2</sub> per year

Boiler with standard burner:

$8000 * 24 * 360 * .6 * .075 / .81 = 393$  tons of CO<sub>2</sub> per year

Total Reduction of CO<sub>2</sub> per year from combustion efficiency differences only is 20 tons or 6.5 %

By taking account the inherent losses of the standard equipment through cycling, lesser quality plant management, etc. the actual difference in fuel usage is 10%.

**Therefore the total reduction of CO<sub>2</sub> per year is 37 tons per year.**