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The quantity of CO₂ emissions prevented when changing to an electric system from a fossil fire system be it a heater or steam generator?

This document contains a comparison of the electric Powered System and a corresponding fossil-fuel combustion system like a heat exchanger or boiler

Better Profits Lower Energy Use Prevent Emissions

Synopsis: The CO₂ emissions prevented by a 10 MW unit can prevent 0.8-2.2 tons or more of CO₂ emission every hour for a one-to-one substitution of a fossil fuel unit.

CTO MHI

Typical Industrial MW Products



Climate Impact

A 10 MW Airtorch® (an example of an electrically powered system) can prevent 0.8-2.2 Tons of CO₂ emission **every hour**.

10 MW = 34.12 million BTU/hr

Assuming an 8 hr day and 200 days gives approximately 1200- 2400 Tons per year of CO₂ prevention.

Other emissions from combustion gases that can be harmful: Combustion gases contain CO₂, NO_x, SO₂, and soot.

This is particularly of concern in large MW installations.

The Airtorch® does not make any CO₂, SO₂, Soot, or NO_x.

What is the growth rate of CO₂ emission?

Emissions increased by over 2.0 GT from 2020 to 2021 (post-pandemic recovery). Very rough numbers indicate that the CO₂ increase averages between 0.4-0.9 GT/year over the past 20 years. The annual growth rate in atmospheric carbon dioxide over the past 60 years is about 100 times faster than previous natural increases.

Is global warming tied to the CO₂ increase?

Yes. With the current acceleration in the atmospheric content, it is rising rapidly.

This is the cause of several climate-related damages to the infrastructure.

Can CO₂ emissions be quickly mitigated?

Yes, by changing to high-efficiency electric heating in the industrial sector www.mhi-inc.com

Airtorch® Specific General Comparison

What is the difference in the principle of heating between electric process gas heaters and fuel-fired combustion heaters?

In combustion heating, the gas is first burnt. This warm gas is then pushed into a tube that is heated by the burnt gas. The process air which must be heated flows against the direction of the burnt gas flow in a separate enclosure (i.e., in the opposite direction). That is why it is called a counter-current flow for a combustion heat exchanger. Such elaborate two-phase flows are not required for an electrically powered heater.

Generally, in an electric heater, the process air flows over-energized electrical heaters. Electric energy is directly converted to thermal energy without the need for two different flows. One of the benefits of electric heating is that one does not have to waste energy to push so many flows. Additionally, the expected pressure drops of electric heaters at mid-flow volumes are lower than gas heaters. This low-pressure drop represents a substantial saving in energy.

Energy Price and Efficiency

Parameters contribute to better energy efficiency for electric heaters.

- The pressure drop required for the flow is less for electric heaters.
- Easier to insulate an electric heater to prevent heat loss. No long pipes to insulate as in gas heat exchangers.
- The ramp-up rate to the final temperature is shorter for electric heaters compare to gas heaters.
- The cool-down rates are also less for electric heaters. Heat exchangers have a large volume of tubes that need to heat and cool.
- Electric systems can use modern electronics that allow adjustment to conditions, so the power used is only the amount that is required. Fossil fuel combustion units often cannot have similar feedback controls. Control is a primitive on-off type.

How does one compare the energy price for an electrical system and a fossil-fuel-fired system?

- **Energy Cost:** When one includes the social cost of CO₂ production, the price of one KWh of electric or combustion energy starts converging. The CO₂ emissions per million kilojoules of energy used range from 50.4 Kg for natural gas to 68.8 Kg for jet fuels. The social cost of making CO₂ is \$50-\$414/ton of CO₂ made.

Why is the Electric Airtorch® Efficient?

It all comes down to the ease of heat transfer between the source and gas. Unlike a combustion counter-current heat exchanger, the patents-protected Airtorch® contains well-insulated heaters in the gas flow and heated surface. Typically, a 15-30% improved efficiency is noted in electric devices over combustion (fossil-fuel) heaters. If the efficiency of Airtorch® devices is even 25% better than combustion heat exchangers, then the operational cost of the electric Airtorch® could be lower than the combustion heat exchanger devices. For **example, a 16 MW combustion gas heater could be replaced with an 11 MW electric Airtorch®.**

Typical energy conversions:

Energy conversion efficiency comparison between the MHI electrical convective heater and Fossil-fuel-fired Combustion heaters.

>95%	~70%
Electric Airtorch® (MHI Modular Unit)	Fossil fuel-fired Heat Exchanger (typical only)

When considering the above factors typical fossil fuel-fired heaters, around 30% of the energy put into the unit is lost during the heating process. Electric heaters lose much less energy. The Electric Airtorch®, in particular, typically loses less than 5% of input energy during the heating process.

General MHI Product Features

www.mhi-inc.com

Custer manufacturer relationships road-map

<https://mhi-inc.com/customer-centric-quality-solutions/>

Total Quality Management

<https://mhi-inc.com/mhi-proprietary-tqm/>