



## Decarbonizing Welding Operations Through Induction Technology

### Technical Summary

- 50–95% reduction in CO<sub>2</sub> emissions per weld
- 80–90% thermal efficiency with zero on-site combustion
- Reduced specific energy consumption (kWh/weld)
- Improved heating cycle time and metallurgical consistency
- Proven industrial deployment with strong ROI



**Welding and heat treatment** are among the most energy-intensive processes in manufacturing. With increasing focus on ESG compliance, Net Zero targets, and Scope-1 emission reduction, the selection of heating technology has become a strategic engineering decision rather than a purely operational choice.

Conventional gas-based heating systems operate at low thermal efficiencies of 20–30%, resulting in high radiant and convective losses and significant direct CO<sub>2</sub> emissions. Resistance heating, while eliminating combustion, still relies on conductive heat transfer and requires longer soak times, leading to higher overall electrical energy consumption.

**Induction heating represents a high-efficiency** alternative by generating heat directly within the workpiece through electromagnetic induction. With thermal efficiencies of 80–90%, rapid response, and closed-loop temperature control, induction systems deliver precise, localized heating with minimal losses. As an all-electric process, induction heating eliminates on-site fuel combustion and enables direct integration with renewable power sources.

Industrial implementation of induction technology has demonstrated **50–60% lower carbon emissions per weld** compared to gas heating, with some facilities **achieving up to 95%** reduction in Scope-1 emissions. Additional benefits include shorter heating cycles, reduced rework, improved metallurgical quality, enhanced operator safety, and significant energy cost savings.

Induction heating therefore, provides a technically proven and economically viable pathway for decarbonizing welding and heat treatment operations while improving overall process efficiency and reliability.

