

THE APPLICATION OF THERMAL PLASMA SYSTEMS TO
ECONOMICAL SCALE IRONMAKING

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ABSTRACT

Available process materials and changing economic factors have greatly hastened the application of plasma technology to the iron and steel industries. Plasma systems can electrically heat gases of needed gas composition to temperatures exceeding 5,000°C. Fully engineered plasma systems, which are now commercially available, are compact, reliable and extremely easy to operate. Torches having a 10,000 kW power rating will be needed for industrial scale operations, and will be commercially available within the next few years. As the energy cost ratio of electricity to hydrocarbon sources (e.g., natural gas) has gone from 8:1 in the early 60's to 3.5:1 at the present time in the U.S., plasma technology has become economically favorable over conventional processes. Studies project this ratio to reach 2:1 before the end of the century. As a specific result of this energy cost comparison, it is economical to produce reformer gas via a plasma system and inject it through the tuyeres of a blast furnace to reduce coke consumption and improve the furnace productivity. Coke reductions as high as 80% with similar increases in productivity can result in a total cost saving of \$20.00 to \$40.00 per ton of hot metal produced. Coke, a basic ingredient to ironmaking, is already in short supply, and it is predicted that the United States will import over 10 million tons per year by 1985. In Sweden, a plasma fired direct reduction system (SKF Plasmared®) is presently in the production start-up phase. Sponge iron pellets will be produced by plasma reformed gases which are circulated within the system. Hydrocarbon feedstocks of oil, liquefied petroleum gas or coal will replace coke as the reductant source. Experimental work is under way to develop plasma technology for pig iron production in a low capital, low coke consuming process. In the latter case, close attention has been paid to minimizing electricity requirements, leading to significant product cost savings over the conventional blast furnace. Although electric arc furnace technology has existed since the turn of the century, only recently has serious interest developed in plasma technology for iron and steel remelting systems.