

# The Process of Steel Manufacturing: Techniques, Technologies, and Environmental Impacts

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**Abstract:** Steel manufacturing is among the world's largest industries, with millions of tons of steel produced every year. This study aimed to analyze the steel manufacturing process, discuss the technological techniques utilized, evaluate the environmental impact of this industry, and assess the current state of steel manufacturing in Uzbekistan.

**Keywords:** Steel Manufacturing, Techniques, Technologies, Environmental Impacts, Uzbekistan.

**Introduction:** Steel is a critical component of modern society, used in construction, transportation, manufacturing, and other industries. The manufacturing process of steel is complicated, starting from the extraction of raw materials to the final product stage. The steel manufacturing industry is one of the world's largest industries, with millions of tons of steel produced globally each year. This study aims to analyze the techniques, technologies, and environmental impacts of steel manufacturing, with particular emphasis on the current state of steel production in Uzbekistan. Our findings reveal that steel manufacturing is a highly complex process that involves several stages, including raw material extraction, refining and smelting, casting, and finally, production. Arc furnace technology is the most commonly utilized technique to refine steel scrap into crude steel. The steel manufacturing process has numerous environmental impacts, including air and water pollution, greenhouse gas emissions, and waste production. Uzbekistan has a robust steel manufacturing industry, producing several products, including construction materials, pipes, and other industrial equipment. The industry has experienced significant growth over the years, driven by abundant resources, technological advancements, and government support.

## Main Part

The steel manufacturing process comprises four main stages, namely raw material extraction, refining and smelting, casting, and production. The first stage of the process involves the extraction of raw materials, primarily iron ore, coke, and limestone. These materials are then transported to the steel manufacturing plant, where they are processed through a series of refining and smelting stages to produce

crude steel. Steel scrap is commonly used, with electric arc furnace technology being the most popular technique utilized in refining steel scrap into crude steel.

The final stages of the steel manufacturing process include casting and production, where the crude steel is transformed into various products, including steel rods, sheets, tubes, and other industrial equipment. The steel manufacturing industry requires massive amounts of energy, and as a result, the environmental impact of this industry is significant. The emissions from steel production include greenhouse gases, such as carbon dioxide and water pollution, mainly from steel plants' effluent discharge and waste production.

Uzbekistan has a well-established steel manufacturing industry, with several large-scale operations producing construction materials, pipes, industrial machinery, and other products. The industry has experienced significant growth over the years, driven by abundant resources, technological advancements, and government support. Uzbekistan is rich in iron ore deposits, and the government's focus on industrial development has resulted in the expansion of the steel manufacturing sector.

**Energy consumption:** Steel production is energy-intensive, and the amount of energy required depends on the production process and the source of energy. According to the International Energy Agency, the global steel industry consumed around 5% of the world's total energy in 2018, equivalent to approximately 1,800 terawatt-hours (TW) of energy.

- **Greenhouse gas emissions:** Steel production is a significant source of greenhouse gas emissions, primarily carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>). According to the World Steel Association, the global steel industry emitted around 2.8 billion metric tons of CO<sub>2</sub> in 2018, accounting for 7% of the world's total carbon emissions.

- **Water consumption:** Steel production requires significant amounts of water for cooling and processing. The amount of water consumed depends on the production process and the source of water. According to the World Steel Association, the global steel industry consumed around 20 billion cubic meters of water in 2018.

- **Waste generation:** Steel production generates various types of waste, such as slag, dust, and sludge. The amount and composition of waste depend on the production process and the type of steel produced. According to the World Steel Association, the global steel industry generated around 500 million metric tons of waste in 2018.

### **Results:**

The analysis revealed that the steel manufacturing process is a highly complex and energy-intensive process that involves multiple stages. The refining of steel scrap using electric arc furnace technology is the most popular method utilized. The study further revealed that the steel manufacturing industry has significant environmental impacts, including air and water pollution, greenhouse gas emissions, and waste production. Nevertheless, Uzbekistan has experienced significant growth in the steel manufacturing industry, with the expansion of large-scale operations that produce various products.

### **Discussion:**

The steel manufacturing industry plays a crucial role in Uzbekistan's industrial development, contributing to economic growth and job creation. Nevertheless, the industry's environmental impact poses a significant threat to the country's ecosystems and public health. As a result, there is a need for the government to implement

sustainable development practices in the steel manufacturing industry, such as energy-efficient technologies and waste minimization.

Accounting books play a critical role in the steel manufacturing industry, providing a framework for financial management, cost accounting, and decision-making. The application of accounting principles, such as budgeting and cost management, can help improve the efficiency and sustainability of the steel manufacturing process. The incorporation of environmental costs into the accounting system can also help in identifying the actual cost of steel production and highlighting the hidden environmental impact of the industry.

The waste generated from 1 ton of steel production includes:

- Blast furnace slag (up to 450 kg)
- Steel slag (up to 160 kg)
- Dust and sludge from the steelmaking process (up to 30 kg)
- Scrap steel that cannot be used (10-20 kg)
- Flue gas emissions containing pollutants like carbon monoxide and sulfur dioxide.

### **Conclusion:**

Steel manufacturing is a critical component of modern society, with the industry contributing significantly to economic growth and job creation. Nevertheless, the steel manufacturing process has significant environmental impacts that pose a threat to public health and the ecosystem. This study concludes that the steel manufacturing industry in Uzbekistan has experienced significant growth driven by abundant resources, technological advancements, and government support. It is worth noting that the environmental impact of steel production can be reduced through various measures, such as using renewable energy sources, improving efficiency, recycling steel scrap, and reducing waste generation and emissions.

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