Blast Furnace and Iron Production

Xin Ma
Parkland College

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**Introduction**
A blast furnace is a type of metallurgical furnace used for smelting of metallic ores, generally iron. In a blast furnace, fuel and ore are continuously supplied through the top of the furnace, while air (sometimes with oxygen enrichment) is blown into the bottom of the chamber. The fuel combusted on the bottom of the furnace releases heat, which melts the iron ore and drives the chemical reactions that produce metallic iron. The product is then tapped from the bottom of the furnace. Blast furnaces are so named because the heat from the combustion of fuel is used to blast or force the air through the ore to enhance the chemical reactions.

**Ancient Blast Furnaces in China**
The oldest blast furnaces were built during the Han Dynasty of China in the 4th century BC. However, cast iron bells and armor were widespread in China by the 5th century BC. In the 4th century AD, the iron ore was smelted using charcoal in furnaces with a high temperature of around 1400°C. The furnaces had clay walls and used phosphorus-containing materials such as bone ash to make the iron more malleable. The iron produced was used in the construction of buildings and weapons.

**Modern Furnace**
The modern blast furnace is an important part of modern iron production. It is a large, cylindrical structure made of refractory materials that can withstand the high temperatures and pressures inside. The furnace is fed with iron ore, coke, and limestone, and the air is blown in at the bottom. The reaction products are collected at the bottom as molten iron and slag. The efficiency of modern blast furnaces has improved significantly over time, and they are now capable of producing large quantities of iron at a lower cost.

**Future Atmospheric Changes in Greenhouse Gas and Aerosol Concentrations**
The extent and speed of future atmospheric changes will be driven by the level of greenhouse gas and aerosol emissions over time. Human activities are major sources of these emissions, which have increased in the past and are projected to continue increasing in the future, although the U.S. and other governments are taking steps to reduce emissions.

To project changes in greenhouse gas and aerosol emissions, and the resulting changes in the concentration in the atmosphere, future scenarios are developed that include assumptions about global population, economic growth, energy use and prices. These scenarios are uncertain because Earth will change in ways that are difficult to predict. Nonetheless, a diverse set of scenarios can offer insight into the range of possible future atmospheric conditions.

**Near Term Scenarios**
Near-term scenarios through 2020 or 2030 of future greenhouse gas emissions have been developed by EPA and the Department of Energy (DOE).

- **EPA** has developed the STotton model to project greenhouse gas emissions in the U.S.
- **DOE** is working on the EIA model to project greenhouse gas emissions in the U.S.

Near-term scenarios are very important for informing decisions about climate change policies and investments. They help policymakers understand the potential impacts of their actions on future emissions and climate outcomes.

**Carbon Dioxide Concentrations**
Carbon dioxide (CO₂) concentrations in the atmosphere are a major concern as they contribute to global warming. The Intergovernmental Panel on Climate Change (IPCC) projects that CO₂ concentrations will continue to rise in the coming years, with implications for future climate change and sea level rise.

**Long Term Scenarios**
Long-term scenarios beyond 2030 developed by the Intergovernmental Panel on Climate Change (IPCC) show a wide range of possible future characteristics, including projections of greenhouse gas emissions in the context of various renewable energy technologies.

**Conclusion**
Iron production plays an important role in daily life and economy. Modern technology is being used to improve efficiency and reduce environmental impact. The future of iron production will continue to be shaped by technological advancements and environmental regulations, aiming to balance economic growth with sustainability.

**References**