

Figure ES-1. Major Goals to Achieve Outcomes

Workplace Safety

- Reduce preventable workplace fatalities to zero while also minimizing non-fatal injuries and incidents
- Achieve continuous safety learning processes based on observations of what went wrong during incidents (e.g., translate historical knowledge into learning)

Energy Efficiency

- Reduce energy intensity significantly in 10 years through new technologies (e.g., low fuel rate operation of blast furnace) and smart approaches that optimize energy resources (long-term goal)
- Optimize the electrical energy inputs to the overall plant; achieve maximum internal electricity generation
- Achieve optimum usage of waste gas as energy resource, including blast furnace (BF) and other waste gases
- Recover sensible heat

Production Efficiency

- Reduce cycle yield times significantly through start-to-finish visualization that enables streamlining of processes
- Maximize the use of inexpensive and newly abundant natural gas via new technology or by improvements to existing technology
- Achieve improvements to processing and development of advanced high-strength steels (AHSS)
- Lower raw material costs through better utilization and recycling; maximize re-use of fines

Reliability and Maintenance

- Substantially reduce and minimize current nonconformance conditions, from safety to downtime and quality, with a priority of *zero nonconformance* from safety
- Increase mean time before failure
- Reduce unplanned breakdown days to near zero over the long term

Environmental Impacts

- Improve by-product utilization by reducing generation and improve by-product beneficiation to significantly reduce landfilling needs
- Reduce CO₂ emissions through more energy efficient processes, recuperation of process gases, and CO₂ capture processes
- Develop CFD process models for emissions that could be based on raw materials composition and process parameters

Raw Materials

- Minimize the generation and need for beneficiation of by-products through improved process efficiency (e.g., improved skimming operation, better separation of scale/oil)
- Develop advanced by-product beneficiation technologies to increase recycling rates and value of by-products
- Develop techniques to reduce degradation during handling, and improve sizing of raw materials
- Develop optimization tools to optimize the use and flow of raw materials plant-wide
- Develop process models that could relate raw material characteristics like size, strength and chemistry to process performance including productivity, quality and environmental aspects
- Develop optoelectronic sensing (sensing of optical properties), to achieve significant reduction in impurities (e.g., 50% in 5 years) (long-term goal)

Smart Steel Manufacturing

- Achieve high-speed simulations and visualizations that allow for iterative design and operational insights
- Improve and optimize product quality through effective modeling and simulation, including integrated processing, improved structure-property, and multi-scale models
- Achieve a comprehensive hot strip finishing mill with broad capabilities for simulation to improve and optimize product quality

Workforce Development

- Achieve full connection and awareness of the workforce opportunities in the steel industry, beginning with education and carrying through to workforce
- Achieve across-the-board occupational competence throughout the entire organization
- Optimize/enhance intellectual capital and company success via knowledge, training, and understanding of new technology