Sustainability in the American Steel Industry

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Two Steelmaking Processes

Iron Ore → Coal Injection → Coal → Coke Oven → Coal By-Products

Natural Gas

Direct Reduction → Produces solid, metallic iron from iron ore

Electric Arc Furnace → Recycled Steel → Basic Oxygen Furnace

Steel Refining Facility

Continuous Casting

Slabs → Thin Slabs

Blooms → Billets

Blast Furnace → Produces molten pig iron from iron ore

Molten Iron

Pig Iron Casting
The Circular Life Cycle of Steel
Overview: American Steel Industry

- Cleanest and most energy efficient of the major steel industries in the world
- Essential to the U.S. decarbonization strategy, national and economic security, and critical infrastructure
- Supports nearly two million American jobs
Social Media – Steel Messaging

The American steel industry is fundamental to the manufacturing sector and to the overall economy. #steel #steelsustains #reducereuserecycle

Steel utility poles are about 50% lighter than wood, reducing transportation costs and making them easier to handle on the job site. #STEELSUSTAINS

Steel is the material of choice to support a clean energy future. Learn more: https://www.steel.org/sustainability/#steelsustains

Recycling one steel food can conserves enough energy to light a 10-WATT LED BULB for over 24 HOURS. #STEELSUSTAINS

Steel is the most environmentally effective choice and a key component to powering today’s vehicles. https://linkd.in/etXDMgwR #steel #steelsustains #reducereuserecycle

Steel is continuously recyclable and enables manufacturers to make lighter, more fuel-efficient vehicles. #STEELSUSTAINS
Message Highlights

• American steel production is the cleanest of the major steel-producing countries
• “It Starts with Steel”
• Steel is vital to most sustainable energy technologies
McKinsey & Company: “The transition to a net-zero economy will be metal-intensive.”

Steel is the only material critical to all low-carbon technologies.
What Makes American Steel Sustainable?

• Integrated mills primarily use pelletized iron, not the lower quality sintered iron used in China and elsewhere

• Significantly greater use of natural gas vs. coal as an energy source

• Larger share of electric arc furnace (EAF) production than other regions

• 60 to 80 million tons of steel scrap is recycled each year into new steel products in the U.S.

• Cleaner electricity grid
U.S. Electricity Generation from Renewable Sources

U.S. electricity generation from selected fuels
AEO2022 Reference case
billion kilowatthours

Source:

[Image of chart showing U.S. electricity generation from selected fuels with historical and projected data for 2010 to 2050, indicating the percentage contributions of natural gas, renewables, nuclear, and coal.]
CO₂ Emissions Intensity Benchmarking Report

• New report released April 2022 by Global Efficiency Intelligence (Dr. Ali Hasanbeigi)
• Calculates CO₂ emissions intensity of the steel industry in various regions and countries
• Report is based on 2019 data
• Continues to support the message that American steel is the cleanest of the major steel producing countries
CO₂ Emissions Intensity Benchmarking Report

Accounting for Emissions in Imported Steel


Equivalent to the CO₂ emissions from:
- 2.7 million passenger vehicles driven for one year
- 1.6 million homes’ energy use for one year

Estimated CO₂ Emissions from Imported Steel - 2021

- Emissions from Direct Steel Imports
- Emissions if Produced at Average U.S. Carbon Intensity

12.7 mmt (32%) less CO₂
Continuing Efforts To Enhance Sustainability

• Work is also underway on projects to further enhance the sustainability of domestic steelmaking:
  o Advancements in the use of Direct Reduced Iron (DRI) and Hot Briquetted Iron (HBI) in place of coal-based pig iron in both integrated and EAF steelmaking
  o Using renewable energy-based hydrogen as a reduction agent in DRI/HBI production
  o Carbon capture and storage/use
  o Increased use of renewable energy in steel industry facilities
What is Driving This? - Buy Clean Initiatives

• Buy Clean California Act, October 2017, established embodied GHG emissions thresholds for select materials used in public buildings

• Buy Clean Colorado Act, July 2021, requires EPDs beginning July 2022

• Other states considering Buy Clean legislation include Washington, Oregon, Texas, Minnesota, New York, and New Jersey

• At the federal level, a Buy Clean Task Force is working toward the goal of a comprehensive federal Buy Clean program
  • Timing unclear at this point
What is Driving This? - Engineers and Architects

COMMITTING TO NET ZERO

The mission of the SE 2050 Commitment is to support the SE 2050 Challenge and transform the practice of structural engineering in a way that is holistic, firm-wide, project based, and data-driven. By prioritizing reduction of embodied carbon, through the use of less and/or less impactful structural materials, participating firms can more easily work toward net zero embodied carbon structural systems by 2050.

From: NCSEA presentation May 2021 “Sustainable Design & Embodied Carbon: What Structural Engineers Need to Know”
What is an EPD?

• “An EPD communicates verifiable, accurate, non-misleading environmental information for products and their applications” (www.sphera.com)

• “An Environmental Product Declaration, or EPD, is a document which transparently communicates the environmental performance or impact of any product or material over its lifetime” (www.oneclicklca.com)

• Intended to be a mechanism for simple presentation of results of an LCA on a material, product or system

• EPDs may be industry-wide or facility-specific
What is an EPD?

Source: USGBC
What is an EPD?

The United States structural steel industry annually supplies, fabricates and erects structural steel framing for more than 10,000 buildings, bridges and industrial projects through a network of producers, service centers, steel fabricators and erectors.

The National Steel Bridge Alliance, a division of the American Institute of Steel Construction (AISC), is a national, not-for-profit organization dedicated to advancing steel bridge design and construction. NSBA is a unified industry organization of businesses and agencies interested in the development, construction and promotion of cost-effective steel bridges. We represent the entire steel bridge community.

Long committed to the principles of sustainable manufacturing, the industry remains the world leader in the use of recycled materials and end-of-life recycling, with the recycled content of steel plate produced at US mills averaging in excess of 80% and an end-of-life recovery rate of 98%.
Steel Recycling

• Steel can be recycled across multiple applications
  o Steel is the most recycled material on the planet
  o A steel beam can become another steel beam, or a refrigerator, car door, or roof panel
  o 60 to 80 million tons of steel scrap are recycled annually in the U.S., with over 1 billion tons recycled in the last 30 years
  o Some steel construction products, such as structural sections and rebar, are typically produced from over 90% recycled steel
Steel Recycling Rates

The overall 3-year average recycling rate for 2019 was 69%, while the 10-year rate has been 71%-75% since 2011.
# Steel Recycling Rates

**Sector Recycling Rates (2019):**

<table>
<thead>
<tr>
<th>Category</th>
<th>Recycling Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction, structural sections</td>
<td>97%</td>
</tr>
<tr>
<td>Construction, rebar</td>
<td>59%</td>
</tr>
<tr>
<td>Construction, other</td>
<td>68%</td>
</tr>
<tr>
<td>*Construction, general</td>
<td>74%</td>
</tr>
<tr>
<td>Automotive</td>
<td>96%</td>
</tr>
<tr>
<td>Appliances</td>
<td>78%</td>
</tr>
<tr>
<td>Containers</td>
<td>62%</td>
</tr>
<tr>
<td>Misc./Other</td>
<td>46%</td>
</tr>
</tbody>
</table>

*This category is a weighted average of the previous three construction sector categories.*
Summary

• The American steel industry leads the world in terms of low carbon emissions intensity steel production

• The American steel industry continues to reduce its greenhouse gas intensity in response to numerous drivers

• Design and construction of bridges will undoubtedly be affected by sustainability initiatives in the near future

• “Embodied GHG emissions intensity” is the likely basis for any sustainability requirements

• EPDs for steel bridge components (“industry average” or “facility-specific”) will eventually be needed to demonstrate compliance
Life Cycle Inventory (LCI) Data Collection Project

- Important data for any EPD study that includes steel. Products included:
  - Hot rolled coil (HRC)
  - Cold rolled coil (CRC)
  - Hot-dip galvanized coil (HDG)
  - Plate
  - Structural sections
- New data now being collected
  - Based on 2021 data year
  - Results expected early 2023
Documents Available at www.steel.org

SUSTAINABILITY IN STEELMAKING

Steel in the EnviroMetal™. Producing a ton of steel today in North America requires less than half the energy that was needed to produce a ton of steel 40 years ago, resulting in a 58 percent reduction in greenhouse gas (GHG) emissions. This means that a single ton of steel produced today, compared to 1980, would save the GHG emissions equivalent to driving a car for 2,000 miles. The American steel

SUSTAINABILITY IN STEEL RECYCLING

Steel is 100 percent recyclable, which means it can be recycled into the same material of the same quality again and again. A steel beam can become another steel beam, or a refrigerator, car door or roof panel. When you buy steel you are buying recycled. In addition to being continually recyclable, steel's durable characteristics enable many common products to be reused.

STEEL SUSTAINABILITY IN THE CONSTRUCTION MARKET

The National Institute of Standards and Technology notes that “steel has become one of the most reliable, most used and most important materials of the age.” As an advanced-engineered material, steel is the material of choice by engineers and architects because of its strong performance characteristics, durability, reliability, versatility in design and consistency as a product.

STEEL SUSTAINABILITY IN THE AUTO MARKET

The North American steel industry continues to work to develop revolutionary new, advanced steel products for the automotive sector. Advanced high strength steels (AHSS) help auto manufacturers to reduce the mass of vehicles while maintaining safety standards — thereby increasing fuel economy and reducing tailpipe emissions. The use of current grades of AHSS can reduce a vehicle’s structural
Thank You / For More Information

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