

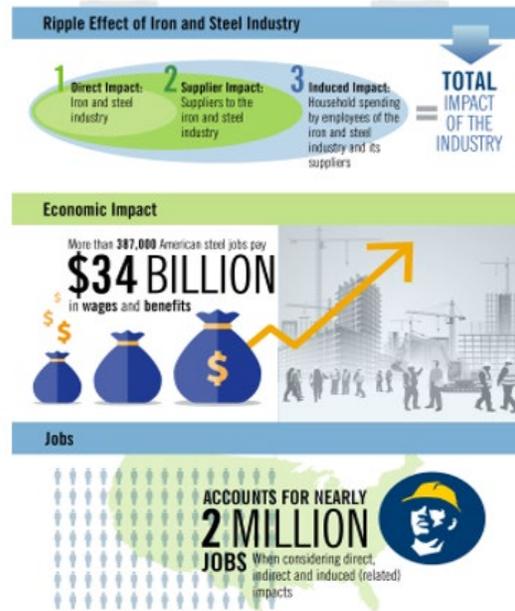
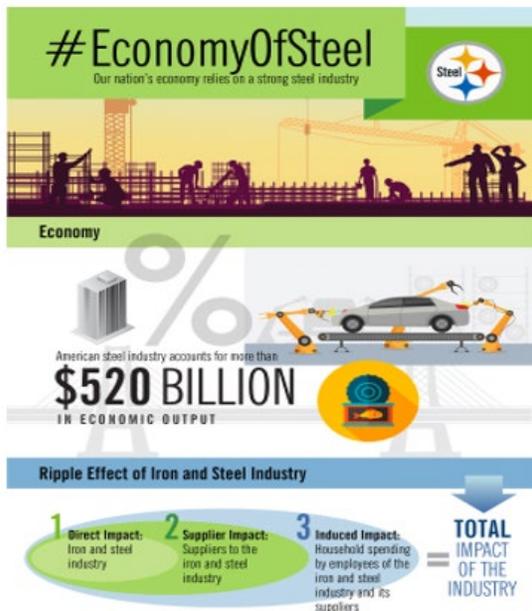


## SUSTAINABILITY OF THE AMERICAN STEEL INDUSTRY

Steel's attributes, including its inherent durability and recyclability, make it vital to modern society. The American steel industry is committed to manufacturing innovative products and implementing processes that achieve environmental, social and economic sustainability. The American steel industry is the cleanest and most energy-efficient of the seven largest steel producing countries in the world.<sup>1</sup>

### VITAL TO THE U.S. ECONOMY

The American iron and steel industry is a dynamic part of the U.S. economy, accounting for more than \$520 billion in economic output and nearly two million jobs.<sup>2</sup> These workers earned more than \$130 billion in wages and benefits, and the industry generated \$56 billion in federal, state and local taxes.



## LEADERSHIP IN RECYCLING

Steel is the most recycled material on the planet<sup>3</sup> and steel products are 100 percent recyclable at the end of their useful lives. Once produced, steel can be continually recycled into new steel products without any deterioration in product quality – a steel beam can become another steel beam, or a refrigerator, car door or roof panel.



In the U.S. alone, there are typically 60 to 80 million tons of steel scrap recycled per year into new steel products.<sup>4</sup> <sup>5</sup>In the past 30 years, more than one billion tons of steel scrap have been recycled into new steel

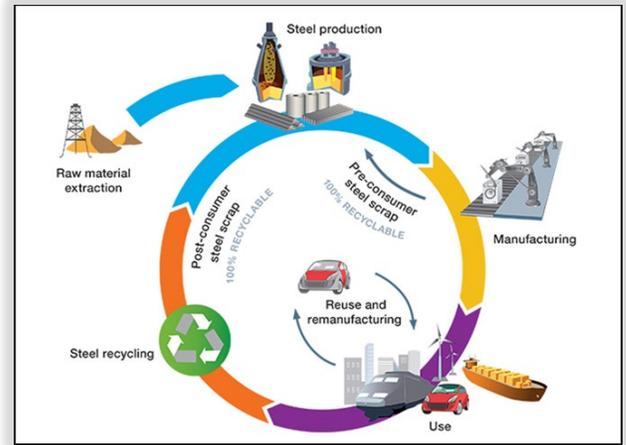
by the American steel industry. The U.S. recycles enough steel scrap to build 25 Eiffel Towers every day of the year,<sup>6</sup> and annually recycles enough steel scrap to build more than 650 Golden Gate Bridges.<sup>7</sup>

In addition:

- Recycling steel from a single car reduces greenhouse gas (GHG) emissions equivalent to consuming more than 300 gallons of gasoline.<sup>8</sup>
- Each year, the steel industry recycles steel from about 12 million appliances.<sup>9</sup>
- Recycling a single refrigerator reduces the equivalent GHG emissions by 225 pounds of CO<sub>2</sub>.<sup>10</sup>
- Recycling one steel food can conserves enough energy to light a 60-watt light bulb for more than four hours.<sup>11</sup>

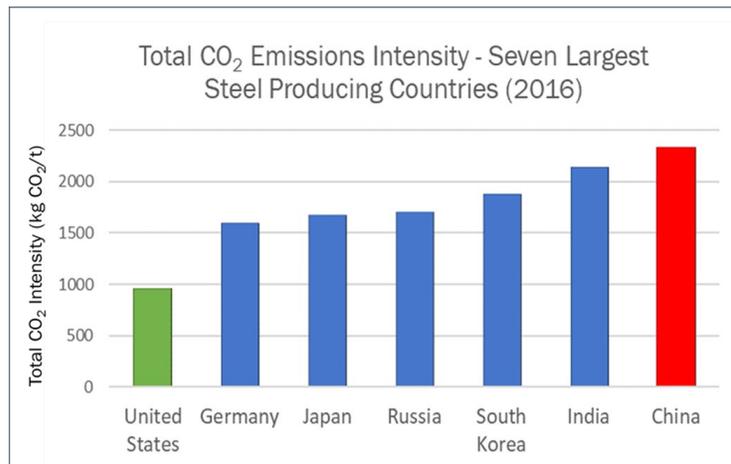
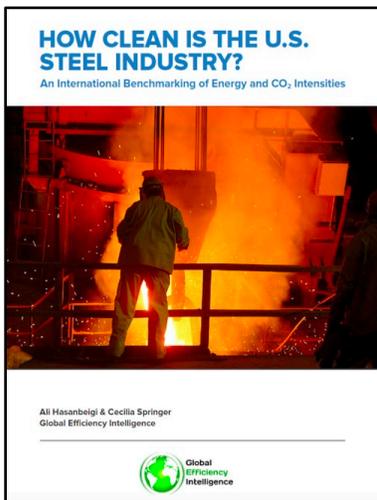
With today's sorting and separating technology, millions of tons of iron and steel are diverted from landfills to recycling and beneficial re-use. Nearly 100 percent of the steel industry's co-products can be used beneficially<sup>12</sup> in other applications. Slag is used in cement, road construction, fertilizers, and hydraulic engineering. Process gases are used to produce heat and/or electricity. Metal oxides, such as iron oxides, nickel and zinc, can be recovered from steelmaking dust.

**Steel in the circular economy:** Steel’s inherent durability and recyclability make it an ideal fit for the circular economy. Once produced, steel becomes a permanent resource that can be continuously recycled into new steel. And, as all steel contains recycled content and is 100 percent recyclable at end of life, steel products are conducive to reuse and remanufacturing. These characteristics of steel make it an ideal material for the circular economy.

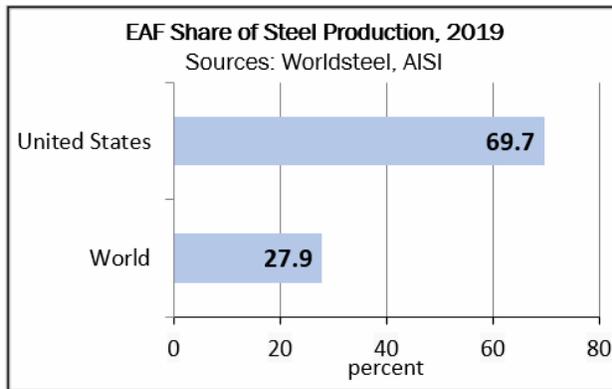


### AMERICAN CLEAN STEEL PRODUCTION VS. OTHER REGIONS

The American steel industry is the cleanest and most energy-efficient of the leading steel industries in the world. Of the seven largest steel producing countries, the U.S. has the lowest CO<sub>2</sub> emissions per ton of steel produced and the lowest energy intensity.<sup>13</sup> By contrast, Chinese steel production creates CO<sub>2</sub> emissions that are almost 2.5 times higher – and uses 50 percent more energy compared to the U.S. – per ton of steel produced.<sup>14</sup>



*Adapted from: Hasanbeigi and Springer, “How Clean is the U.S. Steel Industry?” Global Efficiency Intelligence, 2019.*



U.S. steelmaking GHG emissions are lower than the other major producing countries for several reasons:

**Lower process emissions:** The U.S. produces a higher percentage of its steel from electric arc furnaces (EAF) than most other regions, resulting in lower process emissions of CO<sub>2</sub> from steelmaking. Seventy percent of American steel is

produced this way – recycling steel scrap to produce new steel using electricity. Steel that is produced by blast furnace and basic oxygen furnace (BF/BOF) technology in the United States has the lowest CO<sub>2</sub> intensity of steel produced via BF/BOF in the seven largest steel producing countries. The American steel industry also uses a much higher percentage of low-emitting natural gas in our mills than most other countries.

**Iron pellets vs. sinter:** Integrated steel mills in the United States that employ BF/BOF technologies are almost entirely fed by domestically sourced iron ore pellets – in contrast to a reliance on lower-quality sintered iron used in China and elsewhere – resulting in lower emissions of CO<sub>2</sub>, as well as NO<sub>x</sub>, SO<sub>2</sub> and particulate matter.<sup>15</sup>



**China/U.S. comparisons for specific steel products:** A recent study demonstrated that the GHG emissions resulting from Chinese production of hot-rolled structural sections were three times greater than the production of the same structural sections in the U.S.<sup>16</sup> Another recent study demonstrated that the GHG emissions per ton of hot-dip galvanized (HDG) coil produced in China were nearly 50 percent higher than the emissions from the same HDG coil produced in the U.S.<sup>17</sup>

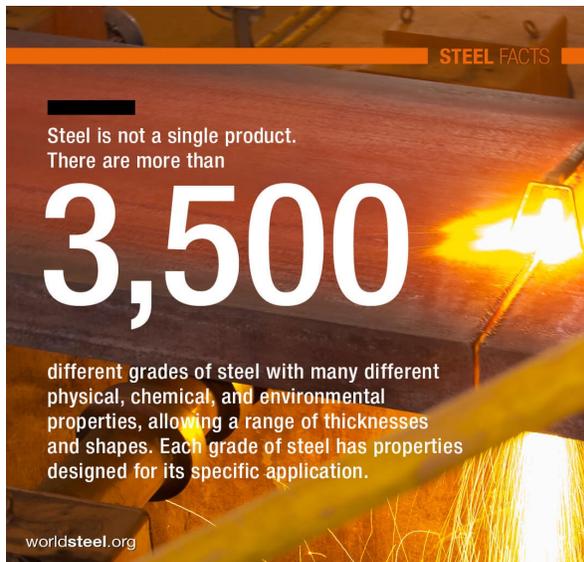
**Renewable energy and technology advancements:** Work is underway on additional projects to further enhance the sustainability of American steel industry operations, including: increased use of renewable energy in steel production, and advancements in domestic production using direct reduced iron (DRI) and hot briquetted iron (HBI) in place of pig iron in both integrated and EAF steelmaking. HBI and DRI use natural gas as a reductant which will further increase blast furnace and electric arc furnace productivity and reduce CO<sub>2</sub> emissions.<sup>18</sup>

America's electrical grid also has a low CO<sub>2</sub> intensity compared to many other countries. According to the Energy Information Administration, the electricity grid was 19 percent coal-based in the U.S. in 2020,<sup>19</sup> whereas China relied on coal for 58 percent of its electricity generation.<sup>20</sup> Coal-based electricity has a significantly higher CO<sub>2</sub> emissions profile compared to other fuel sources.<sup>21</sup>

Steel producers in the U.S. have announced projects that employ renewable energy to supply all or most of a facility’s energy requirements, and additional research is underway to assess the use of carbon capture technology in the steelmaking process.<sup>22</sup> As a result of these and other advancements in steelmaking and energy efficiency, the steel industry in the United States has reduced its energy intensity by 35 percent and CO<sub>2</sub> emissions intensity by 37 percent per ton of steel shipped since 1990.<sup>23</sup> And EPA data indicates that the production of iron, steel and metallurgical coke in the U.S. amounted to less than one percent of national CO<sub>2</sub> emissions, compared to the global scale of total CO<sub>2</sub> emissions from steel – which is nearly seven percent.<sup>24</sup> Additionally, industry innovations will continue to decrease the CO<sub>2</sub> intensity of steel produced in the U.S.

## STEEL INDUSTRY INNOVATION TO MEET CUSTOMER SUSTAINABILITY NEEDS

There are more than 3,500 steel grades available today, and approximately 75 percent of these modern steels have been developed in the past 20 years.<sup>25</sup> These products can help reduce energy consumption and CO<sub>2</sub> emissions throughout the economy.



STEEL FACTS

Steel is not a single product.  
There are more than

# 3,500

different grades of steel with many different physical, chemical, and environmental properties, allowing a range of thicknesses and shapes. Each grade of steel has properties designed for its specific application.

worldsteel.org



STEEL FACTS

Over

# 75%

of the 3,500 steel grades in use today did not exist 20 years ago.

worldsteel.org



**Steel provides solutions:** Steel is a critical component in the continued development of clean energy and technologies to reduce America’s carbon footprint. Wind, solar and tidal renewable energy systems all depend on steel. Stainless steel is vital to industries like solar power, biofuels, wind energy, green construction, low-carbon transportation, sea-water purification and surgical equipment.

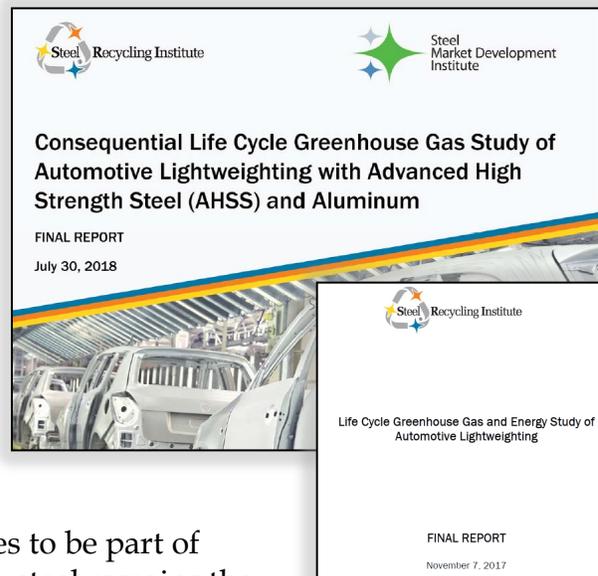


Electrical steels are at the core of the electrical grid, and we continue innovating and producing more efficient electrical steels to power the technologies of today. And advanced high-strength steels (AHSS) help auto manufacturers reduce vehicle mass, thus increasing fuel-efficiency, cost-efficiency and reducing tailpipe emissions.

**Automotive applications:** AHSS helps auto manufacturers to reduce the mass of vehicles while maintaining safety standards, thereby increasing fuel economy and reducing tailpipe emissions. Steel’s superior sustainability performance minimizes environmental impact when measured through the entire life cycle.

An AISI peer-reviewed study demonstrates the use of AHSS for automotive lightweighting results in an immediate and sustained decrease in GHG emissions, whereas the use of aluminum for lightweighting the same vehicle fleet results in a dramatic increase in overall GHG emissions lasting for several decades.<sup>26</sup>

As the move toward electric vehicles continues to be part of many automakers’ future sustainability plans, steel remains the preferred material for battery pack protection due to its inherent strength. Thinner advanced grades of steel also enable optimization of space allowing for packaging of more batteries, which means traveling farther on a single battery charge.





**Construction applications:** Steel has a vital role in infrastructure through replacement and new construction of bridges, roadways, guiderails and utility structures. Infrastructure also includes the energy grid, energy development and transmission, water infrastructure and public safety – all of which use steel.

Steel for short span bridges is lighter than other materials and can provide a savings of up to 25 percent in total superstructure costs, partially due to the fact that heavier equipment may not be needed to set the girders. For example, the American steel industry is leading the development of new technologies like press-brake-formed steel tub girder bridges. This technology provides significant savings in construction costs and can provide an expected life service of more than 100 years – and the girders can be installed in 22 minutes.<sup>27</sup>



Structural steel produced in North America typically contains 90 percent or more recycled steel.<sup>28</sup> Steel framing itself contains a minimum of 25 percent recycled steel<sup>29</sup> and is continually recyclable. Steel utility poles are approximately 50 percent lighter than wood,<sup>30</sup> reducing transportation costs and making them easier to handle on the job site. ENERGY-STAR-qualified metal roof products can lower roof temperatures

significantly, thereby reducing a building's peak cooling demand.<sup>31</sup>

## STEEL vs. WOOD



Steel is a permanent resource able to be continually recycled into any steel product for generations



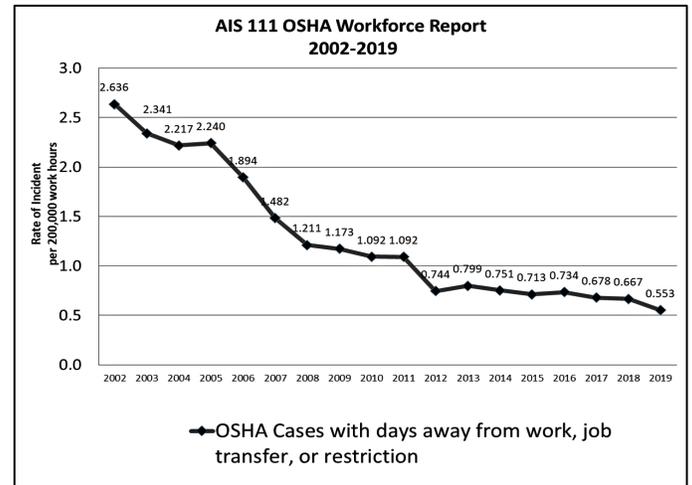
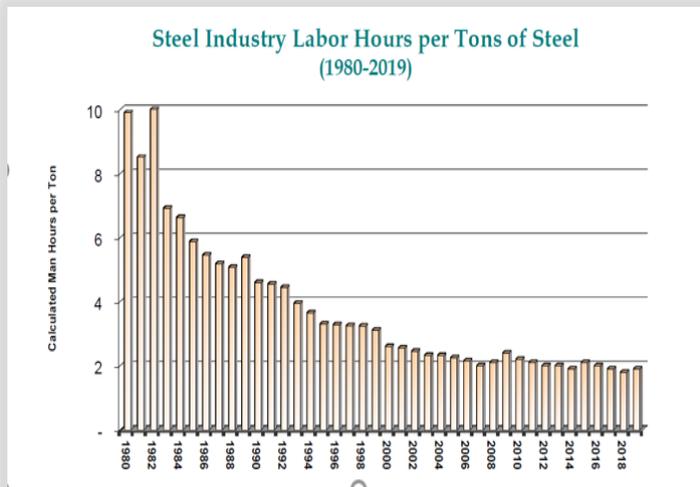
Wood construction products are typically single-use, and can only be downcycled into products like mulch, or burned, returning any stored CO<sub>2</sub> to the atmosphere at end of life

As a building material, steel also meets sustainability requirements in standards such as the International Green Construction Code and in green building rating systems like U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design

(LEED), where steel products can help earn points toward LEED v4 and v4.1 certification.<sup>32</sup> Industry-wide environmental product declarations (EPDs)<sup>33</sup> are available for most steel construction products, allowing designers to select steel and fully understand its environmental impacts and benefits.

## SAFETY AND PRODUCTIVITY – MAKING STRIDES TO INCREASE EFFICIENCY

The American steel industry is committed to strong safety standards and has reduced workplace incidents significantly over time. Even as worker safety improved dramatically, the steel industry has seen a five-fold increase in workforce productivity since the early 1980s – going from an average of 10.1 worker-hours per finished ton of steel to an average of 1.9 worker-hours today, and in some cases under one worker-hour.



Source: AISI Annual Statistical Report and U.S. Bureau of Labor Statistics

## POLICIES MUST ENHANCE STEEL INDUSTRY COMPETITIVENESS

Government policies should promote the American steel industry’s competitiveness to facilitate its role in reducing CO<sub>2</sub> emissions while minimizing negative impacts on domestic production and employment. Environmental and climate policies should not place undue costs on the operations of domestic steel producers that are not borne by international competitors. This will ensure that the production of steel is not shifted to areas of the world with higher levels of energy use and negative environmental impacts.

In particular, the steel industry supports the establishment of a strong and effective border adjustment mechanism so that imported energy-intensive goods bear the same climate-related costs as competing U.S.-made goods. This is essential to ensuring that any CO<sub>2</sub> reduction policies actually reduce overall global emissions, thereby avoiding what is known as “carbon leakage.”

## THE PILLARS OF STEEL SUSTAINABILITY

ENVIRONMENTAL	SOCIAL	ECONOMIC
<ul style="list-style-type: none"> <li>Most recycled material in the world</li> <li>Cleanest among the seven largest steel-producing countries</li> <li>Nearly 100 percent of co-products beneficially used</li> <li>Lowest level of CO<sub>2</sub> emissions per ton of steel produced due to:                             <ul style="list-style-type: none"> <li>- Production of more steel from EAFs</li> <li>- Integrated mills use pelletized iron vs. the lower quality sintered iron used elsewhere</li> <li>- Increasingly using natural gas-based DRI and HBI as a replacement for pig iron</li> </ul> </li> <li>Implementing energy efficiency projects</li> </ul>	<ul style="list-style-type: none"> <li>Supports nearly two million jobs</li> <li>Strongest safety standards and reduced workplace incidents, while attaining five-fold increase in workforce productivity</li> <li>More than 3,500 steel grades reduce energy consumption</li> <li>Inherent durability and recyclability make steel vital to modern society</li> </ul>	<ul style="list-style-type: none"> <li>\$520 billion output</li> <li>Innovation meets customer needs</li> <li>Enables the production of lighter weight vehicles with better fuel efficiency</li> <li>Allows the construction of more efficient steel bridges and buildings using less material, resulting in lower overall CO<sub>2</sub> emissions</li> </ul>

***Learn more about the American steel industry and its sustainability at:  
@AISISteel and @EnviroMetal***



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## ENDNOTES

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