PA MEP
PENNSYLVANIA MANUFACTURING
EXTENSION PARTNERSHIP

Primary Metal Manufacturing Industry Landscape Report

Primary Metal Manufacturing: NAICS 331

DVIRCA
REIMAGINE MANUFACTURING

Helping Manufacturers Grow Profitably Since 1988

Contents

Primary Metals

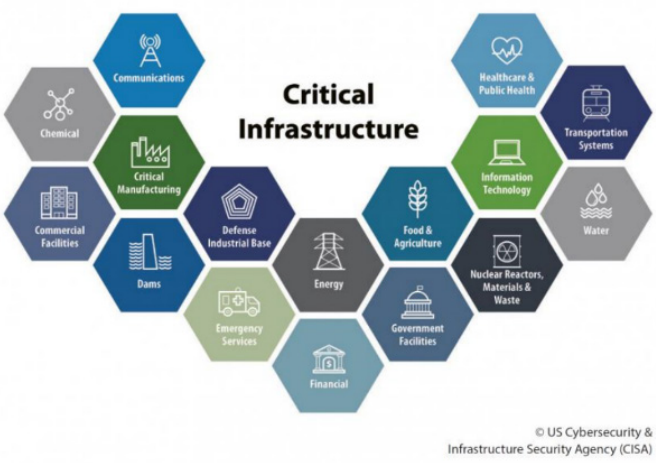
North American Industry Classification System (NAICS) code 331 represents the Primary Metal Manufacturing subsector, a vital segment encompassing operations dedicated to the smelting and refining of both ferrous and nonferrous metals.

These metals are sourced from a variety of materials, including ores, pig iron, and scrap, with their transformation facilitated through diverse metallurgical techniques, including electrometallurgical processes. Furthermore, establishments falling under this subsector engage in the manufacturing of metal alloys and superalloys, accomplished by introducing specific chemical elements into pure metals. The resulting products, typically in the form of ingots, serve as essential raw materials in subsequent manufacturing processes such as rolling, drawing, extruding, and casting.[1]

The Primary Metal Manufacturing subsector is foundational to various industries as it contributes to the production of a wide range of metal products, including sheets, strips, bars, rods, wires, and castings. Involved in the production of raw metal materials such as steel, aluminum, copper, and brass, the industry's output serves as foundational inputs for various critical infrastructure sectors, including critical manufacturing, defense industrial base, and others depicted in the image below.[2] The interdependence between the Primary Metal Manufacturing industry and other critical manufacturing sectors is evident, as the industry's intermediate and final products are essential for fabricating finished metal products crucial for both defense and commercial applications. Primary metals and the fabricated products that are created from them are a crucial component of U.S. military strength, with product applications in missiles, aircraft, submarines, and munitions.

Moreover, the Primary Metal Manufacturing industry intersects with lifeline functions, particularly in the areas of energy, water, and communications.[3] The energy-intensive nature of metal manufacturing highlights its reliance on energy resources. Industrial water is essential for cooling, lubricating, and debris removal in the metal production process. Additionally, the industry heavily relies on communications networks, with the Communications Sector serving as a vital resource for telecommunications access in operations, logistics, and emergency notification and response.

Furthermore, the Primary Metal Manufacturing industry is intricately connected to various supply chain functions, including transportation systems, information technology (IT), and chemicals.[4] Transportation modes such as aviation, rail, highway, and maritime are indispensable for the global movement of large metal materials and products. IT plays a critical role in the industry's manufacturing operations, transit, quality control, critical processes, and facility security. Chemicals, including lubricants, coolants, coatings, and other materials, are integral to the metal manufacturing process, and any delay in the chemical supply could impact production within the realm of critical manufacturing. These interdependencies emphasize the Primary Metal Manufacturing industry's significance in supporting and sustaining the broader critical infrastructure landscape in the United States.

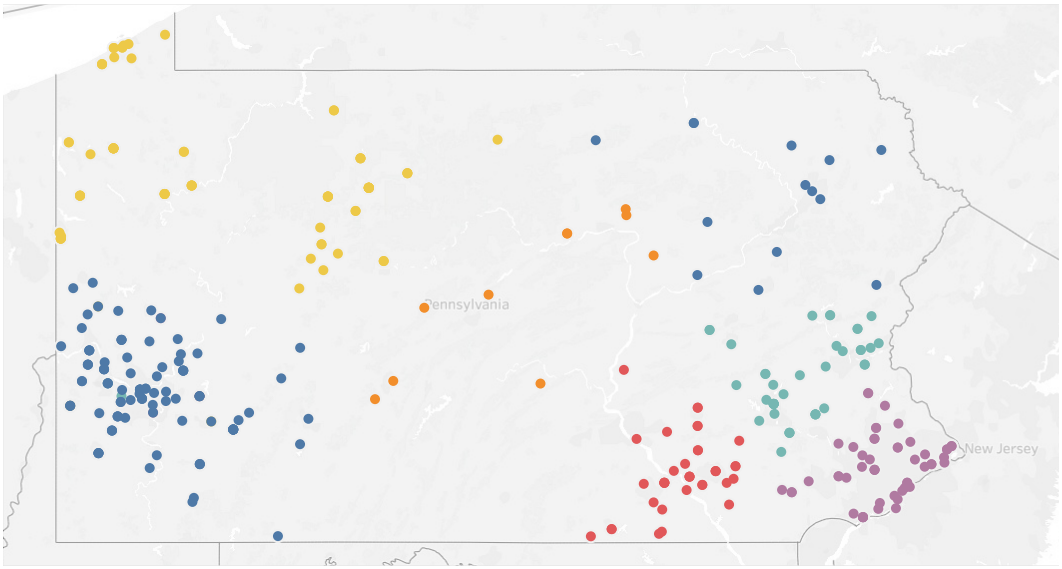


This report will cover primary metals activity throughout the state and segmented by the seven Industrial Resource Center's (IRC's) geographical territories. The IRCs are a network of seven private, nonprofits located strategically throughout the state that works with manufacturers to respond to changing market conditions, adopt new technology, and on creating strategies to remain competitive in today's global economy. IRCs play a crucial role in supporting the U.S. defense sector by providing expertise and assistance to enhance the security, resilience, and functioning of critical infrastructure sectors in Pennsylvania. PA MEP comprises of seven centers represented in the list below.

- **Catalyst Connection:** Serving Lawrence, Beaver, Washington, Greene, Fayette, Somerset, Cambria, Indiana, Armstrong, Butler, Allegheny, and Westmoreland counties.
- **Delaware Valley Industrial Resource Center (DVIRC):** Serving Chester, Montgomery, Delaware, Philadelphia, and Bucks counties.
- **Innovative Manufacturing Center (IMC):** Serving Lycoming, Montour, Northumberland, Union, Snyder, Clinton, Centre, Mifflin, Juniata, Huntingdon, Blair, and Bedford counties.
- **MANTEC:** Serving Adams, Cumberland, Dauphin, Franklin, Fulton, Lancaster, Lebanon, Perry and York counties.
- **Manufacturers Resource Center (MRC):** Serving Lehigh, Berks, Carbon, Schuylkill, and Northampton counties.
- **Northeastern PA Industrial Resource Center (NEPIRC):** Serving Tioga, Bradford, Sullivan, Columbia, Luzerne, Wyoming, Susquehanna, Lackawanna, Wayne, Pike, and Monroe counties.
- **Northwest Industrial Resource Center (NWIRC):** Serving Erie, Crawford, Mercer, Venango, Warren, Forest, Clarion, McKean, Elk, Jefferson, Clearfield, Cameron, and Potter counties.

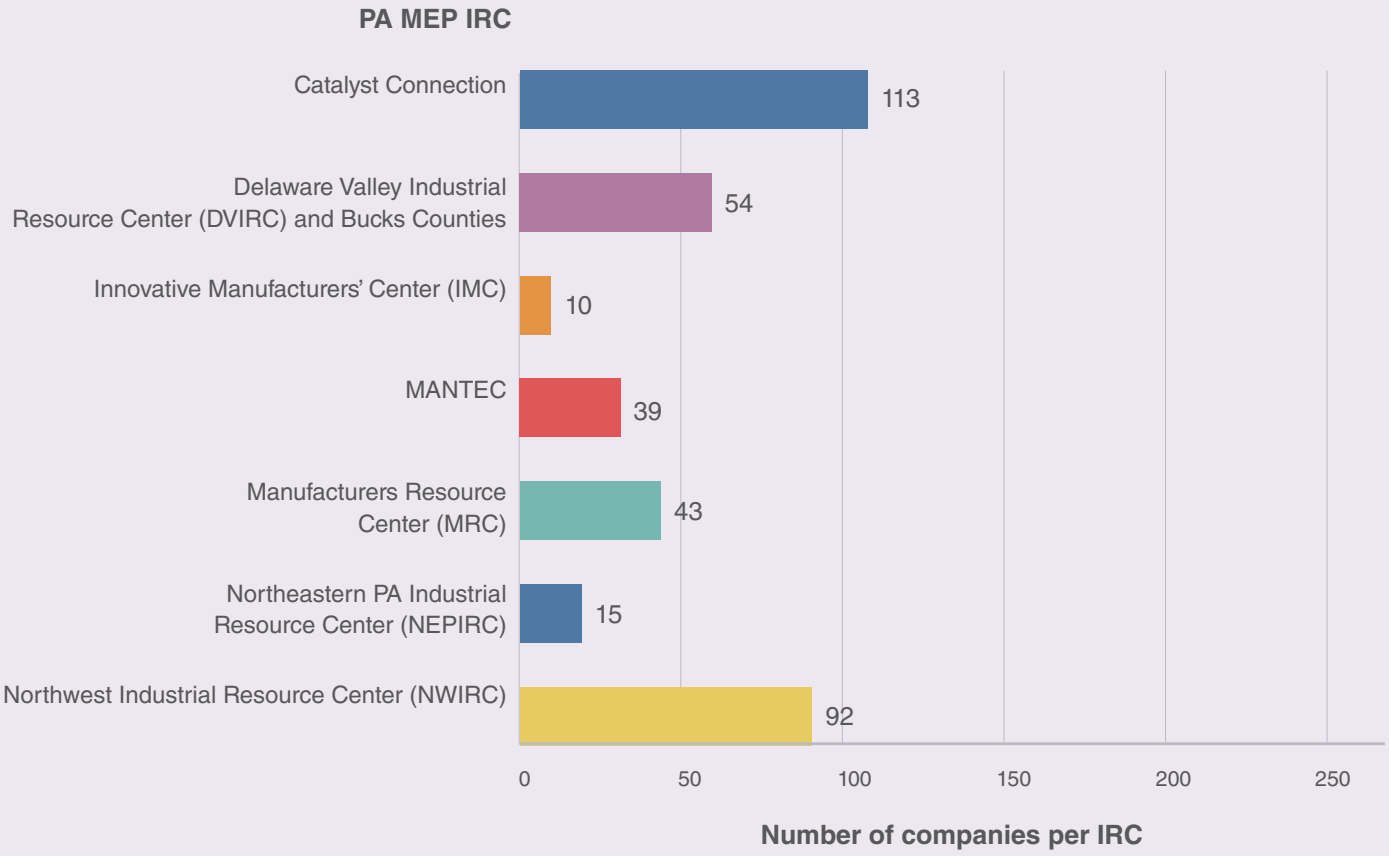
Primary Metals (continued)

PA Primary Metal Segmented by IRC



PA IRC Center

- Catalyst Connection
- Delaware Valley Industrial Resource Center (DVIRC) and Bucks County
- Innovative Manufacturers' Center (IMC)
- MANTEC
- Manufacturers Resource Center (MRC)
- Northeastern PA Industrial Resource Center (NEPIRC)
- Northwest Industrial Resource Center (NWIRC)



Primary Metal Manufacturing (NAICS 331) Landscape

Industry Summary

Primary metal manufacturing is vital to the strength of Pennsylvania's economy, with **over 400 total entities** in operation.

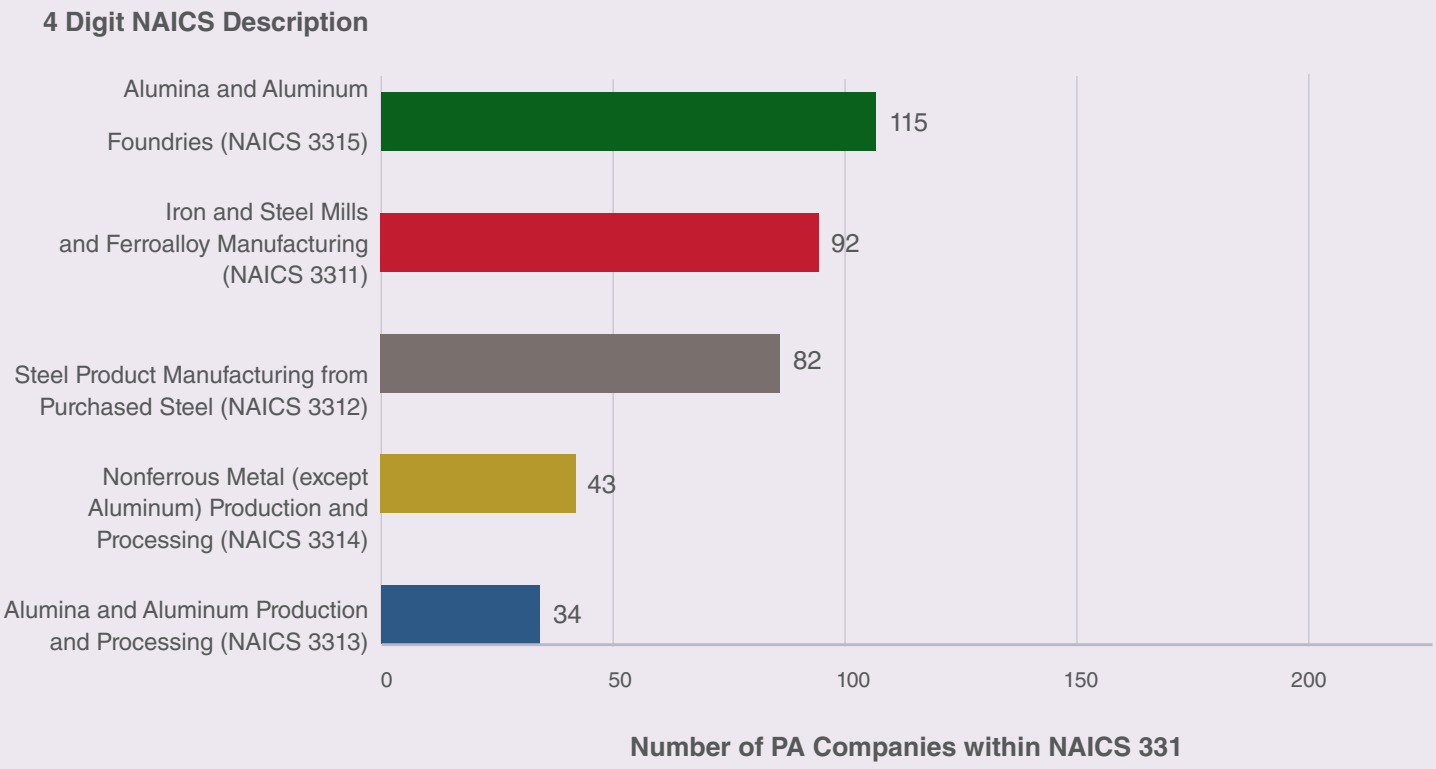
- **Pennsylvania exported over $4 billion worth of Primary Metal products in 2022**, accounting for 8.3% of exports within the state and 4.7% nationally.[5]
- Supply chain resilience was critical as reshoring efforts accelerated by COVID-19 forced industries to shift their supply chains to domestic.[6]
- Pennsylvania is the **3rd highest grossing** state in this industry, behind only Indiana and Ohio.[7]
- Pennsylvania steel is particularly dominant, creating $20 billion in value added towards Pennsylvania's Gross State Product making PA the second highest grossing state, behind only Indiana, with 16.3% of national revenue.[8]
- Primary metal manufacturing is the largest contributor towards Pennsylvania's economic output, accounting for $33.1 billion of the total $55.3 billion total state economic output.[9]

The Primary Metals sector is represented by the 9 subsectors as listed in the table below.

Extended NAICS Codes: 331

33111	Iron and Steel Manufacturing
33121	Metal Pipe and Tube Manufacturing
33122	Steel Rolling and Drawing
33131	Aluminum Manufacturing
33141	Nonferrous Metal Refining
33142	Copper Rolling, Drawing, and Extruding
33149	Nonferrous Metal Rolling and Alloying
33151	Ferrous Metal Foundry Products
33152	Nonferrous Metal Foundry Products

PA NAICS 331 Segmented by Description



Industry Demographics

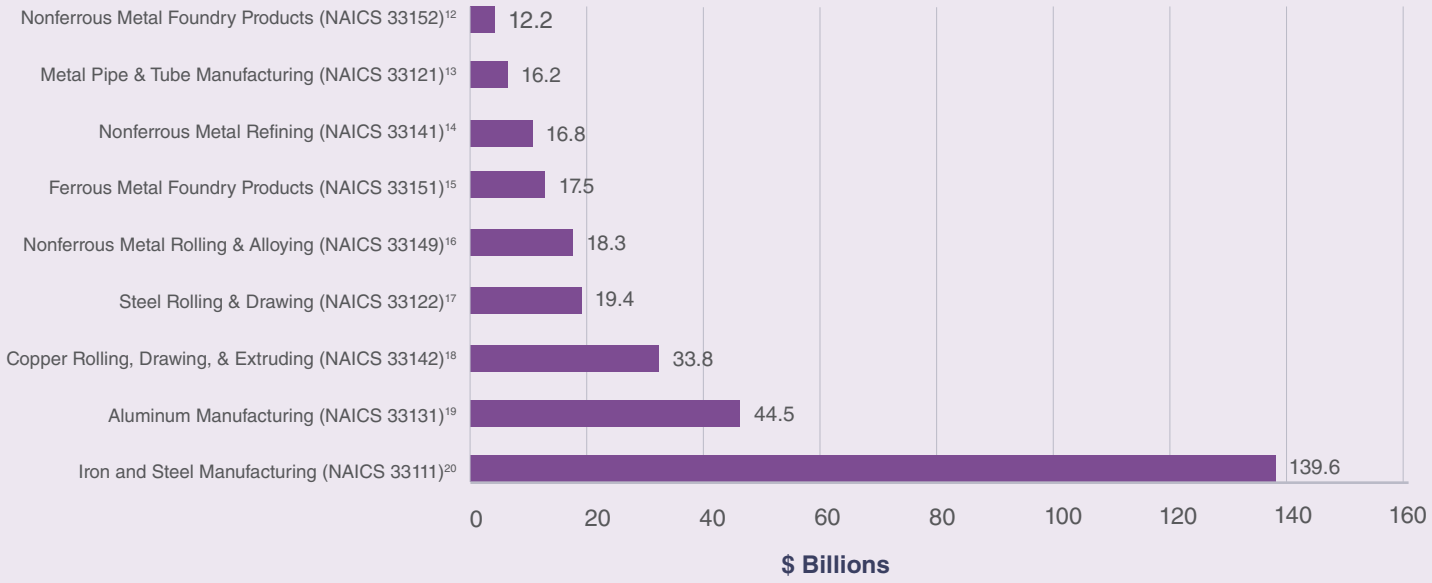
This section provides demographics of the Primary Metal Manufacturing sector, including takeaways such as market size, revenue distribution across segments, establishment statistics, and critical market trends shaping the landscape. The exploration extends to industry profits, drivers, and the influence of external factors, providing a holistic perspective on the current state and future trajectory of the industry.

Primary Metal Manufacturing (331) PA Gross State Product: $8.09 billion (2022)[10]

Primary Metal Manufacturing (331) U.S. Gross Domestic Product: $91.76 billion (2022)[11]

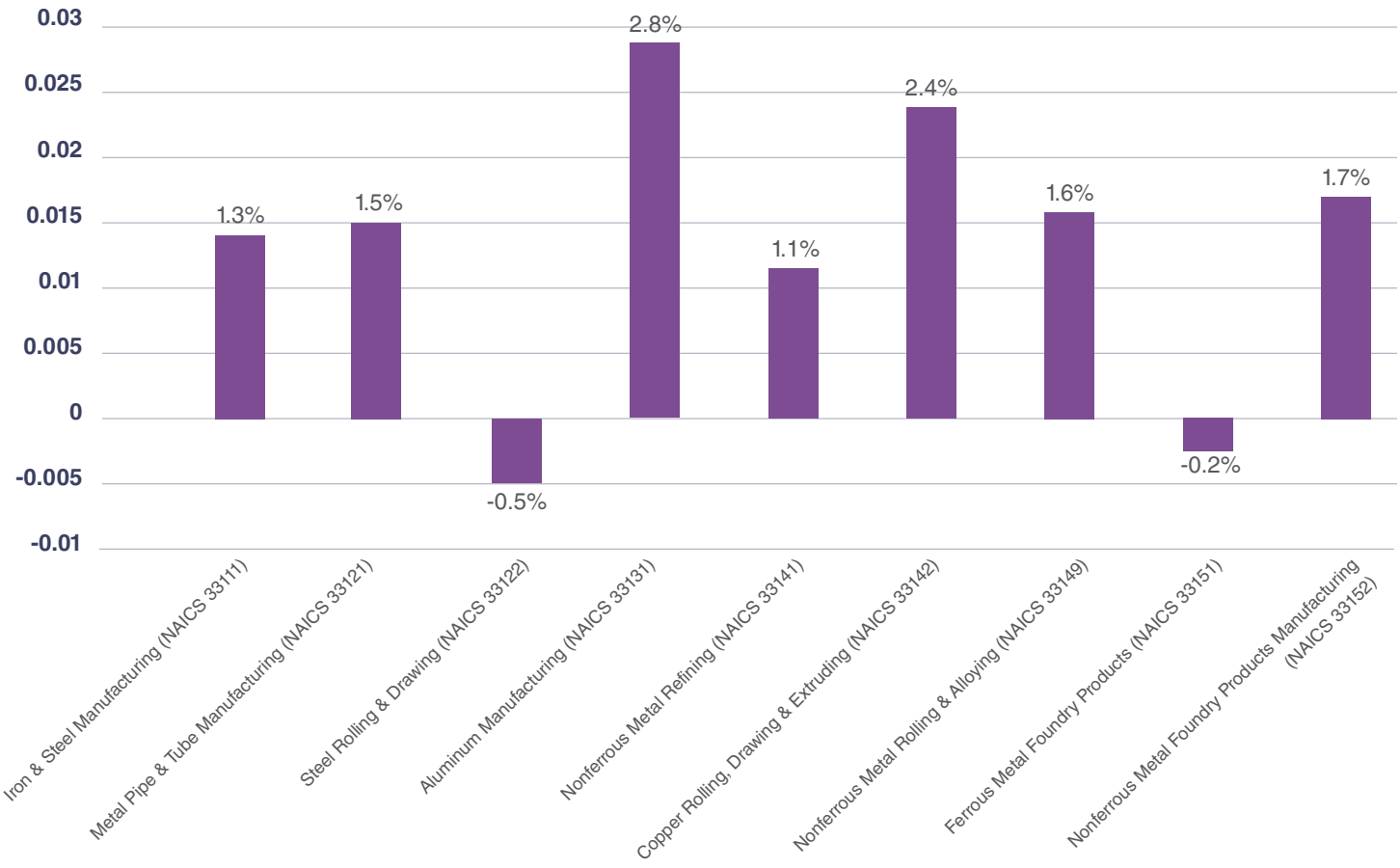
*Compound Annual Growth Rate (CAGR) provides a smoothed estimate of growth over a specific period of time, accounting for year-by-year fluctuations and compounding effects, to provide a longer-term outlook for an industry.

Pennsylvania Industry Revenue by Segment

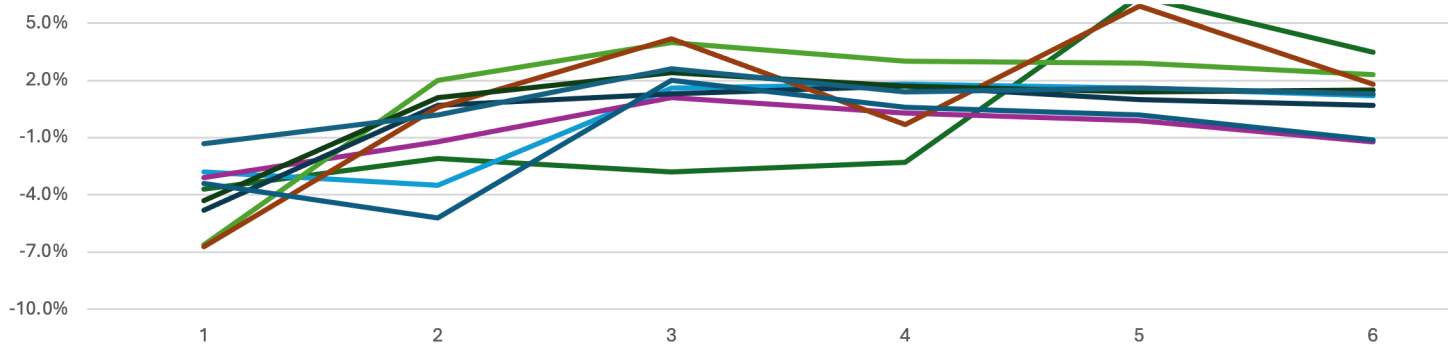


Industry Demographics (continued)

Growth Rate (2023-2029)



Revenue Growth (2023-2028)

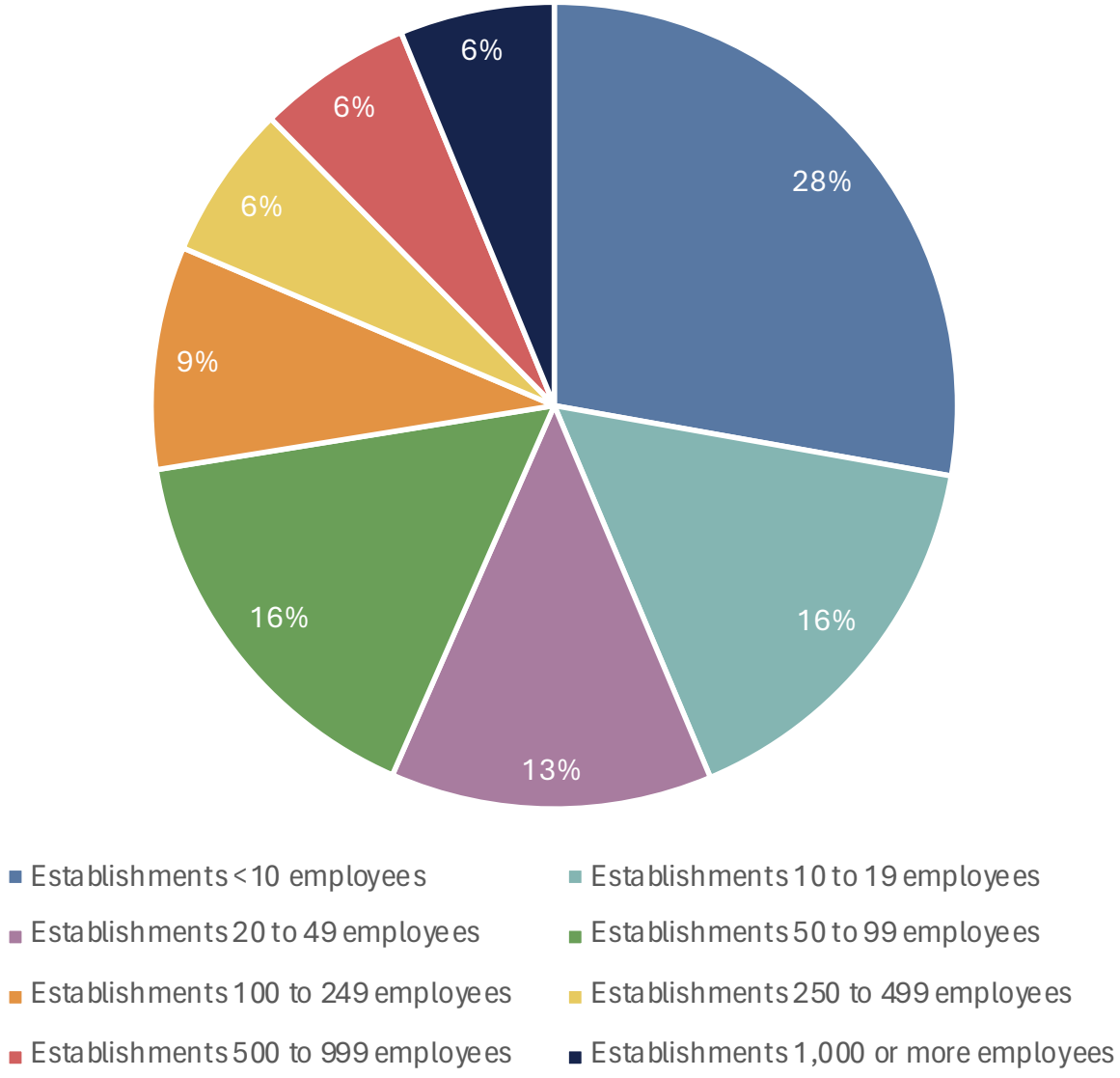


- Primary Metals (NAICS 331)
- Iron & Steel Manufacturing (NAICS 33111)
- Metal Pipe & Tube Manufacturing (NAICS 33121)
- Steel Rolling & Drawing (NAICS 33122)
- Aluminum Manufacturing (NAICS 33131)
- Nonferrous Metal Refining (NAICS 33141)
- Copper Rolling, Drawing & Extruding (NAICS 33142)
- Nonferrous Metal Rolling & Alloying (NAICS 33149)
- Ferrous Metal Foundry Products (NAICS 33151)
- Nonferrous Metal Foundry Products Manufacturing (NAICS 33152)

Industry Demographics (continued)

PA Employee Distribution by Establishment Size

As of 2021, there were **31,729** total employees in the Primary Metal Product Manufacturing industry in PA. This figure can be segmented by the establishment size of each worker's employer:



Industry Demographics (continued)

Key Industry Trends

Workforce Trends

- U.S.
  - Labor productivity index (output per hour) – 3.5% annual decrease in 2023.[21]
  - Labor index (total labor hours) – 2.3% annual increase in 2023.[22]
  - Output index – 1.3% annual decrease in 2023.[23]
  - The number of jobs in the industry is projected to decline nationally by 7.9% from 2022 to 2032.[24]
- Pennsylvania
  - 7.5% decline in employment from 2019 to 2022.[25]
  - 15.3% increase in average wages per worker from 2019 to 2022.[26]

External Market Forces

- The barriers to enter the primary metal industry will remain high through 2029 as tariffs continue to discourage international sales and environmental regulations, such as the Clean Air Act and recycling responsibilities, remain stringent.
- Aerospace, construction, and automotive industries directly correlate to the primary metals industry; when these aforementioned industries experience an uptick in sales, primary metals benefits. The opposite holds true as well.[27]

Innovations in Technology

- Industry 4.0– the revolution in manufacturing that refers to the integration of digital technologies like simulations, Internet of Things (IoT), artificial intelligence (AI), and Big Data with human labor– can benefit steelmakers directly. Benefits can be environmental (increased resource efficiency), social (job creation and closing skills gaps) and economic (increased productivity).[28]
- Automation in steelmaking enables efficient and precise customization of steel alloys, allowing customers to order stronger grades with tailored properties directly from manufacturers rather than having them cold-worked.[29]
- Worker safety in steel manufacturing is enhanced through automation, which provides precise positioning, repetitive motion, and built-in safety features to help operators stay informed and prevent injuries or equipment damage. Robotic systems can also perform particularly dangerous tasks, like the pouring of molten metal or handling of hot steel.[30]
- Steel companies who implemented AI technology to optimize processing instructions and raw input mixes were able to reduce raw material input costs by more than 5%, improve throughput at bottlenecks by more than 6%, and increase end-to-end product yields by more than 15% at the end of 2021.[31]

Mergers & Acquisitions

- The domestic steel industry is becoming increasingly concentrated as major players consolidate.
- An organization representing major automotive companies– General Motors, Toyota, Volkswagen, Hyundai, and others– wrote to Congress in October 2023 to protest a proposed buyout. They noted that the merger of Cleveland-Cliffs and U.S. Steel would concentrate 100% of American iron ore deposits and e-steel, the metal used for EV motor production, into one company.[32]
- In December 2023, Nippon Steel acquired its competitor, U.S. Steel, for $14.1 billion, outbidding domestic rivals such as Cleveland-Cliffs. The purchase price represented a 40% premium over the stock price, and accounts for 4.5% of global crude steel production annually.[33]

Renewable Energy and Green Steelmaking

- The transition to green steel will require significant investment capital from firms into alternative technology, with global spending towards decarbonization estimates ranging from $278 billion to over $1 trillion through 2050.[34]
- Boston Metal recently received a $120 million investment from steelmaker ArcelorMittal to expand production of green steel as part of the effort to decarbonize the industry. In 2022, steel production was responsible for 8% of global carbon emissions.[35]
- For greener steelmaking, transitioning from blast-furnacing to hydrogen-based electric-arc furnaces (EAF) will result in a substantial rise in electricity consumption, from 0.1 megawatt hours (MWh) of power per metric ton of steel to over 3.0 MWh per metric ton.[36]
- According to the International Energy Agency (IEA), emissions from steel must be reduced by 50% by 2050 and continue to fall in order to meet the world's climate goals.[37]
- A complete shift towards fossil-free steelmaking, powered by local renewable energy, has the potential to increase jobs supported by the steel industry in the Ohio River Valley region by 27% to 43% from 2023 to 2031.[38]
- As automobile manufacturers respond to fuel efficiency mandates by making vehicles lighter, the use of lightweight materials in production will become increasingly common.[39]
- Replacing traditional cast iron and steel components with materials like magnesium alloys, aluminum alloys, carbon fiber, and polymer composites can reduce the weight of conventional automotive parts by up to 70% thereby improving fuel economy.[40]
- By incorporating advanced materials into lightweight components and high-efficiency combustion engines into a quarter of the U.S. fleet, it is possible to conserve more than 5 billion gallons of fuel annually by 2030.[41]

Industry Demographics (continued)

- The electrolysis process for smelting aluminum accounts for nearly 80% of the sector's greenhouse gas emissions as of August 2023. Substituting inert anodes for the carbon anodes traditionally used for electrolysis has the potential to eliminate process emissions from production, reduce local air pollution, and conserve energy in the aluminum production industry.[42]

Supply Chain

- Recent supply chain disruptions caused by the COVID-19 pandemic and the Russian war in Ukraine have exposed U.S. reliance on non-allies for strategic minerals, with Russia and China alone owning over half of the primary aluminum market.[43]
- Domestic steelmaking operations have expanded geographically in recent years, moving beyond the traditional hubs for integrated mills – Pennsylvania, Indiana, Michigan, and Ohio – and into the Southeast, where there is increased access to iron ore mining and pig iron suppliers as well as customers.[44]
- The 2021 U.S. and EU tariff rate quota agreement, under which volumes of EU imports below certain levels are exempt from the 25% steel and 10% aluminum tariffs enacted in 2018, expired in October 2023 amid disagreement between the two parties. While there are strong incentives to reach an agreement by EOY 2023, it will likely be a partial one.[45]

Revenue Trends

- U.S. Iron and Steel Manufacturing revenue is expected to continue falling from 2023-2028, down to $82.4 billion and a CAGR of - 6.7%.[46]
- Metal Pipe and Tube Manufacturing in the U.S is projected to increase at a CAGR of 0.9% from 2023-2028, to $16.4 billion.[47]
- Steel Rolling and Drawing is expected to slow slightly, with a CAGR of 2.5% through 2024 and decrease at -0.5% to reach $17.5 billion in 2029.[48]
- Aluminum Manufacturing is expected to recover slightly, with a CAGR of 1.2% from 2023-2028, reaching $45.1 billion.[49]
- Nonferrous Metal Refining is going through a prolonged period of increasing revenue, with a CAGR of 2.7% from 2018-2023; it is expected to continue increasing at 1.1% from 2023-2028, to $16.8 billion.[50]
- Copper Rolling, Drawing, and Extruding experienced a 2.2% increase from 2018-2023, with another 1.3% CAGR from 2023-2028, reaching $31.6 billion.[51]
- Nonferrous Metal Rolling and Alloying is expected to continue expanding over the next five years, with a CAGR of 1.6% taking it to $19.4 billion.[52]
- The Ferrous Metal Foundry Products industry is projected to continue contracting at a -0.2% CAGR from 2023-2028, down to $18.3 billion.[53]
- Nonferrous Metal Foundry Products will bounce back to $12.2 billion by 2028.[54]

Workforce Challenges

- American steel mills have become significantly more productive due to technological advancements driven by AI and automation. The labor hours required to produce one ton of steel fell by at least 85% since the 1980s, going from 10.1 working hours to as low as 0.5 at mini-mills.[55]
- Supplying the Defense Workforce pipeline will require manufacturers to add 35,000 workers per year in the Philadelphia, Berks County, and Lancaster County Metropolitan Statistical Areas (MSAs).[56]
- The region's workforce and educational infrastructure currently lack the capacity to meet this demand; Career and Technical Education (CTE) and post-secondary programs only produce approximately 2,500 students annually.[57]
- Pennsylvania's Talent Pipeline Program is struggling to maintain new workforce entrants, with a current retention rate of 63%.[58]
- Augmented reality (AR) and virtual reality (VR) are empowering manufacturers by facilitating the generational workforce transition.
- IoT and robotic welding are turning facilities into smart factories, decreasing workers and hours needed, and helping to close the gap.
- Wages as a percentage of total revenue in 2023:
  - Iron and Steel Manufacturing: 9.9%
  - Metal Pipe and Tube Manufacturing 9.9%
  - Steel Rolling and Drawing: 8.1%
  - Aluminum Manufacturing: 11.5%
  - Nonferrous Metal Refining: 3.7%
  - Copper Rolling, Drawing, and Extruding: 6.4%
  - Nonferrous Metal Rolling and Alloying: 12.3%
  - Ferrous Metal Foundry Products: 19.8%
  - Nonferrous Metal Foundry Products: 23.1%

Industry Demographics (continued)

Cost Trends

Present:

- One of the key raw inputs for steelmaking, iron ore, is a volatile commodity heavily influenced by Chinese speculative activity.
- Iron ore was the best-performing industrial metal in 2023, with a 17% price increase through November of that year. With China's economy poised for recovery in 2024, this trend is expected to continue.[59]
- Financialization in the metals market has enabled producers to better manage fluctuating prices for raw materials through hedging. This is done through derivative markets—by purchasing futures contracts for commodities like iron and metal scrap, producers can hedge against the risk of increased prices.[60]
- Energy: Aluminum production from alumina is particularly energy-intensive, comprising about 40% of total primary aluminum production costs.[66]
- Wages for skilled labor and workforce training costs continue to grow.
  -Average industry pay in Pennsylvania was $79,891 in 2021, 123% of the average wage across the private sector. This marked an overall 22.1% wage increase since 2016.[61]

Future:

- As the iron ore and pig scrap derivatives markets have grown and become increasingly liquid, financial analysts believe physical trading will stabilize, with shorter price divergences. It will also become easier to raise financing for new mining projects.[62]
- While iron ore miners and traders have increasingly adopted financial tools to minimize exposure to risk, steelmakers remain cautious about hedging; unlike other major metal markets, futures represent just 6% of the domestic steel trade, so there is room for significant growth.[63]
- Future forecasts predict a "normalization" of steel demand in China, which will end its long period of rapid growth. Any decline, however, may be offset by the emergence of India and Southeast Asia as significant global players.[64]
- Steelmakers anticipate a substantial increase in capital expenditure driven by decarbonization investment. This may lead to increased leverage for steelmakers, particularly during a period of high interest rates, necessitating enhanced profitability or government funding.

Industry Profits and Drivers

Construction Industry Dynamics

- Due to strong demand for housing and federal infrastructure initiatives, the construction industry is positioned for recovery in 2024, with stabilizing supply chains and material prices.[65]
- Heightened interest rates and declining starts will likely depress commercial construction in 2024; increased public spending on infrastructure and manufacturing construction, however, will counterbalance the spending slowdown in the private sector for little net change overall.[66]

Demand for Metals

- Revitalized activity in the Oil and Gas Pipeline Construction industry will bolster demand for rolled- and drawn-steel products.[67]
- This industry is expected to decrease at a CAGR of -11% globally and -1.1% in the U.S. from 2023 to 2028.[68]
- As decarbonization grows, copper is positioned to experience an unprecedented surge in consumption, as demand potentially doubles by 2035.[69]
- With the transition toward net zero emissions, copper could become "the new oil", given its use as a construction material in solar, wind, EVs, and other renewable energy sources.[70.]

Macroeconomic Conditions

- With a weak U.S. dollar– down 3.7% in November 2023, its worst monthly performance in a year– metal commodities imports are expected to weaken, while domestic products become comparatively more affordable to buyers.[71]
- Longer lead times and lower production levels secured a 2.53% increase in the Raw Steels Monthly Metal Index (MMI) from September to October of 2023, marking the latest major uptrend since December 2022.[72]

Supply Chain Disruptions

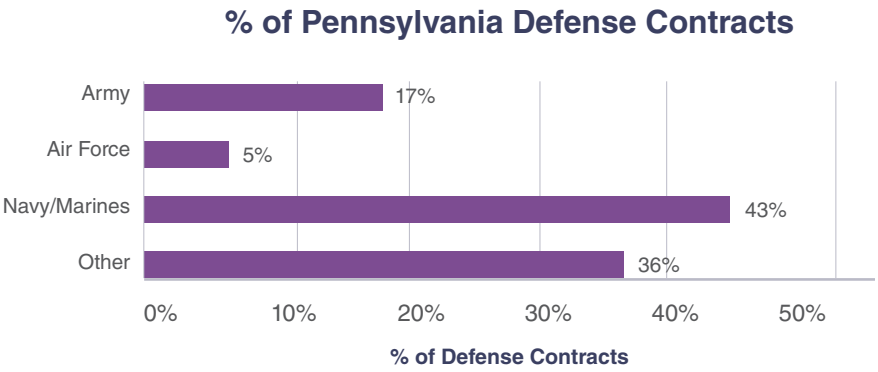
- One of the biggest threats to profitability for the domestic steel industry is overcapacity, with global excess capacity– driven by increased production from major exporters like China, India, Brazil, South Korea, and other nations- nearly six times the capacity of the total American steel industry. This undercuts domestic steel, with surging imports to U.S. markets.[73]
- As the demand for industrial metals outstrips supply due to renewable energy investments, shortfalls of copper and aluminum by 2027 may push prices for these commodities up by 20% and 36%, respectively.[74]
- The U.S. rare-earth metal supply is vulnerable due to Chinese dominance in rare-earth processing. To avoid a looming shortage by 2030, at least 20 mining projects– outstrips supply, roughly $30 billion in funding- are needed.[75]

Key National Defense Trends

Key National Defense Trends Affecting Primary Metals

Defense and Aerospace:

- Pennsylvania received $17.9 billion in state defense contracts in 2023.[76]
- Defense contracts comprised 1.9% of state GDP in 2023.[77]
- Pennsylvania made up 3.2% of total U.S. defense spending.[78]



Top Defense Contractors in Pennsylvania

- Bechtel Group: $2.1 billion
- AmerisourceBergen: $2.0 billion
- Fluor Corp: $1.7 billion
- BAE Systems: $1.1 billion
- Boeing: $781.5 million
- Siemens AG: $651.3 million
- Highmark, Inc.: $504.9 million
- OraSure Technologies, Inc.: $400.5 million
- Lockheed Martin: $361.6 million
- Pennsylvania State University: $251.4 million

Top Defense Contracting Spending Locations within Pennsylvania are listed below.

- Allegheny: $4.2 billion
- Montgomery: $2.4 billion
- York: $1.2 billion
- Franklin: $1.1 billion
- Delaware: $908.8 million
- Philadelphia: $726.7 million
- Bucks: $537.3 million
- Dauphin: $524.4 million
- Northampton: $428.2 million
- Cumberland: $406.4 million

- Rising global tensions such as ongoing wars, conflicts, and potential threats will bolster defense spending and create opportunities for machine shops and forgers.
- The growing commercial space launch sector generates research and development revenue due to booming demand for highly durable and complex parts for rocket structures.
- More than 50% of supply contracts must come from domestic suppliers, limiting demand for imported metals.[79]
- Increase in demand for missiles, hypersonics, autonomous underwater vehicles (AUVs), advanced air mobility (AAM), and aerospace with long-term growth projections.
- Hypersonic growth projections: CAGR of 11.4% from 2023 to 2030.[80]
- AUV growth projections: CAGR of ~19.3% from 2023 to 2030.[81]
- AAM growth projections: CAGR of ~27.6% from 2023 and 2032.[82]
- U.S. Navy's Naval Nuclear Propulsion Program is overseeing the design and building of 12 nuclear submarines, with a projected completion of the first vehicle by 2027.[83]
- The components used in naval reactors require as much as eight years of CNC machining, welding, grinding, heat treatment, and nondestructive testing of large specialty metal forgings.[84]

Primary Metal Buyer and Supplier Relationships

Suppliers

Coal & Ore Wholesaling
Coal Mining
Hydroelectric Power
Industrial Machinery & Equipment Wholesaling
Industrial Supplies Wholesaling
Inorganic Chemical Manufacturing
Iron & Steel Manufacturing
Iron Ore Mining
Metalworking Machinery Manufacturing
Mineral Product Manufacturing
Mining
Molybdenum & Metal Ore Mining
Nonferrous Metal Foundry Products
Nuclear Power
Utilities

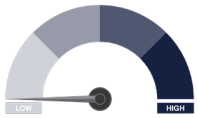
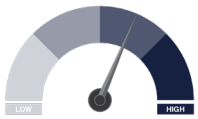
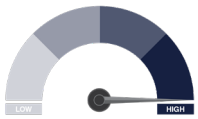
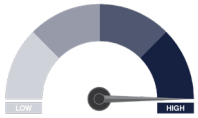
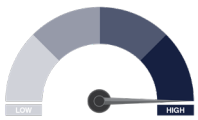
Primary Metal

Buyers

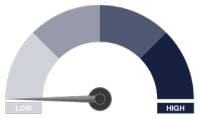
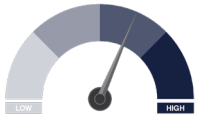
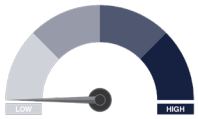
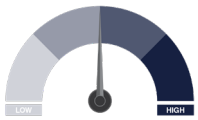
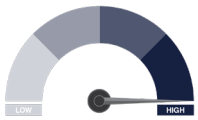
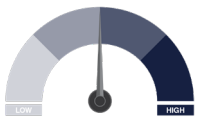
Aircraft, Engine & Parts Manufacturing
Automobile Electronics Manufacturing
Car & Automobile Manufacturing
Circuit Board & Electronic Component Manufacturing
Construction Machinery
Construction & Mining Equipment Wholesaling
Copper Rolling, Drawing, & Extruding
Electric Power Transmission
Ferrous Metal Foundry Products
Hardware Manufacturing
Industrial Building Construction
Iron & Steel Manufacturing
Major Household Appliance Manufacturing
Manufacturing
Metal Can & Container Manufacturing
Metal Pipe & Tube Manufacturing
Metal Plating & Treating
Metal Stamping & Forging
Metal Wholesaling
Mining, Oil & Gas Machinery Manufacturing
Nonferrous Metal Foundry Products Manufacturing
Nonferrous Metal Refining
Nonferrous Metal Rolling & Alloying
Oil & Gas Pipeline Construction
Oil Drilling & Gas Extraction
Plumbing
Power Conversion Equipment Manufacturing
Retail Trade
Sheet Metal Window & Door Manufacturing
Steel Rolling & Drawing
Structural Metal Product Manufacturing
SUV & Light Truck Manufacturing
Truck & Bus Manufacturing
Water & Sewer Line Construction
Wire & Cable Manufacturing
Wire & Spring Manufacturing

* Industries within Critical Infrastructure highlighted in **RED**

Primary Metals Impact on Critical Industries

Critical Industry Sector as defined by Cybersecurity & Infrastructure Security Agency (CISA)	What Primary Metal Provides to Critical Industry	Impact of Primary Metal on Critical Industry	U.S. Growth Rate (2023)
Communications	• Communication towers • Satellite dishes • Underground cable • Antenna masts • Enclosures • Wires and cables		1.43%
Chemical	• Pipelines • Storage tanks • Chemical plants/machinery • Catalyst • Electrodes • Testing equipment		-1.0%
Commercial Facilities	• Construction • Machinery • Infrastructure • Appliances • Packaging		3.4%
Critical Manufacturing	• Infrastructure • Transportation • Pipelines/plumbing • Electrical transmission		-2%
Dams	• Structural support • Drainage systems • Corrosion resistant materials • Turbine components		6%
Defense Industrial Base	• Vehicle construction • Base construction • Weapon manufacturing • Electronics • Communication systems		8%
Emergency Services	• Infrastructure • Vehicles • Fluid conveyors • Mobile services • Equipment		5.8%
Energy	• Power plants • Refineries • Pipelines • Infrastructure • Electrical lines • Renewable energy systems • Turbines/generators		9.3%

Primary Metals Impact on Critical Industries

Critical Industry Sector as defined by Cybersecurity & Infrastructure Security Agency (CISA)	What Primary Metal Provides to Critical Industry	Impact of Primary Metal on Critical Industry	U.S. Growth Rate (2023)
Financial Services	• Critical industry relating to investments • Coin production		7.7%
Food and Agriculture	• Vehicles • Equipment • Processing plants • Storage facilities • Irrigation systems • Packaging • Machinery		3.1%
Government Facilities	• Building Construction		1.6%
Healthcare and Public Health	• Medical Equipment • Laboratories • Water/gas distributions • Hygenic products • Electrical systems		6%
Information Technology	• IT infrastructure • Pipelines • Computer chips • Circuit boards • Networking devices • Portable electronics • IT equipment		8.2%
Nuclear Reactors, Materials and Waste	• Reactor vessels • Containment structures • Transporting liquids • Heat exchange systems • Radiation shielding		1.4%
Transportation Systems	• Bridges • Railways • Roads • Vehicles • Vehicle components		8.8%
Water	• Pipelines • Treatment plants • Storage tanks • Pumps • Valves • Plumbing systems		6.8%

Supply Chain Partners

As part of the metals supply chain, the Primary Metal Manufacturing industry inputs raw materials to be processed and refined for the creation of standard or basic products that may be further fabricated. End-users include the construction, automotive, hardware and machinery manufacturing, pipeline, and other sectors. Below is an overview of the major input supplier and end-use industries, organized alphabetically:

Major Supply Industries

- **Copper, Nickel, Lead and Zinc Mining (NAICS 21223):** These nonferrous metals are key components in alloys and various fabricated products due to their unique properties, including conductivity and corrosion resistance.
- **Hydroelectric Power (NAICS 22111c):** Provides clean and reliable energy for various processes, including metal extraction and manufacturing.
- **Iron Ore Mining (NAICS 21221):** Extracts iron ores, critical raw materials used in subsequent processes like smelting and refining to produce iron and steel.
- **Inorganic Chemical Manufacturing (NAICS 32518):** Provides chemicals integral in various metallurgical processes, including refining and treating metals for specific applications.
- **Molybdenum and Metal Ore Mining (NAICS 21229):** Molybdenum is prized for its alloying properties, enhancing the strength and corrosion resistance of various fabricated metal products.
- **Nuclear Power (NAICS 22111b):** This energy source is instrumental in powering processes such as ore refining, alloy production, and other energy-intensive operations within the sector.
- **Other Metal Ore Mining (NAICS 21229):** Extracts iron ores, critical raw materials used in subsequent processes like smelting and refining to produce refined metals and products.
- **Industrial Machinery and Equipment Wholesaling (NAICS 42383):** Wholesalers in this category supply a wide range of industrial machinery and equipment used in the primary metals industry, including machinery for welding, cutting, and shaping metal components.
- **Metalworking Machinery Manufacturing (v33351):** This industry focuses on manufacturing machinery used in metalworking processes, such as CNC machines, presses, and cutting tools. The equipment is critical to the processes of primary metals.

Major Demand Industries: Primary metals manufacturers are vital partners to American defense contractors and the DoD in support of the Defense Industrial Base (DIB). Primary metals manufacturers also supply to other critical infrastructure sectors, including commercial facilities, in the form of building structures, machinery for critical manufacturing, and pipelines for both the energy (oil and gas) and wastewater sectors.

- **Building Construction:** Demand for structural components, including steel and aluminum for framing, wiring, and various other applications.
- **Hardware Manufacturing:** Hardware manufacturing requires a variety of primary metal components, including fasteners, hinges, and tools.
- **Machinery Manufacturing:** Manufacturing of industrial machinery involves the use of primary metals.
- **Metal Plating & Treating:** Metal plating and treating industries use primary metals in surface treatments and coatings.
- **Metal Wholesaling:** Metal wholesaling directly connects the Primary Metal Manufacturing industry with downstream users and industries.
- **Oil Drilling & Gas Extraction:** The extraction of oil and gas requires various metal components and equipment, creating demand for primary metals used in drilling machinery, extraction tools, and infrastructure.
- **Oil & Gas Pipeline Construction:** The construction of oil and gas pipelines demands a substantial quantity of metal pipes and related products.
- **Sheet Metal, Window & Door Manufacturing:** Supplies necessary materials for sheet metal.
- **Structural Metal Product Manufacturing:** The manufacturing of structural metal products, including beams, supports, and framing components, depends on primary metals.
- **Water & Sewer Line Construction:** Construction of water and sewer lines involves the use of metal pipes, tubes, and other primary metals.
- **Wire & Cable Manufacturing:** Wire and cable manufacturing relies on metal conductors for electrical infrastructure.

Leading Pennsylvania Manufacturers within NAICS 331

This section attempts to document the leading players with operations in PA that fall under the NAICS 331 industry code, segmented by the jurisdictions of each IRC partner, and sorted alphabetically. Leading companies were selected based on revenue estimates[55]:

Southeastern PA Region

Delaware Valley Industrial Resource Center (DVIRC)

- Allied Wire & Cable (Collegeville, PA)
- AMG Advanced Metallurgical Group (Wayne, PA)
- Carpenter Technology Corporation (Philadelphia, PA)
- Cleveland-Cliffs Steel Plate (Coatesville, PA)
- Infra-Metals Co. (Newtown, PA)
- Pennsylvania Steel Company, Inc. (Bensalem, PA)

Southwestern PA Region

Catalyst Connection

- Alcoa Corporation (Pittsburgh, PA)
- Allegheny Technologies Incorporated/ATI (Pittsburgh, PA)
- AMG Resources Corporation (Pittsburgh, PA
- Ampco-Pittsburgh Corporation (Carnegie, PA)
- Arconic (Pittsburgh, PA)
- Howmet Aerospace (Pittsburgh, PA)
- HusseyCopper (Leetsdale, PA)
- Kaiser Aluminum Warrick, LLC (Pittsburgh, PA)
- L.B. Foster (Pittsburgh, PA)
- Matthews International Corporation (Pittsburgh, PA)
- Perryman Company (Houston, PA)
- Tenaris (Koppel, PA)
- United States Steel Corporation (Pittsburgh, PA)
- Universal Stainless & Alloy Products (Bridgeville, PA)

South Central PA Region

MANTEC

- Boose Aluminum Foundry Co Inc (Stevens, PA)
- Donsco Incorporated (Wrightsville, PA)
- H & H Castings, Inc. (York, PA)
- Mountain Ridge Metals LLC (Millersburg, PA)
- PRL Industries, INC. (Lebanon, PA)

Lehigh Valley PA Region

Manufacturers Resource Center (MRC)

- Befesa Zinc US Inc. (Palmerton, PA)
- Cambridge-Lee Industries LLC (Reading, PA)
- Global Advanced Metals (Boyertown, PA)
- Hofmann Industries, Inc. (Sinking Spring, PA)
- Hydro Extrusions North America (Cressona, PA)

Northeast PA Region

Northeastern PA Industrial Resource Center (NEPIRC)

- Alleima USA LLC (Clarks Summit, PA)
- Bardane Manufacturing CO (Jermyn, PA)
- Benton Foundry, Inc. (Benton, PA)
- Global Tungsten & Powders LLC (Towanda, PA)
- Ward Manufacturing, LLC (Blossburg, PA)

Central PA Region

Innovative Manufacturers' Center (IMC)

- Jersey Shore Steel Company (Jersey Shore, PA)
- Muncy Machine & Tool Co., Inc. (Turbotville, PA)
- Standard Steel, LLC (Burnham, PA)
- T-LANE Industries LLC (Port Royal, PA)

Northwest PA Region

Northwest Industrial Resource Center (NWIRC)

- Clarion Sintered Metals, Inc. (Ridgway, PA)
- Ellwood National Forge (Irvine, PA)
- NLMK Pennsylvania LLC (Farrell, PA)
- PHB, Inc. (Fairview, PA)
- Wheatland Tube Company (Wheatland, PA)

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