Feasibility and Impacts of Domestic Content Requirements for U.S. Oil and Gas Pipelines

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Submitted to:
American Petroleum Institute,
Interstate Natural Gas Association of America,
Association of Oil Pipe Lines,
American Gas Association, &
GPA Midstream Association

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Exhibits

Definitions & Acronyms

BOF	Basic oxygen furnace (used to make steel)
CTL	Cut to length. Used to refer to steel plate (usually thick plate) that is sold in flat plates as opposed to rolled coils.
DSAW	Double submerged arc weld
EAF	Electric arc furnace (used to make steel from largely recycled materials)
ERW	Electric resistance weld
FTC	Federal Trade Commission
Heavy wall	Line pipe with walls over 0.75 inches thick
HHI	Herfindahl-Hirschman Index
HRC	Hot rolled coil (refers to both plate coil and sheet coil)
HSAW	Helical (spiral) submerged arc weld
HTS	Harmonized Tariff System (a system to categorize imported/exported products used by the U.S. and many other countries)
JCO or JCOE	Method of forming line pipe into shape of "J" then "C" then "O" followed by Expansion
LSAW	Longitudinal submerged arc weld
OD	Outside diameter
psi	Pounds per square inch
SAW	Submerged arc weld
SAWH	Helical (spiral) submerged arc weld
SAWL	Longitudinal submerged arc weld

UOE	Method of forming line pipe into shape of "U" then "O" followed by Expansion
X70	Specification used for line pipe indicating a specified minimum yield strength of 70,000 psi

1. Executive Summary

1.1 Background

This report was prepared by ICF at the request of the American Petroleum Institute, Interstate Natural Gas Association of America, Association of Oil Pipe Lines, American Gas Association, and GPA Midstream Association to provide information to the Department of Commerce and other interested parties on the feasibility and economic impacts of policies and other actions that might be implemented by the Federal government to require that the repair and construction of oil and gas pipelines exclusively use materials and equipment produced in the U.S. Specifically, line pipe, fittings, and valves for all kinds of oil, gas and other pipelines would have to be manufactured in the U.S. using steel and other materials that are made in the U.S. The purpose of the information provided here is to help inform the Department of Commerce and other parts of the Administration on the practical considerations they may wish to address as they consider next steps.

1.2 ICF's Scope of Work and Methodology

ICF was asked to look at the recent historical markets for line pipe, fittings, and valves and to determine how much of these markets were supplied by domestic *versus* foreign suppliers. ICF was also asked to determine how much domestic suppliers relied on imported intermediate goods (that is, parts and materials used to make the final products) for their production of line pipe, fittings and valves. ICF also looked at the production capacity of the domestic industry and how that capacity compared to the expected near-term level of demand for line pipe, fittings, and valves. In this comparison ICF was asked to identify any "choke points" or "constraints" where U.S. producers lacked the capability or volume capacity to meet the expected demands. ICF was also asked to estimate the possible price increases that the products and materials covered by these proposed policies might experience and how much such price increases would affect the overall cost of new oil and gas pipelines.

To address these issues, ICF collected and analyzed data from multiple sources including international trade data maintained by the Federal Government, commercial publications that track the markets for line pipe and other tubular goods, government and commercial data bases on the steel industry, and data provided through a written survey and individual interviews by members of the sponsoring associations including pipeline operators, integrated steel mills/pipe mills manufacturers, line pipe and pipeline equipment distributors, and equipment manufacturers in the U.S.

1.3 Summary of Key Findings

The overarching finding in this report is **that U.S. pipeline construction and repair activity relies heavily on imported finished goods and imported parts and intermediate materials** used for domestic manufacturing of line pipe, fittings, and valves. In recent years approximately 77% of the steel used in line pipe was imported in the form of finished line pipe (53%), cut-to-length plate and plate coil (19%) used to make line pipe in the U.S. or as steel slabs (5%) used to make cut-to-length plate and plate coil that then was made into line pipe. (See Exhibit 1-1) In that same time approximately 40% of the parts used to make high-pressure valves in the U.S. came from overseas. Also approximately 42% of the market value for finished steel pipeline fittings came from imports as did a substantial fraction of the steel cylinders and other semi-finished steel products used to make pipeline fittings in the U.S.

Exhibit 1-1: Contribution of Imported Finished and Intermediate Steel Products Used to Construct Pipelines

Product	Value of Market 2015-2016 ($billion)	Market Share of Imported Finished Products	Contribution of Imported Intermediate Goods
Line Pipe	$3.40 to $5.82 billion	53%	~52% of domestic line pipe is made from foreign cut-to-length plate and plate coil (or from domestic plate that is made from foreign slabs)
Valves	$1.29 to $1.73 billion	16%	~40% of parts are imported
Fittings	$0.27 to $0.46 billion	42%	use of imported steel is significant

Line pipe and other materials used to build new pipelines and to expand and repair existing pipelines must comply with established, transparent standards and specifications established by API, ASTM, ASME and other industry groups and government agencies. The standards require high-level technical knowhow and very sophisticated manufacturing processes and equipment. There is limited ability to substitute other materials and products to construct and repair pipelines and so the breaking of the extensive existing international supply chains for line pipe, fitting and valves will be very disruptive to pipeline operators until those supply chains can be rebuilt in a new form that would comply with domestic content requirements.

Because of this lack of substitutes, heavy reliance on imported goods and materials, the long lead time required for many items, and the fact that several of these items are not made in the U.S currently, an immediate implementation of stringent domestic content requirement for line pipe, fittings, and valves would mean that **most oil and gas pipeline construction projects would be delayed or stalled**.

The economic impact of such an action would be **the loss of American jobs as some 75% of current pipeline construction expenditures are U.S. value added,** meaning these expenditures end up in the pockets of American workers and business owners. (The line pipe, valves and fittings themselves now represent only about 11% of the total cost of a new large diameter pipeline project.) Other adverse economic impacts would be the **economic costs of delayed or cancelled pipeline projects** (measured as lost profits for shut-in oil and gas production and higher costs to consumers) and potentially **service disruptions** if repairs and replacements of existing line pipe are unable to be made as needed.

Findings Related to Line Pipe

- The *nominal* production capacity of U.S. line pipe manufacturers exceeds anticipated near-term demand levels of 3.1 to 3.4 million metric tons per year including exports. The limiting factor for domestic line pipe production does not stem from the total production capacity but rather from constraints related to specific kinds of line pipe required by U.S. pipeline owners and current gaps in production and testing capabilities of domestic line pipe manufactures and their supply of cut-to-length plate and plate coil made from U.S. melt.

- The existence of such constraints has been acknowledged by the American Line Pipe Producers Association in comments to the Department of Commerce related to what it calls "niche" markets that domestic producer cannot now serve. While such constraints are indeed related to a small portion or "a niche" of the thousands of different steel products made in the U.S., those constrained products do represent a very large and critical portion of the materials used to construct modern pipelines.

- The constraints on domestic line pipe manufacturers' ability to immediately meet all U.S. line pipe demand include:
  - Lack of current capacity to make pipe of certain dimensions, most importantly large diameter pipe with thick walls,
  - Lack of capacity to meet certain quality specifications (low tolerances for variations in chemical composition and physical dimensions and the ability to perform and pass certain quality control tests), and
  - Difficulty in making or obtaining certain kinds of domestically melted hot rolled plate coil or cut-to-length plate from which the line pipe is made.
- Given sufficient investments by the steel industry, these kinds of constraints can be eliminated over time. However, the willingness of the steel industry to make the needed investments may be influenced by concerns related to:

- The relatively small part of the steel market (approximately 3%) made up of line pipe consumption.[1]
- The cyclical nature of the oil and gas production and pipeline industries which means that steel production from any new manufacturing capacity will vary substantially from year to year, making timely cost recovery less certain.
- The inherent uncertainty regarding the long-term legal and political viability of any proposed domestic content requirements, which adds another risk to anticipated returns on new steel manufacturing investments.

Given these concerns, domestic manufacturers of line pipe, cut-to-length plate and plate coils may delay needed investments and/or demand much higher prices to pay back those investments quickly.

- ➢ In addition to creating these supply constraints among certain types and quality of line pipe, limiting the importation of line pipe, the cut-to-length plates and plate coils from which line pipe is made and the slabs from which cut-to-length plates and plate coils are rolled would substantially reduce supply volumes available to the market. (See Exhibit 1-2.) Import restrictions also increase industrial concentration (as measured by the Herfindahl-Hirschman Index or HHI) in portions of the domestic markets for finished line pipe and the related intermediate goods of high strength cut-to-length plates and plate coils.

Exhibit 1-2: How Import Restrictions Would Impact Market Competition

Market or Submarket	Loss of Inframarginal Supplies	Increase in Market Concentration Index (HHI)
Line Pipe 0-16"	-74%	+290
Line Pipe 16.1-24"	-56%	+88
Line Pipe >24"	-30%	+478
Cut-to-length Plate (used to make line pipe)	-51% to -64%	+1,644 to +3,420
Plate Coils (used to make line pipe)	-34% to - 44%	+695 to +1,174
Valves	more than -15%	*not computed*
Fittings	more than -42%	*not computed*

[1] Line pipe supplied in the U.S. measured in million metric tons per year was 4.6 in 2015, 2.6 in 2016, and is expected to average between 3.1 and 3.4 over the next five years. Apparent steel consumption in the U.S. in 2015 was approximately 110 million metric tons according to the USGS steel market report. https://minerals.usgs.gov/minerals/pubs/mcs/

- Large increases in market concentration increase the chances of non-competitive pricing behavior and higher prices. The policy adopted by the federal government in many cases, such as the denial by the Federal Trade Commission of business mergers between large companies, is to avoid actions that lead to large increases in market concentration which is usually defined as an increase of 200 HHI points or more. As shown in Exhibit 1-2, restricting imports causes increases of more than 200 points in the cut-to-length plate, plate coil, >24" outside diameter (OD) line pipe, and <16" OD line pipe markets. Most significantly, the API 5L steel plate market would see an increase of 1,644 to 3,420 HHI points or eight to 17 times the 200-point threshold demarcating a potentially unacceptable increases in market concentration.

Findings Related to Valves and Fittings

- The domestic markets for fittings and valves would also exhibit constraints because some fittings and valves are not made in the U.S. at all or depend heavily on imported parts and materials for their manufacture.

- ICF estimates that approximately 40% on average (and up to 60% in some cases) of the price of large oil and gas valves is represented by foreign parts, some of which are not made in the U.S. Of particular concern is the foundry capacity in the U.S. to make the necessary castings for large valve bodies (for all kinds of valves) and the balls used in ball valves. In addition to supplying a large portion of the parts for domestically produced valves, foreign manufacturers supply finished valves making up about 16% of the market in terms dollar value.

- Approximately 30% of steel pipeline fittings pieces (predominantly in the larger diameter sizes) were supplied by imports and those imports represented about 42% of the steel pipeline fittings market value. Also several U.S. fittings manufacturers currently rely on imported steel.

  As with line pipe, cut-to length plate and plate coil, it would take considerable time and investment dollars to modify these complex international supply chains and overcome the current constraints to having pipeline fittings and valves meet domestic content restrictions.

Findings Related to Economic Costs

- It is difficult to forecast what the cost impact of any domestic content requirement would be for new oil and gas pipelines given the uncertainty in how any requirement might be implemented with regard to:
  - What exact materials, products and equipment would be covered by the policy,
  - How quickly compliance would be required, and
  - Whether and how exemptions or exceptions might be granted.

- An extreme (and presumably unlikely) policy would be to require immediate compliance with the domestic content requirements and to grant few if any exemptions. If this option were implemented it is likely that most (and possibly all) oil and gas pipeline construction projects would be delayed or stalled because foreign materials are now so widely dispersed in the supply chains of line pipe, fittings, and valves. ICF estimates that the total number of U.S. jobs related to all aspects of flow line, gathering system and pipeline construction and repair will average between 417,000 and 456,000 annually between 2017 and 2021. Many of those jobs would be at risk to pipeline project delays and cancelations.

- The economic impact of a quick implementation of domestic content policies also would include the economic costs to energy producers and consumers of delayed or cancelled pipeline projects (measured as lost profits for shut-in oil and gas production and higher costs to consumers) and potentially service disruptions if repairs and replacements of existing line pipe are unable to be made as needed.

- The specific markets and products identified in this report where immediate compliance with domestic content requirements could most likely reveal significant constraints and cause possible shortages and steep price increases include:
  - Steel alloying agents used to make steel for virtually all modern high-strength steel line pipe, high-yield fittings and valve parts;
  - Thick, high-strength, wide, cut-to-length plate;
  - Thick, high-strength, wide, plate coil;
  - Slabs used by non-integrated U.S. rollers to make line-pipe quality cut-to length plate and plate coil;
  - Thick-walled large diameter line pipe;
  - High pressure valve parts;

- Certain seamless pipes and cylinders that are produced in low volumes, made of high-strength steels, and used to fabricate pipeline fittings;
- Low pressure gas distribution regulators; and
- Certain insulating joints used by gas distribution companies.

➢ Other policy alternatives (compared to requiring immediate compliance) might combine a gradual compliance period with exemptions for products not readily available from domestic sources. To illustrate the potential cost impacts of such policy options ICF developed scenarios based on 50-100% price increases for finished line pipe, fittings, and valves during an initial transition period and by 25% price increases in the long run. During the initial transition period international and domestic supply chains would be rearranged; investments in new U.S. capabilities and expanded product lines would be made; and "scarcity pricing" for line pipe, fittings, and valves would prevail as available supplies cannot meet usual demand levels.

➢ After the transition period, the longer-run prices would still remain 25% higher than they would be without import restrictions due to:

- The loss of "inframarginal" supply sources as shown above in Exhibit 1 2 (that is, the supply curves would be shifted to the left when foreign suppliers are removed),
- The more expensive production costs of domestic producers having to recovery additional investment costs and pay higher supplier costs (that is, an upward shift in the supply curve), and
- The increase in concentration in some markets as indicated by the higher HHI measures shown above in Exhibit 1-2 (that is, a change in the shape of the supply curve reducing supplies at lower prices).

➢ Scarcity pricing occurs when supply of a good is limited in the short- to medium-term and the market must be balanced by dramatically higher prices forcing down demand. In such cases the market prices rise far above the marginal long-run cost of production. A recent example of this phenomena was the market for rail tank cars used to transport crude oil. Tank cars were being leased for about $1,000 per month or less until 2013 and 2014 when increasing crude-by-rail transportation demand from rising U.S. tight oil production created a tank car shortage that forced up lease prices to $2,500 per month – a 150% increase. In this recent case of tank cars the scarcity situation was caused by a rapid shift in demand, whereas for the line pipe, fittings, and valve markets discussed in this report the potential scarcity situation could be caused by large loss of price-competitive supplies if domestic content requirements were to be imposed.

- Under the scarcity pricing assumptions used in this study for line pipe, fittings, and valves, the total costs of a new 36-inch diameter oil or gas pipeline project would go up as much as 13.6% in the initial transition period.

- Developers of new pipelines sign long-term service contracts with transporters and obtained approved rate from regulators based on established industry costs before construction on the new pipeline begins. If construction costs were to go up due to domestic content policies after the transportation contracts were signed and rates were approved, project economic viability could be threatened.

- The costs of pipeline construction and repair are expected to be higher during the transition period because fewer suppliers would be available than are now and any new suppliers entering new markets are likely to demand higher prices to speed the payback on their investment.

- The length of time it would take the domestic steel industry to transition away from scarcity pricing to the point where it had the ability to fully meet the domestic content requirements for line pipe, fittings, and valves would depend on many factors and might be expected last from 24 months to ten years.

<u>Findings Related to Policy Considerations</u>

- This study does not address the question of what purpose would expectedly be served by a domestic content requirement for pipelines; whether that purpose would, in fact, be realized; or whether another policy could better serve that purpose. These are important issues, but are not within the scope of this report.

- This study also does not address the question of how a U.S. policy could be enacted to require domestic sourcing of U.S. steel for U.S. pipelines such that the policy would comply with U.S. laws related to private sector activity, U.S. trade laws, international obligations under WTO, and other international agreements. These are also important questions for which a separate legal analysis would be required to make those determinations.

- Putting aside those important political and legal issues, this study does investigate the technical and economic challenges of policies promoting domestic content requirements for pipelines. The study concludes that such policies have the potential to create a large loss of U.S. jobs and the incurrence of high economic costs if pipeline projects are delayed, stalled or cancelled due to lack of supplies or high-priced supplies.

- The study also shows that while the U.S. imports $2.2 billion of steel products related to line pipe from 29 countries, it exports $11.1 billion worth of steel and steel products to those same 29 countries. This indicates the exposure the U.S. has to retaliatory policies that could be pursued by countries adversely affected by U.S. domestic content policies.

- The study also recounts the 2002 experience the U.S. had with steel import restrictions imposed under Section 201 authorities. While these restrictions provided some temporary relief to steel producers who were able to continue operations, many went bankrupt. The restrictions increased the price of steel domestically and adversely impacted the domestic industries that rely heavily on steel as a primary input to their business. According to a study commissioned by the Consuming Industries Trade Action Coalition over 200,000 jobs were lost due to the steel price rise in 2002 due to their negative impact on steel using industries, including metal manufacturing, machinery and equipment and transportation equipment. This experience indicates that when economic policies are pursued to “pick winners” they frequently have the corresponding effect of “producing losers.”

- Therefore, the constraints, practical considerations and historical experiences identified in this report and in other materials submitted to the Department of Commerce are worthy of careful review and analysis as next steps are contemplated for any U.S. domestic content policies related to pipelines.

2. Introduction

This report was prepared by ICF at the request of the American Petroleum Institute and other sponsoring associations to provide information to the Department of Commerce and other interested parties on the feasibility and economic impacts of potential policies and other actions that might be taken by the Federal government to require that the repair and construction oil and gas pipelines exclusively use materials and equipment produced in the U.S.

This chapter presents our understanding of what such policies and actions might entail and explains how we went about analyzing the consequences of such policies and actions.

2.1 Content of Executive Order

The White House on January 24, 2017 issued a memorandum to the Secretary of Commerce containing the following instructions:

> The Secretary of Commerce, in consultation with all relevant executive departments and agencies, shall develop a plan under which all new pipelines, as well as retrofitted, repaired, or expanded pipelines, inside the borders of the United States, including portions of pipelines, use materials and equipment produced in the United States, to the maximum extent possible and to the extent permitted by law. The Secretary shall submit the plan to the President within 180 days of the date of this memorandum.
>
> "Produced in the United States" shall mean:
>
> (i) With regard to iron or steel products, that all manufacturing processes for such iron or steel products, from the initial melting stage through the application of coatings, occurred in the United States.
>
> (ii) Steel or iron material or products manufactured abroad from semi-finished steel or iron from the United States are not "produced in the United States" for purposes of this memorandum.
>
> (iii) Steel or iron material or products manufactured in the United States from semi-finished steel or iron of foreign origin are not "produced in the United States" for purposes of this memorandum.

In the request for comments published in the Federal Register March 16, 2017, the Department of Commerce added the following definitions:

> For the purposes of this notice the term ‘‘*pipeline*’’ refers to any conduit of pipe used for conveyance of gases, liquids or other products. The physical facilities include: Pipes, valves, fittings, connectors, and other iron and steel assemblies or apparatus attached to the pipe.
>
> For the purposes of this notice the term ‘‘*materials and equipment’’* refers to the iron, steel and all precursors, alloys or substitutes used in the fabrication of pipelines (as defined above) as well as pipeline coatings while ‘‘*equipment*’’ refers to valves and other steel and/or iron apparatus attached to pipe.

The study is being conducted under the presumption that policies and actions under consideration by the Department of Commerce would require that line pipe, fittings, and valves for new and repaired/refurbished oil and gas pipelines be made in the U.S. using steel, materials and parts that are also made in the U.S. We further assume that any requirements would not apply to machinery (prime movers, pumps, compressors) and equipment (meters and SCADA systems) that are parts of the larger "pipeline systems." The issue of how any requirements would have to be limited "to the extent permitted by law" was not considered in this report since such legal issues are beyond the expertise of this study's authors and because the focus of this study is the *technical* limitations of trying to substitute domestic products for imports and the *economic* consequences of doing so. Therefore, we are simply assuming that any domestic content requirements for all U.S. oil and gas pipelines could be implemented in way that is consistent with U.S. laws regarding private sector activity and U.S. laws and international obligations under WTO and other agreements, while recognizing there are pending questions on this issue.

2.2 Scope of Analysis

ICF was asked to prepare a report that would present information of the following topics and questions:

- What industry sectors use the kind of steel line pipe that would be covered by the policies and actions under consideration by the Department of Commerce? How much such line pipe do these industry sectors currently have in use?
- What are the annual volumes and dollar values of line pipe installed each year both in total and for relevant submarkets defined by pipe diameter and other characteristics?
- How much of this line pipe is manufactured in the U.S. and how much is imported -- in total and by submarket?
- What is the volume of line pipe expected to be consumed in the U.S. over the next five years and how do these volumes compare to the capacity of U.S. line pipe manufacturers?
- Where do potential constraints exist in the manufacturing capabilities and capacities of domestic line pipe manufacturers and their suppliers of high strength cut-to-length plate and plate coils?
- How much money and time would be needed for line pipe manufacturers and their cut-to length plate and plate coil suppliers to overcome these constraints? What are the impediments to them doing so?

- What are the domestic manufacturing capabilities, limitations and constraints related to the fittings and valves that would also be covered by the policies and action under consideration by the Department of Commerce?

- What is the current degree of competition among domestic and foreign suppliers of line pipe to the U.S. market? How would that degree of competition change if line pipe imports where prohibited?

- What is the current degree of competition in the U.S. among domestic and foreign suppliers of high strength cut-to-length plate and plate coil suitable for line pipe? How would that degree of competition change if line pipe had to be made from domestically produced cut-to length plate and plate coil that, in turn, would have to made from domestic slabs?

- How much of the typical cost of building new oil and gas pipelines is represented by the line pipe, fittings, and valves that would be covered by policies and actions being considered by the Department of Commerce. What range of price increases might be expected if domestic content restrictions were implemented and how would those cost increases for line pipe, fittings, and valves impact the overall cost of new oil and gas pipelines?

Although the Executive Order is not directed at oil country tubular goods (casing, tubing and drill pipe used in the drilling and completing of oil and gas wells), this study does present some information on the OCTG market in the U.S. This is done because the line pipe and OCTG markets are often supplied by some of the same manufacturing companies using similar production processes and because the two product lines have considerable overlap in terms of the semi-finished steel products from which they are made (chiefly hot rolled plate coils and billets composed of carbon and alloy steels). The manufacturing overlap occurs primarily with manufacturers that make small OD line pipe using either seamless or welded manufacturing methods. It is possible that supply chain changes and disruptions in the line pipe industry caused by any domestic content requirements could have spillover effects onto the OCTG markets.

2.3 Key Assumptions for Domestic Content Rule

The premises and assumptions on which this report is based can be summarized as follows:

- The Federal government would implement policies and take other actions as necessary to require that the construction of new oil and gas pipelines and the repair and expansion of existing pipelines be undertaken with line pipe, fittings, and valves that are manufactured in the U.S. from steel, materials and parts that are also made in the U.S.

- These requirements would apply to all kinds of steel pipelines including flow lines on oil and gas leases, gas and oil gathering lines, pipelines connecting to gas processing plants, natural gas transmission lines, natural gas distribution lines, crude oil pipelines, oil product pipelines and natural gas liquids pipelines.

- However, any domestic content requirements would not apply to line pipe and pipes that are owned by the consumers of natural gas and other fuels (for example the gas line inside a home connecting a furnace to the utility's gas meter).

- Furthermore, any domestic content requirements would not apply to machinery (prime movers, pumps, compressors) and equipment (meters and SCADA systems) that are parts of overall "pipeline systems."

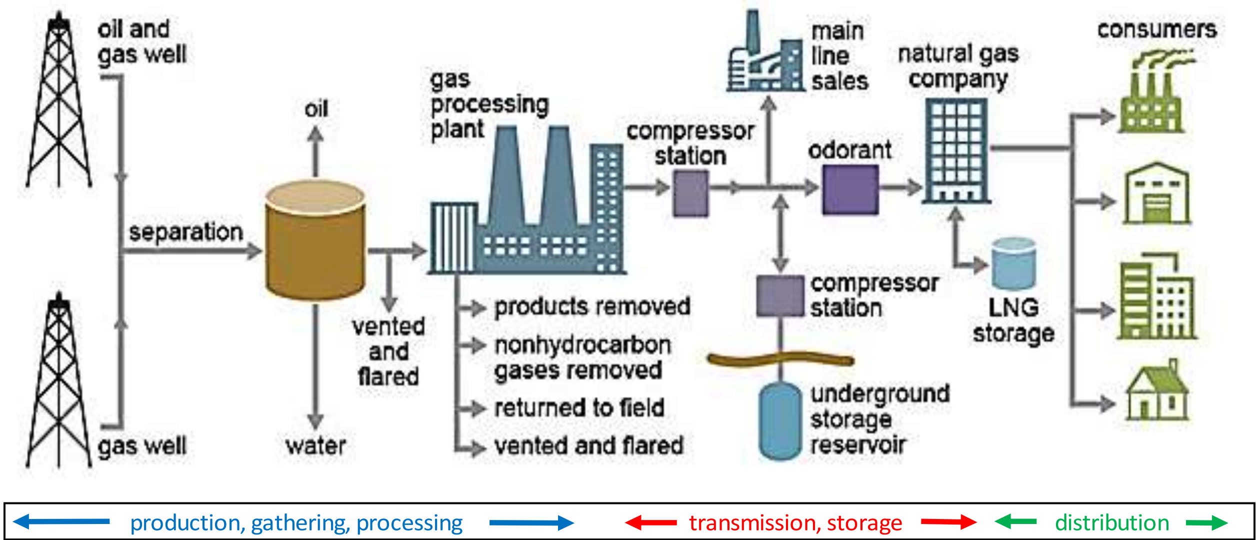
- In analyzing the expected market conditions (e.g. supply and demand for line pipe, cut-to-length plate, plate coil, etc.) and the ability of supply chains to readily adapt to the prohibitions on imports, we assume that any domestic content requirements would be implemented in the near future and be immediately applicable. We also assume that there would be few if any exemptions to the domestic content requirements. With these assumptions we can more readily identify where potential constraints might exist. (As opposed to assuming most of the choke points away by anticipating a very long implementation period.)

- However, for the purpose of evaluating the economic costs of the policies we provide an alternative case which combines a gradual compliance period with exemptions for products not readily available from domestic sources. As is explained further below, this alternative case is provided because the expected economic effects of requiring immediate compliance would be unacceptably high. This is due to the long-lead time needed for large-volume line pipe orders, the significant inventories of line pipe held by distributors and some pipeline owners, and the fact that some items simply are not currently manufactured in the U.S. using entirely domestic material and parts. The reordering of supply chains to meet domestic content requirements would take considerable time.

2.4 Background on Steel Line Pipe Markets

Steel pipes are used along the entire value chain of the oil and gas system from the point of production up to the end user. In the natural gas value chain, steel pipe is used in all segments including production, gathering, processing, transmission and distribution. (See Exhibit 2-1.) Pipelines are also important components of the supply chains for crude oil and petroleum products, natural gas liquids and carbon dioxide, which is used in enhanced oil recovery.

Exhibit 2-1: Natural Gas Supply Chain



Source: Energy Information Administration, DOE

The term "line pipe" refers to high strength carbon (and sometimes alloy) steel pipe used for transporting crude oil, petroleum products, natural gas and water, typically over substantial distances. Line pipe varies in size (diameter and thickness) and grade (strength) of the pipe along the supply chain based on the specific needs at each stage. The focus of this study is line pipe made to API 5L standards and the additional requirements above the API 5L standards that pipeline operators are increasingly demanding from their line pipe suppliers. However, it is permissible to install line pipe conforming to other standards such as those from ASTM and some of the line pipe market demand – particularly for flow lines and gathering systems – may be met non-API 5L steel line pipe.

2.4.1 Where Steel Line Pipe and Pipe is Used

Production Flow Lines for Gas, Oil, Water, Steam and CO_2

Petroleum is produced from over one million wells in the U.S. Steel pipes of various sizes are used to transport natural gas and liquids from the well head to various equipment on the well site and subsequently into the gathering system. Also water is often transported by steel pipes to injection wells where the water is injected back into the reservoir or to storage tanks from which the water is removed by truck for disposal. Generally, all these steel pipes used on the well site for production are referred to as "flow lines" and the sizes of these flow lines range from two inches to 16 inches in outside diameter (OD). Larger diameter pipes are becoming common for flow lines due to horizontal drilling where multiple well heads with horizontal wells are co-located at a single site. Steel flow lines are typically made of carbon steel or alloy steel where corrosion is a concern.

As the hydrocarbon reservoir matures the pressure in the reservoir dwindles and artificial means are necessary to push the hydrocarbons out of the reservoir. This is referred to as enhanced recovery. Steam and carbon dioxide are often used to increase the flow of hydrocarbon liquids in the reservoir and to the surface of the well head. Corrosion resistant steel pipes are used to carry this steam and carbon dioxide to the enhanced recovery injection and production wells.

Gathering Lines

The oil and gas produced at well sites in production are usually separately transported to central gathering sites using steel pipes. The gathering sites have additional steel piping to move the oil and gas between separation, storage, and compression equipment. Finally the gathering steel pipelines carry the natural gas to gas processing facilities and oil to central tank batteries. Some gathering lines are regulated for purposes of safety and environmental protection at the federal level by the Pipeline and Hazardous Materials Safety Administration (PHMSA). Gathering lines fall under PHMSA regulations when the gathering lines exceed a certain diameter, operates above a certain pressure, and are located within proximity of a dwelling or environmentally-sensitive area. State governments regulate the remaining lines which come in a variety of sizes.

Transmission Pipelines

Pipeline quality natural gas (95% methane, plus some heavier hydrocarbons plus small amounts of nitrogen and carbon dioxide) is produced after the separation of natural gas liquids and sometime non-hydrocarbon gases from wet natural gas at natural gas processing plants. This pipeline quality natural gas is transported to residential, commercial, and industrial end-use customers through steel pipelines under high pressure, typically ranging from 500 to 1,500 pounds per square inch (psi). Depending on the distance and volumes of natural gas being transported the size of the pipe may vary from 4.5 inch OD to 48 inch OD. The wall thickness of the pipe typically varies from 0.154 inches to 1.50 inches and higher. Pipeline design engineers determine wall thickness based on the OD of the pipe, the specified minimum yield strength of the steel to be used to make the line pipe, the pipeline design operating pressure, and the class of service based on geographic location and population/building density. The specified minimum yield strength varies from 35,000 psi to 80,000 psi, depending on application. Steel pipelines are also used to transport oil and gas from offshore production platforms to onshore gathering and processing facilities. These pipelines tend to have a higher wall thickness of up to 1.50 inches depending on the depth of the ocean in which they are operating. Currently there are more than 300,000 miles of steel pipe being used in the natural gas transmission systems[2] in the U.S. The most commonly used minimum standard for steel pipe is the API 5L for the transmission systems. The same type of line pipe is used for transmission systems for crude oil, NGLs, petroleum products and carbon dioxide, which combined represent another 208,000 miles of pipeline.

Pipelines to and within Gas Storage Fields

Gas storage fields inject natural gas into underground geological formations for storage at times of low natural gas demand and withdrawal of the natural gas during peak demand period to balance the load in the system. Similar to transmission systems, gas storage field steel pipes transport the gas from the transmission system to storage wells for injection and back to the transmission system after withdrawal from the storage wells. The storage system also consists of dehydration systems to remove water and compression systems to boost the pressure of natural gas withdrawn from the reservoirs. Steel pipes carry the natural gas through these dehydration and compression systems. Storage system steel pipe are similar in specification to the association transmission system and follow API 5L standards.

Natural Gas Distribution Lines

Natural gas distribution systems receive natural gas from large sized high pressure transmission steel pipeline, step down this pressure and distribute it to end users, mainly residential and commercial, but also some industrial customers. The distribution system consists of an intricate grid of pipe laid across large geographic areas, such as cities and townships. Based on function, this grid of pipe can be classified into two broad types – mains and services. The distribution mains carry the natural gas from the transmission system to large density customer areas and typically operate between 10 to 100 psig. The service pipe further steps down the pressure and delivers the gas to customers at lower than 10 psig, typically less than one psig for residential customers. The main line pipe (running along streets) can either be plastic or steel. The service lines (connecting the distribution mains to each house or other customer) are typically made of plastic. The distribution steel pipes are typically less than 16 inches OD.

Connection into/out of Facilities such as Gas Processing Plants, Power Plants and other Large Consumers

Oil and gas facilities often contain many miles of steel pipe within the fence line to move liquids and gas among processes and equipment. Industrial facilities that use natural gas also have steel pipe, such as in power plants and petrochemical facilities.

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[2] U.S. Energy Information Administration (EIA) https://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/index.html

Exhibit 2-2 provides a breakdown of the mileage and weight of installed pipe by pipe OD and sector related to the transportation of crude oil, natural gas, natural gas liquids, petroleum products and carbon dioxide.

Non-oil and Gas Uses

Pipelines which transport hydrogen and chemicals such as ethylene will commonly be built with line pipe that meets or exceeds API 5L standards. Line pipe manufactured to API 5L standards is also sometimes used for less demanding purposes such as water pipelines and piles for construction. Such use usually occur when the line pipe is found not to meet quality control standards or is damaged during handling or storage. Such uses also occur when used line pipe is repurposed.

Exhibit 2-2: Estimated Miles & Weight of Installed Steel Line Pipe and Pipe in U.S. Oil & Gas Industries

Size Category	Flow Lines (miles)	Gas Gathering (miles)	Gas Transmission (miles)	Crude Oil, NGL, Petroleum Products, CO2 Pipelines (miles)	Gas Distribution Mains and Services (miles)	All Oil & Gas Steel Line Pipe, Mains and Services (miles)	All Installed Line Pipe, M&S (metric tons)
Diameter <=4.5"	160,985	126,086	21,720	7,924	636,439	953,154	14,943,448
Diameter 4.6-16"	28,409	159,632	115,819	155,468	118,270	577,598	47,604,581
Diameter 16.1-24"	-	9,687	65,590	28,797	10,737	114,811	20,894,982
Diameter >24"	-	2,100	94,267	16,281	2,628	115,276	51,883,598
All Sizes	**189,394**	**297,506**	**297,396**	**208,470**	**768,074**	**1,760,839**	**135,326,608**

Source: PHMSA database of pipeline and distribution systems and ICF estimates

2.4.2 Markets for OCTG

Steel pipe and tubular products are also used in the construction of oil and gas wells. The wells are drilled using drill pipe that is made of steel. Once the well bore hole is drilled a steel pipe called a casing[3] is installed in the bore hole to retain the structural integrity of the well bore and prevent any cross contamination between hydrocarbons and groundwater and soil. After the casing is in place another steel pipe (production tubing) of a smaller diameter is often placed inside the casing. The hydrocarbons from the reservoir are produced and brought to the surface through the tubing. The drill pipe, casing, and tubing are collectively referred to as oil country tubular goods (OCTG).

[3] Some oil and gas wells are constructed with "liners" instead of casing to provide a barrier between the annulus of the well and the surrounding rock. The difference is that liners are installed starting from the end of the previous casing (or liner) while each string of casing starts from the surface (forming a pipe within a pipe). The term "casing" as used in this report should be understood to encompass both casing and liners.

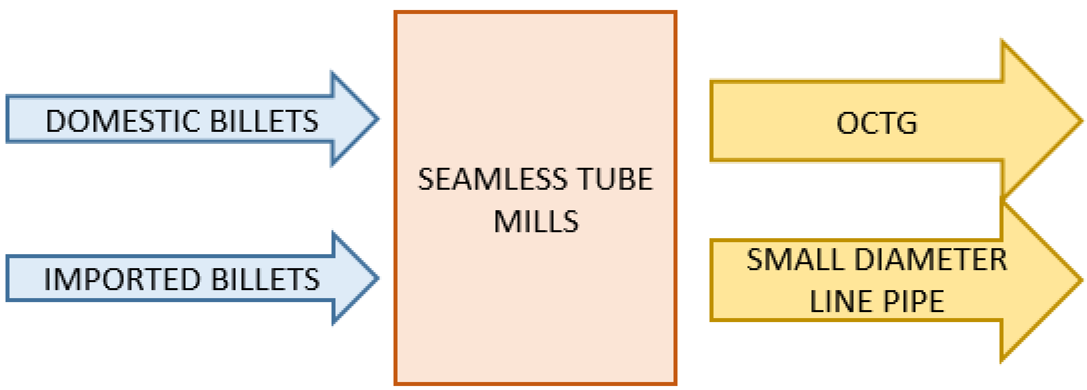
Because OCTG needs to withstand high pressures and a corrosive mix of hydrocarbons, water, and carbon dioxide they are often made from alloy steels. In instances where there is a significant amount of hydrogen sulfide the OCTG might be made of stainless steel. OCTG steel pipe is most commonly made following the API 5CT and API 5CRA standards. An oil and gas well can be anywhere between 600 to 25,000 or more feet deep and hence uses a significant amount of steel for construction.

2.4.3 How Line Pipe and OCTG are Made

Line pipe and OCTG are primarily of two different types – seamless and welded.

Seamless pipe is often made using round cross section steel forms (called rounds) or square billets that are rolled into a round shape. (See Exhibit 2-3.) These billets are heated to a temperature where they are malleable. A mandrel with a pierce or a plug is pushed through the center of the billet as it is being rolled to form a hollow in the center, which results in the pipe shape. The pipe is then sent through several rolling mills to stretch and straighten it. Finally, the pipe is heated again and cooled at a predetermined rate so as to relieve the stresses created during the rolling process and obtain the desirable steel grain structure, hardness and strength.

Exhibit 2-3: Seamless Line Pipe and OCTG Manufacturing



Welded pipe is classified into several categories based on how it is formed and the type of welding technique used. There are five commonly used shaping techniques: (See Exhibit 2-4.)

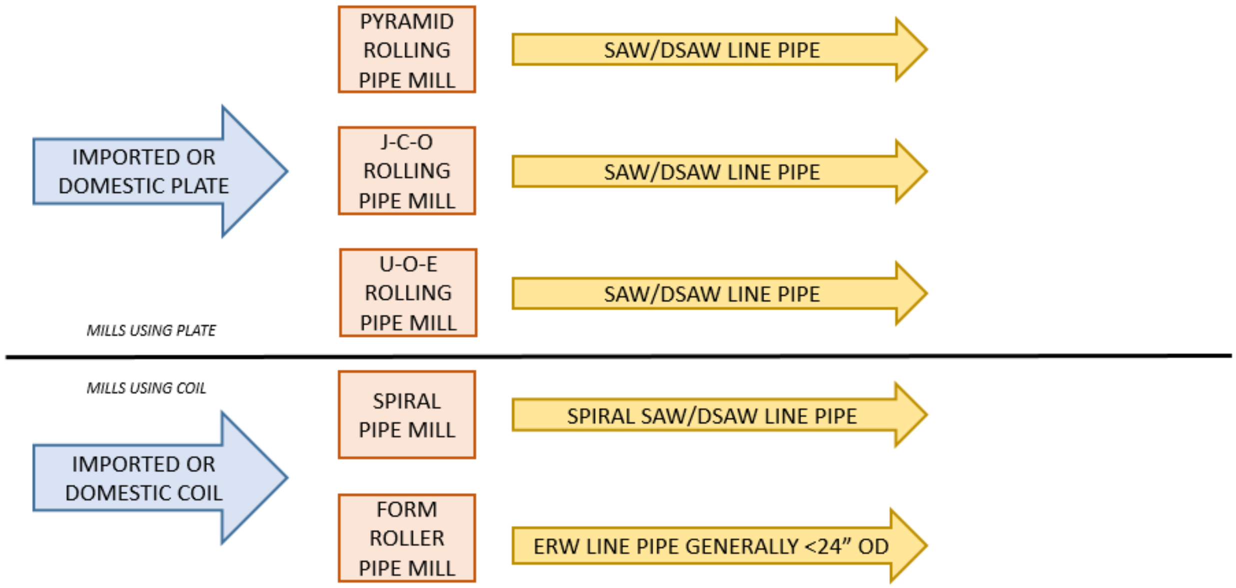
- **Form rollers**: Smaller diameter line pipe of 24 inches and less is usually formed by passing a continuous steel plate coil through sequential forming rollers that gradually turn the flat plate into a cylindrical shape. The cylinder is then cut to form individual pipe “joints” of 40 to 80 feet in length.

- **U-O-E forming** – In this shaping technique a flat plate or coil that is first bent into a U shape using hydraulic presses that pushes down on the center of the plate or coil along the length. This U shaped plate is then formed into an O shape by using hydraulic pressure in a die that forces the two open end edges of the U closer together. The two edges of the O are then welded together to form a pipe. This pipe is then expanded (referring to the E in the U-O-E) using a mechanical mandrel or hydraulic pressure. This step allows for the final shaping and sizing of the pipe. The pipe is then heat treated to relieve stresses.
- **J-C-O forming –** In this shaping technique a flat plate that is bent by a three point bending process with a die on longitudinal side by first shaping into a J then C and finally O. The two edges of the O are then welded together to form a pipe. This pipe is then expanded using a mechanical mandrel or hydraulic pressure. This step allows for the final shaping and sizing of the pipe.
- **Pyramid rolling** – In this rolling technique three rollers are placed in a pyramidal arrangement where one roller on the top center pushes down on the center of the plate along the length as it is rolled by the two bottom rollers. Successive rolling motions along the width with a vertical pressure at the center result in a hollow pipe structure that is welded along the open edges. This pipe is then expanded using a mechanical mandrel or hydraulic pressure. This step allows for the final shaping and sizing of the pipe.
- **Spiral rolling** – In this rolling technique a continuous coil (also known as skelp) is bent into a pipe such that the edge along the length of the coil forms a helical pattern along the length of the pipe. These helical edges are welded to produce spiral pipe. This pipe is then expanded using a mechanical mandrel or hydraulic pressure. This step allows for the final shaping and sizing of the pipe.

There are two commonly used welding techniques – electric resistance welding (ERW) and submerged arc welding (SAW):

- **Electric resistance welding** – In ERW an electrode may be used to generate an electric arc (or high frequency electromagnetic energy can be used to induce electricity flow) to locally heat the two metal edges that need to be joined such that they melt and fuse together. An inert gas is often used to shield the arc as it impinges on the metal to avoid contamination of the weld joint. Today ERW is mostly done in the form of high frequency welding (HFW) without electrodes and is used primarily to make longitudinal welds in form roller manufacturing of line pipe of 24 inch diameters and below. This is also the type of welding predominantly used in making welded OCTG.

Exhibit 2-4: Welded Line Pipe Manufacturing Methods



- **Submerged arc welding** – In SAW a consumable wire electrode is used to generate an arc between the joint and the electrode. The wire melts and fuses with the metal joint to provide a welded joint. A flux is deposited ahead of the electrode along the joint to shield the arc and weld from contamination and in some cases to deposit alloying metals into the weld. Some of the flux melts as the weld progresses and is removed as slag and the remaining flux is recycled. A SAW may be performed on both sides of the joint and is referred to as double SAW or DSAW. The SAW process can be used on both longitudinal welds (LSAW or SAWL) as in the case of U-O-E, J-C-O or pyramid processes or spiral/ helical welds (SSAW, HSAW or SAWH).

The width of the plate of coil needed for pipe making depends on the type of shaping process being used. For U-O-E, J-C-O and pyramid rolling that perform a single longitudinal weld the width can be calculated as the diameter multiplied by *pi* (since the circumference is *pi* multiplied by the diameter). For the spiral pipe making process the width can be calculated as diameter multiplied by a thumb rule factor of 2.0 to 2.2. Exhibit 2-5 provides a listing of the various widths of plate or coil needed to make the various diameters of pipe typically used in the oil and gas industry. This is an important because many domestic cut-to-length plate and plate coil rollers have maximum width limits that are narrower than what is needed for large diameter line pipe and this is one reason (along with thickness limits, rolling ratio limits and quality concerns) that cause U.S. line pipe manufactures to procure over half of their cut-to length plate and plate coil needs from foreign sources.

Exhibit 2-5: Cut-to-length Plate and Plate Coil Widths Required for Different Line Pipe Diameters

Line Pipe Diameter (inches)	Required Plate/Coil Width for Single Longitudinal Weld (inches)	Required Coil Width Helical Weld (inches)
4.5	14.1	9.5
10	31.4	21.0
12	37.7	25.2
14	44.0	29.4
16	50.3	33.6
18	56.5	37.8
20	62.8	42.0
22	69.1	46.2
24	75.4	50.4
26	81.7	54.6
28	88.0	58.8
30	94.2	63.0
32	100.5	67.2
34	106.8	71.4
36	113.1	75.6
38	119.4	79.8
40	125.7	84.0

Pipeline Coatings

Steel pipelines are coated on their outside surfaces to prevent corrosion and protect the line pipe from abrasion damage. Pipeline interiors are also sometimes coated for similar purposes and to provide a smooth surface that offers less resistance to flowing fluids as compare to bare steel. Imported line pipe is almost always brought into the country bare to prevent damage to the coating during shipment and to facilitate inspection upon receipt.

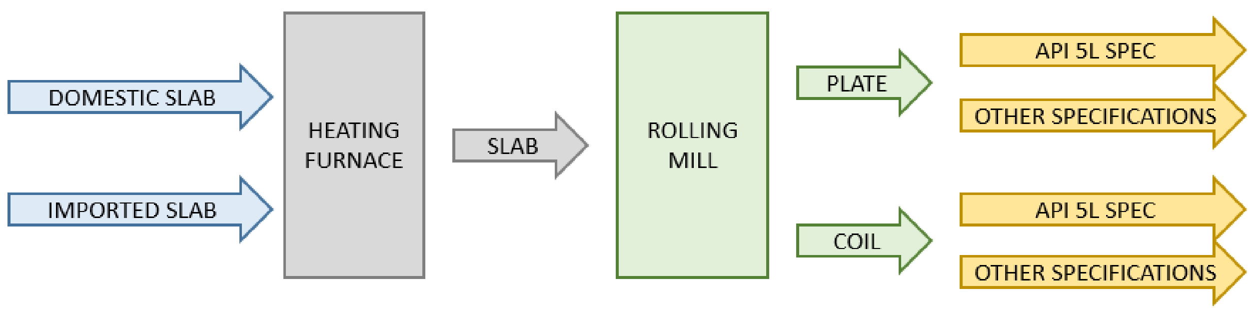
There are many different types of coating services, all of which begin by cleaning the line pipe using sand or other blasted abrasives. The most common coating now applied to oil and gas line pipe is fusion bonded epoxy (FBE) which uses a powdered coating that is bonded to the line pipe with the application of heat. FBE can be enhanced by application of an abrasion resistant overlay (ARO) which is one or more additional outer layers of hard, mechanically strong coating or material. In the factory application of the coating, the ends of line pipe joints are left bare for welding purposes. A separate field coating process covers the joint ends after they are welded together.

Since almost all coating is done domestically, there is no issue with any current dependence on foreign coating services. Also, during ICF's survey of association remembers, no issues were raised with regard to imported coatings materials not being available from U.S. suppliers.

2.4.4 How High Strength Steel Cut-to-length Plate and Plate Coils are Made

High strength steel plates and coil are made primarily from steel slabs that are typically produced through continuous casting of molten steel. To make plate or coil the steel slabs are heated above the recrystallization temperature where they are malleable. (See Exhibit 2-6) They are then run through a series of roughing and finishing rolling mills where the thickness is reduced and the length and width is increased to the desired dimensions. The surface finish is also controlled by removing oxides from the surface through high pressure water jet impingement and controlled cooling of the steel along the rolling process. The grain structure and uniform distribution of alloying elements (molybdenum, manganese, etc.) are controlled through temperature regulation throughout the rolling process. Slabs thickness can be reduced by one tenth to one hundredth for making plates and coils. The reduction ratio also controls the grain structure and thus steel strength as greater reduction ratios lead to stronger steels. Process control on width reduction and width uniformity between rolling stages influences the final quality of the product. Finally, testing equipment and methods used online during rolling as well as post-manufacture determine the consistency in quality within and across batches of products.

Exhibit 2-6: Steel Plate and Coil Manufacturing



2.4.5 How Steel is Made in the U.S.

There are two main types of steel making plants in the U.S. – integrated steel mills and mini mills.

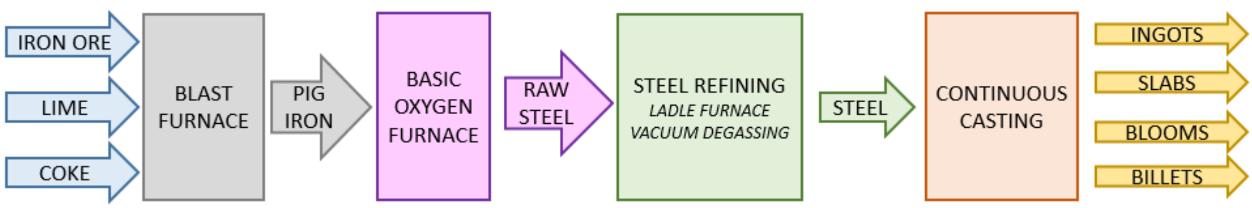
<u>Integrated Steel Mills</u>

In an integrated steel, mill iron is converted into semi-finished or finished products. (See Exhibit 2-7.) This includes the following activities;

Iron making – Iron ore, coke, and limestone are heated in a blast furnace where the oxygen from the iron is remove and molten iron or pig iron is produced. This iron contains more than 2% of carbon.

Steelmaking – In this step the carbon content of the iron is reduced below 2%. This is done by passing oxygen over molten iron in a basic oxygen furnace (BOF). Some amount of scrap steel (~30%) may also be added at the BOF stage. Steel is typically classified as low carbon (<0.3% carbon), medium carbon (0.3 – 0.45% carbon), high carbon (0.45 – 0.75% carbon), and very high carbon (0.75 – 1.5% carbon). Line pipe is usually made from low carbon steel and API 5L specification requires the carbon content to be 0.22 to 0.28% with tolerance bands depending on the manganese content. The molten steel is poured into molds (that is, “cast”) to form ingots (large blocks weighting several hundreds of kilograms), slabs (flat blocks with rectangular cross section), or other semi-finished shapes. (See Exhibit 2-8).

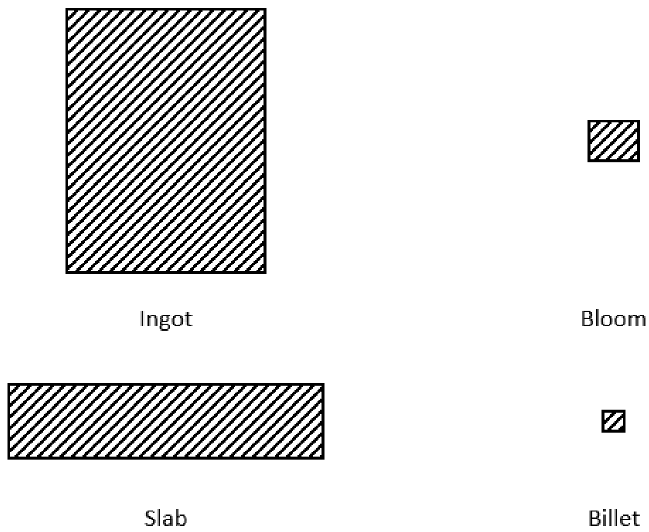
Exhibit 2-7: Integrated Steel Mill (showing only steps to initial semi-finished products)



Making of further semi-finished products – The slabs of steel are rolled into coils or plate in rolling mills, as discussed previously.

Finished products – The coils and plates may be further processed to make finished pipe and tube products, like line pipe and OCTG, and structural steels used in construction and machine parts manufacturing.

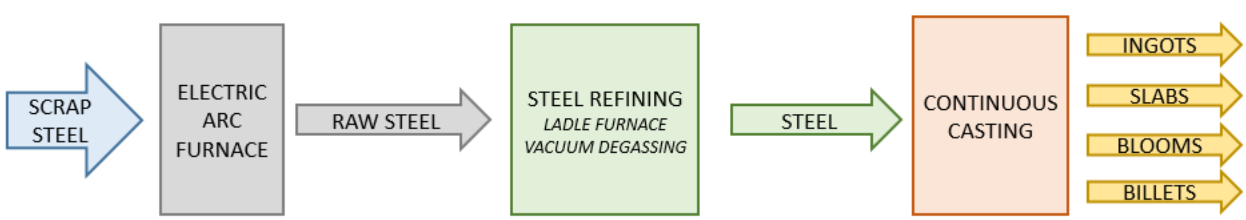
Exhibit 2-8: Semi-Finished Steel Products (indicating relative shapes and sizes)



Mini Mills

A steel mini mill produces steel products from recycled scrap metal. Unlike integrated steel mills, which make new steel from iron ore in a blast furnace, mini mills melt and refine scrap steel using electric arc furnaces (EAF) and turn that steel into semi-finished and/ or finished steel products. (See Exhibit 2-9.) A mini mill consists of the EAF that uses electricity to melt scrap steel and possibly direct reduced iron, or blast furnace iron. Oxygen is impinged on the feed as it is being melted to remove the impurities, including carbon. These impurities form slag that floats to the top of the molten steel. The steel produced in EAF may then be sent to ladle furnaces to homogenize the steel by bubbling inert gas (such as argon) and adjust the chemistry of the steel to remove impurities such as sulfur and phosphorus as slag. In addition, the steel may be sent to a vacuum degasser where hydrogen, nitrogen, and oxygen are extracted from the molten metal under vacuum. The steel is then cast and follows the same pathway of semi-finished and finished product manufacturing as what would be found at an integrated steel mill.

Exhibit 2-9: Steel Mini-Mill (showing only steps to initial semi-finished products)



2.5 Methodology for ICF Study

This section of the report discusses the sources of data and methodologies employed by ICF in preparing this report.

2.5.1 Survey of Association Members

ICF conducted phone interviews with and distributed a written questionnaire to association members that represented industries that would be impacted as a result of the directive, including pipeline operators, integrated steel mills/pipe mills manufacturers, line pipe and pipeline equipment distributors, and equipment manufacturers. During these phone interviews, ICF inquired about companies' suppliers of line pipe, valves, fittings, cut-to-length plate and plate coil and the reasons for their current suppliers from technical to pricing. ICF's asked for the location of the product manufacturer and the origin of the steel used to make the product. ICF also asked each company to provide its view of the impact of domestic content policies on its current supply chain along with any concerns it might have about availability, prices, lead times, and other issues.

ICF also solicited information on historical pipeline purchases, valve purchases and fittings purchases from pipeline operators that utilize steel pipelines within their businesses for high-pressure natural gas, crude oil/liquids, and carbon dioxide. For pipelines, ICF collected information on miles of pipe at each diameter, with the grade of pipe, the manufacturer and where the steel originated. For valves, and fittings, ICF collected information on the number of a particular type of valve/fitting and the manufacturer. The data that was collected was used to help inform and check the findings throughout this report.

2.5.2 Collection of Historical Consumption Data

ICF collected data on historical consumption of line pipe and OCTG from the Preston Pipe Report[4], the American Iron and Steel Institute annual reports, USGS steel and minerals yearbooks[5] and other sources.

2.5.3 Collection of International Trade Data

In order to analyze historic imports and exports, ICF leveraged international trade data available through the United States Census Bureau[6] for line pipe, OCTG, high strength plate, and high strength coil. This trade data is reported as a list by Harmonized Tariff Schedule (HTS) code. ICF reviewed this list and designated HTS codes according to several characteristics such as material, diameter size, or welding type. The underlying

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[4] The Preston Pipe and Tube Report, http://www.prestonpipe.com/publications/preston-pipe-tube-report/
[5] USGS Minerals Commodities Summary, https://minerals.usgs.gov/minerals/pubs/mcs/
[6] "USA Trade Online" – United States Census Bureau; https://usatrade.census.gov/

trade data was then aggregated by category and year to give representative quantities and values of imports and exports for each of the above sources. ICF also aggregated import data by country for use in HHI calculations.

2.5.4 Collection of Data on Line Pipe, Cut-to-length Plate, and Plate Coil Manufacturing Capacity

In order to characterize the current line-pipe market, ICF compiled a list of API 5L certified companies from API's monogram program[7]. From this listing, ICF conducted company by company research into their specifications and operating capacity. ICF cross-checked this research against the Pipeline & Gas Journal's[8] line pipe specifications and the Simdex Metal Tube Manufacturer Worldwide Guide[9]. This data was then separated into three classifications including pipe manufacturers that make less than 16 inch OD pipe, 16 inch to 24 inch OD pipe and greater than 24 inch OD pipe. For the companies where the capacity was not available from any of the sources reviewed, the median capacity of manufacturers in each submarket whose capacity was known was assigned to them.

The cut-to-length plate and plate coil company capability and capacity list was compiled using the information provided by transmission line pipe operators on their source of steel, data from James F. King's "steelonthenet.com" database[10], and information collected from brochures and websites of plate and hot rolled coil (HRC[11]) manufacturers in the U.S. The company websites also provided information on whether their source of slabs or ingots to make cut-to-length plate or HRC was from U.S. melted steel.

2.5.5 Estimation of Future Line Pipe and OCTG Demand

The estimates of future demand for line pipe and OCTG were developed from two ICF forecasts prepared for API of future infrastructure investments expected in many segment of the oil and gas industry.[12] The report focused on the amount of infrastructure needed for two different scenarios, a Base Case and a High Case, each of which are plausible depictions of future market conditions. While the Base Case represents a most likely scenario, the High Case is put forward to assess infrastructure

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[7] API Monogram Program: https://mycerts.api.org/Search/CompositeSearch
[8] Pipeline & Gas Journal: https://s3.amazonaws.com/pgj-wp-media/wp-content/uploads/sites/2/2015/12/12PGJ_15_LinePipe1.pdf
[9] Simdex Metal Tube Manufactures Worldwide Guide: https://www.simdex.com/products/metal-tube-manufacturers-worldwide-guide/
[10] James F. King's database: http://www.steelonthenet.com/pdf/jfk_steel_brochure.pdf
[11] The term hot rolled coil or HRC refers to both plate coils (thick steel) and sheet coils (thin steel) made in a hot rolling mill.
[12] "U.S. Oil and Gas Infrastructure Investment Through 2035," ICF, May 2017: http://www.api.org/news-policy-and-issues/energy-infrastructure/oil-gas-infrastructure-study-2017

development in a more robust environment that is fostered by a larger hydrocarbon resource base and more rapid advancements in E&P technology.

2.5.6 Calculation of Competition before and after Trade Restrictions

This report presents calculations regarding how import restrictions would affect competition in the U.S. line pipe and related cut-to-length plate and plate coil markets. Two measures that are presented: (1) how much “inframarginal” supply is removed when line pipe imports are prohibited and (2) how industrial concentration would increase.

The first measure is the portion of “inframarginal” line pipe supplies that would be removed from the market by prohibiting imports. Economists use the term “inframarginal” to refer to supplies that can enter the market at prices at or below the prevailing market price. This can be thought of as the part of a supply curve that is at or below the market clearing price. When import restrictions are implemented so that inframarginal supplies are removed, the existing supply curve would be shifted to the left and usually leads to higher market clearing prices.

The second measure of the effect of limiting imports to be presented here is a widely used measure of industrial concentration called the Herfindahl-Hirschman Index or HHI. The Herfindahl-Hirschman index (HHI) is calculated by summing across all companies competing in a market, the square of each company’s market share. When used to look at the effects of a merger or restriction on trade or production, the HHI measure can be thought of be an indication of how the shape of the supply curve would change. In other words, after the action in question occurs (e.g., a merger) there might be an increase in market power among the companies remaining in the market that allows one or more of them to increase profits by offering its product at non-competitive prices (that is, prices above the marginal cost of production). This has the effect of changing the shape of the supply curve to reduce the quantities available at low prices.

2.5.7 Estimation of the Economic Impacts for New Pipeline Projects

ICF developed two hypothetical examples of new pipeline projects: the first being a 36-inch diameter 280 mile long natural gas pipeline and the second being an oil pipeline with the same dimensions. One purpose of the examples was to illustrate how much of the typical cost of building new oil and gas pipelines is represented by the line pipe, fittings, and valves that might be covered by policies and actions being considered by the Department of Commerce. The other purpose of the two pipeline cost examples is to use them to compute how much the total cost of the pipelines would increase if the domestic content restriction were to lead to price increase for line pipe, fittings, and valves.

The data for these cost examples came from various sources including financial filings at the FERC by gas pipelines (FERC Form 2[13]) and by oil pipelines (FERC Form 6[14]). Additional cost data came from project-level cost data filed with FERC, press releases from project proponents stating capital costs, and commercial database on steel product prices and pipeline project listings and summaries. Additional information on typical design parameters and component costs came from the survey responses and interviews with the sponsoring association members. Since actual pipeline projects differ greatly in terms of design parameters (length, diameter, wall thickness, line pipe materials and manufacturing method, pumps/compressors sizes and type), these two cost examples should be seen as illustrative rather than being statistical averages.

[13] Federal Energy Regulatory Commissions (FERC), Form 2/2A – Major and Non-major Natural Gas Pipeline Annual Report, https://www.ferc.gov/docs-filing/forms/form-2/data.asp

[14] Federal Energy Regulatory Commissions (FERC), Form 6/6-Q – Annual/Quarterly Report of Oil Pipeline Companies, https://www.ferc.gov/docs-filing/forms/form-6/viewer-instruct.asp

3. Findings

3.1 Domestic Line Pipe Manufacturers and Production Capacity

Line pipe manufacturing is part of the metal pipe and tube industry[15] that is usually described as having six market segments:

Mechanical: This is largest segment with over one-fourth of the domestic production tonnage in the metal pipe and tube industry. The mechanical segment encompasses the production of pipe and round and rectangular tubes used to construct various objects such as tools, metal furniture, industrial machinery, playground equipment, restaurant & kitchen equipment and utensils, home & garden utensils, medical equipment, etc.

Structural: This is the second largest segment with slightly under one-fourth of the tonnage produced in the U.S. The structural segment consists of rectangular and round tubes and pipe used to construct bridges, buildings, posts, drilling rigs, offshore oil & gas production platforms, etc.

Oil Country Tubular goods (OCTG): This is usually the third largest segment with roughly one-fifth of the metal pipe and tube production by weight. It includes tubular products such as of casing, tubing and drill pipe used to drill and complete oil & gas wells.

Line pipe: The fourth largest segment with roughly one-sixth of the tonnage is steel pipe of various diameters used to construct pipeline to convey crude oil, natural gas, NGLs, petroleum products, carbon dioxide, hydrogen, chemicals, water and other fluids and slurries.

Standard: This segment is made up of pipe generally used inside buildings for conveying water, gas, steam or sewer flows. It is the fifth largest segment and makes up roughly one-tenth of the tonnage produced.

Pressure: This is the smallest segment and makes up less than one percent of the metal pipe and tube industry by tonnage. It includes pipes that can tolerate high pressures and often corrosive fluids. These pressure pipe are used in

[15] See Appendix C for listing of formal industry groupings that encompass the line pipe, fittings and valve manufacturers discussed in this report. The metal pipe and tube industry in general and line pipe manufacturing specifically fall under two North American Industry Classification System (NAICS) codes: NAICS Code 331210 "Iron and Steel Pipe and Tube Manufacturing from Purchased Steel" and NAICS Code 331110 "Iron and Steel Mills and Ferroalloy Manufacturing."

boilers, hot water generators, fluid heaters, chemical process furnaces, power plants, etc.

It is very common for companies in the metal pipe and tube industry to produce goods in more than one of these six market segments – often in the same production plants. The capacity of these plants is sometimes considered proprietary data as is the portion of that production capacity that can be used to produce any given product. Another complicating factor in compiling capacity estimates is that the production capacity itself (typically measured in annual short or metric tons), is a function of what products are produced and how many different products are scheduled in a given period of time.

Based on the company-specific research, ICF estimates the total capacity of companies with active API 5L certification who are now producing API 5L pipe to be approximately 10.5 million metric tons across all sizes and grades of pipe. Any one facility will have the capabilities to produce specific grades, sizes and wall thicknesses of pipe based on the forming and welding equipment installed at the facility.

To increase profits, pipe mills try to maximize throughput and minimize downtime. They often run large orders of one specification of pipe all at once and then run the next specification of pipe all at once. Due to the downtime between production runs of different kinds of pipe and tubular products and because certain pipe takes longer to produce, it is difficult for companies to achieve their theoretical or nominal capacity. However, this nominal capacity is still widely used as an index of individual company and the entire domestic industries' ability to produce. Also, since companies that have API 5L certifications often also produce several steel pipe and tube products other than line pipe, the capacity at the facility will have to be split across several products over any given period of time and the actual available line pipe capacity will only be a portion of the total nominal capacity.

For example, the highest monthly production of domestic line pipe in recent years has been about 210,000 metric tons, which translates into a demonstrated annual line pipe production rate of 2.5 million metric tons (assuming that high monthly production rate could be sustained over a year). Adding a similar estimate for OCTG of 4.3 million metric tons per year yields a demonstrated capacity to produce of 6.8 million metric tons of line pipe *plus* OCTG. This compares to the 10.5 million metric tons per year nominal production capacity shown in Exhibit 3-1. The difference (3.7 million metric tons per year) is capacity devoted to other pipe and tube products, unavoidable downtime and inefficiencies that prevent full capacity from ever being realized, and some amount of capacity left unused due to insufficient demand.

For the purposes of this report we have displayed the total nominal capacity with the understanding that all of this capacity would not solely make line pipe. We have also highlighted companies that have typically produced OCTG products as their primary products.

In order to demonstrate the capabilities of the various U.S. companies, ICF has broken the pipe mills into three categories or submarkets including pipeline manufacturers that produce pipe less than 16 inches, 16.1-24 inches and greater than 24 inches. These are displayed in Exhibit 3-1. In the exhibit, the capacities for companies that produce pipe sizes for multiple specifications are included in more than one column. Because of this, it would be incorrect to add up the capacities in the three submarkets as that sum would be higher than the actual total U.S. capacity of 10.5 million metric tons.

In addition to the active API 5L producers, Exhibit 3-2 lists other U.S. companies that have API 5L certifications, but do not appear to actively produce API 5L line pipe as a significant product. It is possible that if domestic content requirements came into being some of these producers could more actively compete in the API 5L market increasing the overall available production capacity. Also it is possible that companies that make line pipe meeting ASTM standards but not API 5L standards could enter the market for API 5L line pipe as could companies making other kinds of pipe and tube products. However, such shifts in production are likely to require substantial investments in basic equipment needed to produce line pipe as well as the measurement, testing and quality control equipment increasingly being demand by line pipe buyers. Such new entrants would also have to factor in the time they would need to demonstrate competence in making high quality line pipe so that they could be placed on pipeline operators' approved manufacturers lists.

Exhibit 3-1: U.S. Companies with API 5L Certification: Capacity to produce pipe and tubular goods (metric tons per year)

Company	Outside Diameter Minimum Size (Inches)	Outside Diameter Maximum Size (Inches)	Minimum Wall Thickness (Inches)	Maximum Wall Thickness (Inches)	Companies Producing Line Pipe <= 16"	Companies Producing Line pipe 16.1"-24"	Companies Producing Line Pipe Greater than 24"	Companies Producing OCTG	Total Pipe and Tubular Goods Capacity
Berg	24.0	60.0	0.3	1.5	-	600,000	600,000	-	600,000
Dura-Bond Pipe LLC/Steelton Pipe Mill	20.0	42.0	0.3	0.8	-	181,437	181,437	-	181,437
Evraz Portland Tubular [5]	24.0	60.0	0.3	1.0	-	181,437	181,437	-	181,437
Jindal Tubular USA, LLC.	18.0	120.0	0.2	1.0	-	340,195	340,195	-	340,195
JSW Steel USA Inc./Baytown Facility	24.0	60.0	0.3	1.3	-	454,000	454,000	-	454,000
Stupp Corporation	10.0	60.0	0.3	1.0	408,000	408,000	408,000	-	408,000
Welspun	1.3	60.0	0.1	1.0	476,273	476,273	476,273	-	476,273
United States Steel [1]	1.9	26.0	0.1	2.3	1,850,659	1,170,270	272,156	1,850,659	1,850,659
Vallourec Star [1,3]	0.7	28.0	0.1	4.0	499,000	499,000	499,000	499,000	499,000
Wyman-Gordon Forgings, Inc. [1,4]	8.6	48.0	0.6	7.0	90,719	90,719	90,719	90,719	90,719
American Steel Pipe/Birmingham Facility	10.8	24.0	0.2	0.8	635,030	635,030	-	-	635,030
CSI Tubular Products, Inc./Tubular	6.0	24.0	0.2	0.8	217,725	217,725	-	-	217,725

Products Facility									
Tex-Tube Company	2.4	8.6	0.1	0.3	327,000	-	-	-	327,000
Axis Pipe and Tube [1]	5.5	16.0	0.2	0.6	272,156	272,156	-	272,156	272,156
Paragon Industries, Inc. [1]	4.5	16.0	0.2	0.5	327,000	327,000	-	327,000	327,000
TMK IPSCO [1]	2.4	16.0	0.2	0.6	1,333,563	498,952	-	1,333,563	1,333,563
SeAH Steel USA LLC/Leonard Road Facility [1]	2.4	6.6	-	-	327,000	-	-	327,000	327,000
Benteler Steel/Tube Manufacturing Corp. [2]		<16			299,371	-	-	299,371	299,371
Boomerang Tube LLC/Liberty Texas Works Facility [2]	2.4	8.6	0.1	0.7	327,000	-	-	327,000	327,000
Borusan Mannesmann Pipe U.S. [2]	0.8	12.8	0.1	0.5	327,000	-	-	327,000	327,000
Northwest Pipe Company [2]	4.5	16.0	0.1	0.4	327,000	327,000	-	327,000	327,000
Tenaris [2]	2.4	16.0	0.1	0.5	327,000	327,000	-	327,000	327,000
Texas Tubular Products [2]	2.4	8.6	0.2	0.3	327,000	-	-	327,000	327,000
Zekelman Industries, Energex Tube [2]	1.5	6.6	0.1	0.5	90,719	-	-	90,719	90,719
Total					**8,789,214**	**7,006,192**	**3,503,216**	**6,725,186**	**10,546,283**

1: Produce both line pipe and OCTG at facility
2. Primarily produce OCTG at facility
3: Primarily produce seamless OCTG at facility
4: Facility produces specialty pipe
5: Facility currently not in operation

Exhibit 3-2: Companies that have API 5L Certification but Produce No or Small Amounts of Line Pipe

Company
AmTex Machine Products, Inc.
Anvil International LLC dba Beck Manufacturing/Waynesboro Facility
Atlas Tube JMC Group
Capitol Manufacturing Company/Crowley Facility
Centric Pipe, LLC/Bossier City Facility
Hunting Energy Services, Inc./Rankin Road Facility
Itex Piping Products LLC
JMC Steel Group / Wheatland Tube - Energex Tube
JRV Technologies
LB Pipe and Coupling Products, LLC
Lincoln Manufacturing of Ohio, Inc.
Maruichi Leavitt Pipe and Tube
Tejas Tubular, Stephenville Works
Texas Couplings
Texas Pipe Works, Inc./Navasota Facility

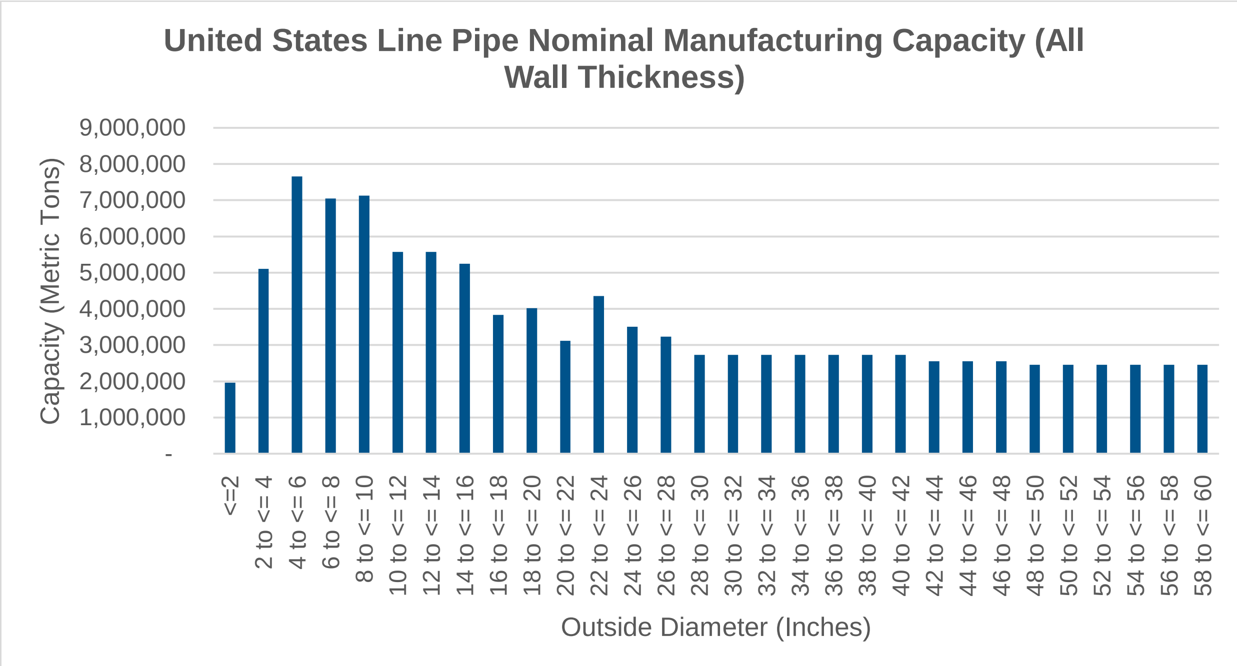
shows companies that have large diameter pipe capabilities with the ability to make pipe greater than 24 inches in diameter. Within the exhibit, there are two companies that have a maximum diameter pipe of 26 inches and 28 inches. The minimum OD column reflects that just three companies are focused on large pipe diameters greater than 24 inches.

Dividing the manufacturers into three categories of 16 inches or less, 16.1 to 24 inches and greater than 24 inches is useful in determining the ability of companies to meet the small, medium and large-diameter pipe demand, but does not fully represent the industry capabilities for a given diameter of pipe. Due to this, ICF has broken the capacity into two-inch segments where the entire capacity of a company was aggregated if it produced pipe within that 2 inch diameter. The results of this are displayed in Exhibit 3-3 which shows the theoretical maximum amount U.S. pipeline manufacturers could produce of each size of pipe.

Obviously, if one pipe mill produces one size of pipe, it would reduce the maximum capabilities of making a different size of pipe, but the graph represents the absolute maximum for the various pipeline producers. This is particularly relevant for certain pipeline diameters. As noted above, there are several pipeline manufacturers that produce high pressure line pipe from 16 to 24 inch OD within the U.S., but certain diameters are run through pipe mills less regularly, including 18 and 22 inch OD pipe. Therefore, these diameters may have significant lead times of several months due to pipe mills focusing on 16, 20, and 24 inch pipe. The same lead time issue is true for large diameter pipe above 24 inch diameter (30, 36, 42, and 48 inches).

Wall thickness is another significant manufacturing constraint. Heavy wall above 0.75 inches is difficult to produce both from the physical and chemical properties of the steel and the manufacturing of the pipe. While steel and pipe manufacturers claim to have the ability and capacity to manufacture heavy wall pipe above 0.75 inches, there are few manufacturers that have demonstrated this capability.

Exhibit 3-3: Line Pipe Production Capacity by U.S. Companies by Diameter



3.2 Domestic High Strength Steel Plate and Plate Coil Manufacturers and Their Production Capacity

ICF has identified six companies in the U.S. that make API 5L quality cut-to-length (CTL) plate. These companies have total cut-to-length plate capacity of 6.7 million metric tons per year, of which 73% is sourced from domestic steel melt. Exhibit 3-4 provides details on the companies with their capacities and plate making capabilities.

In addition to line pipe, cut-to-length plate is used in the construction or manufacturing of many items such bridges, building, storage tanks, offshore production platforms, ships, barges, armored tanks and other military vehicle, railcars, tractors, wind towers, electricity transmission poles and various kinds of industrial equipment and machinery (pressure vessels, furnaces, boilers, separators, etc.). Therefore, a substantial portion of the capacity of these five companies (plus other cut-to-length plate manufacturers who do not supply API 5L plate) is devoted to making plate for uses other than line pipe. There are several ASTM specifications for steel plate used in construction and manufacturing which can be very different than those required for API 5L line pipe. The most common grades used in construction are A36 and A242 which have specified minimum yield strengths of 36,000 psi and 42,000-50,000 psi respectively. Other applications require cut-to-length plate with ASTM standards with a specified minimum yield strength of 100,000 psi or more and may have requirements for abrasion resistance, and corrosion resistance and other characteristics.

Exhibit 3-4: Production Capacity by U.S. Companies Offering API 5L Cut-to-length Plate

Owner Name	Plate Capacity (Thousand Metric Tons)	Grade Capability	Width Range (Inches)	Max Thickness (Inches)	Is Steel Domestically Melted? (Yes/No)
ArcelorMittal Group	3,145	X42M, X60M, X65M, X70M, X80M	74 - 148	Up to 1.5	Yes
Jindal Group	1,200	NA	Up to 160	Up to 6	No
US Steel Group	558	X42,X52,X60, X65,X70,X80	NA	NA	Yes
SSAB - Svenskt Stal Group	300	X42, X52, X60, X65, X70	Up to 120	0.771 - 1	Yes
Nucor Group	891	NA	NA	NA	Yes
Evraz Group	640	X70, X80	48 - 135	Up to 8	No
Total U.S.	6,734				

(Capacity shown is for all cut-to-length plate, not just API 5L plate)

Hot Rolled Plate Coil

ICF has identified 11 companies that make API 5L quality hot rolled plate coil in the U.S. These companies have a total capacity to produce hot rolled coil (both plate coil and various kinds of sheet coils) of 53.3 million metric tons per year. Generally speaking, sheet coils have a thickness of 0.125 inches (10 gauge) or thinner while plate coils are 0.187 inches (3/16 inches) or thicker. Plate coils have many of the same uses as cut-to-length plate. Sheet coils have many applications including the manufacturing of automobiles and appliances. As with cut-to-length plate used to make line pipe, the specifications required for hot rolled plate coil used to manufacture API 5L line pipe can be very different than the specifications required for hot rolled plate and sheet coil intended for other applications.

Of the total HRC capacity among the 11 companies producing API 5L plate coal, 85% of the HRC is made with domestic steel melt with the other 15% using imported slabs. Exhibit 3-5 provides details on the companies with their capacities and HRC making capabilities. Based on limited information available, it seems that only one company, Arcelor Mittal, has the width capability to produce coil for longitudinal weld line pipe of diameter greater than 30 inches.

Exhibit 3-5: Production Capacity by U.S. Companies Offering API 5L HRC (capacity is for all HRC including sheet coils and non-API plate coils)

Owner Name	HRC Capacity (Thousand Metric Tons)	Grade Capability	Width Range (Inches)	Max Thickness (Inches)	Is Steel Domestically Melted? (Yes/No)
AK Steel Group	5,364	X40 - X65, X70F	26 - 80	0.525	Yes
ArcelorMittal Group	9,019	X42M, X60M, X65M, X70M, X80M	74 - 148	NA	Yes
ArcelorMittal Group; NSSMC Group	2,417	NA	NA	NA	No
BlueScope Steel Group; Gerdau Group	1,518	NA	42 - 62	NA	Yes
Evraz Group	800	X70, X80	36 - 96	NA	No
JFE Steel Group; Vale Group	2,918	X80	27 - 72	NA	No
Nucor Group	11,804	X42-X52	42.5 - 64	0.625	Yes
SSAB - Svenskt Stal Group	965	NA	NA	NA	Yes
Steel Dynamics Group	5,687	NA	36 - 76	0.625	Yes
US Steel Group	11,027	X42, X52, X60, X65, X70, X80	40 - 76	0.750	Yes
NLMK Group	1,786	NA	NA	NA	No
Total U.S.	53,306				

Use of Imported Slabs to make Cut-to-length Plate and Plate Coil

Some companies that roll cut-to-length plate and plate coils for line pipe do not make their own suitable-quality steel[16] in an electric arc furnace or blast furnace. Some of these non-integrated rollers[17] expressed concerns that they may not be able to purchase the necessary slabs or other semi-finished products under a domestic content requirement that stipulates that the steel contained in line pipe must be melted in the U.S. These slab-importing rollers are concerned that integrated U.S. steel mills will

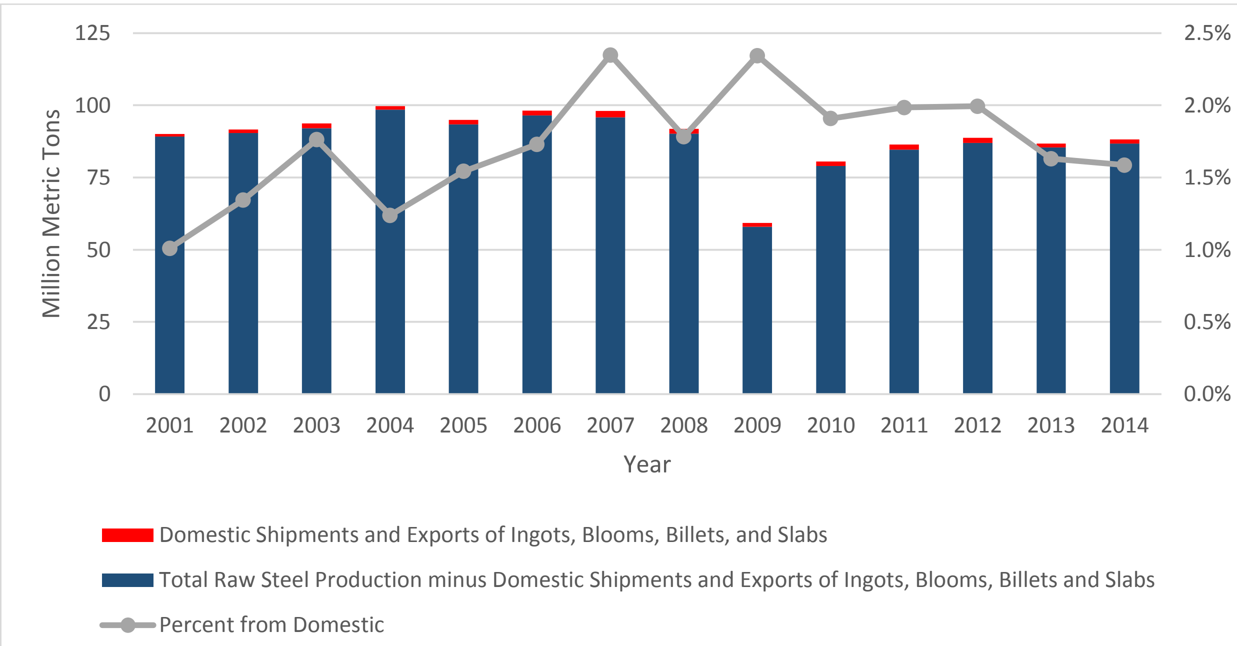
[16] Most steel made in the U.S. is produced at mini-mills using recycled steel. The resulting steel may contain high amounts of non-iron metals such as copper and zinc that make the steel unsuitable for direct use to make plate and coil for high yield strength line pipe. Such steel could be mixed with new steel made at basic oxygen furnaces to adjust its chemical makeup but such mixing is not always logistically or economically feasible. Mini mills usually are set up to make steel and then use it in a continuous process to produce high-volume products such sheet coils and rebar with relative wide specifications for steel chemistry.

[17] See DOC-2017-0002, comments submitted by NMLK Robert D Miller President and Chief Executive Officer to the Department of Commerce April 7, 2017. These comments include a study by a Rutgers economist discussing the reluctance of integrated mills to sell slabs and other semi-finished products to their competitors who do not make their own steel.

follow their recent practice of marketing very little of their semi-finished products to other U.S. steel product producers and instead use their production of semi-finished products to supply their own finished product manufacturing needs. If this occurs, these slab-importing rollers could be at risk of dropping out of the API 5L cut-to-length plate and plate coil markets when any domestic content requirement for pipelines goes into effect.

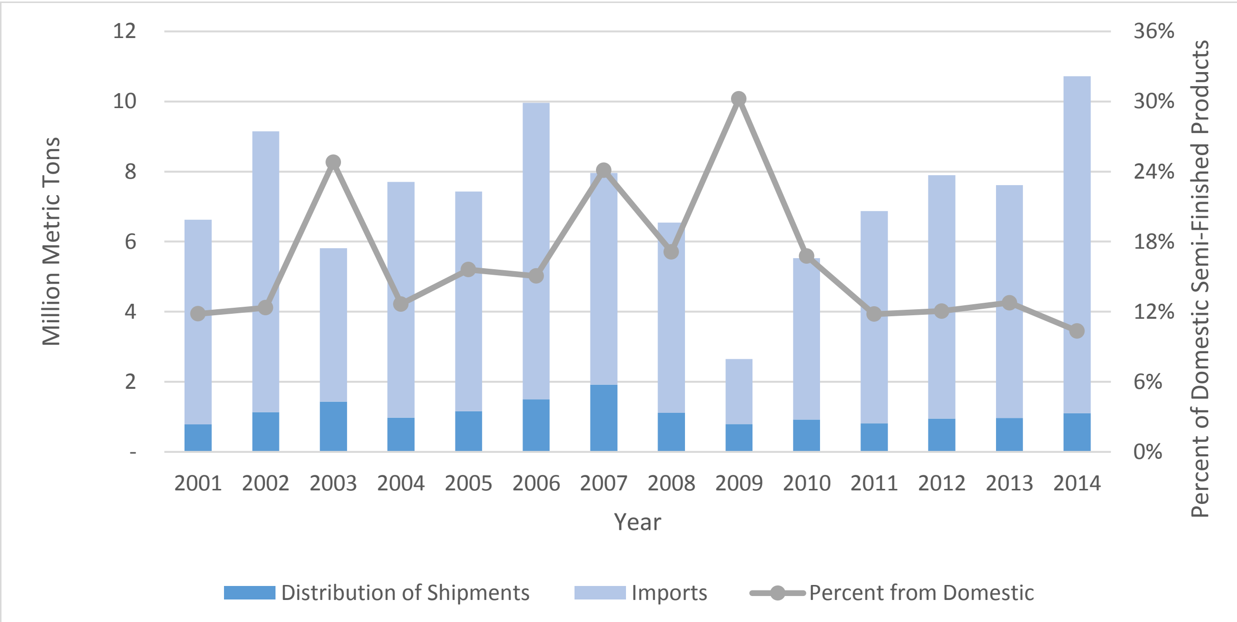
In the U.S. there are numerous companies that have integrated steel mills that operate either an electric arc furnace or a blast furnace and produce semi-finished products of ingots, blooms, billets and slabs. These semi-finished products are often processed further in the same facilities to make cut-to-length plate, HRC and other steel products. In addition to companies selling the finished product, companies have the ability to sell the semi–finished product of ingots, blooms, billets and slab. As shown in Exhibit 3-6, the domestically-marketed or exported semi-finished products make up only 1.5%- 2.5% of the raw steel production in the United States.

Exhibit 3-6: Domestic Steel Production and Portion Market as Semi-finished Products



Specifically for 2014, data provided in USGS's Mineral Yearbook[5] shows there was 1.1 million metric tons of U.S.-produced steel sold as ingots, blooms, billets and slabs. Additionally, the U.S. imported 9.6 million metric tons of ingots, blooms, billets and slabs to supply non-integrated mills and other consumers. As illustrated in Exhibit 3-7, in the last several years of domestic production of semi-finished products constituted only about 12% of supplies to U.S. non-integrated mills, which depended on imports for the remaining 88% of semi-finished supplies. If imports of slabs are prohibited under domestic content policies, non-integrated rolling mills producing cut-to-length plate and plate coil for line pipe manufacturing fear that integrated mills will use their control of semi-products to improve their market position relative to non-integrated rollers. In other words, the non-integrated rollers may be forced out of the market for line pipe-quality cut-to-length plate and plate coil.

Exhibit 3-7: Domestic Market for Ingots, Blooms, Billets, and Slabs met by U.S. Mills



Possible Shifts in Cut-to-length Plate and Plate Coil Production and Sourcing Stemming from Domestic Content Requirements

If domestic content requirements came into effect, domestically produced cut-to-length plate and plate coil that met API 5L standards would be in much higher demand and would likely increase in price relative to cut-to-length plate and plate coil used for other purposes (which would not be covered by the new domestic content requirements and could still be imported at world prices). This might create an incentive for domestic cut-to-length plate and plate coil makers who now concentrate on high-strength plate markets for military vehicles or pressure vessels to shift their emphasis to API 5L specification plate or to enter that market if they are now not certified to do so. However, such a shift might require substantial investment in new steel refining, alloying and rolling equipment as well as the types of measurement, testing and quality control equipment increasingly being demanded by line pipe buyers for the steel going into their new pipelines. Besides the time needed to engineer and implement such investments, the new API 5L plate manufactures (and existing API 5L plate manufacturers who might be expanding their offerings and upping their quality) would need to factor in the time need to demonstrate their competence in making high quality plate so that they could be placed on the line pipe manufacturers approved manufacturers lists.

The domestic content requirements would also affect foreign steel producers. Foreign steel plate makers might try to compensate for the loss of market share in the API 5L plate market by shifting to exports of other kinds of high strength plate whose import into the U.S. is not restricted. Likewise, foreign steel makers that now sells slabs to U.S. rolling mills to make API 5L plate might look for other markets in the U.S. for semi-finished and finished products. To the extent such a shift in foreign steel exports to the U.S. occurs (both because U.S. steel producers concentrate on the now higher-valued pipeline steel market and foreign steel makers seek to make up for lost markets), the net change in U.S. steel production will be lower than might be hoped for by advocates of the domestic content policies. In other words, by restricting imported cut-to-length plate, plate coil, and slabs to serve the pipeline market but leaving open such imports to all other markets, the domestic content requirements for pipelines would result in a shift of the type of steel imports, but not necessarily decrease total imports or increase the net amount of steel made in the U.S.

3.3 Recent Demand for Line Pipe by Diameter Size Class

Exhibit 3-8 shows estimated demand for line pipe in the years 2015 and 2016 broken out by the size classes used to record line pipe imports into the U.S. In 2015 line pipe demand (including exports of line pipe from the U.S.) was 4.1 million tons and in 2016 fell to 2.6 million tons. About 10% of demand was for seamless line pipe, which is used predominately in the smaller diameter markets. Imports of line pipe averaged 53% of the market for those two years. The market share for imports is greater among seamless line pipe and smaller diameters in general.

The survey of association members conducted by ICF for this study resulted in information on 5,500 miles of recently installed line pipe that included data on steel specifications. Of these responses steel with a minimum yield strength of X52 or less made up 11% of the miles (almost all in pipe lines with diameters of 16 inches or less), X60 steel was 20%, X65 steel was 9%, and X70 steel was 59% of the miles. Because larger size pipes tend to be built with stronger steels, the X70 steel constituted around 80% of the recent U.S. line pipe market in terms of total weight.

Recent Sourcing of Steel Products to Make Line Pipe

The estimated amount of billets, cut-to-length plate and plate coil used to make line pipe is shown in Exhibit 3-9. The total tons of these semi-finished products equals the amount of finished line pipe supplied to the U.S. market. Most often, billets are used to make seamless line pipe although other semi-finished steel products such as redraw hollows (thick hollow shapes that are drawn over mandrels and otherwise expanded and formed to produce pipe and other products). Welded pipe can be made from either plate coil or cut-to-length plate. Cut-to-length plate is most likely to be used in longitudinally welded line pipe of diameters over 24 inches with thick walls.

Exhibit 3-8: Estimate of Line Pipe Supplied to U.S. for Years 2015 and 2016 by Source, Diameter and General Process (metric tons)

	2015			2016			
Seamless + Welded	**Imports**	**U.S. Production**	**All Supply**	**Imports**	**U.S. Production**	**All Supply**	**Average Import Market Share**
Diameter <=4.5 in	274,616	85,167	359,784	145,892	60,839	206,731	74%
Diameter 4.6-16 in	826,916	271,313	1,098,229	468,333	193,813	662,146	74%
Diameter 16.1-24 in	769,715	503,447	1,273,162	341,218	381,545	722,764	56%
Diameter >24 in	437,258	957,835	1,395,093	289,016	725,911	1,014,926	30%
All Sizes	**2,308,506**	**1,817,762**	**4,126,268**	**1,244,459**	**1,362,109**	**2,606,568**	**53%**

Seamless	**Imports**	**U.S. Production**	**All Supply**	**Imports**	**U.S. Production**	**All Supply**	**Import M.S.**
Diameter <=4.5 in	139,088	8,978	148,065	59,960	13,601	73,562	90%
Diameter 4.6-16 in	194,130	16,475	210,605	134,536	24,109	158,646	89%
Diameter 16.1-24 in	40,270	3,901	44,171	17,599	5,245	22,844	86%
Diameter >24 in	-	-	-	-	-	-	
All Sizes Seamless	**373,487**	**29,353**	**402,840**	**212,096**	**42,956**	**255,051**	**89%**

Welded	**Imports**	**U.S. Production**	**All Supply**	**Imports**	**U.S. Production**	**All Supply**	**Import M.S.**
Diameter <=4.5 in	135,529	76,190	211,719	85,931	47,238	133,169	64%
Diameter 4.6-16 in	632,787	254,838	887,625	333,797	169,704	503,501	69%
Diameter 16.1-24 in	729,445	499,546	1,228,992	323,619	376,301	699,920	55%
Diameter >24 in	437,258	957,835	1,395,093	289,016	725,911	1,014,926	30%
All Sizes Welded	**1,935,018**	**1,788,409**	**3,723,428**	**1,032,363**	**1,319,153**	**2,351,516**	**49%**

Source: ICF estimate developed from Department of Census international trade data, Preston Pipe Report and ICF survey of sponsoring association members.

Exhibit 3-9: Estimate of Semi-finished Products Used to Make Line Pipe Supplied to U.S. for Years 2015 and 2016 by Source (metric tons)

	2015			2016		
Seamless + Welded	**Imports**	**U.S. Production**	**All Supply**	**Imports**	**U.S. Production**	**All Supply**
Made from Billets	373,487	29,353	402,840	212,096	42,956	255,051
Made from Plate Coil	1,479,332	1,009,874	2,489,206	762,872	729,585	1,492,457
Made from Cut-to-Length Plate	455,686	778,535	1,234,222	269,491	589,568	859,059
Made from All Semi-finished Products	2,308,506	1,817,762	4,126,268	1,244,459	1,362,109	2,606,568

Source: ICF estimate developed from Department of Census international trade data, Preston Pipe Report and ICF survey of sponsoring association members. Seamless line pipe is all made from billets (or similar round or square long shapes) while welded line pipe is made from both flat plate coils and flat cut-to-length plates.

An estimate of the total contribution of imported steel in the U.S. line pipe market is shown in Exhibit 3-10. This includes imported line pipe, imported cut-to-length plate and plate coils used to make line pipe and the imported slabs that are used to make cut-to-length plate and plate coil in the U.S. The statistics on how much imported cut-to-length plate and plate coil is used to make line pipe in the U.S. are based on ICF's assessment of the volumes of cut-to-length plate and plate coil imported to the U.S. that is most suitable for line pipe manufacturing. ICF also estimated the amount of imported slabs used to make cut-to-length plate and plate coil for line pipe in U.S. rolling mills using the capacity of the slab-importing mills as a fraction of all API 5L mills. When the values for imported line pipe are added together with these ICF estimates for the use of imported plate, coil and slabs the total import contribution comes to 77% of the steel materials in line pipe.

Exhibit 3-10: Summary of Imported Pipe and Materials in U.S. Line Pipe Market (average for 2015 & 2016 in metric tons)

	Average of 2015 & 2016	Average Import Market Share
U.S. Line Pipe Market in Total	3,366,418	
Imported Line Pipe	1,776,482	53%
Imported Plate and Coil Used to Manufacture Line Pipe in U.S. (approx.)	650,000	19%
Imported Slab Used to Make U.S. Plate and Coil Used to Manufacture Line Pipe in U.S. (approx.)	176,236	5%
All Imported Line Pipe, Plate, Coil and Slabs (approx.)	**2,602,718**	**77%**

Source: ICF estimate developed from Department of Census international trade data, Preston Pipe Report and ICF survey of sponsoring association members.

Changes in Sourcing of Steel Products Needed to Meet Domestic Content Requirements

Exhibit 3-11 shows the shift in sourcing of billets, cut-to-length plates and plate coils that hypothetically would be needed to accommodate a domestic content requirement for U.S. line pipe. These numbers are based on the average line pipe sales in 2015 and 2016 shown in the previous table and assume that the same volumes in terms of sizes and types of line pipe sold in those years would also be sold in the hypothetical future under a domestic content requirement. The top part of the exhibit represents the historical sales and materials sourcing for 2015-16, the middle part is the sourcing pattern that might be expected under the hypothetical domestic content requirement, and the bottom part of the exhibit is the volume changes (hypothetical *minus* historical actual) that would have to occur.

The columns of the exhibit are set up to distinguish the location where the line pipe is manufactured (foreign *versus* U.S.), the location where the plate or coil is rolled, and the location where the slabs for the plate/coils are melted. The first column represents imports of finished line pipe where all manufacturing is foreign and none takes place in the U.S. The second column represent U.S. manufactured line pipe made from imported cut-to-length plate and plate coil. The third column represents U.S. manufactured line pipe made from U.S. rolled plates/coils made from imported slabs. The fourth column represents the volume of line pipe manufactured in the U.S. using U.S. rolled plate/coil made from U.S. melt. The fifth column is the sum of all manufacturing of line pipe in the

U.S. (regardless of the source of steel) and the last column is the sum of all line pipe supplied to the U.S. including both domestic and foreign.

Exhibit 3-11: Hypothetical Shift Required for Materials in U.S. Line Pipe Market to Satisfy Domestic Content Requirements (based on average for 2015 & 2016 in million metric tons)

Estimated Historical Average of 2015 & 2016 (million metric tons)						
Location Line Pipe Manu.	Foreign	U.S.	U.S.	U.S.	U.S.	All
Loc. Plate/Coil Rolled	Foreign	Foreign	U.S.	U.S.	All	All
Loc. Slab/Billet Cast	Foreign	Foreign	Foreign	U.S.	All	All
Billets	0.29	0.00	0.00	0.04	0.04	0.33
Plate Coil	1.12	0.30	0.11	0.46	0.87	1.99
Cut-to-Length Plate	0.36	0.35	0.06	0.27	0.68	1.05
All Semi-finished Products	1.78	0.65	0.18	0.76	1.59	3.37

If All Must Be Domestic Content (million metric tons)						
Location Line Pipe Manu.	Foreign	U.S.	U.S.	U.S.	U.S.	All
Loc. Plate/Coil Rolled	Foreign	Foreign	U.S.	U.S.	All	All
Loc. Slab/Billet Cast	Foreign	Foreign	Foreign	U.S.	All	All
Billets	0.00	0.00	0.00	0.33	0.33	0.33
Plate Coil	0.00	0.00	0.00	1.99	1.99	1.99
Cut-to-Length Plate	0.00	0.00	0.00	1.05	1.05	1.05
All Semi-finished Products	0.00	0.00	0.00	3.37	3.37	3.37

Change from Historical to All Domestic Content (million metric tons)						
Location Line Pipe Manu.	Foreign	U.S.	U.S.	U.S.	U.S.	All
Loc. Plate/Coil Rolled	Foreign	Foreign	U.S.	U.S.	All	All
Loc. Slab/Billet Cast	Foreign	Foreign	Foreign	U.S.	All	All
Billets	-0.29	0.00	0.00	0.29	0.29	0.00
Plate Coil	-1.12	-0.30	-0.11	1.53	1.12	0.00
Cut-to-Length Plate	-0.36	-0.35	-0.06	0.78	0.36	0.00
All Semi-finished Products	-1.78	-0.65	-0.18	2.60	1.78	0.00

One way of thinking about the domestic content requirement is that it could require that all the production that is the first three columns be shifted to the fourth column. This is what is shown in the middle part of the exhibit as all 3.37 million tons of annual line pipe supplied comes from the U.S. after domestic content requirements go into effect. This is an increase of 1.78 million metric tons in annual line pipe production and would require that 2.60 million metric tons more of U.S. steel to be used for line pipe each year. (The increase in steel production exceeds the increase in line pipe production because imported plate, coil and slabs now used for domestically made line pipe also must be replaced.) This additional need for domestic steel is made up of 0.29 million more metric tons of billets and other shapes for seamless line pipe, 1.53 million more metric tons of cut-to-length plate and 0.78 more million metric tons of plate coil.

As discussed above, these increases in U.S. steel going to make line pipe could come from more U.S. production of raw steel, cut-to-length plate and plate coil or shifts in the markets as to what kind of steel is made and where that U.S. steel production goes. Stated in other words, to the extent changes in sourcing occur due to shifts in type/market of current U.S. steel production volumes, there will be a corresponding shift in steel imports away from markets related to line pipe toward markets not covered by the domestic content requirements. This would bring imported steel volumes of all types back closer to where they began before the domestic content requirements for pipeline took effect.

3.4 Recent Demand for OCTG

The market for oil country tubular goods includes casing, tubing and drill pipe. Well casing commonly has outside diameters starting at 4.5 inch with wall thicknesses of 0.2 to 0.4 inches and can reach outside diameters of 48 inches (for conductor casing installed near the surface) with wall thicknesses of 0.5 to 0.8 inches. Common tubing sizes range from 2.375 to 4.5 inch outside diameter with wall thicknesses of 0.2 to 0.4 inches. Drill pipe typically comes in diameters from 2.375 to 6.225 inches with wall thicknesses of 0.18 to 0.45 inches. Drill pipe is made from steels of very high yield strengths (75,000 to 135,000 psi) to withstand the stresses put on them during the drilling process.

As shown in Exhibit 3-12, the OCTG market was 3.5 million metric tons in 2015, when seamless products made up 52% of the market. Due to much lower levels of oil and gas drilling in 2016, the OCTG market fell to 2.1 million metric tons with seamless products making up 63% of the market. The market shares for imported OCTG averaged 55% in 2015 and 2016 and was similar among both seamless and welded products.

Exhibit 3-12: OCTG Supplied to U.S. for Years 2015 and 2016 by Source and General Process (metric tons)

	2015			2016			Average Import Market Share
	Imports	U.S. Production	All Supply	Imports	U.S. Production	All Supply	
Seamless + Welded	2,037,719	1,511,176	3,548,895	1,045,807	1,052,967	2,098,775	55%
Seamless	1,128,283	733,009	1,861,292	644,721	672,337	1,317,058	56%
Welded	909,436	778,167	1,687,603	401,086	380,631	781,717	53%

Source: Preston Pipe Report

As with seamless line pipe, seamless OCTG is mostly made from steel billets, with some use of other semi-finished steel shapes such as redraw hollows. Welded OCTG products are generally made from plate coils using sequential forming rollers and electric resistance welding. There are many kinds of steel used to make OCTG and are generally characterized by a high molybdenum content that adds strength while resisting damage from sulphides. About 40% of the OCTG market is made from steels with corrosion resistant alloys that typically include higher amounts of molybdenum plus chromium and possibly nickel.

The manufacturing capacity of U.S. mills that make OCTG is over 6.7 million metric tons per year (as shown in Exhibit 3-1) including 2.0 million tons at plants that are making OCTG and little if any line pipe. Given the need to devote some of plant capacity to other pipe and tube products, the practical capacity to make OCTG in the U.S. might better be stated as approximately 5.0 million metric tons per year. Because of their low utilization rates in 2016 (1.05 / 5.0 = 21%) some OCTG manufacturing facilities did not operate and some OCTG products became tight when U.S. oil and gas drilling rebounded in late 2016 and early 2017.

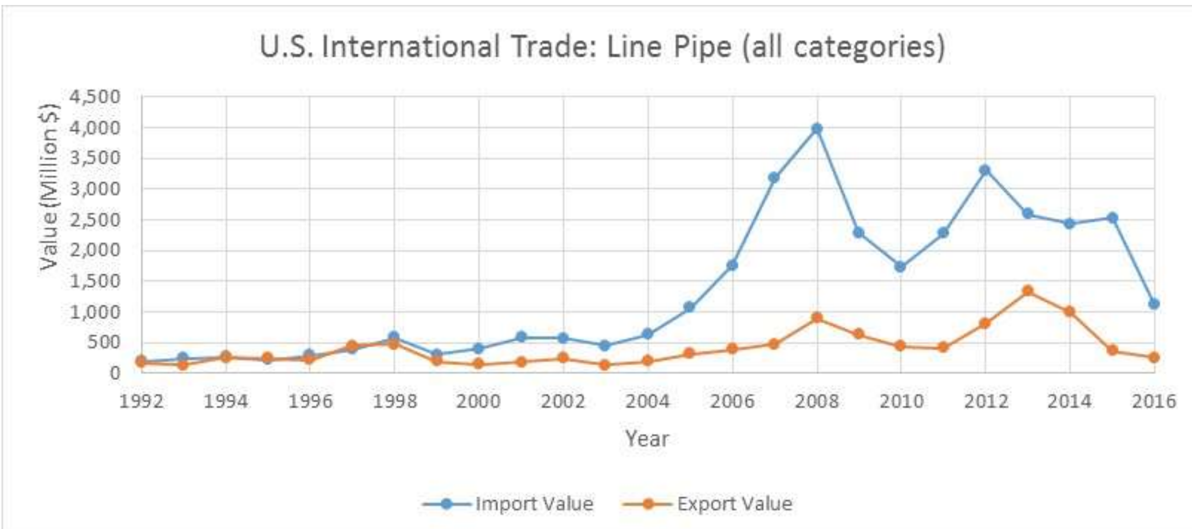
3.5 History of International Trade of Line Pipe and OCTG

This section of the report presents charts and tables showing historic international trade data from the U.S. Census Bureau[6]. ICF has aggregated data by harmonic tariff system (HTS) codes to present results for line pipe (both for an overall total and grouped by various diameter sizes) and OCTG. The results for each combined category are shown for imports and exports as a set of three charts: volume of trade in metric tons, value of trade in million dollars, and value per metric ton. Further disaggregation of this data as well as the HTS codes used are presented in Appendix A and Appendix B.

Exhibit 3-13 to Exhibit 3-17 show line pipe imports and exports in total and by the four diameter-size submarkets used to track international trade. Exhibit 3-18 shows the maximum annual level of exports to the U.S. by country and by size submarket over the last several years. Those maximum exports levels are used later to look at market concentration. The final set of charts in this series is Exhibit 3-19, which shows imports and exports of oil country tubular goods or OCTG. Imports of OCTG in recent years have been made up of approximately 71% casing, 24% tubing and 5% to 6% drill pipe in terms of both weight and value.

Exhibit 3-13 is a summary of all line pipe diameter sizes and shows a peak in imports of 3.0 million metric tons in 2008 before the worldwide financial crisis in the later part of that year caused a drop in all kinds of business investment including investments in pipelines. The years 2007 and 2008 was characterized by a China-led “boom” in demand for energy, metals and other commodities with correspondingly high prices. A large number of pipelines were under construction in the U.S. and around the world and imported line pipe prices hit their peak due to high steel prices in general and high demands for line pipe manufacturing capacity. The slow economic recovery after the financial crisis and the increase in U.S. gas shale and tight oil production led to increasing investment in pipeline and another peak in line pipe imports in 2012. The collapse in oil prices in late 2014 led to reduction in oil and gas drilling and investment in new flow lines, gathering system and pipelines leading to a significant drop in line pipe imports in 2016.

Exhibit 3-13: International Trade in Line Pipe (all size categories)



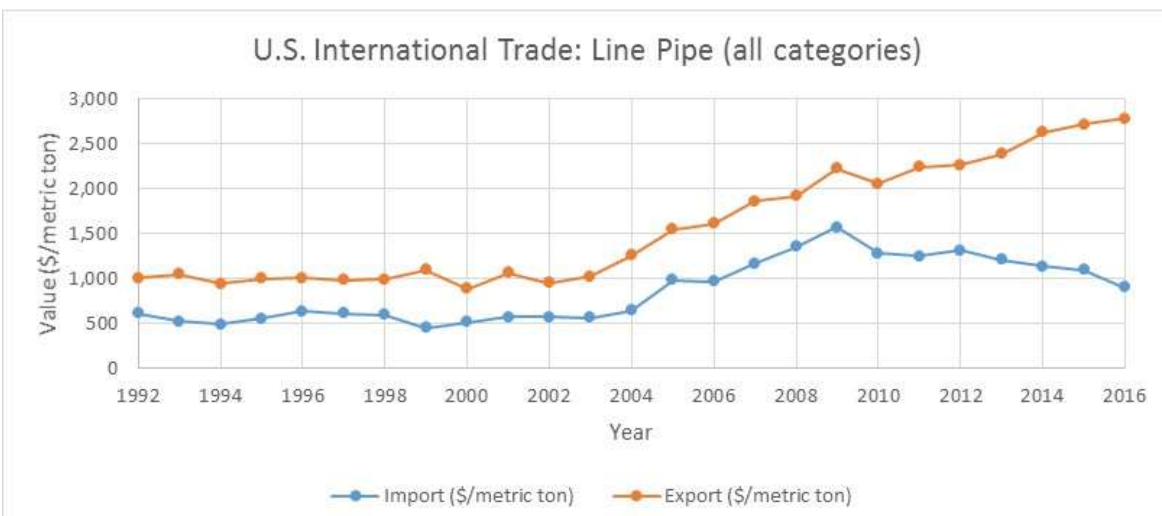
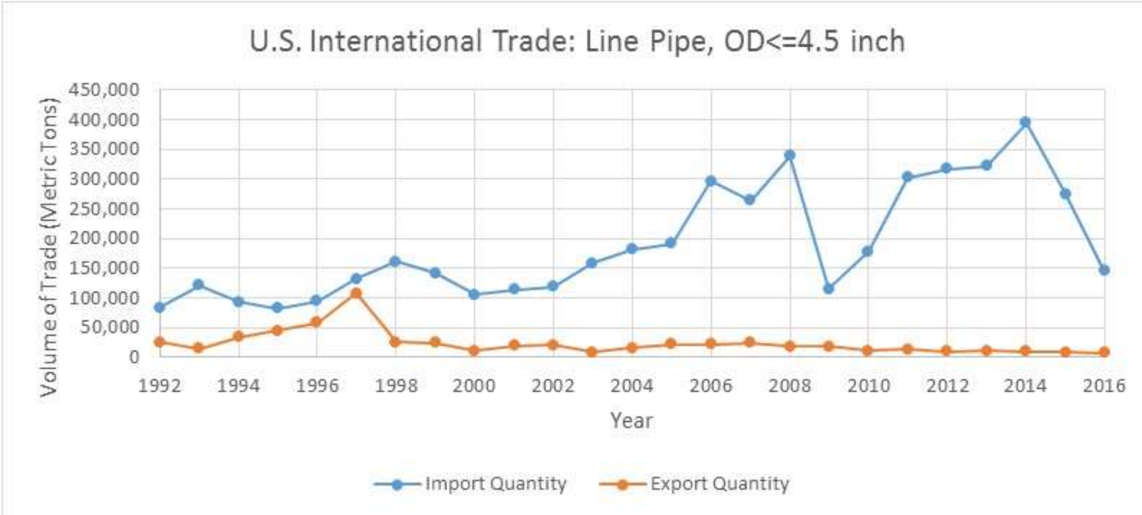
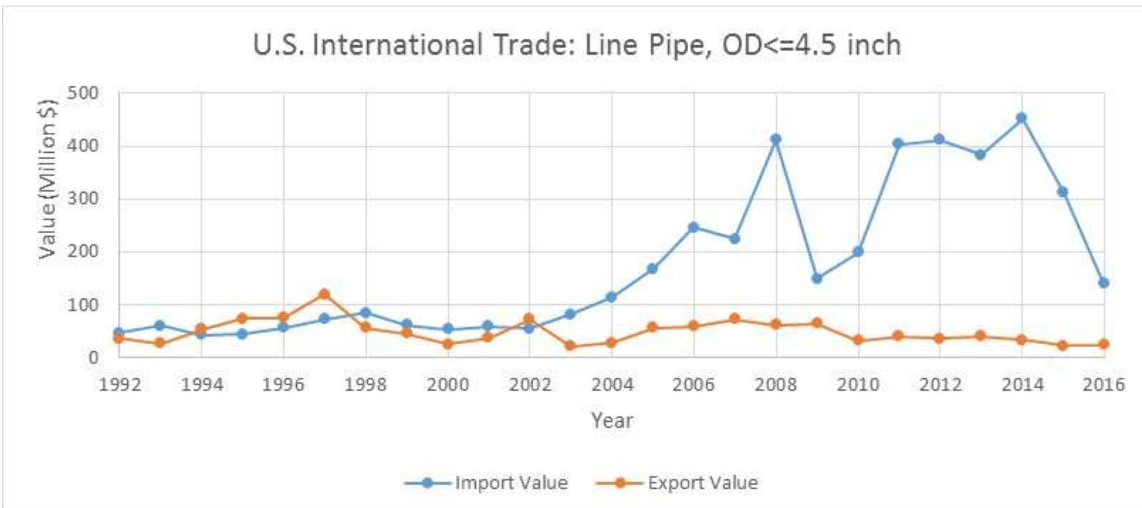


Exhibit 3-14: International Trade in Line Pipe (OD <=4.5 inch)





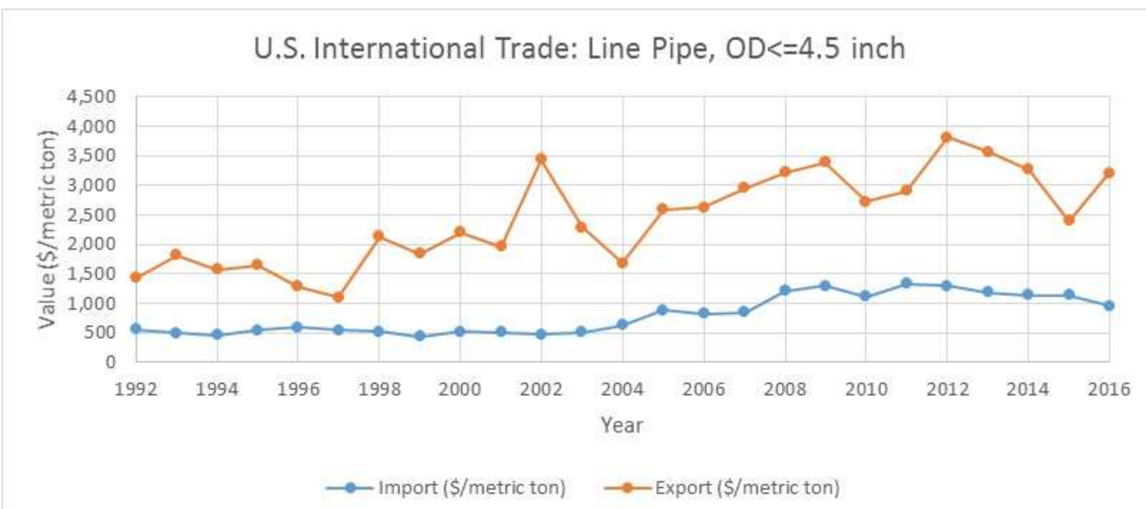


Exhibit 3-15: International Trade in Line Pipe (4.5<OD<=16 inch)

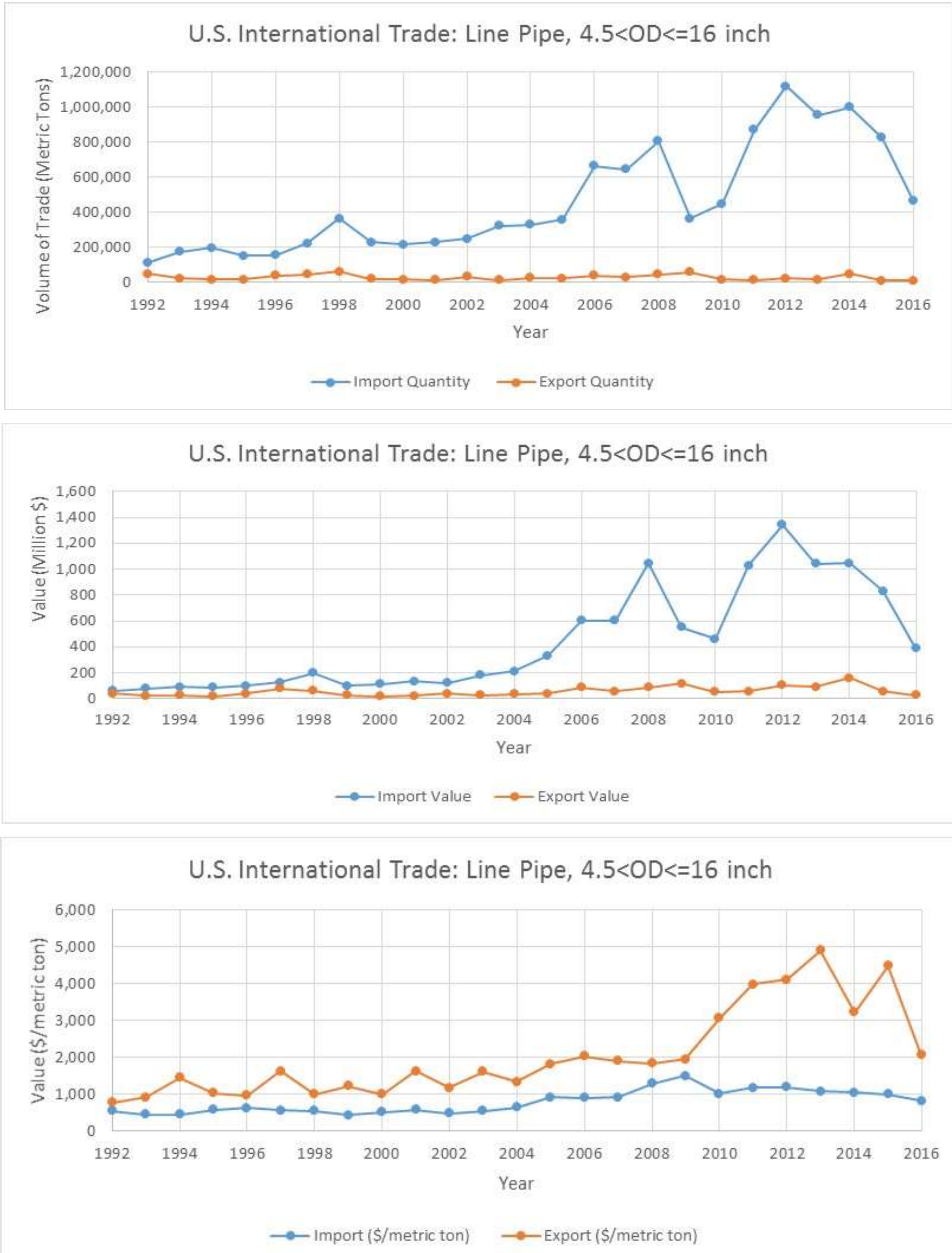


Exhibit 3-16: International Trade in Line Pipe (16<OD<=24 inch)

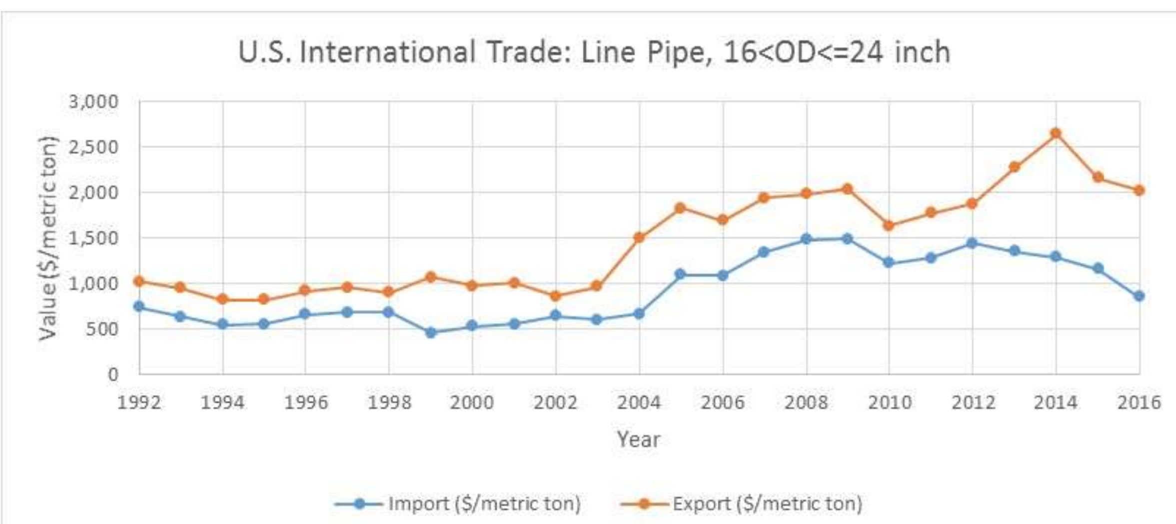
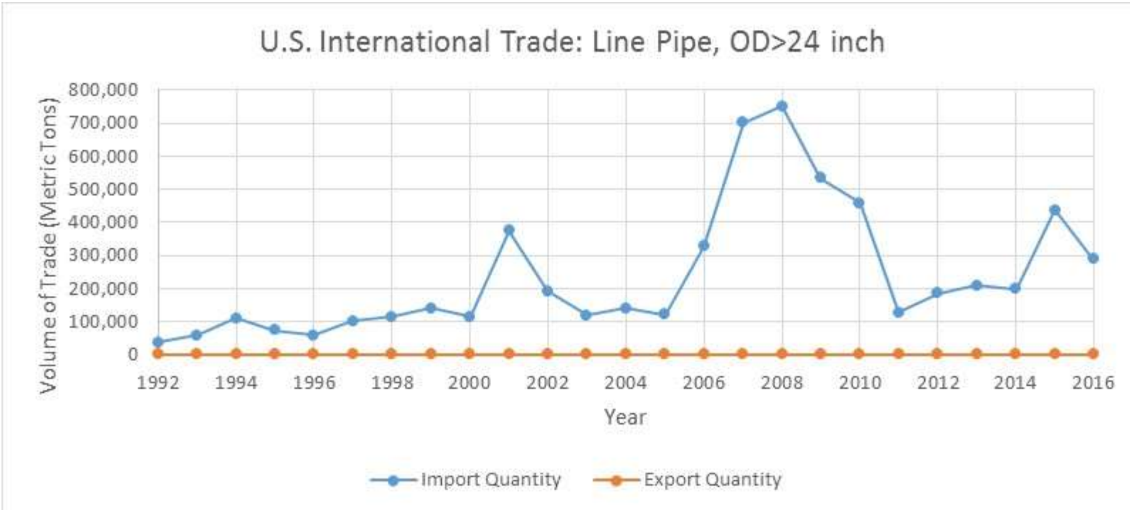
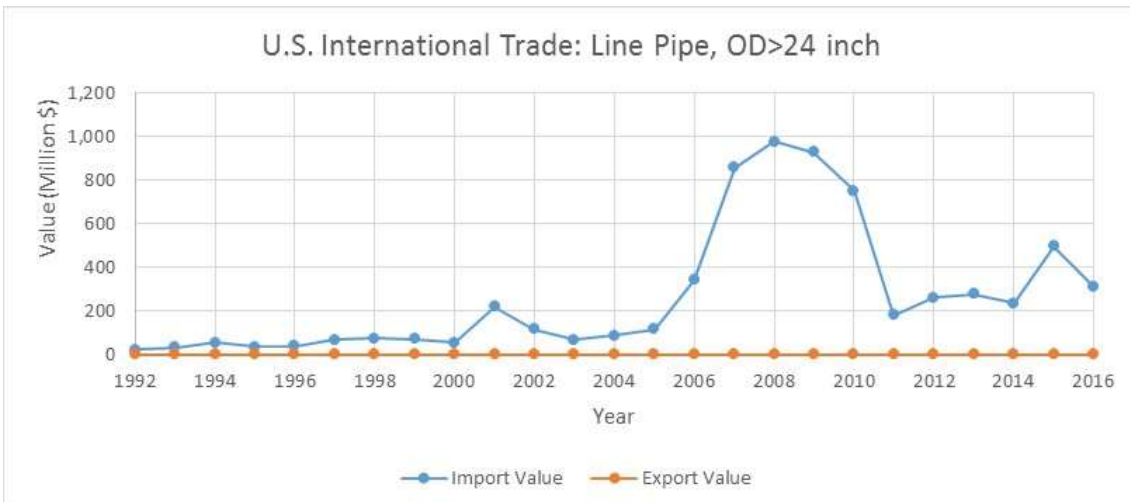


Exhibit 3-17: International Trade in Line Pipe (OD>24 inch)





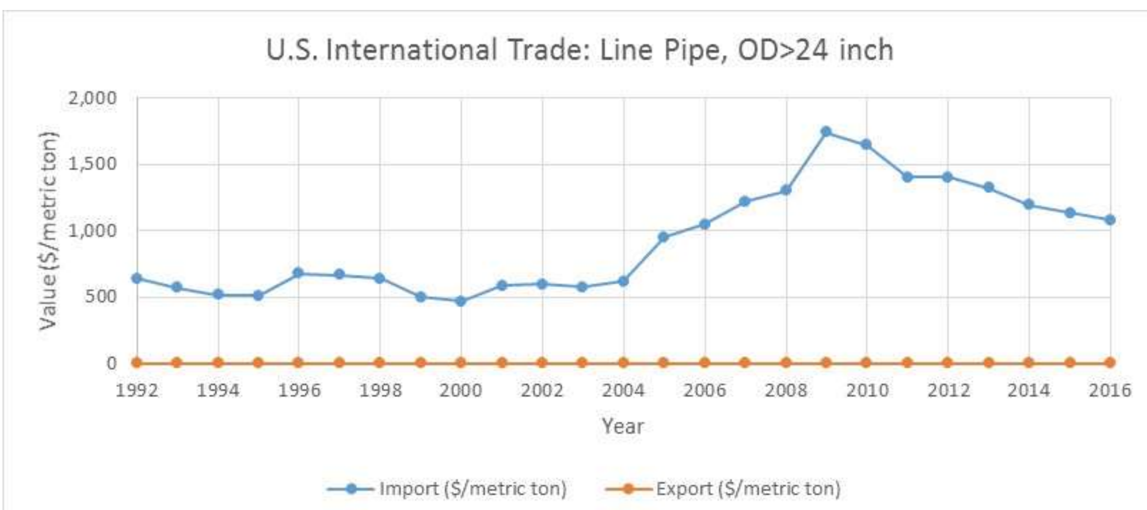


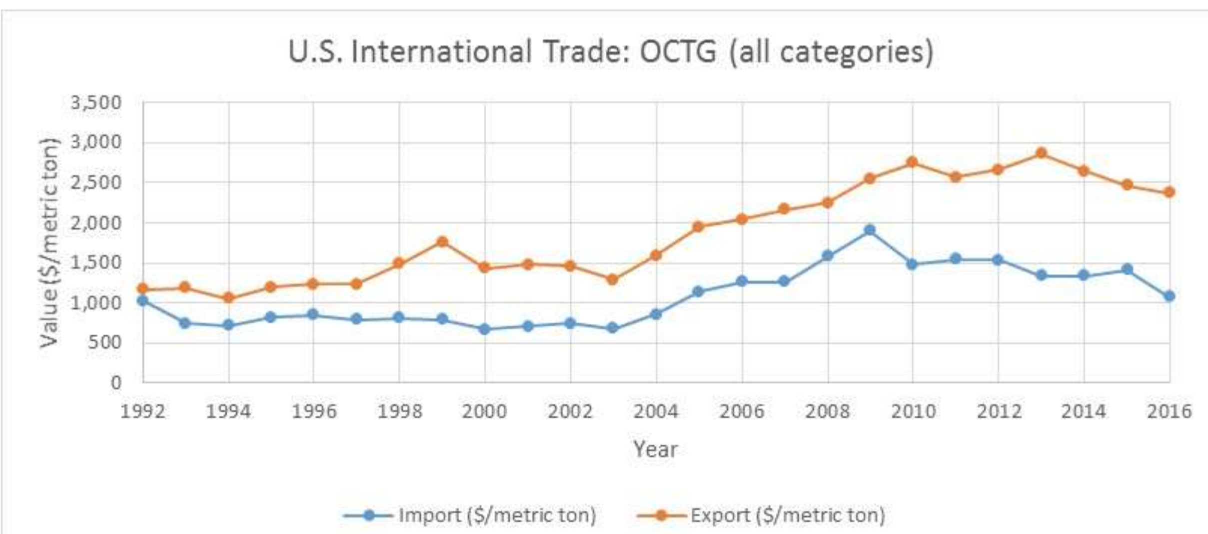
Exhibit 3-18: Maximum Line Pipe Imports into the U.S. by Exporting Country and Diameter Size (2010-2016)

Diameters	Line Pipe Diameter <4.5 in	Line Pipe Diameter 4.5-16 in	Line Pipe Diameter 16-24 in	Line Pipe Diameter >24 in
Country Exporting to U.S.	*Max Quantity (metric ton)*	*Max Quantity (metric ton)*	*Max Quantity (metric ton)*	*Max Quantity (metric ton)*
Algeria	0	0	0	0
Angola	2	0	0	0
Argentina	11,418	11,088	16	20
Australia	6	129	0	0
Austria	12,173	5,229	1	0
Bahamas	0	0	436	0
Belarus	22,356	4,221	0	0
Belgium	14	14	2	0
Brazil	3,712	15,163	2,713	24
Bulgaria	13	0	0	0
Canada	4,748	38,556	212,161	16,543
Chile	0	0	0	0
China	3,386	7,654	16,075	16,622
Colombia	0	0	0	0
Costa Rica	0	0	0	0
Croatia	6,147	9,908	1	0
Czech Republic	13,857	15,455	6,176	0
Denmark	3	6	0	0
Finland	17	162	16	0
France	8,556	820	315	31,511
Georgia	148	0	0	0
Germany	846	78,013	52,450	157,030
Greece	0	16,890	145,514	26,151
Guatemala	5	0	0	0
Hungary	0	4	0	0
India	26,974	20,241	68,129	167,908
Indonesia	303	361	4	7
Iraq	0	0	0	0
Ireland	0	0	0	0
Israel	19	16,898	0	0
Italy	728	42,493	28,349	162,294
Japan	4,150	52,725	72,568	32,200
Korea, South	106,071	464,528	106,539	67,587

Diameters	Line Pipe Diameter <4.5 in	Line Pipe Diameter 4.5-16 in	Line Pipe Diameter 16-24 in	Line Pipe Diameter >24 in
Country Exporting to U.S.	*Max Quantity (metric ton)*	*Max Quantity (metric ton)*	*Max Quantity (metric ton)*	*Max Quantity (metric ton)*
Kyrgyzstan	6	0	0	0
Luxembourg	0	0	0	0
Malaysia	2,272	2,039	11	547
Mexico	52,160	85,440	1,365	951
Mozambique	0	4,308	0	1,131
Netherlands	76	71	51	0
Nigeria	0	59	0	0
Norway	38	400	32	0
Oman	107	6,239	6,431	255
Pakistan	33	0	0	0
Philippines	4,382	10,241	137	0
Poland	214	2,152	1,671	0
Portugal	0	0	4	0
Romania	401	9,685	1,768	13,868
Russia	21,160	24,472	205	234
Saudi Arabia	416	3,397	0	0
Singapore	2	17	38	2
Slovakia	7,590	10	20	0
Slovenia	0	0	0	0
South Africa	22,659	6,151	131	0
Spain	5,144	1,849	1,794	335
Sri Lanka	0	0	0	0
Sweden	578	1,434	5	0
Switzerland	142	3,338	0	0
Syria	0	0	0	0
Taiwan	18,559	39,820	1,603	72
Thailand	7,354	6,760	2,954	1,633
Trinidad and Tobago	0	0	0	0
Tunisia	0	0	0	0
Turkey	32,137	38,870	4,799	110,897
Ukraine	20,769	10,862	2,107	0
United Arab Emirates	1,426	1,071	238	0
United Kingdom	438	17,053	114,744	13,247
Vietnam	13,360	19,252	172	0

Sum (metric tons)	437,077	1,095,552	851,746	821,069
Average $/metric ton	$1,056	$1,007	$1,284	$1,407

Exhibit 3-19: International Trade in OCTG



Anti-dumping and Countervailing Duties for Line Pipe and OCTG

International trade for line pipe, OCTG and other steel products has been influenced by trade disputes with steel producers and the governments of several countries. U.S. steel producers, trade unions and other interested parties have alleged that some foreign producers have “dumped” steel products (that is, sold them at unreasonably low prices) into the U.S. and that foreign government policies have led to illegal subsidization of foreign steel exports. To remedy these alleged abuses, U.S. producers of steel products have sought, and sometimes have successfully obtained, remedies in the forms of anti-dumping duties (AD) and countervailing duties (CVD) for cases of illegal government subsidization. In some instances where trade abuses have been proven, both and AD and a CVD has been imposed.

These remedies may be sought when representatives of 25% or more of the affected U.S. industry petition the International Trade Administration of the Department of Commerce and the International Trade Commission. For dumping cases, the petitioners must show a foreign producer sells a product in the U.S. at a price that is below that producer's sales price in the home country or at a price that is lower than the foreign producer’s cost of production. The difference between the price (or production cost) in the foreign market and the price in the U.S. market is called the dumping margin and represents the amount by which an AD might be imposed.

When improper government subsidization is alleged, the petitioners must show that a “countervailable subsidy” exists. This could be financial assistance from the foreign government to the production, manufacture, or exportation of the product in question or to one or more the primary materials from which the product in question is made. These countervailable subsidies can take the forms of direct cash payments, credits against taxes, and loans at terms that do not reflect market conditions. U.S. laws and regulations (as may be by influenced by international trade agreements) establish the standards for determining what is a countervailable subsidy and what is not. The amount of subsidies the foreign producer receives from the government is the basis for the subsidy rate by which the subsidy is offset, or "countervailed," through higher import duties.

The International Trade Commission has the job of determining whether the petitioning industry is suffering material injury as a result of the imports of the dumped or subsidized products. The International Trade Commission considers all relevant economic factors, including the domestic industry's output, sales, market share, employment, and profits. Both the International Trade Commission and International Trade Administration of the Department of Commerce must make affirmative determinations for remedies to be imposed. When this happens the U.S. Customs and Border Protection agency is instructed to assess duties on imports of that product into the U.S. The duties are assessed as a percentage of the value of the imports and are equivalent to the dumping and/or subsidy margins, described above.

As shown in Exhibit 3-20 currently there are 23 duty orders in force that apply to imports of line pipe and 14 orders that apply to OCTG. The countries with the largest numbers of orders in effect are China, Japan, Turkey, India, Taiwan and South Korea. The AD and CVD margins that have been applied range from under 5% to over 200% with a median value of around 30%.

Exhibit 3-20: Number of U.S. Anti-dumping and Countervailing Duty Orders in Effect for Line Pipe and OCTG by Exporting Country

Country	Line Pipe	OCTG
Brazil	1	0
China	6	2
Germany	1	1
India	1	2
Japan	3	1
Korea	2	2
Mexico	1	0
Oman	1	0
Pakistan	1	0
Romania	1	1
Taiwan	2	2
Thailand	1	0
Turkey	4	2
United Arab Emirates	1	0
Vietnam	0	1
All Counties	**26**	**14**

Source: ITC accessed April 2017: https://www.usitc.gov/trade_remedy/731_ad_701_cvd/investigations.htm

The value of imported goods that are shown in the charts and tables of this report are the so called “customs value” as appraised by U.S. Customs and Border Protection. This is defined as the price actually paid for merchandise when sold for exportation to the U.S. It excludes U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the U.S. It also excludes freight costs within the U.S. Exhibit 3-21 shows the average costs for insurance and freight paid in 2015 and 2016 for steel products imported from selected countries and regions. For line pipe, the average insurance and freight cost to the U.S. port of entry was $72/metric ton.

Exhibit 3-21: Average Cost of Insurance and Freight for Selected Steel Products Imported to the U.S. in 2015 and 2016 ($/metric ton)[6]

Country or Region of Export	Line Pipe	OCTG	High Strength CTL Plate	High Strength Plate Coil	Average of These Steel Products
Africa	$61	$46	$31		$52
Asia	$77	$66	$73	$45	$72
Canada		$14	$20	$13	$15
Eastern Europe/FSU	$47	$68	$64		$56
Mexico	$30	$45	$13	$8	$37
Middle East	$101	$98			$99
South/Central America	$88	$58	$39	$38	$63
Western Europe	$98	$85	$45	$41	$77
World Average	**$72**	**$63**	**$45**	**$25**	**$63**

3.6 History of International Trade of High Strength Cut-to-length Plate and Plate Coil Imports

The following figures display historic results of the aggregated international trade data from the U.S. Census Bureau[6]. For the purposes of this section, high strength steel cut-to-length plate and plate coil imports most suitable for making line pipe are defined as those with a minimum yield strength of 51,000 psi, a width 24 inches or more and a thickness of 0.187 or more.[18] ICF has combined data for various HTS codes to produced totals for high strength steel hot rolled coil and cut-to-length plate. The results for cut-to-length plate and plate coil are shown as a set of three charts. Each set displays the historic values of imports and exports for three parameters: volume of trade in metric tons, value of trade in million dollars, and value per metric ton. The specific HTS codes used to obtain these results were selected to represent the kinds of plates and coil that would likely be used to make line pipe and are listed in Appendix B.

[18] It is certainly possible to use coils less than 24 inches wide and with specified minimum yields strengths below 51,000 psi to make line pipe. Therefore this definition will miss some imports of coils that could be used for line pipe. On the other hand, not all imports of plate and coils that meet this definition are necessarily used to make line pipe.

Exhibit 3-22: International Trade in High Strength Cut-to-length Plate

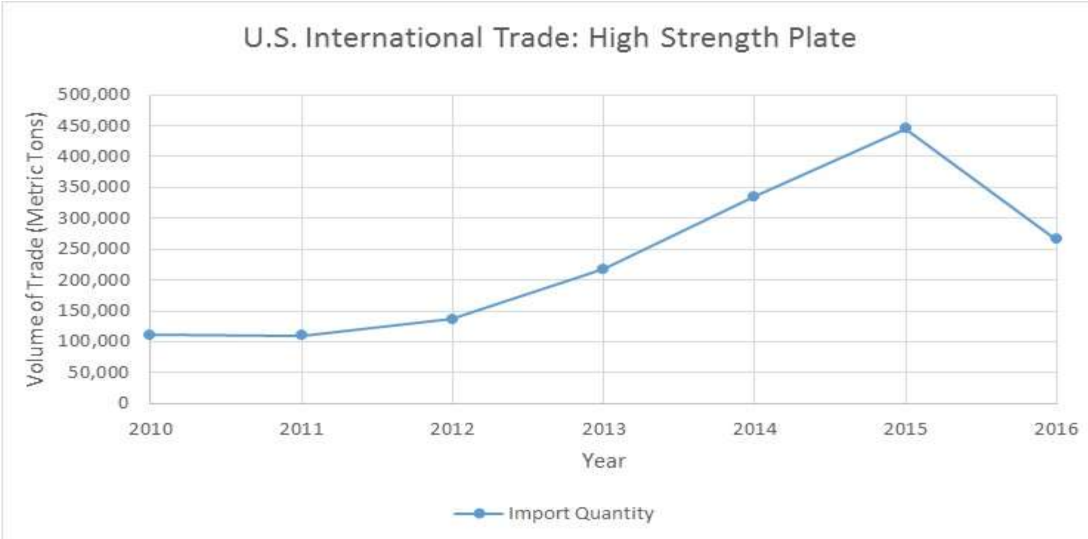


Exhibit 3-23: International Trade in High Strength Plate Coil

Exhibit 3-24: High Strength Cut-to-length Plate and Plate Coil Maximum Imports into the U.S. by Exporting Country

Country Exporting to U.S.	*Max Quantity High Strength Plate Imports (metric tons)*	*Max Quantity High Strength Plate Coil Imports (metric tons)*
Australia	0	6,316
Canada	31,612	100,678
Finland	14,111	2,908
France	181,741	1,609
Germany	171,054	7,136
India	0	4
Korea, South	24,260	86,768
Mexico	1,717	36,362
Netherlands	43	19,777
New Zealand	0	200
Russia	20,408	40,440
Spain	627	0
Taiwan	18,870	467
Turkey	18,306	72,946
Brazil	7,660	17,014
Japan	13,473	7,713
South Africa	6,865	15
Sweden	4,996	1,512
United Kingdom	35,485	33,966
Africa	6,865	15
China	252	310
Belgium	619	0
Italy	16,135	46,117
Switzerland	823	0
Ukraine	4,447	0
Austria	35,838	0
Poland	465	0
Czech Republic	6,809	0
Denmark	205	0
Macedonia	3,640	0
Malaysia	2,712	0
Romania	3,773	0
Bulgaria	674	0
Sum (metric tons)	634,486	482,274

Anti-dumping and Countervailing Duties Applied to Cut-to-length Plate and Plate Coil

As with line pipe, international trade of cut-to-length plate and plate coils has been influenced by trade disputes with steel producers and the governments of several countries. U.S. steel producers of cut-to-length plate and plate coils have obtained remedies in the forms of anti-dumping duties (AD) when imports were deemed to have sold in the U.S. at unreasonably low prices and countervailing duties (CVD) for cases were illegal government subsidization was determined to have occurred. Exhibit 3-25 shows that there are currently 20 duty orders in existence that relate to steel plate and 19 orders that relate to hot rolled products including plate coil and sheet coil. The counties with the largest number of currently effective orders are South Korea, China, India, Indonesia, Brazil, South Africa and Taiwan.

Exhibit 3-25: Number of U.S. Anti-dumping and Countervailing Duty Orders in Effect for Steel Cut-to length Plate and Plate Coil

Country	Plates	Hot Rolled Coil and other Flat Products
Australia	0	1
Belgium	1	0
Brazil	1	2
China	3	1
India	2	2
Indonesia	2	2
Japan	1	1
Korea	4	2
Netherlands	0	1
Russia	0	1
South Africa	3	0
Taiwan	2	1
Thailand	0	2
Turkey	1	1
U.K.	0	1
Ukraine	0	1
All Counties	**20**	**19**

Source: ITC accessed April 2017: https://www.usitc.gov/trade_remedy/731_ad_701_cvd/investigations.htm

3.7 Imports and Domestic Production of Alloying Agents

As was mentioned earlier, the most relevant line pipe specifications and testing requirements are contained in API's 5L (carbon steel) and 5LC (corrosion resistant steel) standards. There are different specs for different types of line pipe such as different yield strength grades (e.g., X60, X65, and X70). API has similar standards for various types of OCTG. Because OCTG are exposed to unprocessed natural gases and oils which sometimes contain corrosive mixtures of water, carbon dioxide and hydrogen sulfide and which sometimes are found in high pressure, high temperature environments that accelerate corrosion, users of casing and tubing are more likely to need corrosion resistant steels alloyed with chromium, nickel and other elements. Corrosion resistant steel may also be needed for gathering lines that collect gas and oil from oil and gas wells and deliver it to separators and processing plants. (Gathering lines in corrosive environments may also be made from high-density polyethylene plastics or composite plastic/fiber materials.) Alloy and stainless steel make up only about 7% of U.S. steel production (the remainder being carbon steel), but alloy steels are in the neighborhood of 40% of U.S. OCTG production[19].

The API standards contain minimum and maximum limits for metals, minerals and other constituents in the steels that are used to make line pipe and OCTG. These alloying agents are often added to the steel to provide it with desired characteristics (tensile strength, yield strength, corrosion resistance, etc.). In other cases, the metals and minerals are considered undesirable and their content is limited by the specifications to certain maximum percentages. Non-iron metals added as alloying agents include manganese, molybdenum, vanadium, magnesium, chromium and nickel and the min/max percentages of these metals are often found in line pipe and OCTG specifications. As shown in Exhibit 3-26, much and sometimes all of the U.S. consumption of some of these metals is supplied by imports.

[19] Platts, "Steel Data and Analysis", https://www.platts.com/IM.Platts.Content/ProductsServices/Products/steeldataanalysis.pdf. In the trade data for OCTG, all items are not broken out by alloy or stainless steel versus carbon. However considering the OCTG items that can be identified as alloy or stainless steel, imports are 25% by weight and 36% by value. Exports of alloy or stainless steel OCTG are 37% by weight and 45% by value. https://usatrade.census.gov/

Exhibit 3-26: U.S. 2015 Balance for Some Metals Used as Steel Alloying Agents (Metric Tons per Year)[5]

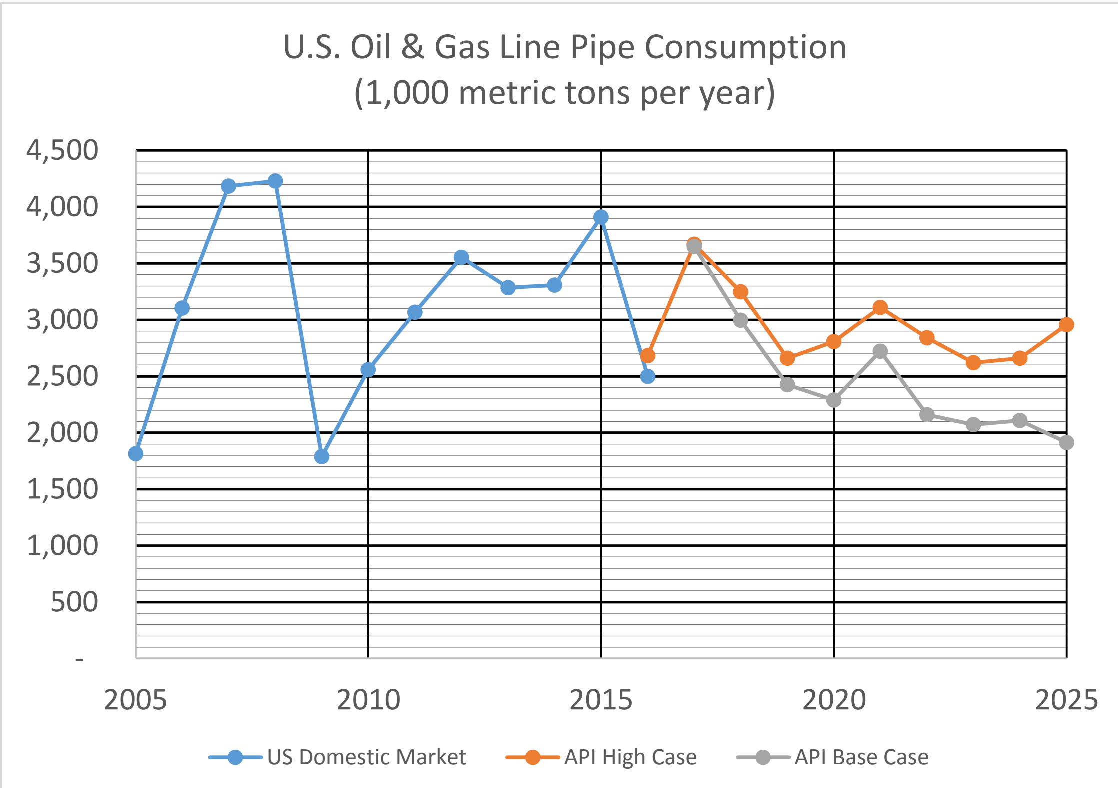
Metal	US Production	Imports	Exports	Recycling	US Consumption (Reported)
Niobium (Columbium)	none	8,900	1,300	-	7,700
Manganese	none mined in US, but there is production from imported ores	1,100,000	5,000	-	990,000
Chromium	only one US company produced metal, quantity unknown	676,000	381,000	162,000	418,000
Molybdenum	56,300	22,200	63,400	-	19,000
Nickel	168,500	162,700	61,270	-	250,000
Vanadium	none	9,490	484	-	3,600
Titanium (does not include titanium oxide used for pigments, etc.)	US prod. withheld by USGS, but imputed as ~10,000	22,600	1,640	-	30,600

It is expected that – in keeping with other domestic content requirements issued by the Federal government in other contexts - any Department of Commerce's domestic content rule for oil and gas line pipe would not require iron ores or alloying agents be sourced from the U.S. If the use of imported alloying agents is not clearly exempted, then the disruption to the API 5L cut-to-length plate and plate coil markets caused by the domestic content rule could be even more severe than anticipated in this report.

3.8 Expected Future Demand for Steel Line Pipe and Comparison to Domestic Capacity

Apparent demand for line pipe in the U.S. (shipments from U.S. plants plus imports minus exports) totaled 3.9 million metric tons in 2015 and 2.5 million metric tons in 2016[4]. According to ICF "Base Case" and "High Case" estimates prepared for API[12] of future pipeline infrastructure needs, line pipe consumption in the U.S. over the next five years will average between 2.8 to 3.1 million tons as shown on Exhibit 3-27. The exhibit illustrates that demand for line pipe has gone up and down dramatically year to year due to commodity price fluctuations and the coming and going of large pipeline construction projects. Line pipe exports from the U.S. have historically averaged 0.3 million tons in the last five years. If that level of exports continues into the future total demand (domestic consumption plus exports) would average 3.1 to 3.4 million tons over the next three years.

Exhibit 3-27: Projected U.S. Line Pipe Consumption (metric tons per year, excludes exports)



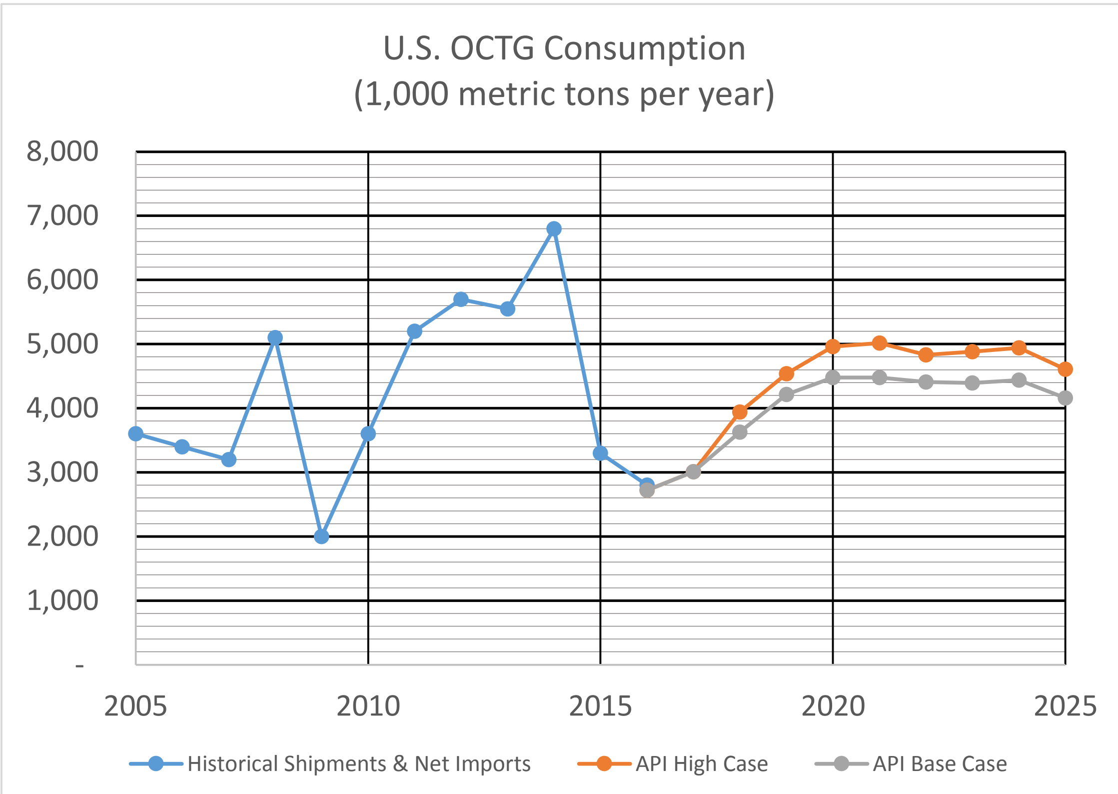
In the study for API ICF also estimated the number of U.S. jobs that would be associated with future pipeline construction and repair projects. The study estimates that there will be an average of approximately 417,000 jobs each year from 2017 to 2021 in the "Base Case" and 456,000 jobs in the "High Case." This job count includes direct, indirect and induced jobs.[20] These jobs relate to all aspects of the construction of flow lines, gathering systems, and pipelines including all compressors, pumps, SCADA systems, and construction costs – not just jobs related to the line pipe itself. These total jobs are the jobs that would be at risk if the domestic content requirements caused pipeline projects to be delayed or canceled.

Projected demand for OCTG in the U.S. from the two API cases is shown in Exhibit 3-28. By 2019 demand is expected to exceed 4.0 million metric tons per year and then stay in the range of 4.0 to 5.0 million tons through 2025. These are values well below the recent peak of 6.8 million metric tons reached in 2014. If imported OCTG maintains a market share slightly over half of the market, then U.S. production of OCTG will

[20] The terms "direct," "indirect," and "induced" are commonly used in economic analysis using input/output modeling. The direct jobs are those related to the expenditures on primary (or direct) goods and services (in this case the materials, equipment, and services purchased during the construction or repair of a pipeline system). The indirect jobs are associated with all of the intermediate materials and services that go into the production of the primary/direct goods and services. The induced jobs are those that are created when the income earners in direct and indirect sectors spend their income.

average 1.7 to 1.9 million metric tons per year over the next five years and will stay well below estimated OCTG capacity of approximately 5.0 million metric tons per year.

Exhibit 3-28: Projected U.S. OCTG Consumption (thousand metric tons per year, excludes exports)



Adding together the next five years' expected levels of domestic manufacturing needs for line pipe under a domestic content policy (3.1 to 3.4 million metric tons per year) to the expected domestic production of OCTG (1.7 to 1.9 million metric tons per year) yields a range for both types of products that is 4.8 to 5.3 million metric tons per year. The nominal production capacity of active U.S. line pipe manufacturers with API 5L certification is 10.5 million metric tons per year, so these anticipated near-term demand levels as measured in metric tons of product are within nominal capacity.

As shown in Exhibit 3-29, these total line pipe plus OCTG production needs are also within the historically demonstrated capacity (that is, the actual maximum achieved rates of production) of 6.8 million tons per year for both products. However, the specific range of need for line pipe (3.1 to 3.4 million metric tons) is above the demonstrated capacity of 2.5 million metric tons per year for line pipe only. This means that line pipe producers would have to activate unused line pipe capacity or shift capacity away from the production of other products to supply all U.S. steel line pipe demand.

Exhibit 3-29: Projected U.S. Line Pipe and OCTG Production Needs *versus* Capacity (million metric tons per year)

Product	Projected Average Demand over Next 5 Years		Capacity	
	Low	High	Nominal	Demonstrated (Historical Peak)
Line Pipe	3.1	3.4	3.8 to 8.5	2.5
OCTG	1.7	1.9	2.0 to 6.7	4.3
Line Pipe + OCTG	4.8	5.3	10.5	6.8

Notes: Assumes domestic content policies require all line pipe to be made in U.S. OCTG market share for U.S. is slightly under 50%. Nominal capacity of 10.5 million metric tons per year includes some capacity to make pipe and tube goods other than LP and OCTG. Demonstrated recent peak was in 2015 for line pipe and 2014 for OCTG.

Although in theory the U.S. consumption of line pipe as measured in total tons could be satisfied with domestic line pipe, in practice this will not be possible due to constraints related to the specific kinds of line pipe demanded by U.S. pipeline owners and gaps in the production and testing capability of domestic line pipe manufacturers and their suppliers of cut-to-length plate and plate coils. The constraints that would make it difficult for domestic line pipe manufactures to immediately meet all U.S. line pipe demand are discussed in the next section

3.9 Limitations of Domestic Line Pipe Manufacturers Given Current Buyer Requirements

Domestic line pipe manufactures under any new domestic sourcing requirements would have to meet transmission pipeline companies' specifications including, dimensions, grade, and the required sourcing of U.S. steel. Assuming multiple manufacturers can produce a given product, then they compete based on the total pipe cost (includes pipe cost, transportation, currency exchange, and import tax) and the schedule/lead time for delivery. Pipeline operators plan pipeline projects by conducting analysis based on the product and the volumes being transported, the terrain the pipe is being laid on, the population density, and the expected pressure necessary. Based on this criteria, pipeline companies have voiced concern at the ability of domestic pipe mills to meet all the demand for U.S. pipeline projects. Specifically, concerns relate to: 1) the difficulty in making or obtaining certain kinds of domestically melted hot rolled plate coil or cut-to-length plate from which the line pipe is made, 2) the inability to make pipe of certain dimensions, and 3) the inability to meet certain quality specifications.

Limitations related to domestic production of cut-to-length plate and plate coil: Welded line pipe is made from hot rolled cut-to-length steel plate or hot rolled steel plate coil.

The thickness of the cut-to-length plate and plate coil to be used is the same thickness as the finished line pipe, which typically ranges from 0.188 to 1.50 inches (4.76 to 38.1 mm). The strength of the cut-to-length plate and plate coil is determined by the chemical composition of the steel, manufacturing process, and the post-rolling heat treatment regime. One important measure of line pipe strength is its minimum yield strength measured in pounds per square inch. The most common yield strength demanded for new large pipeline projects is 70,000 pounds per square inch (designated X70). An important concern among line pipe buyers is that there is limited ability in the U.S. to manufacture cut-to-length plate and plate coil of X70 strength in large widths and particularly for cut-to-length plates in thicknesses above 0.625 inches, from domestically-sourced slabs (per the definition of "produced within the United States" in the Presidential Memorandum).

Operators have indicated challenges with obtaining cut-to-length plate and plate coil with specific tolerances on chemical properties or alloy metal content from domestic suppliers. Operators have indicated that during the procurement process domestic suppliers often respond with specification deviations that are unacceptable. Deviations could be due to a variety of factors ranging from process control, heat treatment methods, available technology for making plates and HRC, and steel refining techniques.

<u>Limitations related to wall thickness, ovality, and other specifications</u>: One specific area of concern among line pipe buyers is that there are no domestic suppliers of line pipe with domestic plate suitable for deepwater offshore applications where pipe with a thickness of 1.5 inches or greater may be needed and where standards for roundness (called ovality specifications) are very strict. Ovality is typically defined as the difference between the maximum and minimum diameter of a cross section of pipe over the nominal outside diameter. Offshore deepwater operations require less deviation in the pipe's roundness because it is submerged under thousands of feet of water and undergoes greater pressures and strains. Additionally, pipe for low temperature applications is not produced within the U.S. Another concern among line pipe buyers is that domestic seamless pipe with thick walls and certain kinds of thick-walled ERW and DSAW pipe have limited availability.

In addition to the items listed above voiced by operators, in theory there is the potential for other limitations to occur based on following items.

- EAF Steel Dilution Limit - The maximum amount of EAF steel (that is, new steel made by recycling old steel products) that can be diluted with blast furnace or direct reduced iron steel without compromising the quality of the steel needed for pipe making in the absence of more advanced refining techniques
- Die Size for Pipe-making – Whether there is a limitation on the hydraulic presses (tonnage and die bed size) that limits the size of pipe being manufactured.
- Ram Pressure Pipe (U-ing, O-ing) - Whether there is a limitation on the hydraulic presses (tonnage) for the equipment to shape the pipe

- Pipe Expansion (E-ing) - Whether there is an expansion limit on the hydraulic mandrel that limits the maximum OD of the pipe being manufactured.
- Rolling and Heat Treatment of Steel for Pipe: Higher grades of line pipe require cut-to-length plate and plate coils that typically have more complex and time consuming rolling and heat treatment processes, which reduces the mill throughput. U.S. mills often prefer to roll higher volume and less complex products with which they can maintain high capacity utilization rates.

Limitations related to quality and testing: Many line pipe buyers require or prefer line pipe that exceeds the manufacturing and testing specifications in the applicable API 5L standards. Companies can have more stringent metallurgical and dimensional quality requirements, smaller deviation allowances, or more stringent hydrostatic testing both in pressure and duration. While some pipeline operators reported no unique differences in the ability of domestic and foreign suppliers to meet their specifications, other pipeline operators, particularly operators with company-specific standards that exceed API 5L, noted that domestic suppliers oftentimes have more exceptions (or deviations) in their bid to the pipeline order specifications. These exceptions indicate each requirement the pipeline manufacturer is unable to meet. Companies oftentimes require specifications more stringent than API 5L for CO_2, offshore, LNG and corrosive pipe. In particular, companies voiced concern about pipe mills ability to produce line pipe greater than 24 inch diameter in the specifications that would be demanded.

There are numerous types of testing that pipe mills conduct to ensure quality including but not limited to radiographic, ultrasonic for the plate/coil, weld and pipe body, hydro testing, magnetic particle, electromagnetic, eddy current testing. Even within the various forms of testing, there are differences in the necessary equipment. For example, some ultrasonic testing equipment have more probes and higher accuracy. Pipeline companies through experience, testing, and third party testing have identified the type of equipment they find necessary to meet the specifications they require. Below are descriptions for some of the types of testing equipment that is used in industry:

- Ultrasonic testing is used to identify transverse, longitudinal, or weld seam flaws within the pipe, with more precise testing equipment utilizing multiple probes. Flaws are oftentimes identified by an audible sound made when an imperfection is identified.
- Magnetic particle testing is utilized such that the pipe or weld seam is magnetized where flaws will create a flux visible under a black light.
- Electromagnetic testing can detect longitudinal defects by using flux leakage by electromagnetic induction.
- Eddy-current testing induces an eddy current around the pipe that flaws will disturb.
- Radiography utilizes gamma rays that eventually produces a latent image depicting the varying densities.

Operators have indicated preference for line pipe makers who have online control of cut-to-length plate, plate coil, and pipe dimensions as the product is being manufactured leading to tighter tolerance control, as opposed to testing the products post manufacturing. The interviews conducted by ICF indicate that these kinds of modern measurement, testing and control processes are much more prevalent at foreign rolling and pipe mills compared to domestic mills, which tend to be older.

ALPPA agrees that limitations to domestic line pipe manufacturing capabilities Currently exist: The American Line Pipe Producers Association (ALPPA) seems to have conceded this point in stating in their comments to the Department of Commerce: “To the extent that there are niche products that the domestic industry does not currently produce, the very purpose of Buy America is to provide incentives for companies to innovate, and develop new products and improve manufacturing processes. ALPPA members are prepared to work with our customers and domestic steel suppliers to reach a mutual solution when niche product issues arise. At the same time, ‘Buy America’ requirements allow waivers in appropriate circumstance to overcome market limitation such as product unavailability.”[21]

Pipeline buyers’ expectations of solely domestic purchasing on line pipe prices: Another major concern among line pipe buyers is that any prohibition on buying line pipe from foreign pipe mills would increase the cost of their future line pipe purchases. Even now companies have observed that equivalent pipe produced domestically can be 0% to 50% (averaging at 25%) more expensive than their foreign counterparts. One concern for the future is that if the necessary investments in new line pipe manufacturing facilities discussed above were to be made, those investment dollars would have to be recovered quickly due to the legal and political uncertainty regarding the domestic content requirement’s long-term status. This may results in even higher line pipe prices in the near term. The other reason for concern is that the loss of competition within a smaller bidders’ pool would raise prices. (See discussion below on market competition before and after import restrictions.) The third concern about higher prices stems from the observation that domestic API 5L-compliant hot rolled plate coil and cut-to-length plates would not be easy to obtain and, thus, the line pipe manufacturer materials cost would go up leading to more upward pressure on line pipe prices.

Potential effect on the reliance of small diameter seamless line pipe: Another potential problem exists in the market for small diameter seamless line pipe where imports represent 89% of the 330,000 metric tons annual market (averaged over 2015 and 2016). It is not clear whether there is now enough excess domestic seamless line pipe capacity to accommodate such a shift. However, the fact that the average capacity utilization rate for OCTG in 2016 was about 21% suggests that there may be enough excess capacity (both seamless and welded) at facilities that make both small diameter line pipe and OCTG to accommodate the shift away from imports. If sufficient excess capacity does not exist, it is possible that domestic production capacity now used to make seamless OCTG could be shifted toward making seamless line pipe, although such a shift might encourage more imports of OCTG. It is also possible that in the face

[21] See ALPPA comments to the Department of Commerce at https://www.regulations.gov/docket?D=DOC-2017-0002

of potential supply limits, buyers of *seamless* line pipe would shift to using domestic *welded* line pipe in the smaller diameter categories.

3.10 Investment that would be Needed for Domestic Steel Manufacturers to meet Current Buyer Requirements

Substantial capital and time investment is necessary to address limitations in domestic steel and line pipe manufacturer's capabilities. Many domestic line pipe manufacturers have been in operation for numerous years and have not made significant process upgrades. Domestic steel mills lack some of the modern technology for production and testing equipment which their international competitors use in their plants. The cost of upgrading these facilities to meet the quality specifications now demanded by U.S. buyers would be in the tens of millions of dollars per facility. As an example, Arcelor Mittal, a manufacturer of steel slab, cut-to-length plate, and hot rolled coil, in their comments[22] to the Department of Commerce states, "ArcelorMittal USA has made significant investments predicated on making higher quality steel for pipeline applications. For example, we have upgraded our steel shop and built a new caster at Indiana Harbor, at an estimated cost of $61 million, largely to support the energy sector. We have made investments in our AM/NS Calvert facility of $58 million to increase capacity and provide bigger, heavier and better coils to the pipe producers. At the Burns Harbor plate mill, we are investing over $14 million in equipment to develop higher strength and heavier gauge plates for pipelines, as well as test our steel "in line" to accommodate ultrasonic testing methods to meet the increasingly scrupulous standards of the industry." Hence a push towards better quality products from all line pipe suppliers would need investments to the tune of several 100 million dollars.

Even more investment dollars would have to be spent to fill in the market niches (particularly large diameter pipe with thick walls) currently not covered by domestic steel and line pipe producers. Even if the domestic steel and line pipe manufacturers were willing to make such investment it would take time for the new capabilities to come on line – possibly 36 months or more – and even more time for buyers to become comfortable that the needed quality standards are being reliably maintained so that the "new" manufacturers can be put on buyers Approved Manufacturer Listings. During ICF's interviews line pipe buyers expressed concerns that the economics of such investments may not look favorable in the eyes of the domestic steel and line pipe manufacturers given the historic cycles experienced in U.S. line pipe demand and the uncertainty as to whether any domestic content rules would withstand legal challenge or be continued in the future.

[22] See DOC-2017-0002, comments from Arcelor Mittal Daniel G. Mull Executive Vice President to Department of Commerce April 7, 2017 at https://www.regulations.gov/docket?D=DOC-2017-0002

3.11 Considerations Related to Line Pipe Distributors

Line pipe distributors act as brokers for some line pipe operators in procuring large orders of line pipe for specific construction projects. They also stock pipe that operators purchase on an as-needed basis for their repair and maintenance activities. Distributors have an established supply chain including cut-to-length plate/plate coil suppliers, pipe suppliers, coaters, and transporters. Distributors also have their own set of inspectors and auditing procedures and standards to ensure that operator needs on quality, cost, and schedule are met.

Much in the same way as some operators, distributor experts conduct routine audits at suppliers both domestically and internationally. They classify their suppliers into a multi-tiered lists, such as acceptable, approved, and preferred. Each of these tiers indicates the compliance with quality standards based on years of experience supplying specific types of pipes to their clients. The addition of new suppliers to approved manufacturers lists is a time consuming process.

Finally, pipe distributors, who have large inventories from domestic and foreign pipe producers, would be greatly affected if they are not given a phased-in period for the new directive. Lack of pipe availability for repair and maintenance may be an issue as would be the monetary loss resulting from the disposal of foreign pipe in their inventories.

3.12 Considerations Related to Line Pipe Procurement Practices

Pipeline operators typically source pipe on a project-by-project basis, but many also have established non-exclusive pricing agreements with pipeline distributors and pipeline mills. These pricing agreements help facilitate expedited pipeline purchases, in particular, for smaller pipeline projects and pipeline repairs and maintenance. For large construction projects operators typically negotiate separate contracts. In the contracts, the main negotiated points include the cost, timeframe, cancelation fees, foreign exchange rate (if applicable) and warranties.

When implementing pipeline projects, operators place pipe orders early on, oftentimes prior to having all of the necessary permits. Large orders of line pipe (particularly for large diameters) are made many months in advance of when the pipe is needed in order to accommodate line pipe manufacturer’s production schedules and to allow for the lead time needed to obtain cut-to-length plate and plate coil of a given specification (particularly when those specs exceed API 5L specs). Line pipe manufacturers do not continuously make all sizes and types of line pipe in their product lines, but rather configure their facilities to run one particular size and type and then retool and run another size and type.

In these contracts, pipeline operators negotiate cancelation fees, which are based on the pipe mill's cost at the time of cancelation. The cancelation fee escalates as the project continues and is a function of the financial risk factor to the pipe mill. For smaller diameter pipe, the risk factor is much smaller as other companies are more likely to order the same diameter pipe, so a cancelation is less problematic to the pipe mill who can likely find another buyer. Once the pipe is made or about to be rolled, the burden of cost of the canceled order is on the purchaser where resale of the pipe is problematic because buying reused pipe has many uncertainties on whether the length of the pipe segments will work for the operator's terrain, whether the different thickness causes any other issues, and whether the pipe has weathered. Operators can usually only sell purchased pipe at a discount to the original cost once mismatched specs and shipping costs are taken into consideration.

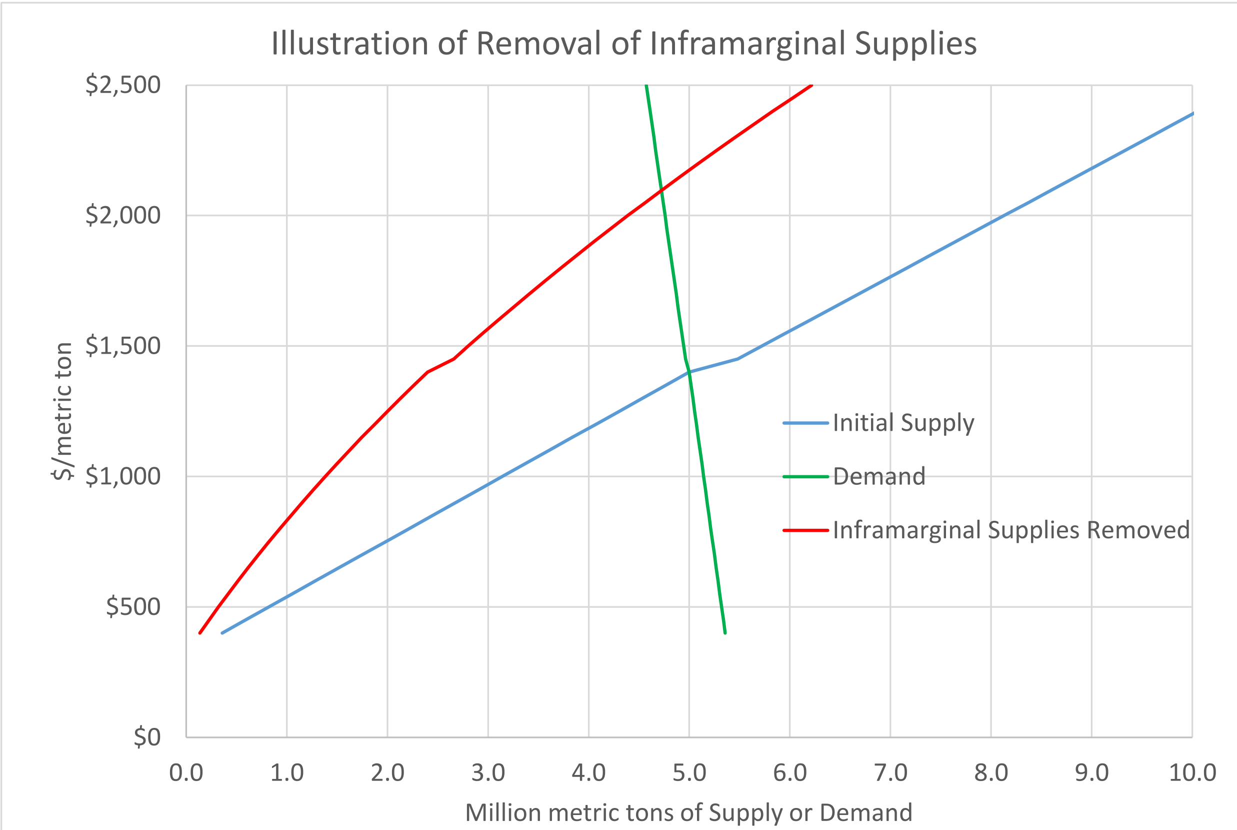
In addition to the cancelation fees, companies negotiate warranties into their pipe contracts focusing on the coverage amount and the coverage timeframe of the warranty. During conversations with pipeline operators, some stated that they found some domestic line pipe suppliers were only willing to warranty a fraction of the line pipe cost, while foreign pipe mills were willing to warranty the total purchase price of the line pipe plus pay the cost to dig up and replace any defective line pipe. This difference in the warranty practices was not universally experienced by all pipeline operators. Some operators also noted that in regards to the indemnification against replacement costs of defective line pipe, while it is in the contract, they have found it difficult to implement in practice. In addition to the differences in the coverage amount between domestic and foreign pipe mills, operators also cited differences in the timeframe of the warranties. Some companies noted that foreign suppliers to have longer warranty coverage timeframes.

3.13 Competition in Line Pipe Markets with and without Imports

There are two measures presented here regarding how import restrictions would affect competition in the U.S. line pipe market: one measures how much "inframarginal" supply is removed when line pipe imports are prohibited and the other measures how much industrial concentration would increase.

The first measure is the portion of "inframarginal" line pipe supplies that would be removed from the market by prohibiting imported line pipe. Economists use the term "inframarginal" to refer to supplies that can enter the market at prices at or below the prevailing market price. This can be thought of as the part of a supply curve that is at or below the market clearing price. As shown in Exhibit 3-30, when import restrictions are implemented so that inframarginal supplies are removed, the existing supply curve (blue line) would be shifted to the left (the red curve) and lead to higher market clearing prices. The original price in the exhibit is where the blue and green line (the demand curve) intersect. The new price is where the red and green line intersect.

Exhibit 3-30: Illustration of How Removal of Inframarginal Supplies Leads to Higher Prices



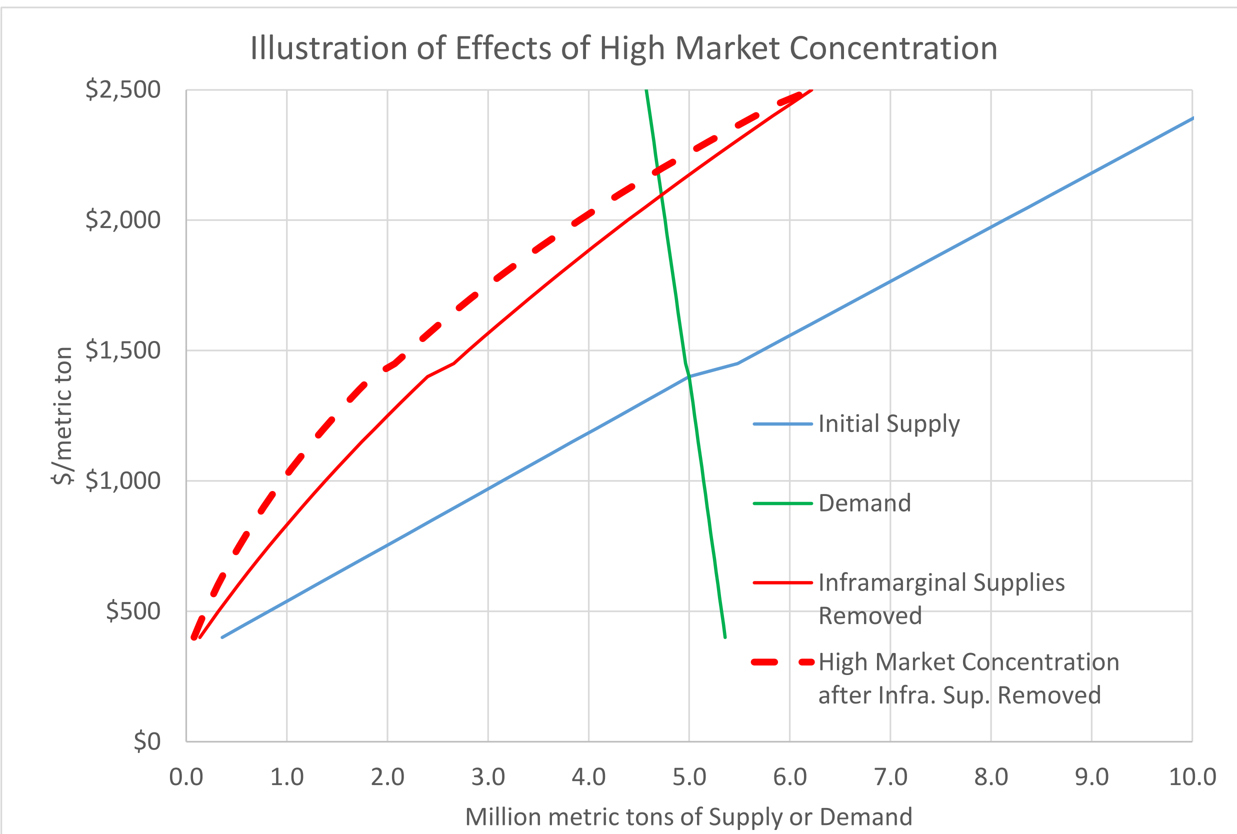
The second effect of limiting imports to be presented here is a widely used measure of industrial concentration called the Herfindahl-Hirschman Index or HHI. The Herfindahl-Hirschman index (HHI) is calculated by summing across all companies competing in a market the square of each company's market share. For example, if there are three companies in a market with market shares of 50, 30 and 20% respectively, the HHI would be $50^2 + 30^2 + 20^2 = 3{,}800$. A market in which only one company competed would have an HHI of 10,000. U.S. agencies generally consider markets in which the HHI is between 1,500 and 2,500 points to be moderately concentrated, and consider markets in which the HHI is in excess of 2,500 points to be highly concentrated.[23] Transactions that increase the HHI by more than 200 points in highly concentrated markets are presumed likely to enhance market power.

[23] See U.S. Department of Justice & FTC, Horizontal Merger Guidelines § 5.2 (2010); https://www.justice.gov/atr/horizontal-merger-guidelines-08192010.

When used to look at the effects of a merger, the HHI measure can be thought of as an indication of how the shape of the supply curve will change. In other words, after a merger the total supply of a product that is available to the market is likely to be the same as before, so the total quantity at the end of the supply curve will not change. However, if a merger increases market power of the merged companies it is possible that the new entity might benefit by offering its product at non-competitive prices (that is, prices above the marginal cost of production). This has the effect of changing the shape of the supply curve to reduce the quantities available at low prices.

In the context of any domestic content requirements that led effectively to prohibiting imports, the supply curve would be shifted to the left by removing inframarginal foreign supplies and -- if market concentration increases substantially -- the remaining (domestic only) suppliers may be able to change their pricing strategy to realize higher prices. These double effects are shown in Exhibit 3-31. The added dashed red line represents what the new supply curve might look like (after the inframarginal imported supplies are removed from the market) if the domestic suppliers are highly concentrated and can improve profits by changing their pricing strategy to offer less supply at lower prices.

Exhibit 3-31: Illustration of How High Market Concentration Can Lead to Even Higher Prices after Loss of Inframarginal Supplies



The calculations of lost inframarginal supplies and the increase in market concentration as measured by HHI are made assuming demand for line pipe is the average of the levels realized in 2015 and 2016 as shown in Exhibit 3-32. This amount of 3.4 million tons per year is similar to the expected levels of line pipe demand for the next five years in the two API infrastructure study cases including an allowance for exports (3.1 to 3.4 million ton per year). Note that these same line pipe demand assumptions will be used below to look at the market effects of import restrictions in the cut-to-length plate and plate coil markets.

Exhibit 3-32: Market Size Used to Compute Loss of Inframarginal Supplies and HHI Indices (average of 2015 & 2016 in metric tons and import market share as a percent)

	Imports	U.S. Production	All Supply	Import M.S.
Diameter <=4.5 in	210,254	73,003	283,257	74%
Diameter 4.6-16 in	647,625	232,563	880,188	74%
Diameter 16.1-24 in	555,467	442,496	997,963	56%
Diameter >24 in	363,137	841,873	1,205,010	30%
All Sizes	**1,776,482**	**1,589,936**	**3,366,418**	**53%**

The first submarket evaluated is for line pipe of 24 inch diameter and greater and is shown in Exhibit 3-33. The top part of the exhibit shows the domestic producers of line pipe in that submarket and their estimated capacity. The average of actual domestic production in 2015 and 2016 is allocated to each company based on a pro rata share of estimated capacity. (Actual production by company is not known.)

The lower part of the exhibit shows the maximum imports by country realized in the last five years. The total trade volumes in this exhibit are the average import volumes into the U.S. for 2015 and 2016 summed across all exporting counties. This total is then allocated to various countries based on their maximum exports.[24] This method of producing a level of export is used (instead of using trade volumes for any given year) so that all countries that have traded with the U.S. in the recent years are shown in the exhibit and the full diversity of supply sources that could trade with the U.S. in the future are included in the HHI market concentration calculation.

About 30% of this submarket for line pipe greater than 24 inches is supplied by imported line pipe and so prohibiting imports would reduce inframarginal supplies by the same percent. Furthermore, market concentration among suppliers would go from 722 points to 1,200 points. This is an increase of 478 points, or twice the 200 point threshold that

[24] The use of exports from a country as a whole (as opposed to individual companies in that country) is typically used to measure market concentration because publically available trade data does not reveal company-level information. This has the effect of overstating market concentration in the unrestricted case and understating the increase in concentration caused by restricting exports to the U.S.

Department of Justice uses to determine if mergers would lead to unacceptable increases in market concentration.[25]

The calculations for the 16.1-24 inch submarket for line pipe are shown in Exhibit 3-34. In this submarket, 56% of the inframarginal supplies will be lost. The market concentration as represented by the HHI shows a small increase of 88 points without imports, going from 699 to 787 points.

The third submarket of line pipe from zero to 16 inches is shown in Exhibit 3-35. The U.S. depends heavily on imports for this submarket and some 74% of inframarginal supplies would be lost. In this submarket the HHI goes up by 290 points without imports, from 659 to 949.

On the whole, these calculations for the line pipe manufacturing submarkets indicate that the biggest effects in the market would come about due to losses of large percentages of inframarginal supplies, particularly for the zero to 16 inch market segment. The increase in market concentration would be most significant in the line pipe submarket above 24 inches where the HHI increases by 478 points.

As indicated in the discussions above, there would likely remain market niches (submarkets within submarkets) where few -- if any -- domestic line pipe producers exist and in those niches market concentration would be greater than would be indicated by this analysis of three broad submarkets. Note also that these calculations are for the line pipe manufacturing segment itself. The market concentration calculations for the cut-to-length plate and plate coil markets (which also have an effect on finished line pipe prices) are presented below.

[25] See: https://www.justice.gov/atr/herfindahl-hirschman-index

Exhibit 3-33: Impact of Import Restrictions on Market Competition: Line Pipe greater than 24 Inch OD

			With Imports to US		Without Imports	
Company	**Capacity (metric tons/ year**	**Allocated Sales (metric tons/ year)**	**Market Share**	**HHI**	**Market Share**	**HHI**
Berg	600,000	144,210	12.0%	143	17.1%	293
Dura-Bond Pipe LLC/Steelton Pipe Mill	181,437	43,608	3.6%	13	5.2%	27
Evraz Portland Tubular	181,437	43,608	3.6%	13	5.2%	27
Jindal Tubular USA, LLC.	340,195	81,766	6.8%	46	9.7%	94
JSW Steel USA Inc/Baytown Facility	454,000	109,119	9.1%	82	13.0%	168
Stupp Corporation	408,000	98,063	8.1%	66	11.6%	136
United States Steel	272,156	65,413	5.4%	29	7.8%	60
Vallourec Star	499,000	119,935	10.0%	99	14.2%	203
Welspun	476,273	114,472	9.5%	90	13.6%	185
Wyman-Gordon Forgings, Inc.	90,719	21,804	1.8%	3	2.6%	7
US Sum	**3,503,217**	**842,000**	**69.9%**	**586**	**100.0%**	**1,200**
Country	**Max Export to US (metric tons/ year)**	**Typical Export to US (metric tons / year)**	**Market Share**	**HHI**	**Market Share**	**HHI**
United Kingdom	13,247	5,894	0.5%	0	0.0%	-
Romania	13,868	6,170	0.5%	0	0.0%	-
Canada	16,543	7,361	0.6%	0	0.0%	-
China	16,622	7,396	0.6%	0	0.0%	-
Greece	26,151	11,636	1.0%	1	0.0%	-
France	31,511	14,020	1.2%	1	0.0%	-
Japan	32,200	14,327	1.2%	1	0.0%	-
Korea, South	67,587	30,072	2.5%	6	0.0%	-
Turkey	110,897	49,341	4.1%	17	0.0%	-
Germany	157,030	69,867	5.8%	34	0.0%	-
Italy	162,294	72,210	6.0%	36	0.0%	-
India	167,908	74,707	6.2%	38	0.0%	-
Foreign Sum	**815,858**	**363,000**	**30.1%**	**136**	**0.0%**	**-**
Total Market Size		**1,205,000**	**100.0%**	**722**	**100.0%**	**1,200**
Increase in HHI w/o Imports				**-**		**478**
Loss of Inframarginal Supplies						**30%**

Exhibit 3-34: Impact of Import Restrictions on Market Competition: Line Pipe 16.1 to 24 Inch OD

			With Imports to US		Without Imports	
Company	**Capacity (metric tons/ year**	**Allocated Sales (metric tons/ year)**	**Market Share**	**HHI**	**Market Share**	**HHI**
American Steel Pipe/Birmingham Facility	635,030	40,107	4.0%	16	9.1%	82
Axis Pipe and Tube	272,156	17,189	1.7%	3	3.9%	15
Berg	600,000	37,895	3.8%	14	8.6%	73
CSI Tubular Products, Inc./Tubular Products Facility	217,725	13,751	1.4%	2	3.1%	10
Dura-Bond Pipe LLC/Steelton Pipe Mill	181,437	11,459	1.1%	1	2.6%	7
Evraz Portland Tubular	181,437	11,459	1.1%	1	2.6%	7
TMK IPSCO	498,952	31,513	3.2%	10	7.1%	51
Jindal Tubular USA, LLC.	340,195	21,486	2.2%	5	4.9%	24
JSW Steel USA Inc/Baytown Facility	454,000	28,674	2.9%	8	6.5%	42
Northwest Pipe Company	327,000	20,653	2.1%	4	4.7%	22
Paragon Industries, Inc.	327,000	20,653	2.1%	4	4.7%	22
Stupp Corporation	408,000	25,769	2.6%	7	5.8%	34
Tenaris	327,000	20,653	2.1%	4	4.7%	22
United States Steel	1,170,270	73,912	7.4%	55	16.7%	279
Vallourec Star	499,000	31,516	3.2%	10	7.1%	51
Welspun	476,273	30,081	3.0%	9	6.8%	46
Wyman-Gordon Forgings, Inc.	90,719	5,730	0.6%	0	1.3%	2
US Sum	**7,006,194**	**442,500**	**44.3%**	**155**	**100.0%**	**787**
Country	**Max Export to US (metric tons/ year)**	**Typical Export to US (metric tons/ year)**	**Market Share**	**HHI**	**Market Share**	**HHI**
Czech Republic	6,176	4,765	0.5%	0	0.0%	-
Oman	6,431	4,961	0.5%	0	0.0%	-
United Kingdom	7,967	6,146	0.6%	0	0.0%	-
China	16,075	12,402	1.2%	2	0.0%	-
Italy	28,349	21,870	2.2%	5	0.0%	-
Germany	52,450	40,463	4.1%	16	0.0%	-
India	68,129	52,559	5.3%	28	0.0%	-
Japan	70,270	54,210	5.4%	30	0.0%	-
Korea, South	106,539	82,191	8.2%	68	0.0%	-
Greece	145,514	112,258	11.2%	127	0.0%	-
Canada	212,161	163,674	16.4%	269	0.0%	-
Foreign Sum	**720,062**	**555,500**	**55.7%**	**544**	**0.0%**	-
Total Market Size		**998,000**	**100.0%**	**699**	**100.0%**	**787**
Increase in HHI w/o Imports				**-**		**88**
Loss of Inframarginal Supplies						**56%**

Exhibit 3-35: Impact of Import Restrictions on Market Competition: Line Pipe zero to 16 Inch OD

Company	Capacity (metric tons/ year	Allocated Sales (metric tons/ year)	With Imports to US: Market Share	With Imports to US: HHI	Without Imports: Market Share	Without Imports: HHI
American Steel Pipe/Birmingham Facility	635,030	22,109	1.9%	4	7.2%	52
Axis Pipe and Tube	272,156	9,475	0.8%	1	3.1%	10
Boomerang Tube LLC/Liberty Texas Works Facility	327,000	11,385	1.0%	1	3.7%	14
Borusan Mannesmann Pipe U.S.	327,000	11,385	1.0%	1	3.7%	14
CSI Tubular Products, Inc./Tubular Products Facility	217,725	7,580	0.7%	0	2.5%	6
TMK IPSCO	1,333,563	46,429	4.0%	16	15.2%	230
Benteler Steel/Tube Manufacturing Corp.	299,371	10,423	0.9%	1	3.4%	12
Northwest Pipe Company	327,000	11,385	1.0%	1	3.7%	14
Paragon Industries, Inc.	327,000	11,385	1.0%	1	3.7%	14
SeAH Steel USA LLC/Leonard Road Facility	327,000	11,385	1.0%	1	3.7%	14
Stupp Corporation	408,000	14,205	1.2%	1	4.6%	22
Tenaris	327,000	11,385	1.0%	1	3.7%	14
Texas Tubular Products	327,000	11,385	1.0%	1	3.7%	14
Tex-Tube Company	327,000	11,385	1.0%	1	3.7%	14
United States Steel	1,850,659	64,431	5.5%	31	21.1%	443
Vallourec Star	499,000	17,373	1.5%	2	5.7%	32
Welspun	476,273	16,582	1.4%	2	5.4%	29
Wyman-Gordon Forgings, Inc.	90,719	3,158	0.3%	0	1.0%	1
Zekelman Industries, Energex Tube	90,719	3,158	0.3%	0	1.0%	1
US Sum	**8,789,215**	**306,000**	**26.3%**	**66**	**100.0%**	**949**

Country	Max Export to US (metric tons/ year)	Typical Export to US (metric tons / year)	With Imports to US: Market Share	With Imports to US: HHI	Without Imports: Market Share	Without Imports: HHI
Philippines	10,241	10,241	0.9%	1	0.0%	-
Argentina	11,418	11,418	1.0%	1	0.0%	-
Austria	12,173	12,173	1.0%	1	0.0%	-
Brazil	15,163	15,163	1.3%	2	0.0%	-
Czech Republic	15,455	15,455	1.3%	2	0.0%	-
Greece	16,890	16,890	1.5%	2	0.0%	-
Israel	16,898	16,898	1.5%	2	0.0%	-
United Kingdom	17,053	17,053	1.5%	2	0.0%	-
Vietnam	19,252	19,252	1.7%	3	0.0%	-
Ukraine	20,769	20,769	1.8%	3	0.0%	-
Belarus	22,356	22,356	1.9%	4	0.0%	-
South Africa	22,659	22,659	1.9%	4	0.0%	-
Russia	24,472	24,472	2.1%	4	0.0%	-
India	26,974	26,974	2.3%	5	0.0%	-
Canada	38,556	38,556	3.3%	11	0.0%	-
Turkey	38,870	38,870	3.3%	11	0.0%	-
Taiwan	39,820	39,820	3.4%	12	0.0%	-
Italy	42,493	42,493	3.7%	13	0.0%	-
Japan	52,725	52,725	4.5%	21	0.0%	-
Germany	78,013	78,013	6.7%	45	0.0%	-
Mexico	85,440	85,440	7.3%	54	0.0%	-
Korea, South	464,528	230,306	19.8%	391	0.0%	-
Foreign Sum	**1,092,222**	**858,000**	**73.7%**	**594**	**0.0%**	**-**
Total Market Size		**1,164,000**	**100.0%**	**659**	**100.0%**	**949**
Increase in HHI w/o Imports				**-**		**290**
Loss of Inframarginal Supplies						**74%**

3.14 Competition in High Strength Cut-to-length Plate and Plate Coil Markets with and without Imports

This section of the report presents for cut-to-length plate and plate coil markets the same two measures of the market effects stemming from restrictions on imports: the lost inframarginal supplies as a percent of the historical market and the increase in market concentration as measured by the HHI. The amount of cut-to-length plate and plate coil demand by the market is based on the average of the 2015 and 2016 consumption estimates presented earlier in this report.

Exhibit 3-36 presents the results for high strength plate that is compliant with API 5L line pipe standards. As with the line pipe calculations, the top part of the exhibit lists the domestic companies in this market and the bottom part of the exhibit shows the countries that export to the U.S. As with line pipe, the production of for plate is spread out among domestic companies based on total estimated plate capacity (which is not necessarily the same as API 5L plate capacity). Export of plate from various countries is based on the maximum level of export seen in the last five years.

One difference compared to line pipe in the calculations for cut-to-length plate (and also for the plate coil market that will be shown next) is that there are two estimates of the lost inframarginal supplies and increase in HHI points. In the first calculation it is assumed that cut-to-length plate (and plate coil) producers that rely now on imported slabs would be able to stay in the market by obtaining domestic slabs suitable for making plate for line pipe. In the second calculation, producers that depend on imported slabs are assumed not to be able to obtain domestic slabs and would have to exit the API 5L market for cut-to-length plate.[26]

Exhibit 3-36 shows that restricting imports would remove 51 to 64% of the inframarginal supplies of cut-to-length plate and that market concentration would increase substantially by 1,644 to 3,420 HHI points. This several times the 200 point threshold used by the Department of Justice and other federal agencies to indicate a worrisome loss of market competition. This loss of inframarginal supplies and large increase in the HHI indicate that restricting imports could put substantial upward pressure on API 5L plate prices and, as a result, API 5L line pipe prices.

The results for plate coil are shown in Exhibit 3-37. In this market 34 to 44% of inframarginal supplies would be removed and the HHI would increase from 695 to 1,174 points (several times the 200-point threshold). As with the cut-to-length plate market,

[26] See discussion of this issue above in Section 3.2. Also see DOC-2017-0002, comments submitted by NMLK Robert D Miller President and Chief Executive Officer to the Department of Commerce April 7, 2017. These comments include a study by a Rutgers economist discussing the reluctance of integrated mills to sell slabs and other semi-finished products to their competitors who do not make their own steel.

these measures are indicative of substantial upward pressures on plate coil prices and line pipe prices if import restrictions were to be imposed.

Exhibit 3-36 Change in Market Competition for API 5L Cut-to-length Plate with and without Imports

			With Imports to US Allowed		Without Imports (Current importers of slab STAY IN market)		Without Imports (Current importers of slab LEAVE market)	
Company	**Capacity All Plate (metric tons/ year)**	**Allocated Sales API 5L Plate (metric tons/ year)**	**Market Share**	**HHI**	**Market Share**	**HHI**	**Market Share**	**HHI**
ArcelorMittal Group	3,145,000	156,456	22.8%	522	46.7%	2,181	64.3%	4,130
Evraz Group	640,000	31,838	4.6%	22	9.5%	90	0.0%	-
Jindal Group	1,200,000	59,697	8.7%	76	17.8%	318	0.0%	-
US Steel Group	558,000	27,759	4.1%	16	8.3%	69	11.4%	130
SSAB - Svenskt Stal Group	300,000	14,924	2.2%	5	4.5%	20	6.1%	38
Nucor Group	891,000	44,325	6.5%	42	13.2%	175	18.2%	331
US Sum	**6,734,000**	**335,000**	**48.9%**	**682**	**100.0%**	**2,853**	**100.0%**	**4,629**
Country	**Max Export to US (metric tons/ year)**	**Typical Export to US (metric tons/ year)**	**Market Share**	**HHI**	**Market Share**	**HHI**	**Market Share**	**HHI**
Japan	13,473	8,112	1.2%	1	0.0%	-	0.0%	-
Finland	14,111	8,496	1.2%	2	0.0%	-	0.0%	-
Italy	16,135	9,715	1.4%	2	0.0%	-	0.0%	-
Turkey	18,306	11,022	1.6%	3	0.0%		0.0%	
Taiwan	18,870	11,362	1.7%	3	0.0%		0.0%	
Russia	20,408	12,288	1.8%	3	0.0%		0.0%	
Korea, South	24,260	14,607	2.1%	5	0.0%		0.0%	
Canada	31,612	19,034	2.8%	8	0.0%		0.0%	
United Kingdom	35,485	21,366	3.1%	10	0.0%		0.0%	
Austria	35,838	21,578	3.2%	10	0.0%		0.0%	
Germany	171,054	102,993	15.0%	226	0.0%		0.0%	
France	181,741	109,427	16.0%	255	0.0%		0.0%	
Foreign Sum	**581,293**	**350,000**	**51.1%**	**527**	**0.0%**	**-**	**0.0%**	**-**
Total Market Size		**685,000**	**100.0%**	**1,209**	**100.0%**	**2,853**	**100.0%**	**4,629**
Increase in HHI w/o Imports						**1,644**		**3,420**
Loss of Inframarginal Supplies						**51%**		**64%**

Exhibit 3-37: Change in Market Competition for API 5L Plate Coil with and without Imports

			With Imports to US Allowed		Without Imports (Current importers of slab STAY IN market)		Without Imports (Current importers of slab LEAVE market)	
Company	**Capacity All HRC (metric tons / year)**	**Allocated Sales API 5L Plate Coil (metric tons / year)**	**Market Share**	**HHI**	**Market Share**	**HHI**	**Market Share**	**HHI**
AK Steel Group	5,364,000	57,358	6.6%	43	10.1%	101	11.8%	140
ArcelorMittal Group	9,019,000	96,442	11.1%	123	16.9%	286	19.9%	395
ArcelorMittal Group; NSSMC Group	2,417,000	25,845	3.0%	9	4.5%	21	0.0%	-
BlueScope Steel Group; Gerdau Group	1,518,000	16,232	1.9%	3	2.8%	8	3.3%	11
Evraz Group	800,000	8,555	1.0%	1	1.5%	2	0.0%	-
JFE Steel Group; Vale Group	2,918,000	31,203	3.6%	13	5.5%	30	0.0%	-
Nucor Group	11,804,000	126,222	14.5%	210	22.1%	490	26.0%	676
SSAB - Svenskt Stal Group	965,000	10,319	1.2%	1	1.8%	3	2.1%	5
Steel Dynamics Group	5,687,000	60,812	7.0%	49	10.7%	114	12.5%	157
US Steel Group	11,027,000	117,914	13.6%	184	20.7%	428	24.3%	590
NLMK Group	1,786,000	19,098	2.2%	5	3.4%	11	0.0%	-
US Sum	**53,305,000**	**570,000**	**65.5%**	**642**	**100.0%**	**1,495**	**100.0%**	**1,974**
Country	**Max Export to US (metric tons / year)**	**Typical Export to US (metric tons / year)**	**Market Share**	**HHI**	**Market Share**	**HHI**	**Market Share**	**HHI**
Australia	6,316	3,987	0.5%	0	0.0%	-	0.0%	-
Germany	7,136	4,505	0.5%	0	0.0%	-	0.0%	-
Japan	7,713	4,869	0.6%	0	0.0%	-	0.0%	-
Brazil	17,014	10,740	1.2%	2	0.0%		0.0%	
Netherlands	19,777	12,485	1.4%	2	0.0%		0.0%	
United Kingdom	33,966	21,442	2.5%	6	0.0%		0.0%	
Mexico	36,362	22,954	2.6%	7	0.0%		0.0%	
Russia	40,440	25,529	2.9%	9	0.0%		0.0%	
Italy	46,117	29,112	3.3%	11	0.0%		0.0%	
Turkey	72,946	46,049	5.3%	28	0.0%		0.0%	
Korea, South	86,768	54,774	6.3%	40	0.0%		0.0%	
Canada	100,678	63,555	7.3%	53	0.0%		0.0%	
Foreign Sum	**475,233**	**300,000**	**34.5%**	**158**	**0.0%**	**-**	**0.0%**	**-**
Total Market Size		**870,000**	**100.0%**	**800**	**100.0%**	**1,495**	**100.0%**	**1,974**
Increase in HHI w/o Imports						**695**		**1,174**
Loss of Inframarginal Supplies						**34%**		**44%**

3.15 Markets for Fittings Used for Gathering, Pipeline and Gas Distribution

Another important aspect of the oil and gas industry that requires steel are certain pipeline fittings. Pipeline fittings represent specific components surrounding equipment such as connectors or joints. Fittings used in oil, gas, NGL, CO_2 and petroleum product pipelines are often designated "high yield fittings" indicating they are made of steel with a high minimum yield strength. Some examples of common fittings include:

Flange: This part fits at the end of a pipe or somewhere along the pipe and provides a means to connect and disconnect that pipe to another pipe, valve, meter or other device using fasteners (nuts and bolts) or other means. Flanges have ridge or protrusions that increase the strength of a connection of pipe and typically have a flat smooth surface against which another pipe or fitting with a similar flat smooth surface will be positioned to help prevent leakage.

Elbow or Bend: This fitting is a bent connector[27] used to change direction of a particular pipe connecting one pipe segment with another. The amount of bend can vary depending on the application.

Tee: This fitting allows for two pipes to connect to a main line at 90 degree angles with the shape created by the intersection giving the source of the name. This fitting is widely used in when connecting pipeline systems.

Sleeves: Sleeves are pipes or two longitudinally split pipe halves that fit over a pipe of slightly small diameter to provide a means of connecting two pipes, protecting a pipe or repairing damage to a pipe.

Reducers: This fitting adapts one diameter pipe to a pipe of a different diameter.

Manifolds: This fitting brings flows from several pipes into a single stream or *vice versa*.

Insulating Joints: Fittings placed between two sections of line pipe to prevent electricity flows between them.

Expenditures for fittings might be expected to be about 8% of the cost of line pipe (at the mill or port of entry). Using this rule-of-thumb the size of the U.S. market for iron and steel fittings for flow lines, gathering systems and pipeline would have been approximately $465 million in 2015 and $270 million in 2016.

[27] Small bends in line pipe (that is, a few degrees of bend) can be made in the field during construction using pipe bending machines. High-degree bends have to be made in facilities that heat the pipe to enable bends without damage to the pipe. The facilities then heat treat the line pipe afterwards to relieve stresses added by the bending process.

ICF compiled a list of fitting manufacturers from survey responses. This list, shown in Exhibit 3-38 below, does not necessary reflect the entire population of domestic suppliers of line pipe fittings.

Exhibit 3-38: List of Domestic Pipe Fitting Manufacturers

Manufacturer	
Advance Products & Systems Inc.	E-Z Line Pipe Support Co., LLC
Allied Fitting LP (Allied Group North America)	Elster Perfection
Boltex	Gajeske, Inc.
Custom Alloy Corp.	GE Oil and Gas - Dresser Pipeline Solutions
Edgen Murray Corp.	Hy-Lok USA
Erne	Hydra Stop
Eze-Flow	Inner-Tite Corp.
Galperti	Iracore International
Hackney Ladish Inc.	ISCO Industries, Inc.
Steam Systems Inc.	Norton McMurray Manufacturing
Steel Forgings Inc.	NOV Wilson
Sumitomo	PCC Energy Group
T D Williamson Inc.	Performance Pipe
Taylor Forge Engineered Systems Inc.	Project Piping Solutions, LLC
Tectubi Raccordi	R.W. Lyall & Company, Inc.
Tube Forgings Of America Inc.	Sandl Surplus
United Products & Services Inc.	Sisco-Specialty
Wolseley Industrial Group	Supply Solutions
Dynamic Products	Swagelok Company
Allied Tectubi	Topaz, Inc.
Team Industrial Services	TPE Supply, LLC
AF Global Corporation	Victaulic
Canadoil Group	Weldbend Corporation
CRC-Evans Supply	Weldfit
Dow Chemical Company	Worldwide Pipe & Supply

Pipeline fittings are normally made from high strength steel alloyed with manganese and other agents. Fittings are subject to maximum content limits for carbon and other important alloying elements to assure the finished components can be easily welded and retain specified strength and toughness specifications without requiring post-weld heat treatments. As with line pipe, a high level of metallurgical engineering and manufacturing know-how is required to produce fittings for modern high strength pipelines -- particularly for large pipe diameters where the dimensions and mass of the fittings make manufacturing and quality control more difficult.

Forged fittings: A wide variety of manufacturing methods are used to make pipe line fittings. For example, flanges and some other type of fittings are usually machined from forgings made from steel ingots, billets or blooms. These steel shapes are hot forged to form a near-final shape and then heat treated to achieve their specified mechanical properties (i.e. strength, toughness). The final steps in the manufacturing process are to machine the flange to specified dimensions and drilling bolt holes in the flange ring.

Wrought fittings: Other kinds of fittings such as elbows, tees and reducers are wrought, or hot formed from steel cylinders or other steel shapes. These cylinders are most commonly cut from seamless pipe but welded pipe is used for larger diameter fittings. For very large fittings the starting shape might be steel plates that are hot formed and welded together to produce the desired finished form. As with flanges, the final manufacturing steps include heat treatment and machining to smooth edges and form a smooth end where the pipe will be welded.

In an effort to characterize the pipe fitting market using U.S. International trade data, ICF reviewed imports reported by HTS code. However, these codes are not specifically delineated by industry type. As such, fittings for water pipes or residential usage were not readily distinguishable from fittings using for oil and gas line pipe. Given this, ICF did not include this data for the purposes of market review. However, ICF did collect data on fitting purchases as part of our survey of association members. The survey included responses that cover the purchase of approximately 34,000 fittings of which 32,000 had data on country of manufacture. The results of the survey revealed that 70% of the finished fittings were manufactured in the U.S., 27% came from Europe (primarily Italy) and 2% were made in Canada. The remaining 1% were identified as coming from Japan and China.

The results were very different for the subset of purchases of fittings of diameters over 16 inches (these large fittings made up 2,300 out of 34,000 fittings of all sizes) where the U.S. market share was only 20% and imports were 80%. Because imported fittings are more common among the large diameter sizes which are more expensive, imports make up a bigger share of the estimated value of the fittings (42%) than they do of the count of fittings (30%) reported in the survey.

The survey responses indicated that manufacturing quality considerations often led the buyers to use for foreign suppliers. One respondent explaining the high number of forge fittings purchased from Italy said “Historically, U.S. suppliers have had great difficulty achieving material properties for high strength forgings (through body properties).” Another buyer or large induction bends from Japan said that “U.S. suppliers were included in bid but were unable to meet all requirements.”

The survey indicated that the value added represented by the fittings was often not contributed by a single country. For example, fittings formed in Europe can be finished and heat-treated in the U.S. Also fittings made in the U.S. are sometimes made from steel imported from foreign sources. As an example, the largest domestic manufacturer for high strength (a.k.a. high yield) fittings sources specialized pipe from Japan and Korea to use in its manufacturing processes. Foreign sources supply the seamless pipe used to make fittings because the volume requirements for semi-finished steel pipe for fittings generally do not meet the minimum volume manufacturing tonnage currently required by domestic mills.

Of particular concern for gas distributors are 3 to 5 inch prefabricated insulated joints, a type of pipe fitting that is used to prevent electrical current flow between two sections or steel or iron main or service line. Stopping the current flow helps to prevent pipe corrosion. Such 3 to 5 inch prefabricated insulated joints for distribution lines are not produced in the U.S.

3.16 Markets for Oil and Valves and Regulators Used for Gathering, Pipeline and Gas Distribution

The oil and gas industry requires control of the flow of product throughout the supply chain to maintain safe operation. Regulation of the flow of oil, gas, water and other liquids transported via pipeline is accomplished through various kinds of valves. Some common types of valves include the following:

Ball Valve: These valves involve a ball-shaped gateway with two openings which can rotate independently of the pipe. To regulate flow, the ball valve rotates in such a way that the openings of the gateway line up with the cross sectional area of the pipe allowing materials to pass through. To close the valve, the openings within the gateway are rotated such that they are no longer parallel with the pipe, preventing material from passing through.

Butterfly Valve: These valves containing a rotating circular disk that, when the valve is considered closed, can fill the entire cross-sectional area within a pipe. The valve is considered open when the disk is rotated in such a way that some space within the pipe is clear allowing the contents of the pipe to pass through.

Gate Valve: These valves contain a sliding plate or panel that can be extended into or retracted from the pipeline, preventing flow once completely extended. The valve is considered open when the sliding plate is completely removed, allowing flow to continue as normal.

Globe Valve: These valves operate by engaging a blockage in an opening within a specially designed spherical valve body. The design forces the contents of the pipe to pass through an opening within the body, which the valve regulates using a disk like plug that can prevent flow entirely. When the valve is open, flow continues through the opening within the body normally.

Valves are made using either forging or casting processes. In the forging process a semi-finished steel shape such as an ingot, bloom or billet is heated and then forced at high pressure to conform to the shape of molds for each major part of the valve. Then the forged work that will be the valve body is machined to remove steel so as to form the interior of the valve and to deburr and shape its exterior. For large valves the body may be formed by two forged pieces that are welded together. The forged work that becomes the valve bonnet is also machined to form its shape.

The second common way to make a valve is the casting process in which molten steel or iron is poured into a mold to form the valve body and other parts. The advantages of casting is that can produce complex forms, accommodate strong steels that may be difficult to forge and by forming a hollow shape it eliminates the need to remove steel to form the valve interior or to welded two pieces to from the body. For these reason the casting process is often used to manufacture large diameter, high-pressure valves.

Exhibit 3-39 shows ICFs estimate of the number of valves purchased in 2015 for certain applications and their dollar value[28]. These applications include production, gathering, transmission and distribution of oil, gas, NGLs, petroleum products and CO_2. In total there were an estimated 933,000 valves sold at a cost of $2.4 billion. However this includes a large number of valves connected to plastic pipe in distribution system and at gathering and production facilities where -- by the presumptions used in this study -- any domestic content requirements would not apply. The valves that would be expected to be included in the domestic content policies are those connected to steel line pipe and pipe and that subset of the market represent 95,000 valve units and $1.7 billion in dollar sales value.

There are many companies in the U.S. that make valves that are used in production flow lines, gathering lines, pipelines, and distribution systems. However, a large portion of the value added in these valves (approximately 40% on average and up to 60% in some cases) comes from imported parts. Requiring the valves to be manufactured entirely within the U.S. using domestic iron and steel would severely disrupt existing valve-parts supply chains. Of particular concern is the foundry capacity in the U.S. to make the necessary castings for large valve bodies (for all kinds of valves) and the balls used in ball valves. As an example, the ball for ball valves over 12 inches are not cast within the U.S.

[28] The value for sales in the displayed table were developed by ICF using the Annual Survey of Manufacturers (ASM) shipment data and percent of sales by industry from the Valve Manufacturer's Association (VMA) (https://www.census.gov/programs-surveys/asm.html and http://c.ymcdn.com/sites/www.vma.org/resource/resmgr/Files/Annual_Shipments_by_End-User.pdf). Please note, the value of shipments reported by ASM is much larger than reported by VMA. Our interpretation for this is that the VMA data only represents a subset of the industry reported by ASM.

Exhibit 3-39: Estimate of U.S. Valve Market that Might be Included in Domestic Content Policies

	Estimated Annual Units Sold (1,000)	**U.S. Domestic Market Size ($million)**	**Comments Related to What Portion of Valves Might be Covered by Domestic Contetn Policies**
Oil and Gas Wells and Flow Lines	70	$700	No hard data available on what portion of flow lines are steel. Estimated range is 50% to 75%.
Gathering Systems	36	$725	Approximately 75% of gathering systems are steel.
Pipelines (natural gas, crude oil, NGL, petroleum products, CO2)	6	$725	Virtually all line pipe is steel
Gas Distribution Systems	821	$270	Only a small portion of new LDC valves (~2%) are connected to steel pipe.
Sum of All Type of Valves Listed Above	933	$2,420	Approximately 71% of sales value (and 10% of valve count) represents valves connected to steel pipe.
Subset of Valves Connected to Steel Line Pipe and Pipes	**95**	**$1,728**	

Source: ICF estimates based on Annual Survey of Manufacturers shipment data and percent of sales by industry from Valve Manufacturers Association.

Exhibit 3-40 contains a list of oil and gas valve producing companies with an indication of whether they have the capability of producing valves above 16 inches in size. This list was compiled using the Valve Manufacturers Association[29] membership and industry buyers guides and therefore may be an incomplete listing of all domestic valve manufacturers. The list contains companies that supply valves to oil and gas producers, processors, refiners and pipelines. Companies that could be confirmed to produce valves larger than 16 inches are indicated in the second column of the exhibit.

ICF also analyzed U.S. International trade data for industrial valve manufacturing and valve components. Exhibit 3-41 below contains a comparison of imports and exports (quantity and value) of industrial valves as well as value per metric ton. Additionally, Exhibit 3-42 also includes a comparison of the domestic value of shipments of industrial valves from the Annual Survey of Manufacturers[30] (ASM) and the import value of valve components from the U.S. International trade data. These data indicate that imported parts represent approximately 40% U.S. industrial valve production.

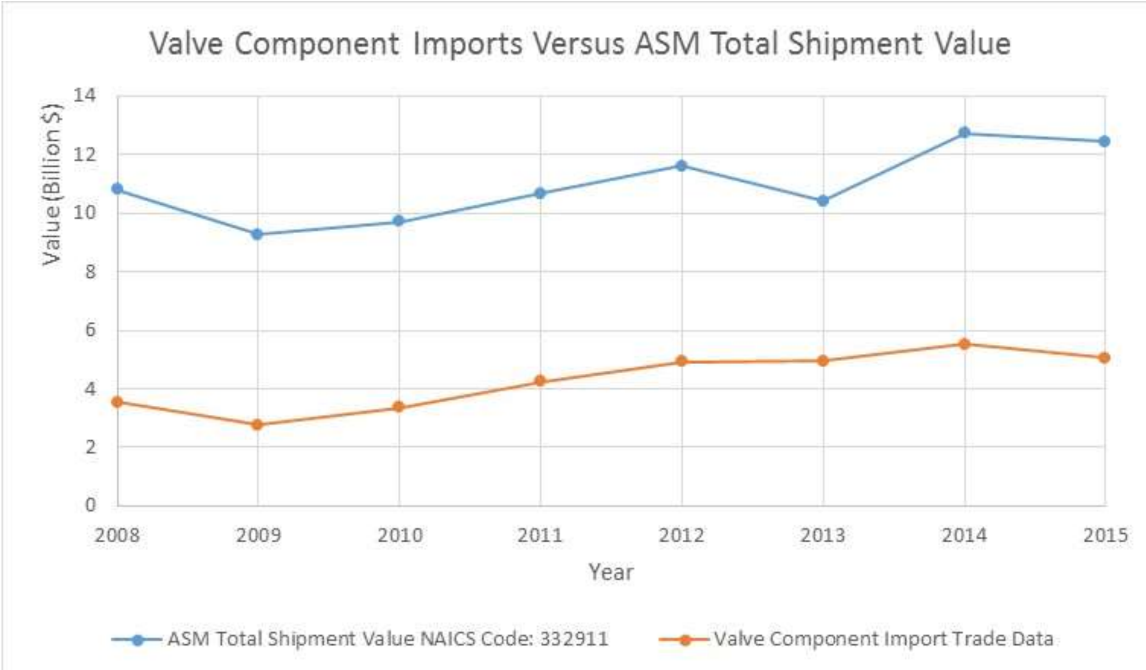
[29] http://www.vma.org/?MemberListing
[30] https://www.census.gov/programs-surveys/asm.html

Exhibit 3-40: U.S. Domestic Valve Manufacturers Supplying Valves to Oil and Gas Markets

Manufacturer	Larger Valves (>16") Available
American Valve, Inc.	Y
Automation Technology, Inc.	
Bray International Inc.	Y
Cameron Flow Control (includes Maxtorque)	Y
Champion Valves, Inc.	Y
Circor International, Inc.	
Conval, Inc.	
Crane Energy Flow Solutions	Y
Curtiss-Wright Valve Group (inludes Farris)	Y
DFT Inc.	Y
DistributionNOW	
Emerson (includes Fisher, Pentair)	Y
Flowserve Corp. (includes Vogt, Nordstrom)	Y
GE Oil & Gas (includes Becker)	Y
Gulf Coast Modification	
Mercer	
Metso Flow Control USA Inc.	Y
Powell Valves	Y
Process Development & Control, Inc.	Y
Setpoint Integrated Solutions	
Southern California Valve (SCV)	Y
Spirax Sarco, Inc.	
SPX M&J Danflo	Y
VALVTechnologies, Inc.	Y

Exhibit 3-41: International Trade in Industrial Valves

Exhibit 3-42: ASM U.S. International Trade Data Valve Comparison



Pressure Regulators

Another area of concern raised during the survey is pressure regulators used in the gas distribution industry to control the flow of natural gas in distribution networks. Of particular concern are regulators installed on low-pressure mains that crisscross city streets and are designed for small pressure differentials (between the upstream and downstream sides of the regulators). Such regulators, as specified by some gas distribution companies, are not produced in the U.S. and are purchased from manufacturers in Germany and Italy. Although polyethylene and other kinds of plastic are the primary choice for new mains installed by distribution companies, a significant portion (42%) of the in-place distribution mains in the U.S. are made from iron and steel. Regulators repaired or replaced on such iron and steel main systems would presumably fall under the domestic content rules and would need to be sourced from domestic manufacturers, which currently – at least for some kinds of regulators – is not possible.

3.17 Broader Context of U.S. Imports and Exports of All Steel Products

Exhibit 3-43 lists the countries from which the U.S. imports line pipe and the high strength steel cut-to-length plate and plate coils from which some domestic line pipe is made. The trade volumes by country in this exhibit are the ones shown early in the HHI computations. They reflect the average imports volumes into the U.S. for 2015 and 2016 summed across for all counties. This total is then allocated out to various countries based on the maximum exports to the U.S. from 2010 to 2016. This method of producing a “typical” level of export to the U.S. was used (as opposed to using trade volumes for any given year) so that all countries that have traded with the U.S. in the recent years (and could trade with the U.S. in the future) are shown at trade levels consistent with each country’s demonstrated ability to export. An average of 2.4 million tons of line pipe and related cut-to-length plate and plate coil were imported in 2015 and 2016 with a total approximate value of $2.2 billion dollars as measured at the port of export. Imports are dispersed among exporting countries in that there are a total of 29 countries in the exhibit, including 13 countries for which these “typical” exports to the U.S. are $25 million or more.

Also shown in the exhibit are 2016 values for all steel product exports and imports with the same countries. In total the U.S. exported steel products valued at $11.1 billion to the same countries from which it imports line pipe and associate cut-to-length plate and plate coil worth $2.2 billion. In other words, the U.S. sells these countries nearly five times the value of steel products as it imports as line pipe and relate cut-to-length plate and plate coil. Most notably, U.S. exports of steel products in 2016 were $5.3 billion to Canada (with which the U.S. has a $915 million surplus in steel products) and $4.1 billion to Mexico (with which the U.S. has a $1,984 million surplus in steel products). These trade pattern indicate the vulnerabilities facing the U.S. steel industry if the countries affected by U.S. domestic content polices for pipeline were to retaliate and impose their own restrictions on steel product imports from the U.S.

Exhibit 3-43 Overall Steel Trade with Countries Exporting Line Pipe and Related Materials to U.S.

	Recent Exports Levels to U.S. Related to Line Pipe (metric tons per year, $million per year)							Trade in All Steel Products 2016	
Countries Exporting Line Pipe, Plate or Coil to U.S.	Cut-to-length Plate (metric tons)	Plate Coil (metric tons)	Line Pipe <=16" (metric tons)	Line Pipe 16.1-24" (metric tons)	Line Pipe >24" (metric tons)	Sum Metric Tons Related to Line Pipe	Approx. Annual Value ($million)	Imports from U.S. ($million)	Exports to U.S. ($million)
Argentina			11,418			11,418	$11	$29	$83
Australia		3,987				3,987	$3	$55	$234
Austria	21,578		12,173			33,751	$24	$5	$295
Belarus			22,356			22,356	$22	$0	$16
Brazil		10,740	15,163			25,904	$22	$120	$2,127
Canada	19,034	63,555	38,556	163,674	7,361	292,180	$276	$5,290	$4,376
China				12,402	7,396	19,797	$21	$358	$1,347
Czech Republic			15,455	4,765		20,220	$20	$4	$174
Finland	8,496					8,496	$5	$3	$144
France	109,427				14,020	123,447	$76	$63	$459
Germany	102,993	4,505	78,013	40,463	69,867	295,841	$257	$168	$1,351
Greece			16,890	112,258	11,636	140,784	$149	$1	$91
India			26,974	52,559	74,707	154,241	$166	$153	$412
Israel			16,898			16,898	$16	$46	$1
Italy	9,715	29,112	42,493	21,870	72,210	175,401	$171	$104	$572
Japan	8,112	4,869	52,725	54,210	14,327	134,243	$133	$60	$1,684
Korea, South	14,607	54,774	230,306	82,191	30,072	411,950	$392	$172	$2,456
Mexico		22,954	85,440			108,394	$99	$4,072	$2,088
Netherlands		12,485				12,485	$9	$39	$519
Oman				4,961		4,961	$5	$12	$65
Philippines			10,241			10,241	$10	$11	$12
Romania					6,170	6,170	$7	$8	$70
Russia	12,288	25,529	24,472			62,289	$49	$39	$1,345
South Africa			22,659			22,659	$22	$13	$522
Taiwan	11,362		39,820			51,182	$45	$61	$1,062
Turkey	11,022	46,049	38,870		49,341	145,282	$132	$20	$1,149
Ukraine			20,769			20,769	$20	$2	$284
United Kingdom	21,366	21,442	17,053	6,146	5,894	71,901	$57	$155	$443
Vietnam			19,252			19,252	$19	$13	$514
Sum	**350,000**	**300,000**	**858,000**	**555,500**	**363,000**	**2,426,500**	**$2,237**	**$11,077**	**$23,896**

Note: Line pipe trade volumes are based on 2015/2016 average imports allocated to countries based on recent maximum annual exports. (Same concept as used to calculate HHI Indices.) They do not reflect actual exports to U.S. for any particular year. Value of exports are based on average prices for each product for 2015/2016 and do not reflect actual prices from each country.

The 2002 Experience with Steel Import Restrictions

The attempts to restrict competition and protect the domestic steel market are not new. In 2002, the U.S. government imposed a Section 201 on imports of classes of steel products to the U.S. A Section 201 action can be imposed by the President if the International Trade Commission, a quasi-judicial independent federal agency, makes a positive determination on the validity of the grounds for imposition of the section. The ITC provides the following information on Section 201.

> *Under section 201, domestic industries seriously injured or threatened with serious injury by increased imports may petition the USITC for import relief. The USITC determines whether an article is being imported in such increased quantities that it is a substantial cause of serious injury, or threat thereof, to the U.S. industry producing an article like or directly competitive with the imported article. If the Commission makes an affirmative determination, it recommends to the President relief that would prevent or remedy the injury and facilitate industry adjustment to import competition. The President makes the final decision whether to provide relief and the amount of relief.*
>
> *Section 201 does not require a finding of an unfair trade practice, as do the antidumping and countervailing duty laws and section 337 of the Tariff Act of 1930. However, the injury requirement under section 201 is considered to be more difficult than those of the unfair trade statutes. Section 201 requires that the injury or threatened injury be "serious" and that the increased imports must be a "substantial cause" (important and not less than any other cause) of the serious injury or threat of serious injury.*

Based on initiation of a Section 201 investigation by the President in June 2001, the ITC ruled in October 2001 that 16 steel import categories were causing injury to U.S. steel producers. The President then imposed a Section 201 safeguard with the imposition of tariffs on 10 steel categories, including a 30% tariff on flat rolled steel for a period of three years. This decision was challenged by competing nations with the EU specifically threatening to impose counter tariffs on goods imported from the U.S. The World Trade Organization dispute panel eventually ruled that the imposition of tariffs on all 10 categories of steel was illegal in May 2003. The ruling was disputed by the U.S., but the ruling was upheld by WTO in November 2003. By December 2003 the Section 201 imposition was revoked.

The imposition of Section 201 provided some temporary relief to steel producers who were able to continue operations, although many ultimately went bankrupt. However, this increased the price of steel domestically and impacted the domestic industries that rely heavily on steel as a primary input to their business. According to a study commissioned by the Consuming Industries Trade Action Coalition over 200,000 jobs were lost due to the steel price rise in 2002 due to their negative impact on steel using industries, including metal manufacturing, machinery and equipment and transportation equipment[31].

[31] Dr. Joseph Francois and Laura M. Baughman, Trade Partnership Worldwide, LLC, The Unintended Consequences of U.S. Steel Import Tariffs: A Quantification of the Impact During 2002, February 4, 2003.

The imposition of any protective measure can have an impact counter to what was intended. The foreign import pipe market supports its own supply chain of importers, transporters, and distributors in the U.S. that would all be negatively impacted. In addition, increases in domestic steel prices would negatively impact demand of steel products made by domestic industries and may encourage protectionist measures that would affect U.S. exports of steel products and other goods and services.

3.18 Illustration of Potential Cost Impacts for New Oil and Gas Pipelines

This section of the report presents item-by-item cost estimates of one hypothetical new oil pipeline project and one hypothetical natural gas pipeline project. The first purpose of these examples is to illustrate how much of the typical cost of building new oil and gas pipelines is represented by the line pipe, fittings, and valves that might be covered by policies and actions being considered by the Department of Commerce. The other purpose of the two pipeline cost examples is to use them to compute how much the total cost of the pipelines would increase if the domestic content requirements leads to price increase for line pipe, fittings, and valves.

Both the oil and the gas pipeline examples assume that the project involve building a 280 mile long pipeline of 36 inch diameter made of X70 steel. The overall current cost of the two projects is shown in the upper left-hand portion of Exhibit 3-44. The right-hand portion of the exhibit shows ICF's estimate of the current "domestic value added" ("domestic content") for each cost item and what portion might be expected to come from U.S. value added under the domestic content policies now under consideration. Domestic value added" in this context represents the percentage of the money spent that ends up in the pockets of American workers and business owners. Note that even items manufactured in the U.S. will typically have domestic value added of only 80 to 90% since expenditures on foreign intermediate goods and the investment and depreciation of foreign capital goods (for example, the machinery used to make the product) will not be counted as U.S. value added. The last column in the exhibit shows what price change is expected in each cost item in the long-run.

Exhibit 3-45 provides additional detail on what makes up the costs for the "line pipe" items shown in the prior exhibit. The cost of the line pipe itself (measured at the pipe mill or port of import) represents $244 million out of the $538 million for this line item in these two examples. The remainder of the costs are transportation costs, the cost of pipeline coatings, brokering and inspection services, materials, and various supervisory services and overhead expenses.

The long-term price change expected for line pipe if imports are prohibited is 25%. This value is based on the survey conducted among association members by ICF as part of this study. The survey responses were based on the experience of survey respondents have had in comparing recent actual bids for API 5L line pipe among international and domestic suppliers (where the domestic bids have tended to be 0% to 50% higher), the survey respondent's expectations of how costs for cut-to-length plate and plate coil would increase, and how pricing and bidding strategies might change with lessened competition among line pipe suppliers. As shown in Exhibit 3-46, actual domestic and imported line pipe prices have had a price range (maximum annual average price *versus* minimum annual average price) of roughly $350 for smaller diameters to $600 per metric ton (for larger diameters). These swings in prices represent 36% to 69% of the minimum prices in that seven-year period. The 25% long-run expected price change is well within the range of recent price swings and would represent about $275 per metric ton on average. This price increase would be made up of both increased cost for the API 5L cut-to-length plate and plate coil plus higher line pipe manufacturing margins.

ICF did not receive useful survey responses on expected price changes for fittings and valves given the wide variety of fittings and valves used in oil and gas production and transportation and the lack of any standard measure of historical valve prices specifically related to all oil and gas pipeline uses. The BLS has several producer price indices that relate to industrial valves for all applications (not specifically to oil and gas). The one that is the most relevant series to oil and gas pipelines is labeled "Industrial ball valves (all metals, pressures and types), including manual and power operated." The price index for this all valve wholesale price series shows upward trends in each year since 2000 with an average annual increase of 6.1% in nominal dollars. This industrial ball valve price index has a 0.58 correlation coefficient to Brent crude prices and a 0.76 correlation coefficient with the annual BLS index for "Iron and steel pipes and tubes [made from] purchased iron and steel" of which line pipe is a major component.

The BLS also has a price index for "Metal fittings, flanges, and unions for piping systems" which shows an average 2.5% annual increase in nominal dollars and has a 0.79 correlation coefficient to Brent oil prices and a 0.92 correlation coefficient to the pipe and tube index. High correlation coefficients among these steel products are to be expected since they all are affected by iron and steel prices and all serve the same or related infrastructure and construction markets. Given the lack of useful data related to expected valve and fittings prices from the ICF survey of association members and the fact that general fitting and valves price indices as published by the BLS correlate with pipe and tube price indices, we applied the same 25% long-term price increase assumption used for line pipe to fittings and valves.

Exhibit 3-44: Illustration of Impact on Total Costs for New Pipelines (based on long-run price increase of 25% for line pipe, fittings, and valves)

	Crude Oil				Natural Gas						
	Dollars	**% Dollars**	**$/mile**	**$/inch-mile**	**Dollars**	**% Dollars**	**$/mile**	**$/inch-mile**	**Domestic Content Now**	**Domestic Content Under Rule**	**Cost with Rule as % of Old**
Land	$12,559,680	0.5%	$44,856	$1,246	$12,559,680	0.5%	$44,856	$1,246	**100%**	**100%**	**100%**
Rights of Way	$116,625,600	4.8%	$416,520	$11,570	$116,625,600	5.0%	$416,520	$11,570	**100%**	**100%**	**100%**
Line Pipe	$538,272,000	22.2%	$1,922,400	$53,400	$538,272,000	23.0%	$1,922,400	$53,400	57%	88%	112%
Line Pipe Fittings & Non-mainline Valves	$44,856,000	1.8%	$160,200	$4,450	$44,856,000	1.9%	$160,200	$4,450	**42%**	**84%**	**125%**
Pipeline Construction	$1,081,926,720	44.6%	$3,864,024	$107,334	$1,081,926,720	46.3%	$3,864,024	$107,334	**84%**	**84%**	**100%**
Building	$46,282,594	1.9%	$165,295	$4,592	$47,838,312	2.0%	$170,851	$4,746	**84%**	**84%**	**100%**
Pumps or Compressors, Tool, Other Station Equip.	$340,905,600	14.1%	$1,217,520	$33,820	$412,675,200	17.7%	$1,473,840	$40,940	**65%**	**65%**	**100%**
Oil Tanks	$136,125,277	5.6%	$486,162	$13,504	$0	0.0%	$0	$0	**84%**	**84%**	**100%**
Delivery Facilities	$27,225,055	1.1%	$97,232	$2,701	$0	0.0%	$0	$0	**84%**	**84%**	**100%**
Communication Systems	$17,942,400	0.7%	$64,080	$1,780	$17,942,400	0.8%	$64,080	$1,780	**42%**	**42%**	**100%**
Office Furn. & Equip.	$13,612,528	0.6%	$48,616	$1,350	$14,070,092	0.6%	$50,250	$1,396	**84%**	**84%**	**100%**
Vehicles	$13,612,528	0.6%	$48,616	$1,350	$14,070,092	0.6%	$50,250	$1,396	**75%**	**75%**	**100%**
Other Property	$35,392,572	1.5%	$126,402	$3,511	$36,582,238	1.6%	$130,651	$3,629	**84%**	**84%**	**100%**
Sum	**$2,425,338,555**	**100.0%**	**$8,661,923**	**$240,609**	**$2,337,418,333**	**100.0%**	**$8,347,923**	**$231,887**			

	Crude Oil		Natural Gas	
Domestic Content Now	$1,821,800,376	75.1%	$1,734,269,985	74.2%
Foreign Content Now	$603,538,179	24.9%	$603,148,348	25.8%
Total Cost Now	$2,425,338,555	100.0%	$2,337,418,333	100.0%
Domestic Content With Rule	$2,069,802,619	82.7%	$1,982,272,229	82.1%
Foreign Content With Rule	$431,875,148	17.3%	$431,485,317	17.9%
Total Cost with Rule	$2,501,677,767	100.0%	$2,413,757,546	100.0%
Long-run cost increase caused by rule	***3.1%***		***3.3%***	

Note: average domestic content for U.S. manufacturing is about 84% counting all the way back through supply chain.

Exhibit 3-45: Details of Costs Related to Line Pipe Materials and Transportation (these are components in "Line Pipe" row in prior table)

Detailed Items Under Line Pipe Accounting Category	Crude Oil					Natural Gas							
	Dollars	% Dollars	$/mile	$/inch-mile	$/metric ton	Dollars	% Dollars	$/mile	$/inch-mile	$/metric ton	Domestic Content Now	Domestic Content Under Rule	Cost with Rule as % of Old
Line Pipe Accounting Category Total	$538,272,000	22.19%	$1,922,400	$53,400	$3,417	$538,272,000	23.03%	$1,922,400	$53,400	$3,417	57%	88%	112%
Line pipe (FOB mill or port of import)	$243,710,347	10.05%	$870,394	$24,178	$1,547	$243,710,347	10.43%	$870,394	$24,178	$1,547	21%	84%	125%
Line pipe broker and other services mark-up @10% (procurment, inspection, logistics)	$24,371,035	1.00%	$87,039	$2,418	$155	$24,371,035	1.04%	$87,039	$2,418	$155	84%	84%	100%
Packing for shipping @$30/ton	$4,725,486	0.19%	$16,877	$469	$30	$4,725,486	0.20%	$16,877	$469	$30	100%	100%	100%
Rail shipping to coating plant @$0.05/ton-mile x 500 miles	$3,937,905	0.16%	$14,064	$391	$25	$3,937,905	0.17%	$14,064	$391	$25	84%	84%	100%
Factory coating @ $5/sf of pipe surface	$69,667,959	2.87%	$248,814	$6,912	$442	$69,667,959	2.98%	$248,814	$6,912	$442	84%	84%	100%
Repacking for shipping @15/ton	$2,362,743	0.10%	$8,438	$234	$15	$2,362,743	0.10%	$8,438	$234	$15	100%	100%	100%
Rail shipping to staging @$0.05/ton-mile x 400 miles	$3,150,324	0.13%	$11,251	$313	$20	$3,150,324	0.13%	$11,251	$313	$20	84%	84%	100%
Truck shipping to site @0.12/ton-miles x100 miles	$1,890,195	0.08%	$6,751	$188	$12	$1,890,195	0.08%	$6,751	$188	$12	84%	84%	100%
Field Joint Coatings	$10,450,194	0.43%	$37,322	$1,037	$66	$10,450,194	0.45%	$37,322	$1,037	$66	84%	84%	100%
Welding electrodes @$2000/ton	$217,333	0.01%	$776	$22	$1	$217,333	0.01%	$776	$22	$1	50%	50%	100%
Trench bedding and fill materials @$31/cubic yard	$45,109,372	1.86%	$161,105	$4,475	$286	$45,109,372	1.93%	$161,105	$4,475	$286	84%	84%	100%
Mainline valves	$6,533,333	0.27%	$23,333	$648	$41	$6,533,333	0.28%	$23,333	$648	$41	42%	84%	125%
Steel sleeve pipes for HDD crossings @2/mile x100 feet each	$10,257,170	0.42%	$36,633	$1,018	$65	$10,257,170	0.44%	$36,633	$1,018	$65	21%	84%	125%
Engineering, surveying, permitting, construction monitoring, AFUDC, ovehead & misc.	$111,888,603	4.61%	$399,602	$11,100	$710	$111,888,603	4.79%	$399,602	$11,100	$710	100%	100%	100%

Exhibit 3-46: Historic Swings in Line Pipe Prices 2010 to 2016

Category	Maximum $/metric ton	Minimum $/metric ton	Range $/metric ton	Range as %
Domestic Prices Estimated from BLS Producer Price Survey				
Carbon ERW 16-24 inches	$1,321	$962	$359	37%
Carbon DSAW =>24 inches	$1,774	$1,306	$468	36%
Prices for Imports from U.S. Census Bureau Data				
Line Pipe Diameter <4.5 in	$1,331	$960	$371	39%
Line Pipe Diameter 4.5-16 in	$1,199	$824	$374	45%
Line Pipe Diameter 16-24 in	$1,448	$855	$594	69%
Line Pipe Diameter >24 in	$1,644	$1,080	$564	52%

ICF expects that price increases immediately after the imposition of import restrictions could very likely be higher than the expected 25% long-term price change. It is difficult to know what the near-term price impact of the domestic content requirements would be for line pipe, fittings, and valves given the uncertainty in how any requirements might be implemented with regard to 1) what materials, products and equipment would be covered by the requirements, 2) how quickly compliance would be required and 3) and whether and how exemptions might be granted. To illustrate the potential near-term cost impacts ICF assumed that any domestic content requirement could possibly increase prices by 50-100% during an initial transition period, wherein supply chains are rearranged and investments in new capabilities and expended product lines are made. Such price spikes would reflect what economists call "scarcity value" whereby buyers bid up the prices to compete for supplies that have been limited by the restrictions on imports and by the fact that few domestic producers are able to immediately produce goods that meet the regulatory requirements.

Under the near-term pricing assumptions that line pipe, fittings, and valves prices could increase by 50-100%, the total cost of new 36-inch diameter oil or gas pipeline would go up by 6.3 to 13.6% in the initial transition period before settling down to the 3.1 to 3.3% in the long run. The costs are expected to be higher during the transition period because few existing suppliers would be compliant and those suppliers who do enter new markets would demand a fast payback of the investment they have made given the inherent uncertainty regarding the long-term legal and political viability of any requirements. The investors might reason that the any domestic content requirements could be reversed by these legal and political challenges thus shortening the time over which their investment costs could be recovered.

Exhibit 3-47 illustrates how one might think about how long the transition period could last. The first consideration is that because of the uncertain legal and political viability of the requirements, investors might delay making their final investment decisions by, for example, 6 to 24 months. The second consideration is that new industrial equipment that modifies existing production lines can be designed, procured and installed in about 6 to 12 months and that more extensive facilities changes would take 18 to 36 months. And the final consideration is that suppliers might demand long-term contract commitments for their new investments that would lock-in transition pricing for a period of time even after the needed new production capacity is in place. All together these three factors would lead to a transition period that could be expected last from 24 months to several years.

Exhibit 3-47: Illustration of Transition Time (period when scarcity pricing leads to prices above cost of production)

Consideration	Low End (months)	High End (months)
Suppliers delay making investments due to legal and political uncertainty	6	24
Time needed to design, procure and install/build new equipment and facilities	6	36
Time of locked-in contracted price increases needed to reduce investment risks	12	60
Total	**24**	**120**

3.19 Conclusions

Imports play critical roles: Currently U.S. pipeline construction and repair activity relies heavily on imported finished goods and imported parts and intermediate materials used for domestic manufacturing of line pipe, fittings, and valves. In recent years 53% of finished line pipe and approximately 77% of all the steel line pipe supplied to the U.S. was imported. In that same time approximately 40% of the parts used to make high-pressure valves in the U.S. came from overseas. Also approximately 42% of the market value for finished steel pipeline fittings came from imports as did a substantial fraction of the steel cylinders and other semi-finished steel products used to make pipeline fittings in the U.S.

Substitution of materials and supply chains will not be easy: Line pipe and other materials used in pipelines must comply with standards that require high-level technical knowhow and very sophisticated manufacturing processes and equipment. There is limited ability to substitute other materials and products to construct and repair pipelines. Domestic content requirements would break the extensive existing international supply chains for line pipe, fitting and valves and would be very disruptive to pipeline operators until those supply chains can be rebuilt in a new domestic-only form.

Requiring immediate compliance would be very costly: Because of this lack of substitutes, heavy reliance on imported goods and materials, the long lead time required for many items and the fact that several of these items are not made in the U.S currently, an immediate implementation of stringent domestic content requirement for line pipe, fittings, and valves would mean that most oil and gas pipeline construction projects would be delayed or stalled. The economic impact of such an action would be the loss of American jobs as some 75% of current pipeline construction expenditures represents U.S. value added. Other adverse economic impacts would be the economic costs of delayed or cancelled pipeline projects (measured as lost profits for shut-in oil and gas production and higher costs to consumers) and potentially service disruptions if repairs and replacements of existing line pipe are unable to be made as needed.

There are several "choke points" to consider: The specific markets and products identified in this report where immediate compliance with domestic content requirements could most likely reveal significant constraints and cause possible shortages and steep price increases include:

❖ Steel alloying agents;
❖ Thick, high-strength, wide, cut-to-length plate;
❖ Thick, high-strength, wide, plate coil;
❖ Slabs used by non-integrated U.S. rollers to make line-pipe quality cut-to-length plate and plate coil;
❖ Thick-walled large diameter line pipe;
❖ High pressure valve parts;
❖ Certain seamless pipes and cylinders used to fabricate pipeline fittings;
❖ Low pressure gas distribution regulators; and
❖ Certain insulating joints used by gas distribution companies.

Transition period could be characterized by high "scarcity pricing": The period immediately after the domestic content requirements would come into effect is referred to in this report as the transition period. During the transition period international and domestic supply chains would be rearranged; investments in new U.S. capabilities and expanded product lines would be made; and "scarcity pricing" for line pipe, fittings, and valves would prevail as available supplies cannot meet usual demand levels. The cost impacts would depend on several factors related to how the domestic content requirements are specified and implemented. The cost analysis presented in this report is based on a scenario that 50-100% price increases for finished line pipe, fittings, and valves would prevail during this initial transition period. This transition period could last from 24 months to ten years.

Higher prices could prevail even in long term: After the transition period, the longer-run prices would be expected to still remain 25% higher than they would be without import restrictions. The factors leading to these higher prices include the loss of "inframarginal" supply sources, the more expensive production costs of domestic producers having to recovery additional investment costs and pay higher supplier costs, and the increase in concentration in some markets as indicated by the higher HHI measures.

There are broader policy issues to consider: This study does not address the economic justification or efficiency of domestic content policies or the legal foundations on which they might be implemented, although both issues are important. However, the study does look at some international trade patterns and shows that while the U.S. imports $2.2 billion of steel products related to line pipe from 29 countries, it exports $11.1 billion worth of steel and steel products to those same 29 countries. This indicates the exposure of the U.S. has to retaliatory policies that could be pursued by countries adversely affected by U.S. domestic content policies. The study also recounts the historical experience the U.S. had with steel import restrictions imposed under Section 201 authorities where an estimated 200,000 jobs were lost due to the steel price rise in 2002 due to their negative impact on steel using industries, including metal manufacturing, machinery and equipment and transportation equipment.

Final summary: The constraints, practical considerations and historical experiences identified in this report indicate that the domestic content requirements for pipelines have the potential to be very disruptive and costly. Therefore, careful review and analysis of the information presented here is warranted as next steps for any U.S. domestic content policies for pipelines is contemplated.

4. Appendix A

All data in this Appendix is generated from the U.S. Trade data[6].

Table 4.1: Imports - All Line Pipe (seamless + welded)

Size Category	Seamless	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	178,227	303,386	317,544	321,795	394,693	274,616	145,892
Line Pipe Diameter <4.5 in	Value of Imports ($)	198,798,887	403,741,659	411,786,646	383,473,129	452,060,497	311,565,427	140,068,133
Line Pipe Diameter <4.5 in	Value ($/metric ton)	1,115	1,331	1,297	1,192	1,145	1,135	960
Line Pipe Diameter 4.5-16 in	Volume of trade (metric tons)	450,940	872,778	1,119,879	955,876	1,001,260	826,916	468,333
Line Pipe Diameter 4.5-16 in	Value of Imports ($)	460,353,814	1,027,234,388	1,342,241,517	1,041,786,835	1,047,427,948	832,856,174	386,026,763
Line Pipe Diameter 4.5-16 in	Value ($/metric ton)	1,021	1,177	1,199	1,090	1,046	1,007	824
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	265,837	519,710	890,914	656,653	540,446	769,715	341,218
Line Pipe Diameter 16-24 in	Value of Imports ($)	325,517,406	667,335,202	1,290,349,033	893,146,751	697,644,673	892,448,315	291,661,633
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,224	1,284	1,448	1,360	1,291	1,159	855
Line Pipe Diameter >24 in	Volume of trade (metric tons)	457,964	128,563	187,009	210,538	198,815	437,258	289,016
Line Pipe Diameter >24 in	Value of Imports ($)	752,999,819	180,198,639	262,806,665	278,316,774	237,748,663	497,192,321	312,228,432
Line Pipe Diameter >24 in	Value ($/metric ton)	1,644	1,402	1,405	1,322	1,196	1,137	1,080

Table 4.2: Imports - Seamless Line Pipe

Size Category	Seamless	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	66,643	151,886	142,721	161,775	184,610	139,088	59,960
Line Pipe Diameter <4.5 in	Value of Imports ($)	95,398,073	242,226,095	223,733,777	230,996,028	260,487,431	190,363,046	79,893,323
Line Pipe Diameter <4.5 in	Value ($/metric ton)	1,431	1,595	1,568	1,428	1,411	1,369	1,332
Line Pipe Diameter 4.5-16 in	Volume of trade (metric tons)	110,311	235,264	280,420	262,670	247,108	194,130	134,536
Line Pipe Diameter 4.5-16 in	Value of Imports ($)	158,304,787	368,281,605	466,985,766	426,566,264	381,122,185	298,245,574	157,796,816
Line Pipe Diameter 4.5-16 in	Value ($/metric ton)	1,435	1,565	1,665	1,624	1,542	1,536	1,173
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	21,641	36,035	57,409	43,225	41,779	40,270	17,599
Line Pipe Diameter 16-24 in	Value of Imports ($)	40,548,525	76,031,222	121,625,250	103,652,866	96,751,167	80,837,102	36,513,063
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,874	2,110	2,119	2,398	2,316	2,007	2,075
Line Pipe Diameter >24 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value of Imports ($)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value ($/metric ton)	0	0	0	0	0	0	0

Table 4.3: Imports - Welded Line Pipe

Size Category	Welded, riveted, or similarly cl	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	111,584	151,500	174,823	160,020	210,082	135,529	85,931
Line Pipe Diameter <4.5 in	Value of Imports ($)	103,400,814	161,515,564	188,052,869	152,477,101	191,573,066	121,202,381	60,174,810
Line Pipe Diameter <4.5 in	Value ($/metric ton)	927	1,066	1,076	953	912	894	700
Line Pipe Diameter 4.5-16 in	Volume of trade (metric tons)	340,628	637,514	839,459	693,205	754,152	632,787	333,797
Line Pipe Diameter 4.5-16 in	Value of Imports ($)	302,049,027	658,952,783	875,255,751	615,220,571	666,305,763	534,610,600	228,229,947
Line Pipe Diameter 4.5-16 in	Value ($/metric ton)	887	1,034	1,043	888	884	845	684
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	244,197	483,676	833,505	613,428	498,667	729,445	323,619
Line Pipe Diameter 16-24 in	Value of Imports ($)	284,968,881	591,303,980	1,168,723,783	789,493,885	600,893,506	811,611,213	255,148,570
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,167	1,223	1,402	1,287	1,205	1,113	788
Line Pipe Diameter >24 in	Volume of trade (metric tons)	457,964	128,563	187,009	210,538	198,815	437,258	289,016
Line Pipe Diameter >24 in	Value of Imports ($)	752,999,819	180,198,639	262,806,665	278,316,774	237,748,663	497,192,321	312,228,432
Line Pipe Diameter >24 in	Value ($/metric ton)	1,644	1,402	1,405	1,322	1,196	1,137	1,080

Table 4.4: Imports – Welded Line Pipe, LSAW >16”

Size Category	LSAW	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	46,399	118,849	256,280	177,029	120,818	129,308	98,499
Line Pipe Diameter 16-24 in	Value of Imports ($)	62,752,842	149,579,476	411,471,121	249,971,693	138,332,385	126,095,520	81,929,101
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,352	1,259	1,606	1,412	1,145	975	832
Line Pipe Diameter >24 in	Volume of trade (metric tons)	239,602	80,522	166,965	184,507	161,877	295,732	140,626
Line Pipe Diameter >24 in	Value of Imports ($)	332,239,376	122,756,765	236,905,785	244,566,527	196,275,930	345,825,807	168,324,815
Line Pipe Diameter >24 in	Value ($/metric ton)	1,387	1,525	1,419	1,326	1,212	1,169	1,197

Table 4.5: Imports – Welded Line Pipe, longitudinally welded other than LSAW >16” (ERW)

Size Category	Other longitudinal	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	71,551	190,408	391,952	216,022	242,705	354,297	190,473
Line Pipe Diameter 16-24 in	Value of Imports ($)	68,117,761	224,005,711	482,082,615	220,159,705	267,740,201	367,150,553	140,804,328
Line Pipe Diameter 16-24 in	Value ($/metric ton)	952	1,176	1,230	1,019	1,103	1,036	739
Line Pipe Diameter >24 in	Volume of trade (metric tons)	15,569	33,554	12,218	5,171	9,578	6,837	4,133
Line Pipe Diameter >24 in	Value of Imports ($)	23,540,269	39,888,853	14,636,861	5,805,474	13,586,950	8,384,626	4,495,806
Line Pipe Diameter >24 in	Value ($/metric ton)	1,512	1,189	1,198	1,123	1,419	1,226	1,088

Table 4.6: Imports – Welded Line Pipe, not longitudinally welded <16” (helical)

Size Category	Other (Helically/Spiral Welded	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	126,247	174,418	185,274	220,377	135,144	245,840	34,647
Line Pipe Diameter 16-24 in	Value of Imports ($)	154,098,278	217,718,793	275,170,047	319,362,487	194,820,920	318,365,140	32,415,141
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,221	1,248	1,485	1,449	1,442	1,295	936
Line Pipe Diameter >24 in	Volume of trade (metric tons)	202,793	14,487	7,825	20,859	27,361	134,689	144,257
Line Pipe Diameter >24 in	Value of Imports ($)	397,220,174	17,553,021	11,264,019	27,944,773	27,885,783	142,981,888	139,407,811
Line Pipe Diameter >24 in	Value ($/metric ton)	1,959	1,212	1,439	1,340	1,019	1,062	966

Table 4.7: Imports – Seamless Line Pipe, Alloy Steel

Size Category	Seamless	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	317	4,911	3,165	2,331	4,714	8,462	4,411
Line Pipe Diameter <4.5 in	Value of Imports ($)	603,621	9,191,113	5,086,825	3,970,915	7,064,990	11,615,949	6,908,321
Line Pipe Diameter <4.5 in	Value ($/metric ton)	1,903	1,872	1,607	1,704	1,499	1,373	1,566
Line Pipe Diameter 4.5-16 in	Volume of trade (metric tons)	3,128	3,079	12,147	19,389	43,198	31,059	14,349
Line Pipe Diameter 4.5-16 in	Value of Imports ($)	8,603,944	8,469,697	28,285,124	41,319,699	96,024,217	66,602,263	26,662,688
Line Pipe Diameter 4.5-16 in	Value ($/metric ton)	2,750	2,751	2,329	2,131	2,223	2,144	1,858
Line Pipe Diameter >16 in	Volume of trade (metric tons)	1,328	1,084	867	1,956	3,226	3,939	1,374
Line Pipe Diameter >16 in	Value of Imports ($)	1,701,141	2,028,322	1,699,052	5,310,209	13,355,461	13,504,508	4,060,643
Line Pipe Diameter >16 in	Value ($/metric ton)	1,281	1,872	1,959	2,715	4,139	3,428	2,955

Table 4.8: Imports - Welded Line Pipe, Alloy Steel

Size Category	Welded, riveted, or similarly cl	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	192	410	541	1,138	3,149	803	555
Line Pipe Diameter <4.5 in	Value of Imports ($)	253,130	581,791	977,206	2,905,039	2,832,403	1,094,250	1,242,452
Line Pipe Diameter <4.5 in	Value ($/metric ton)	1,321	1,418	1,808	2,552	899	1,363	2,241
Line Pipe Diameter 4.5-16 in	Volume of trade (metric tons)	7,095	18,410	32,914	10,923	16,886	41,385	1,435
Line Pipe Diameter 4.5-16 in	Value of Imports ($)	6,888,162	23,830,886	47,186,497	14,810,927	23,139,537	49,572,740	1,989,224
Line Pipe Diameter 4.5-16 in	Value ($/metric ton)	971	1,294	1,434	1,356	1,370	1,198	1,387
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	154,799	238,581	283,850	279,983	265,076	476,217	53,469
Line Pipe Diameter 16-24 in	Value of Imports ($)	196,760,066	320,764,143	444,691,167	412,693,794	388,050,657	596,391,381	57,688,474
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,271	1,344	1,567	1,474	1,464	1,252	1,079
Line Pipe Diameter >24 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value of Imports ($)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value ($/metric ton)	0	0	0	0	0	0	0

Table 4.9: Exports - All Line Pipe (seamless+welded)

Size Category	Seamless	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	11,999	13,802	9,753	11,508	10,306	9,612	7,736
Line Pipe Diameter <4.5 in	Value of Exports ($)	32,674,853	40,078,967	37,173,837	41,100,806	33,711,541	23,011,119	24,816,183
Line Pipe Diameter <4.5 in	Value ($/metric ton)	2,723	2,904	3,811	3,571	3,271	2,394	3,208
Line Pipe Diameter 4.5-16 in	Volume of trade (metric tons)	17,118	14,259	24,896	18,983	49,985	12,785	12,494
Line Pipe Diameter 4.5-16 in	Value of Exports ($)	52,427,313	56,868,084	102,636,567	93,156,183	161,439,068	57,274,583	25,794,576
Line Pipe Diameter 4.5-16 in	Value ($/metric ton)	3,063	3,988	4,123	4,907	3,230	4,480	2,065
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	95,973	81,591	242,181	443,065	224,855	72,322	37,831
Line Pipe Diameter 16-24 in	Value of Exports ($)	156,919,947	144,823,990	455,420,627	1,007,037,581	594,904,024	156,416,403	76,592,405
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,635	1,775	1,880	2,273	2,646	2,163	2,025
Line Pipe Diameter >24 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value ($/metric ton)	0	0	0	0	0	0	0
Line Pipe Not Specified	Volume of trade (metric tons)	88,454	72,927	79,893	86,853	93,623	41,433	33,599
Line Pipe Not Specified	Value of Exports ($)	196,998,169	168,111,014	212,357,686	197,872,215	205,580,344	133,950,303	128,069,689
Line Pipe Not Specified	Value ($/metric ton)	2,227	2,305	2,658	2,278	2,196	3,233	3,812

Table 4.10: Exports - Seamless Line Pipe

Size Category	Seamless	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	11,999	13,802	9,753	11,508	10,306	9,612	7,736
Line Pipe Diameter <4.5 in	Value of Exports ($)	32,674,853	40,078,967	37,173,837	41,100,806	33,711,541	23,011,119	24,816,183
Line Pipe Diameter <4.5 in	Value ($/metric ton)	2,723	2,904	3,811	3,571	3,271	2,394	3,208
Line Pipe Diameter 4.5-16 in	Volume of trade (metric tons)	17,118	14,259	24,896	18,983	49,985	12,785	12,494
Line Pipe Diameter 4.5-16 in	Value of Exports ($)	52,427,313	56,868,084	102,636,567	93,156,183	161,439,068	57,274,583	25,794,576
Line Pipe Diameter 4.5-16 in	Value ($/metric ton)	3,063	3,988	4,123	4,907	3,230	4,480	2,065
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	29,194	26,751	49,351	85,774	43,709	9,387	10,040
Line Pipe Diameter 16-24 in	Value of Exports ($)	54,986,490	51,496,004	128,360,097	364,897,884	229,827,489	24,334,129	21,995,412
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,883	1,925	2,601	4,254	5,258	2,592	2,191
Line Pipe Diameter >24 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value ($/metric ton)	0	0	0	0	0	0	0
Line Pipe Not Specified (Excl	Volume of trade (metric tons)	7,887	6,702	11,804	9,572	8,065	3,945	2,375
Line Pipe Not Specified (Excl	Value of Exports ($)	42,012,988	36,259,638	80,136,416	59,934,715	50,071,315	46,032,501	31,897,136
Line Pipe Not Specified (Excl	Value ($/metric ton)	5,327	5,410	6,789	6,262	6,209	11,669	13,430

Table 4.11: Exports - Welded Line Pipe

Size Category	Welded, riveted, or similarly cl	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter <4.5 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter <4.5 in	Value ($/metric ton)	0	0	0	0	0	0	0
Line Pipe Diameter 4.5-16 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter 4.5-16 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter 4.5-16 in	Value ($/metric ton)	0	0	0	0	0	0	0
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	66,778	54,839	192,830	357,290	181,147	62,936	27,791
Line Pipe Diameter 16-24 in	Value of Exports ($)	101,933,457	93,327,986	327,060,530	642,139,697	365,076,535	132,082,274	54,596,993
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,526	1,702	1,696	1,797	2,015	2,099	1,965
Line Pipe Diameter >24 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value ($/metric ton)	0	0	0	0	0	0	0
Line Pipe Not Specified	Volume of trade (metric tons)	80,567	66,225	68,089	77,281	85,558	37,488	31,224
Line Pipe Not Specified	Value of Exports ($)	154,985,181	131,851,376	132,221,270	137,937,500	155,509,029	87,917,802	96,172,553
Line Pipe Not Specified	Value ($/metric ton)	1,924	1,991	1,942	1,785	1,818	2,345	3,080

Table 4.12: Exports - Welded Line Pipe, LSAW >16"

Size Category	Other longitudinal	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	8,679	7,390	8,330	3,324	5,526	3,089	1,699
Line Pipe Diameter 16-24 in	Value of Exports ($)	14,631,844	13,481,263	16,919,156	7,049,064	10,631,346	4,948,472	3,105,218
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,686	1,824	2,031	2,121	1,924	1,602	1,828
Line Pipe Diameter >24 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value ($/metric ton)	0	0	0	0	0	0	0

Table 4.13: Exports - Welded Line Pipe, not longitudinally welded >16" (helical)

Size Category	Other (Helically/Spiral Welded	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	42,364	10,592	98,262	149,260	92,927	27,534	5,782
Line Pipe Diameter 16-24 in	Value of Exports ($)	58,286,948	15,972,556	152,751,313	264,539,093	127,479,793	31,909,967	7,011,076
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,376	1,508	1,555	1,772	1,372	1,159	1,213
Line Pipe Diameter >24 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value ($/metric ton)	0	0	0	0	0	0	0

Table 4.14: Exports - Seamless Line Pipe, Alloy Steel

Size Category	Welded, riveted, or similarly cl	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter <4.5 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter <4.5 in	Value ($/metric ton)	0	0	0	0	0	0	0
Line Pipe Diameter 4.5-16 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter 4.5-16 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter 4.5-16 in	Value ($/metric ton)	0	0	0	0	0	0	0
Line Pipe Diameter >16 in	Volume of trade (metric tons)	38,304	25,760	120,168	318,840	111,703	20,367	15,730
Line Pipe Diameter >16 in	Value of Exports ($)	61,656,717	40,635,764	194,170,900	508,566,029	177,277,840	40,505,804	24,026,549
Line Pipe Diameter >16 in	Value ($/metric ton)	1,610	1,577	1,616	1,595	1,587	1,989	1,527
Line Pipe Not Specified	Volume of trade (metric tons)	9,906	7,251	5,745	4,376	4,448	6,518	2,947
Line Pipe Not Specified	Value of Exports ($)	21,338,645	16,415,363	15,564,508	10,061,279	19,858,325	25,303,659	9,188,821
Line Pipe Not Specified	Value ($/metric ton)	2,154	2,264	2,709	2,299	4,465	3,882	3,118

Table 4.15: Exports - Welded Line Pipe, Alloy Steel

Size Category	Welded, riveted, or similarly cl	2010	2011	2012	2013	2014	2015	2016
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter <4.5 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter <4.5 in	Value ($/metric ton)	0	0	0	0	0	0	0
Line Pipe Diameter <4.5 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter 4.5-16 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter 4.5-16 in	Value ($/metric ton)	0	0	0	0	0	0	0
Line Pipe Diameter 16-24 in	Volume of trade (metric tons)	38,304	25,760	120,168	318,840	111,703	20,367	15,730
Line Pipe Diameter 16-24 in	Value of Exports ($)	61,656,717	40,635,764	194,170,900	508,566,029	177,277,840	40,505,804	24,026,549
Line Pipe Diameter 16-24 in	Value ($/metric ton)	1,610	1,577	1,616	1,595	1,587	1,989	1,527
Line Pipe Diameter >24 in	Volume of trade (metric tons)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value of Exports ($)	0	0	0	0	0	0	0
Line Pipe Diameter >24 in	Value ($/metric ton)	0	0	0	0	0	0	0
Line Pipe Not Specified	Volume of trade (metric tons)	9,906	7,251	5,745	4,376	4,448	6,518	2,947
Line Pipe Not Specified	Value of Exports ($)	21,338,645	16,415,363	15,564,508	10,061,279	19,858,325	25,303,659	9,188,821
Line Pipe Not Specified	Value ($/metric ton)	2,154	2,264	2,709	2,299	4,465	3,882	3,118

5. Appendix B

HTS Codes - Line Pipe
7304110020
7304110050
7304110080
7304191020
7304191030
7304191045
7304191060
7304191080
7304195020
7304195050
7304195080
7304110000
7304191050
7305111030
7305111060
7305115000
7305121030
7305121060
7305125000
7305191030
7305191060
7305195000
7305111000
7305121000
7305191000
7306110010
7306110050
7306191010
7306191050
7306195110
7306195150
7306110000
7306191000

HTS Codes - OCTG		
7304220030	7304292040	7305202000
7304220045	7304292050	7305204000
7304220060	7304292060	7305206000
7304233000	7304292080	7305208000
7304236030	7304293110	7305314000
7304236045	7304293120	7305316000
7304236060	7304293130	7305316010
7304243010	7304293140	7305316090
7304243020	7304293150	7305391000
7304243030	7304293160	7305395000
7304243040	7304293180	7305901000
7304243045	7304294110	7305905000
7304243050	7304294120	7305203000
7304243060	7304294130	7305207000
7304243080	7304294140	7306213000
7304244010	7304294150	7306214000
7304244020	7304294160	7306218010
7304244030	7304294180	7306218050
7304244040	7304295015	7306291030
7304244050	7304295030	7306291090
7304244060	7304295045	7306292000
7304244080	7304295060	7306293100
7304246015	7304295075	7306294100
7304246030	7304296115	7306296010
7304246045	7304296130	7306296050
7304246060	7304296145	7306298110
7304246075	7304296160	7306298150
7304291010	7304296175	7306201500
7304291020	7304220000	7306202500
7304291030	7304236000	7306206000
7304291040	7304241000	7306213500
7304291050	7304246000	7306218000
7304291060	7304291050	7306291500
7304291080	7304291055	7306293000
7304292010	7304293155	7306296000
7304292020	7304295000	7306298100
7304292030	7304296100	

HTS Code – High Strength Plate
7208510045

HTS Codes – High Strength Hot Rolled Plate Coil
7208360030
7208370030

HTS Codes - Industrial Valves
7325100030
8481100020
8481100040
8481100060
8481100090
8481200010
8481200020
8481200030
8481200040
8481200050
8481200060
8481200070
8481200080
8481302010
8481302090
8481309000
8481400000
8481805040
8481809005
8481809015
8481809035

6. Appendix C

This appendix presents the North American Industry Classification System (NAICS) codes for the primary industries engaged in manufacturing line pipe, valves and fittings.

Steel Plate and Steel Plate Coil

NAICS Code **331110** Iron and Steel Mills and Ferroalloy Manufacturing: Establishments primarily engaged in one or more of the following: (1) direct reduction of iron ore; (2) manufacturing pig iron in molten or solid form; (3) converting pig iron into steel; (4) making steel; (5) making steel and manufacturing shapes (e.g., bar, **plate, coils,** rod, sheet, strip, wire); (6) making steel and forming pipe and tube; and (7) manufacturing electrometallurgical ferroalloys such as silicon, manganese, chromium, vanadium, tungsten, titanium, and molybdenum.

NAICS Code **331221** Rolled Steel Shape Manufacturing: Establishments primarily engaged in rolling or drawing shapes (except wire), such as plate, sheet, strip, rod, and bar, from purchased steel. **Cut-to-length plate and plate coil manufacturers that purchase imported or domestic slabs** for rolling would appear under this 331221 NAICS code while integrated steel companies making cut-to-length plate and plate coil appear under 331110.

Line Pipe and OCTG

NAICS Code **331210** Iron and Steel Pipe and Tube Manufacturing from Purchased Steel: Establishments primarily engaged in manufacturing **welded, riveted, or seamless pipe and tube from purchased iron or steel**.

Integrated steel producers who make both steel and line pipe would appear under NAICS Code **331110** Iron and Steel Mills and Ferroalloy Manufacturing which includes "making steel and forming pipe and tube."

Valves

NAICS Code **332911** Industrial Valve Manufacturing: Establishments primarily engaged in manufacturing industrial valves (e.g., industrial process control valves, **pipeline valves**, nuclear power station valves) and valves for water works systems.

NAICS Code **333132** Oil and Gas Field Machinery and Equipment Manufacturing: Christmas tree assemblies (which contain several high-pressure valves) fall under this code among many other items such as drill bits, drilling rigs and oil/gas production equipment. For the purpose of this study ICF has assumed that Christmas trees will be considered part of the oil and gas wells and not "pipelines" for purposes of domestic content policies. However, some **valves for flow line, gathering and pipeline systems** are made by the same manufacturers that make valves for Christmas trees and so such sales might appear in business statistics under this 333132 NAICS code.

Fittings

NAICS Code **332996** Fabricated Pipe and Pipe Fitting Manufacturing: Establishments that make things out of purchased pipe. This includes manufacturers of pipelines fittings made from line pipe including **bends, elbows, reducers, couplings and manifolds**.

NAICS Code **332919** Other Metal Valve and Pipe Fitting Manufacturing: Establishments making **flanges** may appear under this code along with many other valve and fitting-related items.