Expertise in Mini Mills

Technology, mechanical engineering, automation, and electrical engineering from a single source – for maximum overall plant performance
The world needs steel. Particularly in newly industrialized countries, the demand for structural steel is growing at a tremendous rate. At the same time, these countries want to replace costly steel imports with local steel production from scrap. This is the best possible environment for new Mini Mills.

You expect:
- Maximum equipment availability
- Seamless integration of all processes
- Short start-up times
- Reliable, calculable OPEX
- High productivity
Mini Mills – local solutions for global demands

The first requirement is a coherent, comprehensive concept that integrates all processes, from the EAF to casting and rolling.

Secondly, all of the equipment must be absolutely reliable. Top-quality service and support throughout the entire lifecycle must be ensured.

Finally, emissions must be limited so that future environmental requirements can be easily met.

If all of these prerequisites can be realized in a relatively short time, nothing stands in the way of profitable steel production over the long term, utilizing reliable OPEX calculations.

Positive expected growth rates in the coming years, especially in countries with a high GDP and growing infrastructure.

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**Metallurgic requirements**

<table>
<thead>
<tr>
<th>Years</th>
<th>Million metric tons</th>
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<tbody>
<tr>
<td>2010</td>
<td>375</td>
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<tr>
<td>2015</td>
<td>462</td>
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<tr>
<td>2020</td>
<td>585</td>
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Electric steel production
Siemens VAI Mini Mills – complete solutions from a single source

Everything from a single source
We are your partner when it comes to supplying technology for all process steps from a single source and then integrating them into a flawlessly operating plant. Whether you define “Mini Mills” as a partial system or as a total plant from furnace to rolling mill, we will provide all the expertise as well as all the components.

Reliable partnership
We can provide you with any level of support you choose – from planning through implementation to commissioning and beyond. A wide range of services and high-performance modernization packages ensure a long lifecycle while also maintaining consistently high cost efficiency.

Innovation
We can look back on decades of experience in every product sector. However, that fact alone doesn’t satisfy us – because we also know that linking individual processes, using the world’s leading innovative process controls and automation, is just as important.

High productivity
Short paths, highly integrated processes, and perfect timing ensure that scrap can be processed into finished rolled steel in just two hours.

Low investment costs
Extensively modular, individually configurable solutions mean that your investment costs will be manageable.

Reduced consumption
Efficient energy recovery and waste heat utilization reduce the need for electricity, while intelligent process controls drive down the consumption of operating materials.

Flexible selection of raw materials
You can quickly and easily respond to different scrap density and quality between tapping cycles.

Environmentally compatible processes
Emission control has long been a crucial competitive factor. With effective treatments for exhaust gas, energy-efficient filters, and reliable noise damping, our Mini Mill solutions are also well-equipped for stricter guidelines in the future.
Our Mini Mills work according to two simple principles: the highest-quality equipment and optimal integration. Following these two guidelines, we plan, implement, and install a plant that precisely meets your requirements.

Advantages of working with Siemens VAI:

- **Optimized project implementation** – with a reliable partner, even for large projects
- **Simpler financing** – as a result of assured on-time completion, fast ramp-up, and flexible sourcing
- **High plant quality** – thanks to Siemens VAI’s market and technology leadership and to time-tested partnerships with selected suppliers
- **Totally systems-engineered plants from a single source** – using in-house expertise for the integration of layout, electrical and mechanical engineering, and metallurgy
- **Time- and cost-optimized processes** – through plant-wide coordination of all component parts: equipment units, infrastructure, auxiliary processes, and logistics (balance of plant)
- **Profitability along the entire plant lifecycle** – due to dependable services with long-term optimization concepts
Mini Mills – fast to implement, fast to produce, fast to pay off

Short throughput time and flexibility of input
A Mini Mill needs only about two hours to generate new structural steel from scrap. Scrap quality and limited scrap availability, which increases scrap prices worldwide, forces steel producers to use a high percentage of substitutes. In order to manage this market demand, Siemens VAI has developed flexible and highly productive Mini Mill concepts that use up to 40% hot metal or up to 100% cold DRI or HBI and hot DRI.

Current trends in the direct connection between melt shop and rolling mill are addressed by means of the hot charging of billets and direct rolling. These factors result in the process and economic advantages of modern Mini Mills.

Support on every level
We’re ready to support you in every way throughout all of these stages and operations – and this also includes the financial planning for your project.

Siemens VAI’s all-inclusive approach not only benefits your plant through cost and productivity advantages in ongoing operations. It also ensures dependable project implementation with no risk of interface problems, as well as an on-time operation start-up. As a result, you can expect a predictable payback of your financial investment.
All from a single source

Automation
With SIMATIC, Siemens has been setting the de facto standard in automation technology for about 20 years. No other system is so widely used in the metals industry.

The concept of Totally Integrated Automation supports a homogeneous automation landscape that’s also a safe long-term investment, from the factory floor to the management level.

Drives and energy supply
A majority of rolling mills rely on Siemens drives. They are known for top-notch performance and for their precise controllability – characteristics that are becoming indispensable with the influx of new materials and increased productivity requirements.

Siemens also provides the entire energy supply system required for a stable, uninterrupted production process. Flicker compensation can be an especially critical factor in the implementation of new electric steel plants.

Lifecycle services
High availability requires a well-designed service concept, including around-the-clock monitoring of the plant at Siemens headquarters. Clearly defined processes, uniform manuals, assured parts availability, and a globally available team of specialists ensure minimized shutdown times and high performance throughout the lifecycle of the plant.

Total engineering
Accurate planning that addresses everything from energy supply and raw material logistics to throughput goals is a prerequisite for the successful launch of your plant. We provide all the up-front necessities to make sure your project gets off to a safe start, including technical consulting, financing, and simulation of all processes.
A solid concept for interconnecting diverse plant areas is crucial to the flawless interaction of all your plant’s processes. The purpose is to achieve perfect coordination of production, storage, and material logistics. As your general contractor, we meet these objectives and more.

The benefits of Siemens as your general contractor

Dependable project implementation – simple financing
Our widely respected planning and implementation expertise assures investors that they won’t be confronted with unexpected budgetary deficits.

Accelerated approval processes – as a result, for example, of a dependable emissions calculation for the entire process

On-budget/on-budget completion – from decades of project management experience

High acceptance by creditors – based on a solid record of successful projects

Excellent export credit prospects – thanks to our access to all large European Credit Agencies (ECAs), you will benefit from optimized financial packages
Electric arc furnaces: SIMETAL EAF
SIMETAL EAF has been setting standards for 40 years in both design and innovation – for example, with our SIMETAL EAF Ultimate technology for maximum productivity, flexible process control, and high availability. Siemens VAI is again the frontrunner with SIMETAL EAF Quantum, for the most efficient and environment-friendly steelmaking.

Ladle furnaces
The installation of a ladle furnace allows steelmakers to precisely adjust steel temperatures and composition. This substantially improves steel quality as well as the productivity of casting plants. Our ladles share the same outstanding design features found in SIMETAL EAF. An installed base of more than 130 ladle furnaces producing 30 to 350 tons worldwide highlights Siemens VAI’s market leadership.

Secondary metallurgy
From alloy handling to degassing, desulfurization, and decarburization, the production of high-quality steels without secondary metallurgy is unthinkable. Siemens VAI supplies the entire range – from ladle metallurgy with optimized methods of adding alloying agents to all widely accepted vacuum technologies – and at present has an installed base of more than 170 secondary metallurgy plants.

Continuous casting
The speed, throughput, and flexibility of Mini Mills are in large measure determined by the continuous casting line. Modular continuous casting systems from Siemens VAI enable steelmakers to precisely meet production requirements in every detail, and to readily implement future changes.
lessly integrated
Perfect balance = maximum productivity

Rolling mills
Siemens VAI Mini Mills lend themselves to configurations that allow immediate processing of billets while they’re still hot. Less energy is required to produce high-quality half-finished products immediately after the billets have been cast. Siemens VAI applies over 250 years of combined experience in this technology, accumulated by Pomini in Italy and Morgan Construction in the U.S.

Dust collection systems
Siemens VAI offers the entire spectrum of state-of-the-art dedusting technology from a single source. Our technology ensures that emission levels always remain within the green zone – and will continue to do so even as emission standards tighten up in the future.

Energy supply and power quality
The power supply is an essential component of the Mini Mill. Solutions for energy supply, power quality, and efficient energy management are some of the basic prerequisites for success. Siemens VAI can provide the development, manufacture, and installation of systems for substations and distribution systems. Filter circuits and dynamic reactive power compensators (SVC and SVC PLUS) can be connected to an existing supply network to reduce the negative impact of the flicker and keep the bus voltage constant.

Water treatment for Mini Mills
With its own water treatment and utility department for designing water treatment plants, Siemens VAI can offer specialized solutions for the iron and steel industry that are perfectly integrated into the overall plant process. Based on global presence, close cooperation with the steel industry, and knowledge of regional environmental legislation and climatic requirements, the real strength of Siemens VAI water management is the ability to guarantee an optimized process.

Seamless plant layout – low operating costs
Our expertise ensures low, predictable operating and consumption costs.

Fewer replacement parts – standardized components help save on floor space and investment costs

Reduces energy costs – by optimizing the utilization of thermal, electrical, and fossil energy

Balances out fluctuating raw-material prices – through a flexible accommodation to different raw materials

Optimizes energy consumption – by flexibly up- or down-ramping the plant during periods of higher or lower energy demand

Stable processes – high product quality
We can also deliver stable processes and high steel quality.

High availability – the result of wear-optimized construction and seamless integration of all process steps

Simple-to-manage processes – optimized paths and clearly defined interfaces help minimize complexity among partial processes; a uniform operating philosophy helps your personnel quickly familiarize themselves with the entire plant

Comprehensive quality – as both planners and builders, we’re in complete control of all technical and logistical factors that affect the quality of the final product

Equipped for future requirements – designed to flexibly accommodate the production of new kinds and grades of steel
Some of our highlights
Siemens VAI – solutions all over the world

Furnace
Breaking records with hot DRI link EAF
Siemens VAI supplied a new 150-ton EAF to a plant in Saudi Arabia. The EAF is designed to produce steel using up to 100% hot DRI, with an annual capacity of 1.76 million tons of hot DRI.

By using 100% hot DRI, the SIMETAL EAF and the Siemens VAI hot DRI melting process achieve productivity and consumption figures that are within the range of scrap-based processes – while also meeting the highest steel quality requirements.

Hot DRI charging is more economical due to its lower energy consumption and higher productivity in the EAF.

Revolutionary EAF Ultimate
In Turkey, Siemens VAI installed a revolutionary new 320-ton electric arc furnace (Ultimate design). This new equipment is the heart of an electric melt shop for the production of 2.5 million tons per year of liquid steel. This EAF represents a new generation of electric arc furnaces for high-capacity plants.

Caster
Modernization of a high-speed six-strand billet caster
A Russian steel producer awarded Siemens VAI a contract to upgrade their six-strand billet caster. With Siemens VAI’s DynaFlex hydraulic mold oscillator, casting speeds exceeding seven meters per minute on a 100x100-millimeter billet have been achieved. The producer significantly increased their casting speed and as a result their total billet production.

High-speed eight-strand billet caster
Siemens VAI received a contract to supply a new 1x8-strand high-speed billet caster as part of a new Mini Mill complex. The caster will be capable of casting approximately 1.5 million tons of billets per year in square formats of 125 to 150 millimeters.
Rolling mill
High-productivity rolling mill for rebar
Siemens VAI constructed a turnkey hot rolling mill with 18 rolling stands for rebar and an annual capacity of 700,000 tons. The rolling train is followed by a completely automated cooling and handling area, with cutting-to-length, counting, bundling, binding, and weighing operations. Commercial production began just 28 days after start-up. After two months, salable production was greater than 70% of nominal capacity. The new mill allows our customer to double their yearly production capacity, which will better serve the booming construction market in the Persian Gulf region.

Revamp of rebar rolling mill
Siemens VAI performed a major revamp of a rolling mill for rebar.
The scope of the project included a new hot charging system for billets, fourteen new and seven retrofitted stands in the rolling area, and a new cooling bed equipped with both apron and high-speed delivery equipment capable of delivering single bars onto the grid. The revamped mill significantly increased production capacity and at the same time improved operating conditions.
Mini Mill flat with Arvedi ESP

Steel production at the highest level

The world’s most compact thin-slab casting and direct rolling process
This Mini Mill is based on an EAF with a capacity between 150 tons and 300 tons, to meet the liquid steel demand of the Arvedi ESP line. Secondary metallurgy is achieved with twin LFs and if necessary in addition with twin VDs. The yearly capacity for hot-rolled strip ranges from 1.5 to 2.7 million tons.

Arvedi ESP is a new generation of casting/rolling plants that produce a wide range of high-quality and ultrathin steel products in an endless casting/rolling process – that meets the changing and challenging demands of the market.

More than 50% of the entire product mix can be produced at strip thicknesses less than 1.5 millimeters at full plant productivity. In addition, the Arvedi ESP line is capable of producing the complete spectrum of carbon steel strips in addition to advanced steels such as HSS and AHSS grades.
From melting to rolling – the main benefits:
- Economical production of hot-rolled thin strip, substituting cold-rolled strip for many applications
- Significant cost savings due to the short line length (180 meters) and direct linkage of casting and rolling
- Environment-friendly operation due to lower energy consumption and reduced emissions
- Production of high-quality coils with precise dimensions and uniform mechanical properties

Lower energy costs – environmental protection and economics in balance
The new Arvedi ESP line concept achieves the world’s best energy balance for the production of hot-rolled coils from liquid steel. Direct processing costs are distinguished by lower energy consumption (about 45% lower than conventional hot strip mills), lower costs for consumables (including molds and rolling cylinders), and improved liquid steel yield (up to 97%). Processing costs in ESP lines are approximately 37% lower than those incurred in conventional plants.
Introducing a Mini Mill project – ESISCO I

Installation, start-up, and commissioning of a new Mini Mill
The steel melt shop comprises a 160-ton EAF, a 160-ton LF, a six-strand high-speed caster, and a dedusting system as well as the engineering for integration facilities, overhead cranes, water treatment plant, and media supply system.

Integration of direct hot DRI feeding from the neighboring DRI plant
The hot DRI feed at 600 °C into the EAF results in lower energy consumption. The optimized plant and production logistics minimize personnel requirements and operational costs.

Achieved results
- Lower energy costs due to a 40-meter hot link – which enables HDRI to be fed at 600 °C into the EAF
- Low-cost production, low operational costs – featuring a minimum of energy consumption, personnel requirements, and yield loss
- Maximized plant availability
- Optimized plant and production logistics

The customer
Egyptian Sponge Iron & Steel Company
Location: Sadat City, Egypt
Production: 1.3 million tons/year

Plant data

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<thead>
<tr>
<th>Electric arc furnace</th>
<th>Six-strand billet caster</th>
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<tr>
<td>Tapping weight</td>
<td>Number of machines</td>
</tr>
<tr>
<td>160 t</td>
<td>1</td>
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<tr>
<td>Transformer</td>
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<td>Machine radius</td>
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<tr>
<td>Tap-to-tap time (scrap)</td>
<td>Metallurgical length</td>
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<td>23 m</td>
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<td>Furnace diameter</td>
<td>Strand center distance</td>
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<td>7.1 m</td>
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<tr>
<td>Electrode diameter</td>
<td>Casting section range</td>
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<td>610 mm</td>
<td>130 to 200 mm²</td>
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<table>
<thead>
<tr>
<th>Ladle furnace</th>
<th>Max. casting speed</th>
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<td>Ladle size</td>
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<td>Heating rate</td>
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<td>4.0°C/min</td>
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<td>Transformer</td>
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<td>24 MVA</td>
<td>ultralow/medium carbon steel, spring steel</td>
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<tr>
<td>Electrode diameter</td>
<td>Billet length</td>
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<td>406 mm</td>
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Scope of supply and services
- Project management
- Basic data, basic engineering, detail engineering
- Purchase and supply of main process equipment
- Supply and commissioning of application software
- Automation process level 1 and level 2
- Supervision services for installation, start-up, and commissioning
- On-site training
Excellence from experience
Selected Mini Mill success stories with Siemens VAI

Lower energy costs due to hot DRI feeding
Customer: ESISCO I, Egypt
Plant type: Mini Mill, 1.3 million tons per year
Our solution: 160-t EAF, 160-t LF, six-strand billet caster, water treatment plant, dedusting
The result: The hot DRI feed at 600 °C into the EAF results in lower energy consumption. The optimized plant and production logistics minimize personnel requirements and operational costs.

Proven technology of Siemens VAI
Customer: Revda, Russia
Plant type: Mini Mill, 1.0 million tons per year
Our solution: 120-t EAF, 120-t LF, six-strand billet caster, dedusting
The result: We could exceed the planned capacity of 1.0 million tons per year for this project and thus prove our state-of-the-art technology and competence as a Mini Mill supplier.

New Mini Mill with low emissions for the growing demand in the Gulf region
Customer: Qatar Steel, Qatar
Plant type: Mini Mill, 1.1 million tons per year
Our solution: 110-t EAF, 110-t LF, six-strand billet caster, dedusting
The result: The project includes a dedusting plant to significantly reduce emissions. The new steel mill is characterized by low specific consumption in areas such as electrodes, electrical power, and utilities.

Turnkey project with fast realization
Customer: Hadeed, Saudi Arabia
Plant type: Mini Mill, 1.4 million tons per year
Our solution: 150-t EAF (based on 100% hot DRI), 150-t LF, one-strand slab caster, dedusting, turnkey
The result: Turnkey expansion of the Hadeed flat products facility, steelmaking, and caster plant. The project includes hot DRI charging technology to acquire the benefits of energy savings and higher liquid steel productivity.
You need both in-depth vertical and horizontal expertise in order to successfully realize a Mini Mill. This includes not only a profound familiarity with each process, but also an understanding about how they are embedded and interconnected within the plant as a whole. Siemens VAI has decades of experience in every relevant area – proven in some of the world’s leading Mini Mills. The success stories presented below provide only a brief impression of our comprehensive expertise.

### High-performance furnace and caster for increased throughput
- **Customer:** KNPEMZ, Russia
- **Plant type:** Mini Mill, 1.5 million tons per year
- **Our solution:** 120-t EAF Ultimate, twin 120-t LF, eight-strand billet caster, dedusting
- **The result:** Highest production output – 50% more productivity compared with standard EAFs.

### Extra production boost based on scrap preheating
- **Customer:** Severstal, Russia
- **Plant type:** Mini Mill, 1.0 million tons per year
- **Our solution:** 150-t EAF Fingershaft, 150-t LF, five-strand billet caster, dedusting
- **The result:** Maximized productivity with simultaneous minimization of electrical energy consumption.

### Reroller invests in a Mini Mill
- **Customer:** Med Steel, Syria
- **Plant type:** Mini Mill, 0.8 million tons per year
- **Our solution:** 85-t EAF, 85-t LF, five-strand billet caster, dedusting
- **The result:** A reroller invests in a Mini Mill for backward integration. The positive experience with Siemens VAI rolling mill leads to a follow-up order for steel plant equipment.

### World’s first real endless process from liquid steel to hot-rolled coil
- **Customer:** Arvedi, Italy
- **Plant type:** Mini Mill with Arvedi ESP Line
- **Our solution:** Installation of a thin-slab casting machine directly connected to a specially designed continuous roughing mill, followed by an inductive heater, finishing mill, and run-out area.
- **The result:** World’s first endless strip production facility based on thin-slab casting and direct rolling to produce ultrathin strip gauges.
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