

strategy&

*Steel and
aluminum,
quo vadis?*

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**A pathway
to growth in
challenging times**



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Executive summary



The steel and aluminum industries have multiple similarities. Both industries produce alloyed metals from price-volatile ores and secondary scrap material. These products are manufactured in comparable capital-intensive processes from casting to finishing and are used by similar customers, such as those in automotive, engineering, and construction companies. However, an analysis of key performance indicators reveals how dissimilar steel and aluminum enterprises are from each other. They face vastly different volume, demand, volatile commodity pricing, and competitive challenges, and their metrics are different in profitability, cash flow, capital investment requirements, net-debt-to-EBITDA ratios, and equity-to-EBITDA ratios.

At present, the aluminum sector is faring better than steel, in large part because aluminum is a still evolving market. But four megatrends — energy shifts, digitization, urbanization, and globalization — are already transforming both industries, and their impact will only be amplified in the coming years. In response, aluminum and steel companies need to adopt new strategies that effectively address investment constraints, changing market demands, R&D, product development, cost containment, efficiency, and the strategic moves of competitors. These strategies, the centerpiece of a framework developed by Strategy& to provide a dynamic pathway to growth for the steel and aluminum industries, take four forms: strengthen core, extend capabilities, tap into new regions, and revamp business models. To address capital constraints and build the capabilities they need, many companies will develop new core strategies directly related to their value proposition and identity. This will often require partnerships and alliances, some with those inside the sector, and some with outside industries.

Difference in demand

The steel and aluminum industries have a curious relationship. On the surface, the two sectors exhibit strong similarities. Their predominant and most valuable outputs are alloys made from metals known for their price volatility: iron (in the case of steel) and bauxite (in the case of aluminum). Moreover, both steel and aluminum are durable and can be produced by recycling methods, primarily remelting of scrap. Additionally, their manufacturing processes are alike, from the initial casting to hot forming and hot rolling to finishing. And they compete for the same customers, with similar products targeted at the automotive, engineering and construction, aerospace, and industrial manufacturing sectors.

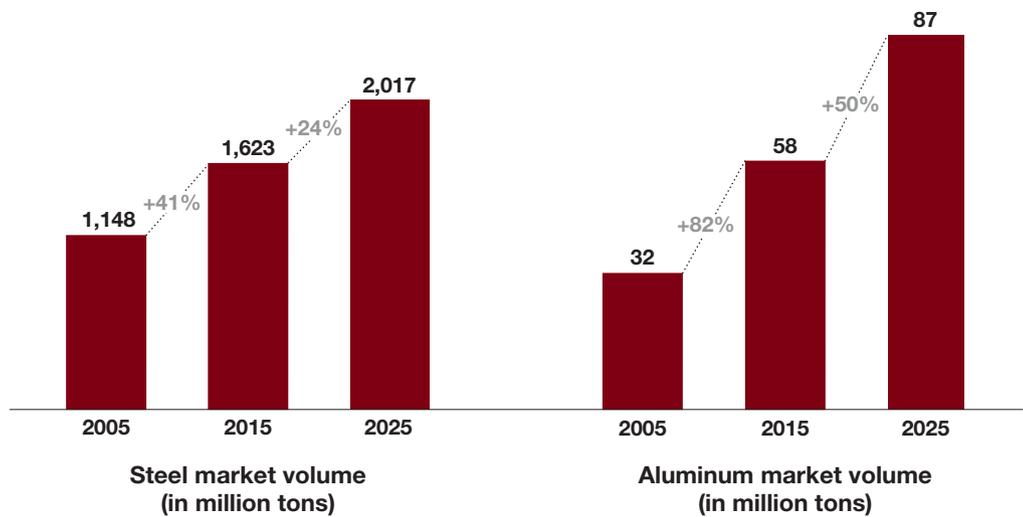
But that is where the parallels between these two industries end. A recent Strategy& analysis of key performance indicators (KPIs) covering demand, volume, profitability, and financing reveals significant differences between the sectors.

Aluminum volume sales have grown twice as fast as those of steel — up 82 percent versus 41 percent, respectively, from 2005 to 2015 (*see Exhibit 1, next page*). And we expect that in the subsequent 10 years, aluminum sales will increase by another 50 percent (representing a 4.1 percent annual growth rate), while steel consumption will grow at a much slower pace, about 24 percent, or about 2.2 percent per year.

Because of its special material properties — low weight, high strength, superior ductility, easy machining, excellent corrosion resistance, and good thermal and electrical conductivity — aluminum is an increasingly attractive option for many applications. Examples include industrial designs that make use of aluminum's elasticity and malleability, improving the mobility of heavy equipment (because it is denser and thus allows for lower-weight vehicles), and minimizing the materials used in building projects.

As a result, aluminum (which is itself a frequent substitute for steel) has become the second-most-used metal in the world after iron. Steel is thus facing relentless commoditization pressure, reflected in another KPI: EBITDA margins. Although both industries suffered from substantial

Exhibit 1
Global growth of steel vs. aluminum



Source: Strategy&;
World Steel Association;
International Aluminium
Institute

price erosion of their raw materials, steel companies fared worse: EBITDA margins declined some 55 percent between 2005 and 2015, from 24.6 percent to 11.1 percent. Aluminum EBITDA margins in that time fell only about 40 percent, from 20.3 percent to 11.5 percent. The steel sector hopes to make up some of this difference by competing directly against aluminum with so-called advanced high-strength steel, a material that has many of aluminum’s characteristics, particularly flexibility, light weight, and great strength.

And as their margins have slipped, aluminum and steel companies have had to broadly invest in their operations to stabilize margins or seek growth prospects. In turn, steel companies’ debt-to-equity ratios doubled between 2005 and 2015, while among aluminum firms this ratio was flat. A financing KPI shows similar results. The net-debt-to-EBITDA ratio has risen steadily among steel businesses — some 32 percent a year between 2005 and 2015 — but has risen less than 7 percent annually in the aluminum sector.

Since EBITDA margin declines in their two sectors were relatively in line with each other, the big gap between steel and aluminum companies in net-debt-to-EBITDA ratios can best be explained by examining expenses over the last decade. Steel companies financed, primarily through debt, big restructuring and cost-cutting programs in all regions of the globe, in large

part as a reaction to relatively weak demand, overcapacity, and price declines. As well, in this environment, R&D outlays could not be recovered.

By contrast, aluminum companies' investments were chiefly focused on expanding capacity to meet growing demand in specialty and customized products whose prices were stable or on the rise. That trend buoyed margins and made it possible to make up for R&D expenditures. And aluminum companies generated enough cash flow to repay their debts. In general, the aluminum industry is in a much earlier stage of its life cycle than steel, enjoying growth channels that enabled it to bounce back from the 2008 recession well and perform better overall in our KPI analysis.

To determine whether these industry KPIs varied by company size, we divided both the steel and aluminum sectors into three categories: large companies (annual revenue of more than €10 billion), medium-sized companies (revenue between €2.5 billion and €10 billion), and small companies (revenue of less than €2.5 billion).

We found that large companies in both sectors had seen the biggest gains in net-debt-to-EBITDA ratio and their profits had fallen the most. In other words, the largest businesses had to go deeper into debt to pay for restructuring, R&D, and mergers and acquisitions. Small and midsized firms did not have as much financing power to adopt this approach (see Exhibit 2).

Exhibit 2 Key KPIs by company size

Size (by revenue)	Quartile border revenue (in € millions)		2005			2015		
			EBITDA- margin	Net-debt- EBITDA ratio	Debt- equity ratio	EBITDA- margin	Net-debt- EBITDA ratio	Debt- equity ratio
Small (lower quartile)	≤2.5	Steel	29.3%	0.2	1.6	6.0%	8.3	2.5
		Aluminum	21.3%	1.8	1.9	14.5%	1.4	0.8
Medium (middle half)	2.5–10	Steel	22.5%	0.6	1.2	13.9%	4.3	3.7
		Aluminum	15.3%	3.7	2.0	10.1%	4.2	2.5
Large (upper quartile)	>10	Steel	23.2%	0.6	1.1	10.8%	13.9	1.4
		Aluminum	24.7%	1.0	1.3	9.2%	8.9	2.2
Total	All	Steel	24.6%	0.5	1.3	11.1%	8.4	2.7
		Aluminum	20.3%	2.2	1.8	11.5%	4.0	1.7

Source: Strategy& analysis;
Bloomberg; company
annual reports

Disruptive trends

Looking into the immediate future, we believe that both steel and aluminum companies will be driven by four key megatrends: energy shifts, digitization, urbanization, and globalization. These trends will challenge both sectors; however, they will also offer new opportunities for innovative and dynamic players. Laggards will, of course, face further deterioration in their performance and competitiveness. Leaders will benefit from new and disruptive technologies.

Here, we discuss the types of responses that the steel and aluminum sectors should consider in confronting these megatrends.

- *Energy shifts.* This category includes global CO₂ reduction, driven in many regions by local regulations. In response, aluminum and steel companies can invest in R&D to produce lighter and stronger grades of materials, using process gases as alternative energy sources. These new materials will support customers' carbon footprint reduction initiatives, particularly by reducing the weight of cars and other heavy equipment and fostering the development of e-mobility equipment, which will have fewer traditional steel components than internal combustion vehicles. In addition, aluminum and steel companies will need to develop more energy-efficient production technologies, eliminating waste and earning CO₂ certificates.
- *Digitization.* At the most fundamental level, digitization involves improvements in e-commerce platforms that offer customers simple and transparent purchasing and logistics channels able to handle custom or routine orders, which, in turn, will lead to more flexible end-to-end material flow. Customers will be able to place orders directly in procurement systems linked with steel and aluminum companies, improving the efficiency of inventory management and storage — and potentially cutting costs significantly. But in a more complex vein, steel and aluminum companies will need to develop capabilities to effectively use advances such as the Internet of Things, 3D printing, robotics, smart manufacturing, and automated supply chains.

- *Urbanization.* The burgeoning of megacities will challenge all aspects of urban life and infrastructure, whether transportation systems or waste management. Megacities will lead to the growth of vehicle sharing systems, such as autonomous taxis and buses, while reducing individual automobile ownership. As that market declines, aluminum and steel companies will have to design new applications for nonautomotive areas such as sustainable products and services. As companies begin to pry open additional channels for metal products, they must be extremely careful to target improved profit margins and avoid commoditization by developing or acquiring process, testing, quality control, and sales capabilities for these new markets. Connected cars and smart cities will also produce a lot of data — about the way people live, the products they want, and the features they prefer — that can be useful to steel and aluminum company R&D efforts, especially for fast prototyping and reducing development time for new materials.
- *Globalization.* The final megatrend, globalization, will be reflected by more local sourcing, greater commoditization as companies from emerging countries enter the aluminum and steel markets of developed countries, and increasing price volatility. For aluminum and steel companies to avoid the worst outcomes of globalization — primarily shrinking margins and price wars — constant innovation in processes and quality is needed. The aim should be to outperform new rivals in developing growth markets, differentiating themselves with high-end products, and avoiding the dangers to profitability associated with low-end products. In addition, aluminum and steel companies should upgrade their skills in procuring local raw materials to save money when possible. They should also invest in building operations in low-cost countries, where it is possible to do the finishing work on materials produced elsewhere, thus cutting shipping and manufacturing expenses.

Each of these profound transformations is well under way, but steel and aluminum companies must develop the right capabilities — which we define as those involving people, processes, tools, and technology — to manage these responses. They have to grasp the opportunities and overcome the challenges already manifested by these trends. In our view, most metals companies fully realize the dangerous situation that their industry faces: the level of competition, the massive global shifts affecting their customers and themselves, and the rush toward commoditization. In a highly competitive market with many imponderables, such as Brexit, Chinese overcapacity and discounted prices, possible new tariffs in the U.S., Russian sanctions, and global trade uncertainty, companies must find and develop individual paths toward sustainable profitability and growth.

Connected cars and smart cities will produce a lot of data about the way people live that can be useful to steel and aluminum company R&D efforts.

In an attempt to determine how much aluminum and steel companies need to invest in order to address megatrends and other challenges, we explored medium-sized companies (revenue between €2.5 billion and €10 billion) to derive a useful median. We found that the steel industry would have to earmark about €5.7 billion through 2025 (or about 7.5 percent of revenue) and the aluminum industry would have to invest about US€8.2 billion through 2025 (about 11 percent of revenue). Investments would primarily be targeted at R&D; building out new equipment; recruiting, developing, and training high-quality employees; changing organizational culture; and embracing digital technologies. Larger companies will likely have to invest lower percentages of revenue, and smaller companies may have to allot greater percentages to reach their targets and maintain competitiveness against bigger players. The aluminum sector's investment will be even higher than steel's because its global market is expected to continue to grow faster than steel's; further, unlike the steel industry, the aluminum sector has very little unused capacity in its plants to meet higher demand volumes.

The returns from such an investment, however, would be substantial, a significant turnaround in the KPIs we examined that are currently in decline:

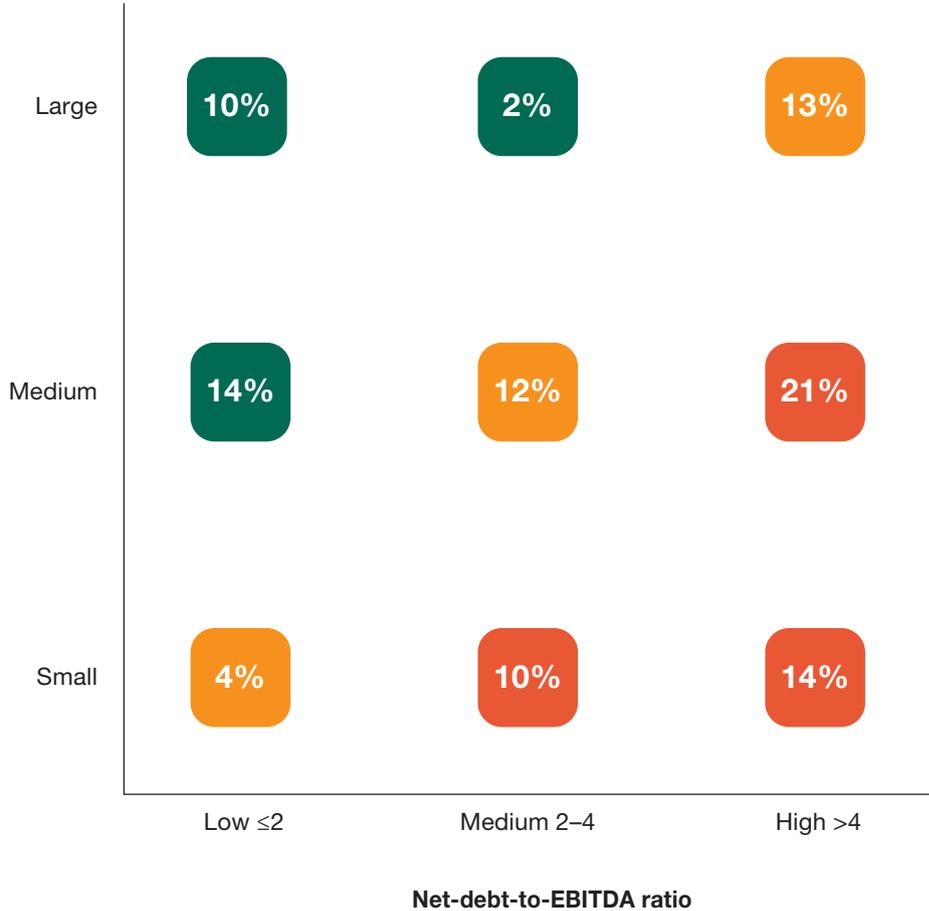
- For steel companies, we calculated that EBITDA margins would improve by 2.1 percent until 2025 and net-debt-to-EBITDA ratios would drop to 2.7, bringing the steel industry back into investment grade.
- For aluminum companies, we calculated that EBITDA margins would improve by 2.3 to 12.4 percent, with a net-debt-to-EBITDA ratio of 1.7 percent.

Examining the prospects for steel or aluminum companies to invest in the range of about 7 to 11 percent of their revenue over the next 10 years, we found that only 12 percent of large companies and 14 percent of medium-sized companies had a sufficiently low net-debt-to-EBITDA ratio to be in a position to manage the needed transformation on their own (*see Exhibit 3, next page*).

For the rest of the companies — that is, more than 70 percent of the industry — partnerships, mergers and acquisitions, and other types of joint ventures will be necessary to extend capabilities and to fund the investments needed to support tactics that overcome disruption.

Exhibit 3
The need for partnerships

Company size



Figures represent the percentage of all companies surveyed

- Partnerships are necessary to manage transformation
- Partnerships are recommended to manage transformation
- Companies can manage transformations on their own (already driving multiple initiatives)

Source: Strategy& analysis of 104 companies; Bloomberg; annual reports of companies

A dynamic strategy

Although the broad challenges and investment priorities are becoming clearer every day, the precise approaches to making the right funding, development, and M&A decisions are not as certain. For that reason, we have produced a structured framework built upon four key strategies for growth that can help steel and aluminum companies move forward. This dynamic strategic program, which is a far cry from typically rigid industry five-year plans, enables individual companies to determine their most relevant entry points, depending on size, current capabilities, financing structures, market position, growth prospects, product mix, collaborations, and partnerships, among other things.

The four key strategies for growth are as follows:

- *Strengthen the core.* This strategy starts with the core business and makes it stronger. It involves continuously improving efficiency and cost optimization in the short term, while expanding this activity into enhancing operational and network excellence — investing in production technologies and quality control systems — over the medium term. This could involve further consolidation of aluminum and steel companies.
- *Extend capabilities.* This step essentially moves the organization into strategically valuable downstream markets and builds out its technical capabilities. New business comes from finding opportunities for an extension of the current core capabilities system. This could involve integrated components, for example, that mix steel and aluminum materials.
- *Tap into new regions.* Considering the weight and bulk of metals, widening the geographic footprint for steel and aluminum manufacturing is a critical activity for long-term profitability. This could involve building joint processing and distribution capabilities located relatively close to new markets.
- *Revamp business models.* This strategy involves innovative thinking about how a company can change its product line and the markets it usually serves. This could involve altogether new business model or ecosystem approaches, such as hot processing technologies.

Widening the geographic footprint for steel and aluminum manufacturing is a critical activity for long-term profitability.

Implementing key strategies

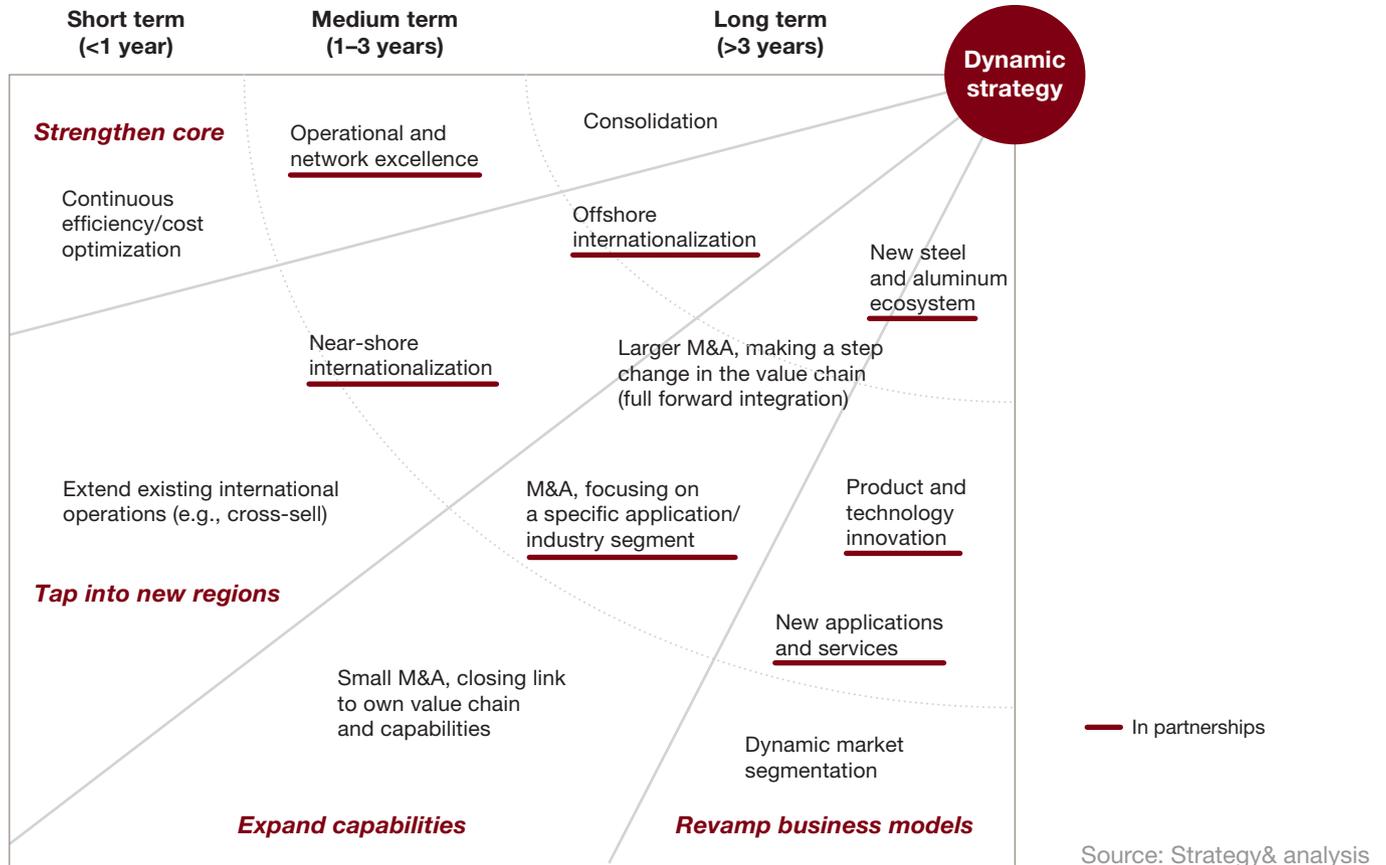
Each of the four strategies for growth involves a connection to the company's current business. The further from the center, the more of a leap it requires in terms of building new capabilities. Precisely which strategy (or strategies) a company should choose depends on a careful evaluation of the organization's current situation and outlook. For example, it would be risky for a financially unstable company to choose an expensive strategy, such as revamping the business model, as the first step.

A thorough examination of the business and the choice of a strategic approach should be tackled by senior leadership. First, determine your market position against your main competitors as well as the organization's core capabilities in innovation, technology, supply chain, logistics, and marketing and sales. Second, develop and prioritize potential strategic directions based on core capabilities and analyze the business cases for selected strategic directions, including market attractiveness; financial returns; funding restraints; capabilities fit; and coherence with the company's current products, assets, and skills. Third, overlay selected strategic directions onto the key strategies map (*see Exhibit 4, next page*) and create a clear growth plan with specific steps to follow in the short, medium, and long terms.

For example, a mid-sized flat- and long-products steel producer had strong capabilities in product development, but suffered from financial constraints. The company embarked on a plan that started with strengthening its core position through a cost optimization program. With its savings and additional cash flow, the company funded a series of mergers and acquisitions, each one a small deal in its own right, designed to enhance its existing business operations and capabilities in automotive applications.

As the steel producer strengthened its capabilities, new options became available, such as larger M&A transactions and greenfield investments to further improve its international presence. The company chose to invest in a facility in the U.S. that made sophisticated pre-materials. This move strengthened its international footprint, diversified its revenue sources, and set new technology standards.

Exhibit 4
Landscape of potential growth strategies



Over the long term, the company might expand its business model into an entirely new steel and aluminum ecosystem. Going this route would mean extending its product portfolio to include flat steel, composite material production, and steel and aluminum processing. It would need to acquire new multiple-metal-based connection technologies and application development capabilities. With this strategic growth plan, the steel player would become a system supplier delivering directly to the end customers, such as automotive and engineering original equipment manufacturers.

To successfully implement the four key strategies, steel and aluminum companies — particularly small and medium-sized businesses — will need to build partnerships.

Although partnerships are often viewed as a financial imperative, in this case they are essential to shoring up existing capabilities, adding capabilities that are aligned with the company's market approach, and increasing the speed of implementing a dynamic strategy.

Depending on the circumstances, these combinations can involve cross-industry partnerships between steel and aluminum companies; value chain combinations, such as with companies in mining and component manufacturing; and joint ventures with companies in industries that are not normally within the sphere of metals producers. In some cases, when steel or aluminum companies lack critical capabilities in such areas as R&D, innovation development, and sales and marketing, joining forces with another company that has these strengths or acquiring those capabilities through M&A is the right option.

There are numerous examples of various types of partnerships already in place in the steel and aluminum sectors, many of them producing promising returns. For instance, materials producer thyssenkrupp has been able to extend its reach into the aluminum business through a partnership with a specialized player to develop ultra-lightweight wheels for premium vehicles. The goal is to lower the weight by as much as 40 percent compared to steel.

Or in a somewhat more counterintuitive move, a regional steel market leader has partnered with a global manufacturing and construction player, Hitachi, to provide the materials and building support for wind farms off the coast of Taiwan. ArcelorMittal has combined with a cement company in Europe to use blast furnace slag — a by-product of the manufacturing process of iron and steel to produce low-carbon cement in Europe.

And in an intriguing development that could be a window into a future in which steel and aluminum are more frequently used in combination, a research team in South Korea has added nickel to a mixture of aluminum and steel to produce an alloy that is strong enough for automotive and aerospace applications. POSCO (formerly the Pohang Iron and Steel Company, named after the city where it is based) has already begun industrial-scale trials of this advancement and recently received a huge order from a technology provider, which hopes to use the material in automotive exhaust systems.

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Conclusion

Although the differences between the steel and aluminum sectors are notable, in our view the steel industry is a window into what the aluminum industry will eventually look like if it doesn't take steps to stop its slide. Both sectors face big challenges and have big opportunities. Both have to be proactive if they hope to overcome the obstacles in their way. The megatrends and industry metrics are troubling, but they shouldn't induce paralysis. The more dynamic organizations in the sector have the opportunity to drive toward sustainable profitability by choosing and implementing the right key strategies.

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