The NOES Chronicle:
Everything Non Grain Oriented

Issue 1

NOES Meteoric Growth With Developing Economies

The Non Oriented Electrical Steel (NOES) market has achieved a strong 4.6% compound annual growth rate (CAGR) for a the past decade, despite a 21.6% drop in 2009 following the global economic seizure of 2008. The unparalleled growth and expansion of consumer living standards around the world resulted in the age of electrical drives and electronics propelling production/ consumption of NOES in 2018 to 13.7 million tonnes. As with the overall steel industry, a significant percent of the capacity surge has occurred in China, but about one-fourth of the capacity growth was outside of China in South Korea, Europe, Vietnam and Other Asia (including India).

The main drivers behind the growth of NOES are: a) the global consumption of consumer durable goods including refrigerators, heating & air conditioning and washing machines in part measurable through housing starts; b) industrial and manufacturing development; c) consumption of electrical and electronic goods, including power tools; d) increasing global vehicle sales, compromised of both conventional and electric models; e) oil & water drilling/exploration; f) mining, both open cut

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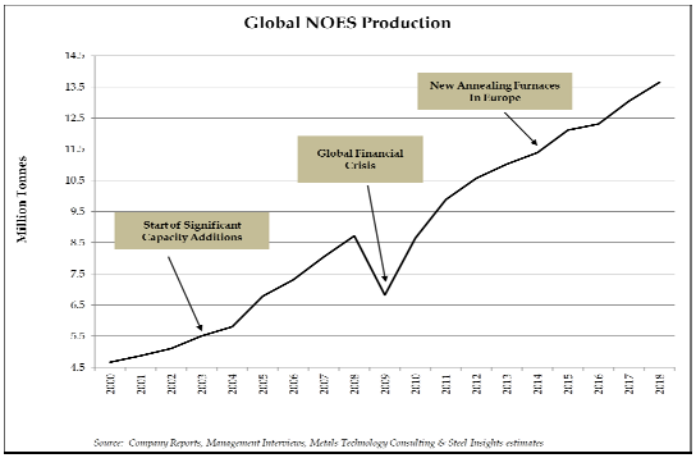
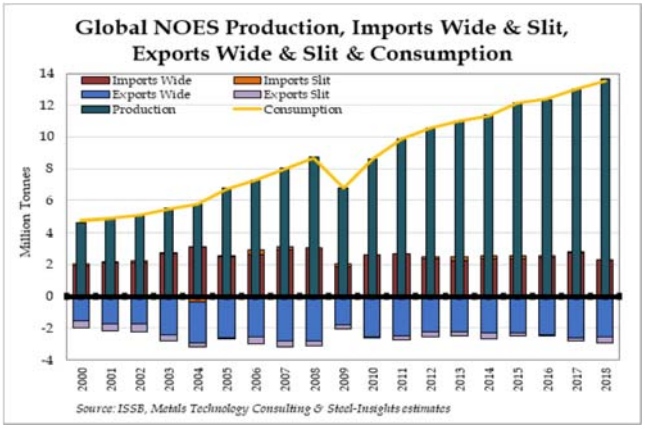


NOES Trade Has Remained Flat While Global Production Is Up 193%



USA NOES Pricing Has Recovered

Pricing in the USA of domestically produced NOES has increased every year since 2011 and in 2017 surpassed the prior 2008 peak levels in 3% Si NOES products (M19/M15) and reached 94% of the 2008 peak in 2% Si NOES products (M36). The rise has been gradual, delivering a 1.4%-1.8% five year compound annual growth performance with the highest increase of 3.2%-4.3% in 3% Si NOES products (M19/M15) in

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STEEL-INSIGHTS®, LLC
Metals, Mining & Manufacturing Strategic Consulting

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Becky E. Hites (917) 862-6557
becky.hites@steel-insights.com

and underground; g) power generations, primarily portable, stand-by, and smaller fixed units; and h) increasing use of brushless DC motors (new technology), consistent with increasing demand for higher efficiency consumer goods.

NOES is unique in that there are no known alternative materials that can be used as a magnetic field conductive substitute. Powdered and compacted iron maintains a small (less than 1%) part of the motor market and is not expected to grow significantly. A further barrier to entry is the extended testing and approval process at the manufacturer for NOES grades used in applications such as motors, ceiling fans, garage door openers, and critical oil well pumps (and many other applications) due to the high, and unacceptable, cost associated with product failure.

NOES Production Year-To-Year Change

2001	4.4%	2010	26.8%
2002	5.0%	2011	14.3%
2003	7.8%	2012	7.0%
2004	5.3%	2013	4.3%
2005	17.0%	2014	3.3%
2006	7.7%	2015	6.3%
2007	10.0%	2016	1.6%
2008	8.3%	2017	6.0%
2009	-21.8%	2018	4.6%

Source: Company Reports, Management Interviews, Metals Technology Consulting & Steel-Insights estimates

For 2018, China was the largest NOES consuming region accounting for 59.3% of the market (down from 60.6% in 2017), followed by Europe at 12.4% (down from 13.1% in 2017), Japan at 8.2% (down from 8.5% in 2017), Other Developing Asia at 7.8% (up from 6.8% in 2017), South Korea at 3.8% (up from 3.2% in 2017), the Americas at 3.5% (no change from 2017), India at 3.4% (down from 3.6% in 2017), Russia & Turkey at 1.3% (down from 2.1% in 2017), and the Middle East & Africa at 0.24% (down from 0.7% in 2017).

The NOES market is delineated by four product categories:

- CRML (cold rolled magnetic lamination), defined as cold rolled steel with aluminum and silicon additions, mostly supplied without coating and finished with a heavy temper pass, and usually used in the annealed condition, after stamping of parts. CRML is mostly a NAFTA grade and accounts for 10% of market demand (dropping to 8% by 2030);
- Low grade NOES, defined as coated, cold rolled steel with silicon and aluminum contents up to 1.8%, typically without a hot band anneal, and used in the as-stamped condition – accounts for 74% of market demand and dominated by one grade (50H800) which accounts for 65% of the category consumption (dropping to 71% by 2030);
- High grade NOES, defined as coated, cold rolled steel with silicon and aluminum contents above 1.8%, normally with a maximum silicon of 3.2%, typically with a hot band anneal and used in the as-stamped condition – accounts for 14% of market demand (increasing to 18% by 2030); and

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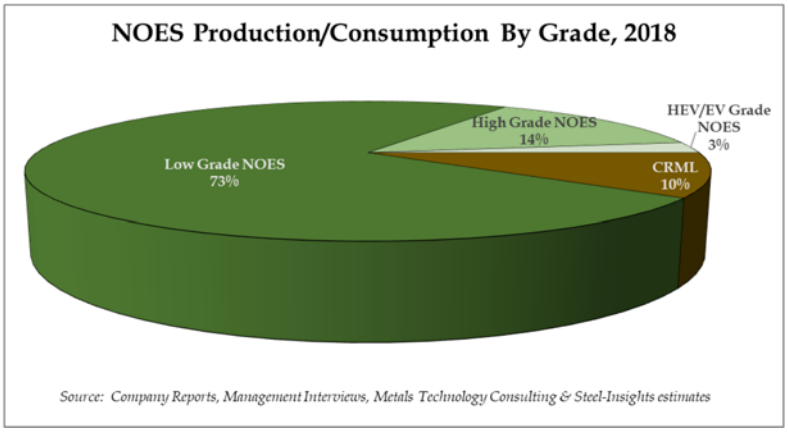
- HEV/EV NOES, which is a extension of the high grade NOES category and differentiated by thickness less than or equal to 0.35 mm and used uniquely in automotive drive motor applications – accounts for 2% of market demand (increasing to 3% by 2030).



The use of conventional cold rolled in low grade motors, as has been the case until recently in India, has not been included as this use is declining and of insignificant importance. We have also not included the use of hot rolled silicon sheet, specifically in China, as active steps are in place within the country to eliminate the use of this product.

We include CRML in the analysis because in many motor applications, CRML and low grade NOES can be used interchangeably which, in our opinion, makes it a legitimate competing participant in the NOES market.

About one-fifth of the global market consumption is supplied with imports, and wide coil sales dominate at 85% of the market over slit coil sales at 15% of the market. The import mix of wide to slit coil changes depending upon the region and whether there is a producing company within the region. Due to the significance of imports to the market supply, international standards have been developed and are similar to and consistent with USA/ ASTM standards for NOES.

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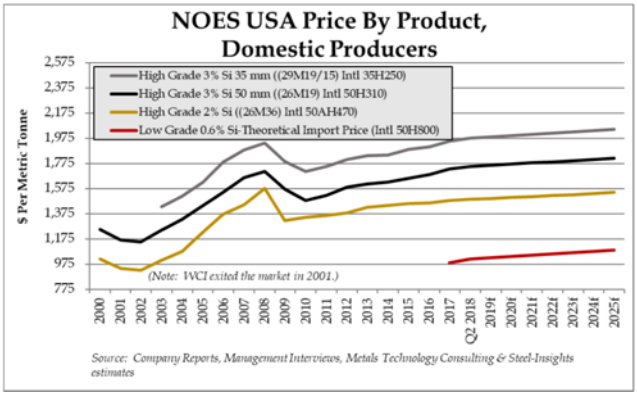
2012 and 3.2% in 2% Si NOES (M36) in 2013. The lowest increase for 3% Si NOES products was 0.4% and 0.9% in 2014 and for 2% Si NOES products was 0.3% in 2016.



Steel-Insights, LLC is launching a new monthly publication "The NOES Chronicle" on an annual subscription basis for $2,000 per year. Additional NOES offerings include a detailed industry analysis report and HEV market forecasts. For further details, please contact Becky E. Hites at becky.hites@steel-insights.com.

Industry Charts