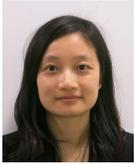


Bloomberg Intelligence

Autos Shed Weight with More Aluminum



Yi Zhu, BI Industry Analyst
BI Aluminum, Global Dashboard

Aluminum Sales to Surge as Lighter Cars Boost Fuel Efficiency

Contributing Analysts Steve Man (Autos)

(Bloomberg Intelligence) -- Automakers are increasingly turning to aluminum to reduce vehicle weights in response to more stringent fuel-efficiency requirements. The trend may boost sales for metals makers such as Alcoa, Novelis and Aleris, which have developed aluminum alloys that are stronger than steel, while weighing only about as one-third as much. The U.S. has implemented Corporate Average Fuel Economy standards (CAFE) for vehicles. Europe and China have also announced efficiency targets.

Key Points:

- Alcoa, Novelis Expand Capacity as Carmakers Use More Aluminum
- Auto Frames Provide Growth Opportunity for Aluminum Producers
- Aluminum Makes Vehicles More Fuel Efficient, Easier to Produce
- Aluminum Sheet Demand to Triple by 2025 on Fuel-Economy Rules
- China Carmakers Face Three-Year Shortage of Aluminum Auto Sheets

Alcoa, Novelis Expand Capacity as Carmakers Use More Aluminum

Contributing Analysts Steve Man (Autos)

Aluminum makers are adding capacity for producing auto sheets in anticipation of greater demand, as automakers turn to the metal to reduce vehicle weight. Alcoa has spent \$575 million to expand the company's plants in Davenport, Iowa, and Knoxville, Tennessee. Novelis has invested \$500 million since 2011 to triple global capacity to 900,000 metric tons by the end of this year. Click on the table for a list of aluminum auto-sheet-production projects, capital expenditure and expected commission dates.

List of Aluminum Auto-Sheet Capacity

Company	Plant	Greenfield/Brownfield	Capex (US\$ mn)
Aleris	Lewisport, Kentucky, US	Brownfield	350
	Duffel, Belgium	Brownfield	70
	Zhenjiang, China	Greenfield	200
Alcoa	Davenport, Iowa, US	Brownfield	300
	Tennessee, US	Brownfield	275
	Saudi Arabia	Greenfield	10,800 for the integrated project including alumina refinery, smelter and rolling mill
Novelis	Oswego, NY, US	1st line	
		2nd line	
		3rd line	120
	Changzhou, China	Greenfield	110
	Nachterstedt, Germany	Brownfield (2nd line)	85

Source: Company Filings, News Reports, Bloomberg Intelligence

Companies Impacted: Alcoa, Aleris, Constellium, Norsk Hydro, Kobe Steel, Aluminum Corp. of China and China Zhongwang make aluminum-alloy auto sheets or are working on facilities to produce them. Automakers are using more aluminum to meet tightened fuel-efficiency standards. (Updated on 11/12/15)

GM's Aluminum-Body Truck Plans Could Pose Threat to Steelmakers

Contributing Analysts Kenneth W Hoffman (Metals) & Kevin P Tynan (Autos)

GM has been quiet on aluminum as a possible lightweighting option for its new T1XX platform, which will underpin the Chevrolet Silverado, GMC Sierra, Chevrolet Suburban and GMC Yukon beginning in 2018. Despite knocking Ford for its aluminum-based F-150, GM may be heading down a similar path with both Alcoa and Novelis signed to provide aluminum sheet for the next generation, according to just-auto.com. A more prevalent shift to aluminum would dent steel producer profitability, especially galvanized sheet. (Updated on 02/26/16)

GM Plans Aluminum Truck, But Keeps It On Down Low

Bloomberg Intelligence Automobile F Last updated: 2/01/2016

Name	Maker	Comments
GMC Savana (2002 to 2018)	GMC	This big van is sold mostly in North America. It is bui
GMC Sierra HD & Sierra Denali HD (2014 to 2021)	GMC	As with previous generations of this full-sized pick-u
GMC Sierra 1500 (2013 to 2018)	GMC	General Motors revealed this new pick-up and its tw
GMC Canyon (2014 to 2018)	GMC	A new generation of this body-on-frame pick-up wa
GMC Yukon, Yukon XL, Denali, Denali XL (2013 to 2021)	GMC	The current generation of these big SUVs was reveal
Chevrolet Express (2018 to 2030)	Chevrolet	This successor to the Chevrolet Express is not expect
Chevrolet Silverado HD (2014 to 2021)	Chevrolet	As with previous generations of this full-sized pick-u
Chevrolet Suburban (2013 to 2020)	Chevrolet	The current Suburban is, like t
Chevrolet Tahoe (2013 to 2020)	Chevrolet	The Tahoe replacement would
GMC Sierra 1500 (2018 to 2025)	GMC	General Motors is said to be d

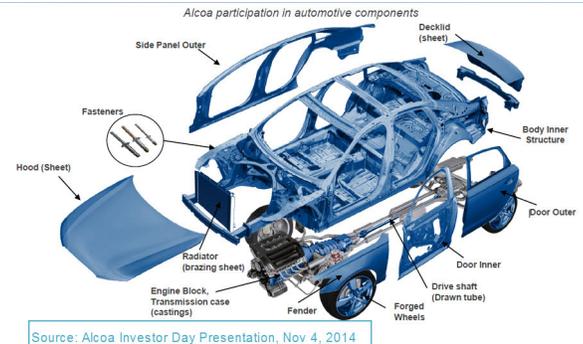
Click On Image To Download Excel Model

Auto Frames Provide Growth Opportunity for Aluminum Producers

Contributing Analysts Steve Man (Autos)

Vehicle frames, also referred to as body-in-white, are the fastest-growing application for aluminum auto sheets, given they're the heaviest components and offer the greatest opportunities to cut weight. More than 500,000 metric tons of capacity for body-in-white sheets is scheduled to come online by the end of 2018, according to data compiled by Bloomberg Intelligence. Aluminum content per vehicle will rise 39% by 2025 to 547 pounds amid greater use in car frames and panels, according to Alcoa.

Alcoa's Content Is Deployed Bumper to Bumper



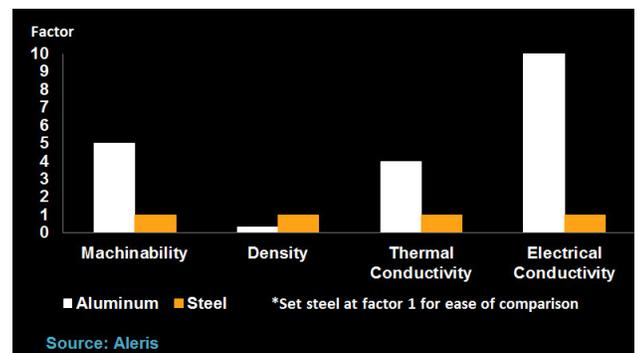
Companies Impacted: Alcoa, Aleris, Constellium, Norsk Hydro, Kobe Steel, Aluminum Corp. of China and China Zhongwang make aluminum-alloy auto sheets, or are working on facilities to produce them. Automakers are using more aluminum to shed weight and meet tightened fuel-efficiency standards. (Updated on 11/12/15)

Aluminum Makes Vehicles More Fuel Efficient, Easier to Produce

Contributing Analysts Steve Man (Autos)

Aluminum alloys are about one-third the weight of steel, which means automakers can use them to produce lighter and more fuel-efficient vehicles to meet stringent fuel-efficiency requirements. The alloys also have manufacturing advantages. For instance, they are better at conducting heat, which reduces the time needed for metal to cool. They are also easier to cut, so there is less wear on tools. Automakers could alternatively replace steel with high-strength steel or polymer reinforced with carbon fiber.

Aluminum vs. Steel



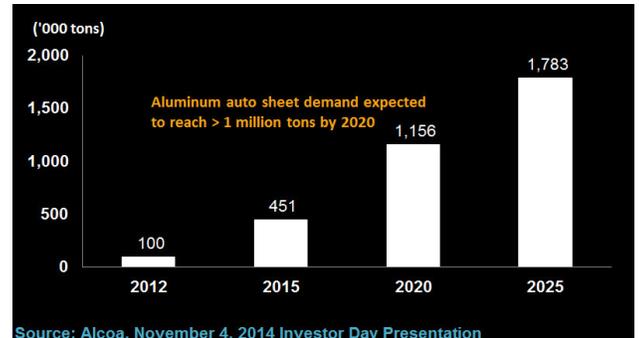
Companies Impacted: Alcoa, Aleris, Constellium, Norsk Hydro, Kobe Steel, Aluminum Corp. of China and Hindalco's Novelis are either producing aluminum-alloy auto sheets or building facilities to make them. (Updated on 11/12/15)

Aluminum Sheet Demand to Triple by 2025 on Fuel-Economy Rules

Contributing Analysts Steve Man (Autos)

Demand for aluminum-alloy auto sheets in North America will almost triple to 1.78 million tons a year in the decade ending 2025, according to Alcoa. That's partly because U.S. Corporate Average Fuel Economy targets aim to almost double vehicle fuel efficiency vs. 2011 to 54.5 mpg. Aluminum producers in the U.S. are boosting capacity by investing in new and existing facilities. They are converting can-sheet lines to make auto sheets, and working with customers to recycle more scrap into alloys.

North America Aluminum Auto Sheet Demand



Companies Impacted: Alcoa, Aleris, Constellium, Norsk Hydro, Kobe Steel, Chalco and Hindalco's Novelis are either producing aluminum-alloy auto sheets or building facilities to make them. (Updated on 01/21/16)

China Carmakers Face Three-Year Shortage of Aluminum Auto Sheets

Contributing Analysts Steve Man (Autos)

Chinese automakers are under pressure to cut vehicle weight to meet fuel-efficiency rules. Their efforts are hindered by a shortage of aluminum sheets that could last as long as three years. Some types of auto sheets, such as those for frames and panels, mainly rely on imports as domestic supply is limited by bottlenecks at the heat-treatment stage and delayed production starts. Overseas companies that have built auto-sheet plants in China, such as Novelis and Aleris, generally use them for export.

Aluminum Auto-Sheet Facilities in China



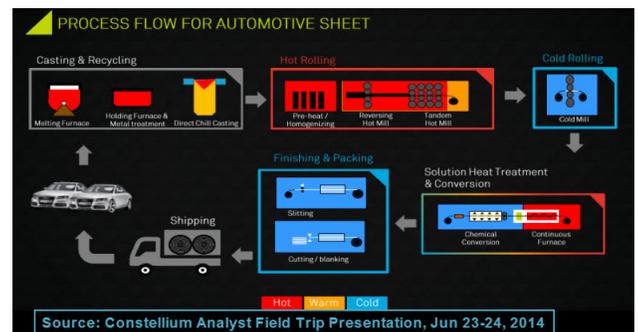
Companies Impacted: Alcoa, Aleris, Constellium, Norsk Hydro, Kobe Steel, Aluminum Corp. of China and China Zhongwang produce aluminum-alloy auto sheets or are building facilities to make them. (Updated on 11/12/15)

China Automakers Face Supply Bottleneck in Switching to Aluminum

Contributing Analysts Steve Man (Autos)

China automakers seeking to make more use of aluminum face supply constraints stemming from limited local auto-sheet production. This is because the latest technology for the heat-treatment and finishing stages, which are unique to auto sheets, is owned by a limited number of overseas companies. China aluminum makers also struggle to keep pace with new developments, such as Alcoa's Micromill process, which creates auto sheets that are 40% easier to shape than the industry standard and are 30% stronger.

Auto Sheet Production Process



Companies Impacted: Alcoa, Aleris, Constellium, Norsk Hydro, Kobe Steel, Chalco and China Zhongwang are among aluminum makers producing alloy auto sheets or building facilities to make them. (Updated on 01/21/16)

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