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# ECONOMIC UPDATE

Number 22 • MARCH 2022

## EXECUTIVE SUMMARY

**ALERT: RUSSIA'S WAR IN UKRAINE HAS IGNITED AN UNPRECEDENTED INCREASE IN THE PRICE OF NICKEL**, a key metal used in stainless steel and electric vehicle batteries. The information contained in this month's *Economic Update* has yet to fully capture the wild nickel price volatility that occurred after the first week of March. For example, **the London Metal Exchange (LME) was forced to halt nickel trading and cancel trades after prices doubled on March 8 to more than \$100,000/tonne (over \$45 per lb) in a surge attributed to short covering by one of the world's top producers.** The LME said trading could be closed for several days, giving market participants time to find cash to pay margin requirements. In the April issue, we will report more extensively on the rapid escalation of nickel prices and the prospects for the industries dependent on nickel and other metals caught up in the European conflict.

**AMERICAS: U.S. EMPLOYERS ADDED 678,000 WORKERS TO PAYROLLS IN FEBRUARY**, the strongest gain since last July. The jobless rate fell to 3.8% from 4.0% a month earlier. **Retail sales** surged 3.8% in January, the largest rise since last March and their highest level since the government started tracking the series in 1992. Receipts at auto dealerships snapped back 5.7% after dropping 1.6% in December. **Factory production** increased 0.2%, while overall industrial output expanded 1.4%. **Utilities production** soared 9.9%, the biggest gain in the index's history. **Durable goods orders** advanced 1.6%, boosted by a 3.4% increase for transportation equipment. **Inflation** accelerated to a 7.5% annual rate, led by soaring costs for rents, electricity and food. Electricity prices jumped 4.2%, offsetting a 0.8% decline in the cost of gasoline and a 0.5% drop in natural gas. **A new supply-blockages measure** developed by economists at the Federal Reserve Bank showed a record level of strain in November, but a decline in December, January and February. From a peak of 4.5 in December, it has fallen over three consecutive months and hit 3.3 in February, with zero representing the index's long-term average.

**OVERSEAS: CHINA'S FACTORY ACTIVITY UNEXPECTEDLY EXPANDED IN FEBRUARY** as new orders improved, pointing to some resilience in the world's second-largest economy. **Japan's GDP** rose an annualized 5.4% during the fourth quarter of 2021. For the whole of 2021, Japan's GDP rose 1.7%, turning positive for the first time in three years. **The European Commission** unveiled a €43 billion investment plan to promote research and production of higher tech chips used in computers, smart-phones and vehicles.

**STEEL: STAINLESS STEEL SHEET CUSTOMERS ENDURED ANOTHER MONTH OF STRONG DEMAND**, customer tonnage allocations and long lead times in February. The stainless mills fully implemented the January base price increase and higher raw material surcharges, resulting in higher transaction prices and inventory valuation. **Tariffs on Japanese steel** imported into the U.S. will be eliminated under a new deal reached in February. The agreement will allow Japan to ship up to an annual 1.25 million tonnes of steel to the U.S. duty free. **U.S ferrous scrap prices** are poised to increase sharply in the wake of Russia's invasion of Ukraine.

**AUTOMOTIVE: EIGHT CARMAKERS ANNOUNCED FACTORY CLOSURES OR FROZE SALES TO RUSSIA** as the industrial fallout from the country's invasion of Ukraine spread. **Ford, Renault and BMW** have already closed Russian plants. Analysts say the initial impact of the war on some car makers could lower global vehicle production by 1.5 million vehicles this year. **Ford Motors** announced a major restructuring, separating its legacy ICE (internal combustion engine) business from its electric vehicle division.

**ENERGY: CHINA'S TOKAMAK FACILITY HELD 120MN C° PLASMA FOR 1,056 SECONDS**, a new record for holding superheated plasma. The work is dedicated to the development of fusion as a power source that could replace coal-fired power plants and other non-renewable resources. **Rising energy costs** are one immediate consequence of the confrontation between Russia and Western powers over Ukraine. With Russia being a major energy supplier, sanctions against the country have affected energy prices.

**MEDICAL: SCIENTISTS DEVELOPED A NOVEL CANCER THERAPY** called *minimally invasive image-guided ablation*, which comprises a ferromagnetic thermoseed navigated to a tumor using magnetic propulsion gradients generated by an MRI scanner, before being remotely heated to kill nearby cancer cells. **Moderna** expects the pandemic to end this year ("an 80% chance", said CEO Bancel).

**INNOVATION: A POLYMER THAT HAS TWICE THE YIELD STRENGTH OF STEEL**, but only a sixth of the density, has been created by a team from MIT. The plastic could have a range of uses, from bridges to automobile manufacturing. German startup Magment developed a **magnetizable concrete** technology for road surfaces, which can be used to wirelessly charge electric vehicles while driving.

**AEROSPACE: A DEFENSE DEPARTMENT REPORT DETAILED THE POST-COLD WAR SURGE IN MERGERS** which has shrunk the number of American defense prime contractors from 51 in 1990 to 5 today, leaving the U.S. military less well-equipped. The report is aimed at reversing the consolidation trend. **Airbus** expects to deliver 720 commercial jets this year, an 18% YOY increase.

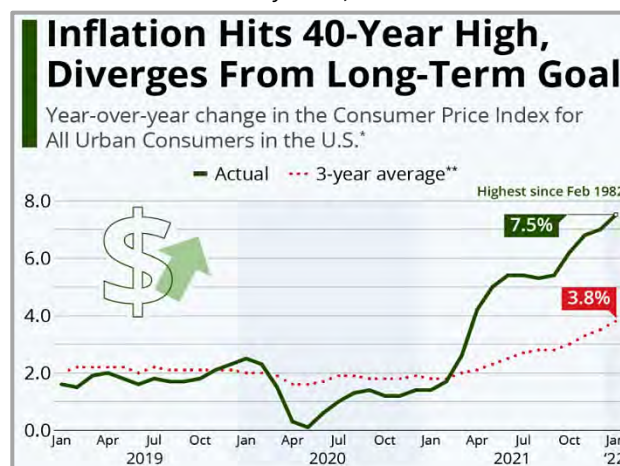
**COMMODITIES: Stockpiles of important commodities** are at historically low levels, especially metals. For example, copper stocks at major commodity exchanges were just over 400k/tonnes in late February, less than a week of global consumption.



## THE AMERICAS

- **U.S. producer prices** increased 1% in January amid a surge in the cost of hospital outpatient care (+1.6%) and goods such as food (+1.6%) and motor vehicles (+0.7%). Energy products increased 2.5%, but prices for iron and steel scrap fell 10.7%. The cost of hotel and motel accommodation rose as did freight transportation by trucks. In the 12 months through January, the PPI has climbed 9.7 percent.
- **The Index of Leading Economic Indicators** fell 0.3% in January, the first drop in nearly a year amid a resurgence in COVID-19 cases, high inflation and supply chain disruptions. The decline supports expectations that growth would slow below a 2.0% annualized rate in the first quarter.
- **U.S. import prices** increased 2.0% in January, the most in nearly 11 years, amid a 9.3% jump the cost of energy products. Export prices advanced 2.9%. Export prices have increased 15.1% year-on-year in January.
- **The U.S. trade deficit in goods** widened sharply to a record high in January amid a surge in imports as businesses continued to replenish depleted inventories. The goods trade deficit jumped 7.1% to \$107.6 billion. Imports of goods increased 1.7%, led by food and motor vehicles. There were large increases in imports of industrial supplies, capital and consumer goods. Exports dropped 1.8%.
- **U.S. retail sales** surged 3.8% in January, the largest gain since last March and their highest level since the government started tracking the series in 1992. Receipts at auto dealerships snapped back 5.7% after dropping 1.6% in December. Electronics and appliance stores sales increased 1.9%. Building materials sales surged 4.1%. Sales at service stations fell 1.3% amid lower gasoline prices.  
*Key Update: January's solid real (inflation-adjusted) core retail sales gain of 2.7% suggests 1<sup>st</sup>Qtr consumer spending would probably not be as weak as economists had expected. Real consumer spending declined 1.0% in December, which had set consumption on a slower growth path.*
- **Durable goods orders** advanced 1.6% in January, boosted by a 3.4% increase in orders for transportation equipment. Motor vehicle orders fell 0.4% after a 1.8% gain in December. Orders for the volatile civilian aircraft category increased 15.6% after rising 23.9% in December. Boeing received 77 aircraft orders compared to 80 in December.
- **U.S. factory orders** rose 1.4% in January, pointing to continued strength in manufacturing. December data was revised sharply higher to show orders gaining 0.7% instead of falling 0.4% as previously reported. There were increases in orders for machinery and transportation equipment.

- **U.S. inflation** accelerated to a 7.5% annual rate in January, led by soaring costs for rents, electricity and food. Electricity prices jumped 4.2%, offsetting a 0.8% decline in the cost of gasoline and a 0.5% drop in natural gas. It was also boosted by strong gains in prices for household furnishings and used cars and trucks. Healthcare costs rose 0.7%, lifted by hospital services and prescription medication. On a monthly basis, the CPI increased 0.6%.



- **Production at U.S. factories** increased 0.2%, while overall industrial output expanded 1.4% in January. Capacity utilization for the industrial sector rose one point to 77.6%. Buoyed by both electric utilities and natural gas output, utilities production in January jumped 9.9%, the biggest gain in the index's history. Mining was up 1%, while production of motor vehicles and parts slid 0.9%.
- **U.S. consumer confidence** fell to a five-month low in February. The Conference Board's survey found fewer consumers planning to purchase homes, automobiles or go on vacation over the next six months due to concerns about the short-term economic outlook.
- **Employers** added 678,000 workers to payrolls in February, the strongest gain since last July. The jobless rate fell to 3.8% from 4.0% a month earlier. Hospitality industries led all sectors in hiring, accounting for one in four of all new jobs, but the gains were broad based, spanning office jobs, construction, healthcare and other sectors.
- **Consumer spending** surged 2.1% in January, driven by purchases of motor vehicles, nondurable goods and recreational goods, as well as outlays on heating amid freezing temperatures across many parts of the country. Consumer spending is being supported by massive savings and strong wage growth, offsetting a reduction in government money to households. Personal income was unchanged, as a 0.5% increase in wages was offset by a decrease in government social benefits.

- **Existing home sales** sales rose 6.7% in January to an annual rate of 6.5 million. The median existing home price rose 15.4% YOY to \$350,300. The typical home sold was on the market for just 19 days. New home sales fell 4.5% to an annual rate of 801,000 units. Housing starts dropped 4.1% to an annual rate of 1.638 million units. Permits for future homebuilding rose 0.7% to a rate of 1.899 million units, the highest since 2006. Average home prices in major metropolitan areas rose a record 18.8% in 2021.
- **U.S. business activity** regained speed in February as the drag from the winter surge in COVID-19 infections diminished, but higher prices for inputs remained a burden amid lingering supply constraints. Data firm IHS Markit said its flash U.S. Composite PMI Output Index, which tracks the manufacturing and services sectors, rebounded to a reading of 56.0 from 51.1 in January. IHS attributed the sharp rise to employees returning from sick leave, increased traveling and greater availability of raw materials. Activity regained momentum in the manufacturing sector, with strong order growth and rising employment.
- **A new supply-blockages measure** developed by economists at the Federal Reserve Bank showed a record level of strain in November, but a decline in December, January and February which “seems to suggest that global supply chain pressures, while still historically high, have peaked and might start to moderate somewhat going forward”. From a peak of 4.5 in December, it has fallen over three consecutive months hitting 3.3 in February, with zero representing the index's long-term average.
 

**Blockages Easing**  
Logjams in global supply chains grew from late 2020, but have started to shrink in recent months.

**Global Supply Chain Pressure Index**

Month	Index Value
Dec 2020	0.5
Jan 2021	1.5
Feb 2021	3.5
Mar 2021	2.5
Apr 2021	2.0
May 2021	1.5
Jun 2021	2.0
Jul 2021	2.5
Aug 2021	3.0
Sep 2021	3.5
Oct 2021	4.0
Nov 2021	4.5
Dec 2021	4.0
Jan 2022	3.5
Feb 2022	3.3

**Key Update:** The lengthy backup of container ships waiting to unload in Southern California is shrinking. The number of container ships queuing to enter the ports of Los Angeles and Long Beach declined to 78 vessels on February 15, down from the peak of 109 ships reached a month earlier.
- **U.S. construction spending** surged 1.3% in January and 8.2% YOY, boosted by strong outlays on single-family homebuilding and private nonresidential structures. Still, homebuilding remains constrained by higher prices for building materials, especially framing lumber.
- **U.S. services industry activity** dropped to a one-year low in February and employment contracted. It was the third straight monthly decline despite Omicron coronavirus cases decreasing substantially from mid-January.

- **Tariffs on Japanese steel** imported into the U.S. will be eliminated under a new deal reached in February. The agreement will allow Japan to ship up to an annual 1.25 million tonnes of steel to the U.S. duty-free, a level similar to its exports in 2018 and 2019. Japan chose not to agree to a deal to eliminate the 10% aluminum tariff. Negotiations will continue on Japan's potential entry into a global effort to reduce excess capacity by China and other nonmarket economies and to cut the carbon emissions resulting from manufacturing of metals. The U.S. is currently in negotiations with the U.K., aiming to reach a similar tariff-reduction deal.
 

**Key Update:** The deal will help lower the costs of imported steel for U.S. users and discourage increases in imports with tariffs on shipments beyond the agreed-upon level.
- **Stainless steel sheet customers** endured another month of strong demand, customer tonnage allocations and long lead times in February. The mills fully implemented the January base price increase and higher raw material surcharges, resulting in higher transaction prices and inventory valuation. LME nickel averaged \$9.68/lb in the January surcharge period, up 54¢/lb from the prior month. That compares to \$7.92 a year ago. Stainless mills with full order books are pressing scrap processors for more material and prices were pulled higher by the rising price of nickel. LME nickel climbed over \$11/lb for the first time since 2011. The SMC strike continues, affecting the availability of special metals such as nickel-based alloys, with prices rising and lead times pushed out to 30-35 weeks.
- **U.S. steel mills** shipped 7.871 million tons of steel in December, up 11.7% from December 2020. Shipments for the full year 2021 were 94.719 million tons, a 16.9% increase vs. all of 2020. (See **Appendix: Steel**, page 9)
- **Foreign steel imports** into the U.S. in 2021 totaled 31.5 million tons, including 22.8 million tons of finished steel and represent increases of 43% and 41% respectively vs. the prior year. Of note, tinplate imports were up 14.2% to 877,698 tons last year. Data for January showed total steel imports at 3.079 million tons, including 2.265 million tons of finished steel. Finished steel import market share was 24% in January and 21% for full year 2021.
- **U.S ferrous scrap prices** are poised to increase sharply in the wake of Russia's invasion of Ukraine. Both countries are major exporters of steel, pig iron and ferrous scrap. The war may alter the global steel and scrap market indefinitely.



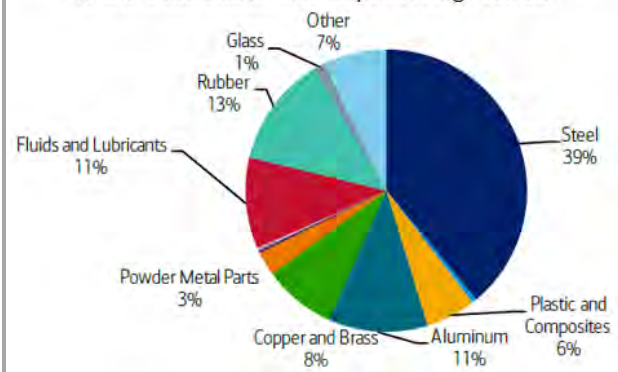
- **Alcoa** will no longer sell raw materials to Russian aluminum businesses in response to Russia's invasion of Ukraine. Alcoa supplied bauxite and alumina (crucial ingredients for making aluminum) to Russia's aluminum industry.

**Key Update:** *The war in Ukraine provides additional momentum for higher aluminum prices. Elevated demand for the metal, low inventories and rising costs for electricity to produce it have been boosting prices for months. The cash price on the London Metal Exchange is up 25% since January to nearly \$3,500/tonne.*

- **A polymer that has twice the yield strength of steel** but only a sixth of the density has been created by a team from MIT. The plastic could have a range of uses, from bridges and buildings to automobile or electronics manufacturing (ideal for phones). The material was developed using a polymerization technique that generates an impermeable sheet called a *polyaramide*, previously thought impossible to make. The material is six times stronger than bulletproof glass and could be used as a protective coating on surfaces.

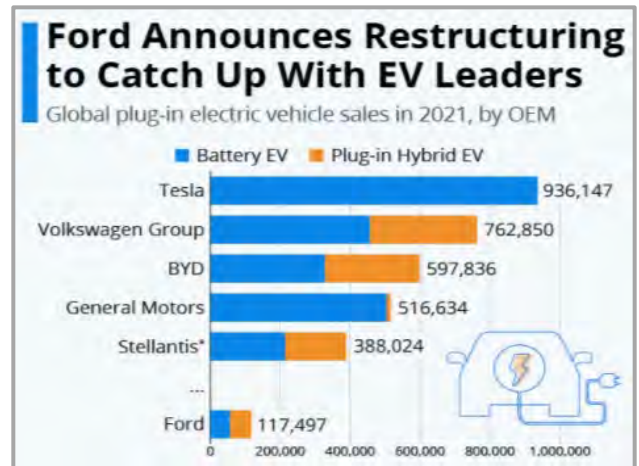
#### Raw material composition of an average US vehicle:

Total average around \$3,900. Steel currently comprises ~40% of \$ raw materials cost per average vehicle



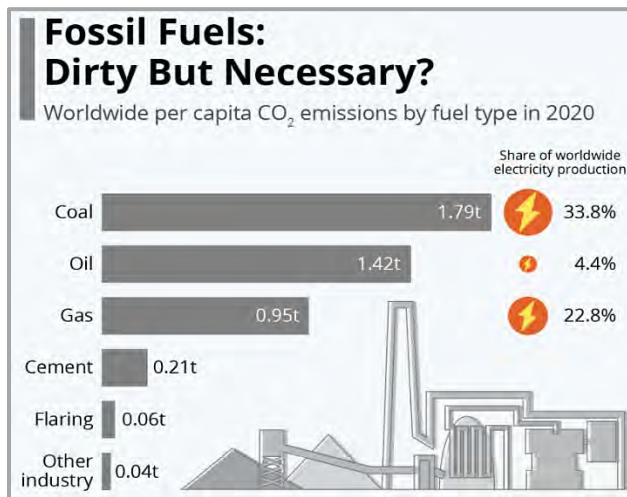
- **General Motors** plans to increase production of electric trucks and Cadillac sport utility vehicles this year by more than six times the previously planned output, according to information shared with suppliers. GM CEO Mary Barra said the automaker intended to accelerate production of electric vehicles, aiming to deliver 400,000 in North America during 2022 and 2023. (See [Appendix: Automotive](#), page 9)
- **Auto makers' third supply-chain crisis** in as many years has been unleashed by the fighting in Ukraine. After a pandemic and a global chip crunch, the fighting has shut down small but important industry suppliers' plants far away from the conflict zone. Sanctions and severed trade routes are hindering car and parts shipments to and from Russia, once a growth market. Analysts say the initial impact of the war on some car makers could lower global vehicle production by 1.5 million vehicles this year.

- **Ford Motors** announced a major restructuring, separating its legacy ICE (internal combustion engine) business from its electric vehicle division. The former, to be called Ford Blue, is supposed to take advantage of the company's portfolio of iconic ICE-powered vehicles in a very cost-effective manner. The EV division (Model e) is designed to bring "the focus and speed of a startup" to keep up with the dynamics of the EV market. Ford aims to produce 2+ million EVs per year by 2026 and to make half of its annual sales volume electric by 2030. In 2022, the company plans to invest \$5 billion in EV capacity, double the 2021 total.



- **Tritium, an Australian company** that makes chargers for electric vehicles, will build a manufacturing facility in Tennessee. Tritium's new plant will produce up to 30,000 electric vehicle chargers per year and create 500 jobs.
  - **Deere & Company** expects a margin boost from price hikes and solid demand for its tractors and combines in 2022. Equipment sales rose 6% to \$8.53bn for the 1<sup>st</sup>Qtr ended Jan. 30. Deere has raised equipment prices to combat rising shipping and supply chain costs, but that has not deterred demand, with the company's North American order books full for most of its large farm equipment in 2022.
  - **Tariffs on imported solar panels** were renewed for four years as the administration tries to boost U.S. manufacturing of clean energy infrastructure. However, it will continue to exempt the double-sided panels common in large projects from levies. It also doubled the amount of solar cells (which make up solar panels) that can be imported before tariffs are applied from 2.5 gigawatts to 5GW of generating capacity, giving relief to utilities and power producers worried about panel costs.
- Key Update:** *The price of solar panels declined in the decade from 2010, with the average value of shipments falling from \$1.96 per watt in 2010 to \$0.38 per watt in 2020.* (See [Appendix: Energy](#), page 12)

- **Coal and gas** combined amount to more than half of the world's current energy production. In 2020, the coal industry released roughly 1.8 tons of CO<sub>2</sub> per person into the atmosphere, followed by 1.4 tons from oil and roughly one ton from the gas sector. Bigger economies are still largely reliant on fossil fuels for their energy needs. The electricity mix in China and the U.S. is comprised of 66% and 60% fossil fuels, respectively. While the U.S. relies on nuclear energy and renewables for 20% each, China's energy mix already contains 29% renewables. A short-term solution could be turning to nuclear energy, a strategy that France, Japan and India are already relying on.



- **The U.S. coal industry** is raking in money. In February, America's biggest coal mining companies reported profit bonanzas, notching up some of their best results in decades due to resurgent demand and soaring prices. Volumes of coal burnt in power stations jumped an estimated 20% last year to 503 million tons, the first annual rise in coal generation since 2014. This helped push energy-related carbon emissions up more than 6% in 2021. Coal emits roughly double the CO<sub>2</sub> of natural gas. The trend mirrors the international picture, with global power generation from coal jumping 9% last year to an all-time high.  
***Key Update:** The respite for coal will be short-lived. Analysts estimate 94 gigawatts of coal-fired power capacity — half of the U.S. fleet — will be shut by 2030. Two of the biggest electric utilities, Duke Energy and Georgia Power, have announced plans to phase out their coal generation by 2035.*
- **SpaceX** is ramping up satellite deployments to power Starlink, the high-speed internet service the company has been rolling out around the world. SpaceX asked the FCC to authorize 30,000 additional satellites. NASA raised concerns (collisions) about boosting the number of tracked objects in space—by a factor of more than five in certain lower orbits.

- **A Department of Defense report** has detailed the post-cold war surge in mergers which have shrunk the number of American defense prime contractors from 51 in 1990 to 5 today: Lockheed Martin, Raytheon, General Dynamics, Northrop Grumman and Boeing. Decades of mergers in the American defense sector have left the U.S. military less well-equipped and has needlessly overburdened taxpayers, according to the Pentagon report which is aimed at reversing the consolidation trend.



- **Key Update:** *In a sign of the new approach, Lockheed Martin dropped its \$4.4bn bid to buy rocket engine maker Aerojet Rocketdyne after the FTC sued to block the deal, claiming it would reduce competition and raise prices in the sector.*
- **U.S. passenger airlines** carried 670 million passengers in 2021, up 83% over 2020 levels but still down significantly from pre-coronavirus pandemic levels. Airlines carried 303 million more passengers in 2021 but 245 million fewer, or 27%, than in 2019. Domestic flights in 2019 accounted for 88% of all passengers, while domestic trips accounted for 91% of all passengers in 2021, and international flights accounted for 9%. U.S. air passenger travel fell 60% in 2020 to the lowest level since 1984, down 549 million passengers from 2019. (See **Appendix: Aerospace**, page 14)
- **American Airlines** is further trimming its summer flying schedule due to continuing delays in delivering new Boeing 787 Dreamliners. American, which had originally planned to have 13 new Dreamliners for this summer's schedule, first trimmed its plans in December but had planned on flying passengers with four new 787s that it had expected to receive in the spring. Now, it is removing those remaining Dreamliners from its summer schedule.
- **Moderna** expects the pandemic to end this year ("an 80% chance" said CEO Stéphane Bancel) but has forecast that a seasonal booster shot will be needed in the autumn to protect people from "breakthrough" infections. The drugmaker is developing a bivalent booster combining its Spikevax COVID-19 vaccine and an Omicron-specific booster, which it believes would provide more durable protection against coronavirus variants. It is pushing ahead with clinical trials of a combination COVID-19 and flu vaccine and other drug candidates — a move that comes amid investor concerns about future Spikevax sales owing to competition from new vaccines and COVID-19 entering an endemic phase. (See **Appendix: Medical**, page 11)

## EUROPE, AFRICA & THE MIDDLE EAST

- **Russia's invasion of Ukraine** risks disrupting the export of critical commodities and rupturing supply chains. Russia is a key source of metals used in manufacturing such as nickel, titanium, palladium and aluminum. Titanium is needed by aircraft and aero-engine manufacturers such as Boeing, Airbus and Rolls-Royce, while palladium is used in catalytic converters, electrodes and electronics. Ukraine-based Ferrexpo is the world's third-largest exporter of high-grade iron ore pellets. Russia and Ukraine are key sources of chemical gases that are vital for semiconductor production. Chip manufacturers could be among the most badly affected if supplies from Ukraine are severely hampered for an extended period. Ukraine is home to factories that make car parts, connecting it to the supply chains for both the Russian and the broader European auto industry.



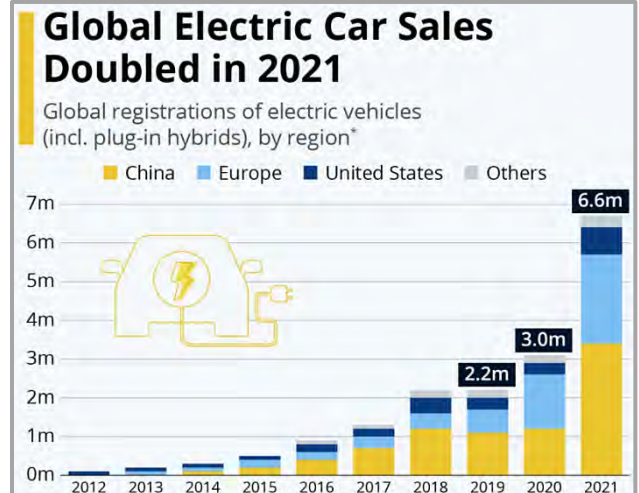
**Key Update:** Rabobank said that a prolonged conflict and tough sanctions may deliver the "same kind of shock as COVID-19, when we found out that this elegant, concentrated, just-in-time structure we had built up is flawed".

- **The European Commission** unveiled a €43Bn investment plan to promote research and production of higher tech chips used in computers, smart-phones and vehicles. The plan aims to double the EU's share of the semiconductor market to 20% in 2030 by quadrupling output. Brussels and national governments would spend €11Bn to build three pilot facilities for any company to use. Member states and businesses are to invest a further €32Bn by 2030.
- **The global energy markets** are in turmoil, with natural gas prices in Europe at record highs. Natural gas is the primary marginal driver of electricity prices in most European countries and electricity costs for many users are up 20%. Electricity buyers may see a further 70% increase in 2022 and another price jump in 2023. Energy accounts for around 40% of operating costs at aluminum smelters, implying that this year's 70% increase of energy prices could lift operating expenses by as much as 30% at some smelters.
- **Eight carmakers** announced factory closures or froze sales to Russia as the industrial fallout from the country's invasion of Ukraine spread. Porsche and BMW became the latest groups to shut European plants because of a lack of parts from Ukraine, while Toyota and Hyundai, which is one of the largest brands in Russia, will cease manufacturing in the country. Ford, Renault and BMW have already closed Russian plants. (See [Appendix: Automotive](#), page 9)

- **Bosch** will spend €2 billion retraining part of its 400,000 staff to limit further job losses as the car industry switches from combustion engines to electric technology. The move by Europe's largest car parts supplier follows warnings that the EU target of phasing out gasoline and diesel engines by 2035 could cost hundreds of thousands of jobs.

**Key Update:** European parts suppliers have raised the alarm about the consequences of a rapid shift to battery-powered cars. Clepa, the European association of automotive suppliers, warned that 500,000 jobs could be eliminated under EU plans for the decarbonization of transport.

- **Global electric car sales** more than doubled over the past twelve months, reaching 6.6 million, compared to 3 million in 2020. While 2021 was another difficult year for the auto industry, hampered by the global chip shortage, all net growth in global car sales can be attributed to EVs.

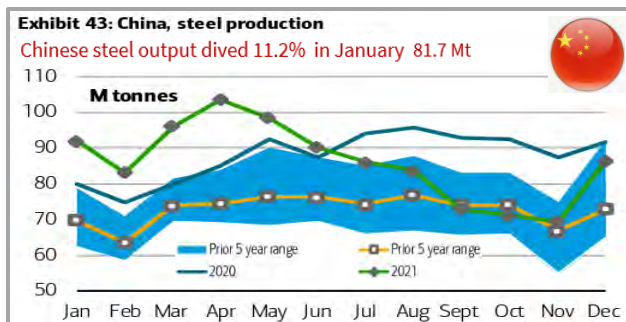


- **Arcelor Mittal** said the French government will support its decarbonization plan, which includes investments of US\$1.95 billion in facilities at the company's mills in Fos-sur-Mer and Dunkirk. ArcelorMittal said the investment will help achieve its goal of cutting carbon emissions from producing steel by 40%, or 7.8 million metric tons/year, by 2030. The steelmaker plans to install an electric arc furnace in Fos-sur-Mer, using the electric power grid rather than coal, while banking on hydrogen combined with an electric furnace at the Dunkirk site.
- **Airbus** earned record annual profits of €4.86Bn last year, up from €1.7Bn a year earlier, restored its dividend and struck an optimistic note about prospects for a sustained rebound in the aviation industry. Airbus continues to have an impressive order backlog. It exited the year with more than 7,000 firm orders for its commercial jets. Airbus expects to deliver about 720 commercial jets this year, which would represent an 18% YOY increase.



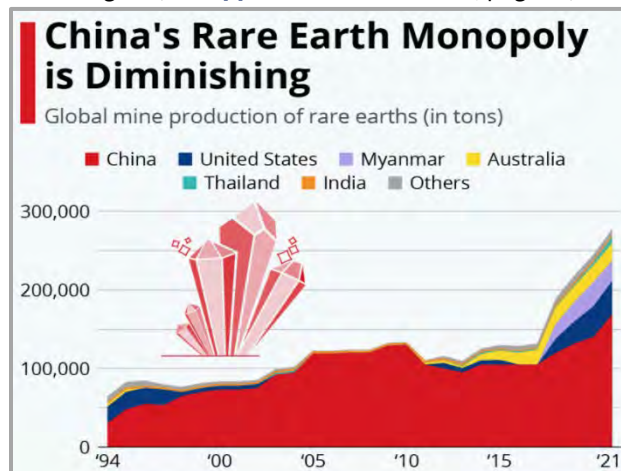
## ASIA/PACIFIC, JAPAN, AUSTRALIA & INDIA

- **China's factory activity** unexpectedly expanded in February as new orders improved, pointing to some resilience in the world's second-largest economy even as downward pressure builds and Russia's invasion of Ukraine heightens global uncertainty. Policymakers have vowed to stabilize growth this year and all eyes are on the annual meeting of its top legislative body in March, during which the government will unveil economic targets for the year and will likely institute more stimulus measures.
- **Japan's economy** rebounded in the 4<sup>th</sup>Qtr of 2021, as a relaxation of COVID restrictions prompted a boost in consumer spending. Japan's GDP rose an annualized 5.4% during the October to December period. For the whole of 2021, Japan's GDP rose 1.7%, turning positive for the first time in three years. In 2020, Japan posted a 4.5% decrease.  
*Key Update: Economists believe that Omicron, which hit domestic travel and caused some manufacturers to halt production, may have caused a slowdown or even a contraction in consumer spending during the 1<sup>st</sup>Qtr of 2022.*
- **Total world crude steel production** was 155.0 million tonnes (Mt) in January, a 6.1% drop compared to a year ago. Chinese crude steel output fell 11.2% to 81.7 Mt vs. January 2021. The U.S. produced 7.3 Mt, a gain of 4.2%. China's share of January's total crude steel output was 52.7%.



- **China's tokamak facility** was able to hold 120Mn C° plasma for 1,056 seconds, a new record for holding superheated plasma. The work is dedicated to the development of fusion as a power source that could replace coal-fired power plants and other non-renewable resources.
- **BMW** will pay \$4.2 billion to take majority control of its Chinese joint venture, as global automakers seek a tighter grip on business in the world's biggest car market. BMW is increasing its stake in the venture with Brilliance Auto to 75% from 50%. China said in 2018 it would remove foreign ownership caps for companies making fully electric and plug-in hybrid vehicles in 2018, for makers of commercial vehicles in 2020 and for the wider car market by 2022.

- **Precious rare earths** that are important in the production of microchips, electronics and electric motors have been almost exclusively sourced in China. In recent years, several nations have picked up production again and new players entered the market, diversifying it to some degree. The U.S. once mined and produced rare earths for military uses and has re-entered the market as rare earths were getting more important as a part of the implementation of crucial technologies. (See [Appendix: Commodities](#), page 15)



- **Sumitomo Metal Mining Co. (SMM)** will increase its capital expenditure to boost its output capacity of nickel and cathode materials used in batteries. The Japanese miner/smelter plans to spend US\$4.3 billion over the next three years. To secure nickel, SMM plans to make an investment decision on the Pomalaa nickel project in Indonesia. SMM supplies the nickel-cobalt-aluminum (NCA) cathode materials used in Panasonic Corp's lithium-ion battery that powers Tesla's Model 3 and Model X cars.  
*Key Update: Indonesian nickel miner PT Vale Indonesia said it aims to start construction at its Pomalaa project this year and expects completion by 2026.*
- **Stockpiles of important commodities** are at historically low levels. A large number of commodities on the futures market have flipped into backwardation, a pricing structure that signals scarcity. Problems are particularly acute in metals. Copper stocks at major commodity exchanges were just over 400k/tonnes, less than a week of global consumption. Aluminum stocks are also low, as smelters in Europe and China have been forced to cut capacity because of spiraling energy costs. Citigroup reckons demand for lithium will outstrip supply by 6% this year due to rising sales of electric vehicles.
- **China's five-year plan** for the development of its space industry will include a satellite launch center in Pakistan and steps to develop an inhabitable Moon base by 2035.



## ECONOMIC UPDATE: APPENDIX TO THE MARCH 2022 ISSUE

## STEEL: SOLAR ENERGY IS FUELING MORE SUSTAINABLE STEEL PRODUCTION

**The integration of solar energy is helping usher in a new era of more sustainable steel production, with facilities making the switch to renewable power.** As the world becomes more and more focused on limiting the global temperature rise, industries across the world are working to limit their emissions and stop using fossil fuels where possible, including giants such as Amazon, Apple and Walmart. Following this boom in demand for renewable energy technologies, steel-making facilities are increasingly exploring the opportunities that solar represents for steel production. Steel is a resource- and emissions-heavy industry, but is also one that plays a vital role in producing the materials needed for the transition to a more sustainable global economic model. Wind turbines, solar farms and hydroelectric dams are all steel-intensive infrastructure that underpin renewable energy production. If the world is to successfully limit the impacts of climate change, it will be relying on steel to help get there. The industry has been hard at work on improving the efficiency of its operations– producing a ton of steel takes 40% less energy than it did in 1960 – and solar is set to play a key role in improving steel’s sustainability.



**The world’s first solar-powered steel mills:** Traditional steel production uses large amounts of fossil fuel energy to generate the temperatures needed, but the industry is working hard to find alternative ways of powering this process. Three of the world’s top steel producing companies are already taking the leap towards solar powered steel production.

**In Pueblo, Colorado, EVRAZ North America has announced that solar energy will power its steelmaking operations there.** The Pueblo site operates an electric arc furnace that can produce finished steel from recycled ferrous scrap, making it Colorado’s largest recycler. Its recently unveiled Bighorn solar project will reduce emissions, and the mill will be the world’s first to be powered largely by solar energy. Modern steelmaking techniques allow EVRAZ to create longer rails, meaning safer, quieter train journeys. The project boasts a 300-MW DC/240 MW AC solar field located on 2.82 square miles of land and is the largest on-site solar facility in the U.S. dedicated to a single customer. The site’s 750,000 solar panels provide nearly all the plant’s annual electricity demand. “This pioneering partnership will make EVRAZ North America the industry leader in the use of renewable energy to produce the greenest steel and engineered steel products in the world, from rail to rod and bar,” said James Herald, president and CEO of EVRAZ North America.



**Nucor is also working on a 250MW of solar energy project to be constructed in Texas.** Unlike the single site Pueblo facility, this project will produce electricity that will power Nucor’s entire North American operations. The Nucor project involved the signing of a virtual power purchase agreement with EDF renewables North America that will run for 15 years, in a deal that is the largest of its kind for the steel industry. “Nucor is one of the most efficient and cleanest steel producers in the world and we are always looking for ways to reduce our carbon footprint,” said Leon Topalian, President and CEO of Nucor Corporation. “That is why we are proud to make our production process even cleaner by supporting the development of this solar energy project.” Construction is expected to begin in the summer of 2022 with electricity production slated to begin in 2023.

**Tata Steel and Tata Power are working together on a grid-connected 41MW solar project in Jharkhand and Odisha, India.** Using rooftop, floating and ground-mounted solar panels, the project will produce solar power for the Jamshedpur and Kalinganagar steel mills, saving 45,210 tonnes of CO<sub>2</sub> per year. T. V. Narendran, CEO & MD of Tata Steel, said, “We have taken several definitive steps across the value chain to reinforce our sustainability credentials. We will continue with our pursuit of clean energy solutions and expand our renewable energy footprint.” In 2017, the two companies also collaborated on the commissioning of a 3MW photovoltaic power plant at Tata Steel’s iron ore mine in Noamundi. This made it the first solar powered iron mine in the country and underlined Tata Steel’s commitment to whole lifecycle thinking in its approach to reducing the emissions associated with steelmaking. Steel produced by these innovative companies will be among the greenest on the planet. As the industry increasingly moves away from coal powered operations, the world’s steel is set to get more sustainable.



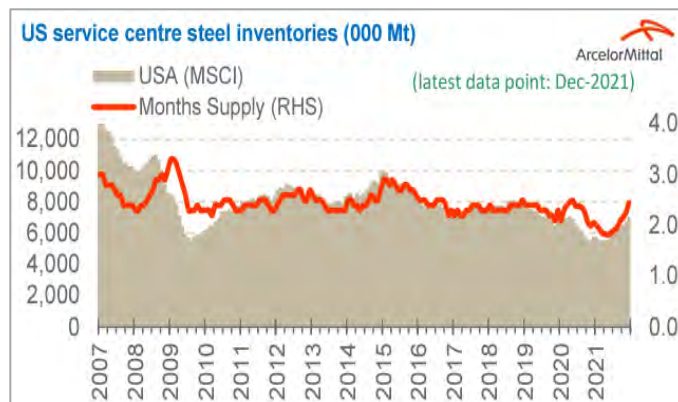
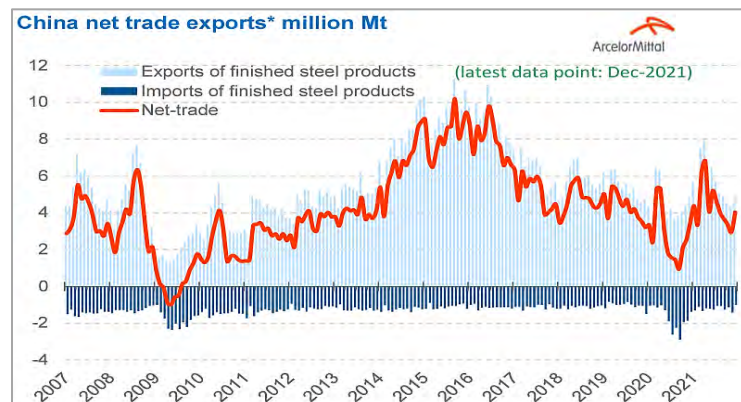


## STEEL: ARCELORMITTAL'S CURENT FORECAST — STEEL MARKET CONDITIONS REMAIN SUPPORTIVE

The year 2021 was characterized by recovering real demand, augmented by the required replenishment of inventories. The restocking effect has now run its course, with inventories returning to normal levels. **However, the real demand recovery continues, and this is expected to support further apparent demand growth in 2022, particularly if the automotive supply chain constraints ease. The medium to longer term fundamental outlook for steel is positive.** The global steel industry is expected to benefit from the structural changes that are occurring, including China's focus on decarbonization and removal of VAT rebates on steel exports, and the actions taken by governments to protect against the threats of unfair trade. Steel will play a critical and vital role in the transition to a decarbonized and circular economy.

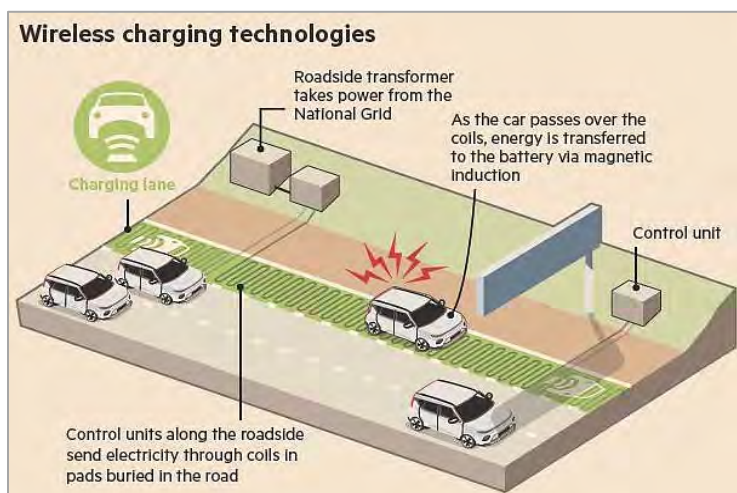


(AM Financial Results/Strategic Update, 2/10/2022)



## AUTOMOTIVE/INNOVATION: WIRELESSLY CHARGE ELECTRIC VEHICLES WHILE DRIVING

Swiss building materials producer Holcim has entered into a strategic partnership with German startup Magment. The aim of the cooperation is to improve Magment's magnetizable concrete technology for road surfaces, which can be used to wirelessly charge electric vehicles while driving. Magment is magnetizable concrete made from cement and magnetic particles from recycled electronic waste. Holcim calls the technology a "groundbreaking concrete-based solution" that is expected to reduce the need for charging stations and also save users time. The announcement said, "It is made possible by a unique concrete with high magnetic permeability jointly developed by Holcim and Magment's R&D teams." Although the strategic partnership has only just been announced, the two companies have already been working together in the background. **The technology is currently being tested by researchers at Purdue University, including on Indiana highways.** Other applications under development include the electrification of industrial floors to charge robots and forklifts while they work. Imagine the road itself powering and charging your vehicle as you drive along. Visions of a grown-up version of slot-car racing toys spring to mind. Could this be the way to close the charging-supply gap? For example, the UK government recognizes there is a lack of chargers. In order to meet the UK's 2050 net zero carbon goals, it must intervene. There are only 25,000 charge points in the UK or 34 per 100,000 people. That number must rise to almost half a million by 2030. The biggest problem with magnetic tarmac is that deploying the technology widely would mean replacing a lot of road. Waiting in traffic at road construction sites would only increase range anxiety for EV owners.



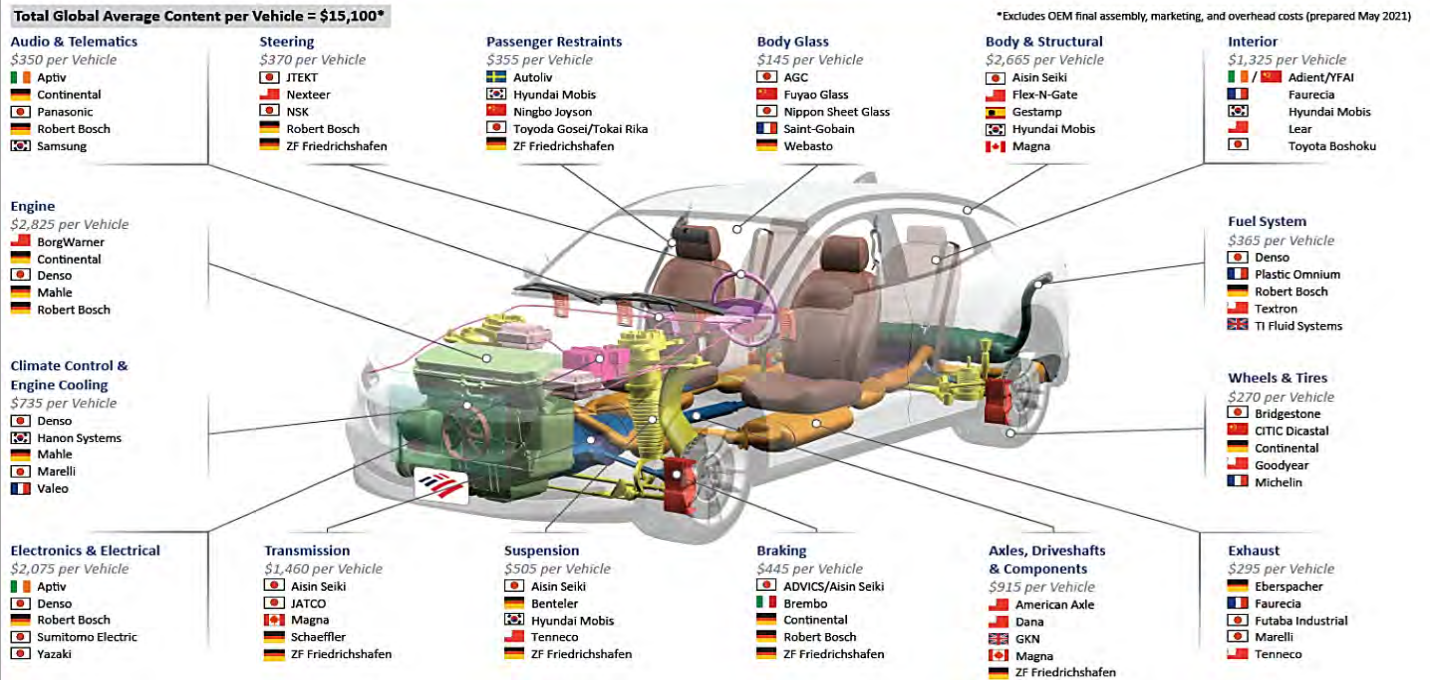


## AUTOMOTIVE: WHO MAKES THE CAR? - MAJOR COMPONENT SYSTEMS FOR ICE OR ELECTRIC VEHICLES

### Who Makes the Car – 2021

Major Component Systems, Estimated Content per Vehicle and Key Global Suppliers

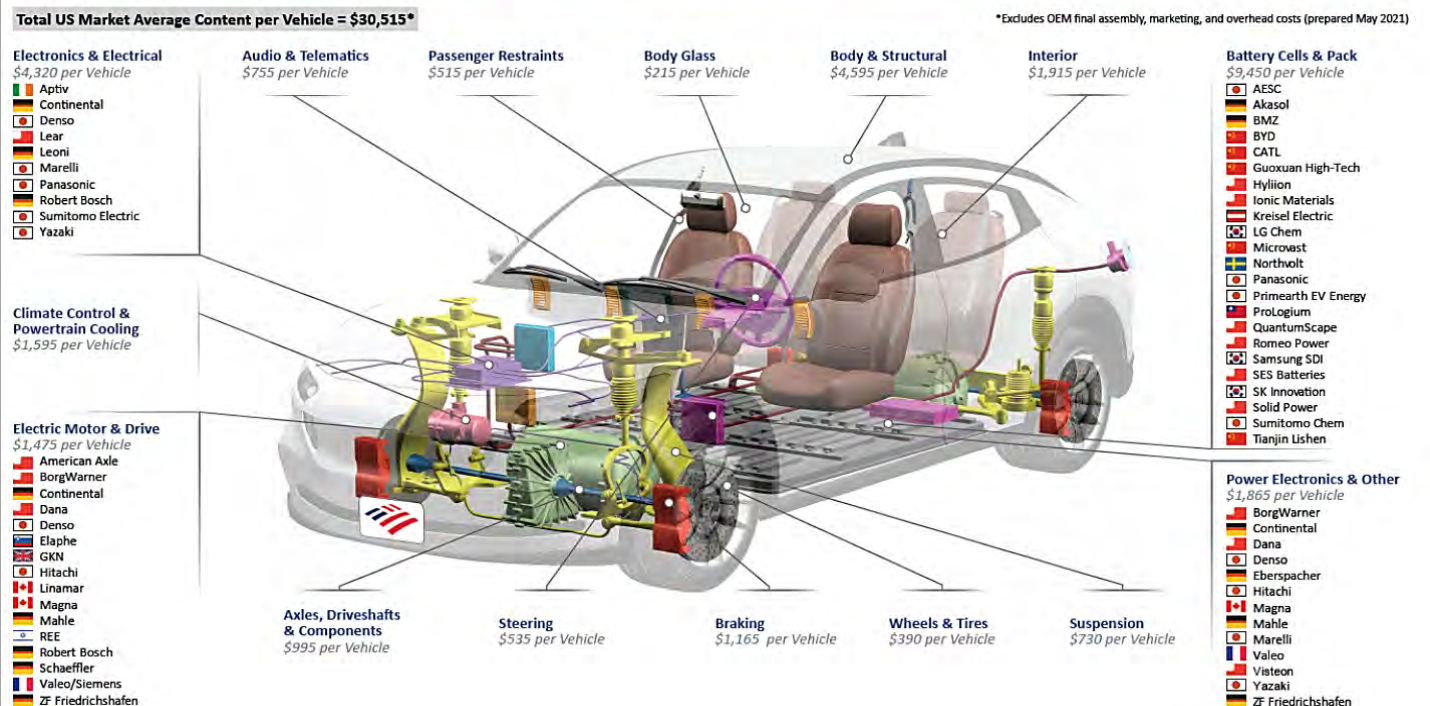
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### Who Makes the Electric Car – 2021

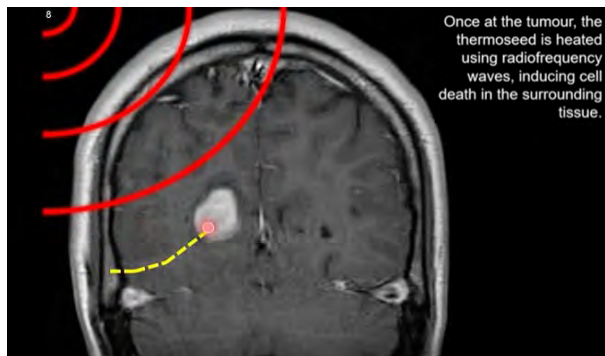
Major Component Systems, Estimated Content per Vehicle and Key Global Suppliers

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## MEDICAL/INNOVATION: NEW THERAPY USES FERROMAGNETIC SEEDS TO HEAT AND KILL CANCER

Scientists at University College London have developed a novel cancer therapy that uses an MRI scanner to guide a magnetic seed through the brain to heat and destroy tumors. **The therapy, demonstrated in mice, is called *minimally invasive image-guided ablation*, or MINIMA, and comprises a ferromagnetic thermoseed navigated to a tumor using magnetic propulsion gradients generated by an MRI scanner, before being remotely heated to kill nearby cancer cells.** Researchers say the findings establish proof-of-concept for precise and effective treatment of hard-to-reach glioblastoma, along with other cancers such as prostate that could benefit from less

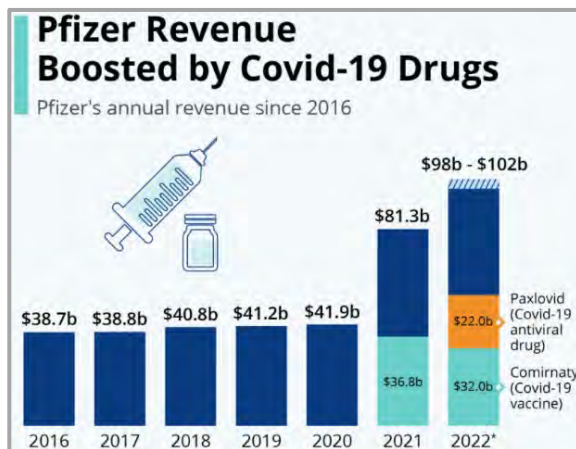


invasive therapies. Senior author Professor Mark Lythgoe said, "MINIMA is a new MRI-guided therapy that has the potential to avoid traditional side effects by precisely treating the tumor without harming healthy tissues. Because the heating seed is magnetic, the magnetic fields in the MRI scanner can be used to remotely steer the seed through tissue to the tumor. Once at the tumor, the seed can then be heated, destroying the cancer cells, while causing limited damage to surrounding healthy tissues." In the study, the UCL team demonstrate the three key components of MINIMA to a high level of accuracy: Precise seed imaging; navigation through brain tissue using a tailored MRI system, tracked to within 0.3mm accuracy; and eradicating the tumor by

heating it in a mouse model. Ferromagnetic thermoseeds are spherical in shape, 2mm in size and made of a metal alloy. They are implanted superficially into tissue before being navigated to the cancer. Lead author Rebecca Baker said, "Using an MRI scanner to deliver a therapy in this way allows the therapeutic seed and the tumor to be imaged throughout the procedure, ensuring the treatment is delivered with precision and without having to perform open surgery. This could be beneficial to patients by reducing recovery times and minimizing the chance of side effects." MRI scanners are readily available in hospitals around the world and are pivotal in the diagnosis of diseases such as cancer. **The work at UCL shows that MINIMA has the potential to elevate an MRI scanner from a diagnostic device to a therapeutic platform.** Professor Lythgoe added, "We are now able to image and navigate a thermoseed in real-time through the brain using an MRI scanner. As MRI is already used to detect the boundaries of cancers, the seed can be moved precisely to ensure it does not stray into surrounding healthy tissue. As the seed is guided through the tissue, it can be heated to destroy the cancer. This combines therapy and diagnosis into a single device, creating a completely new class of imaging therapy."

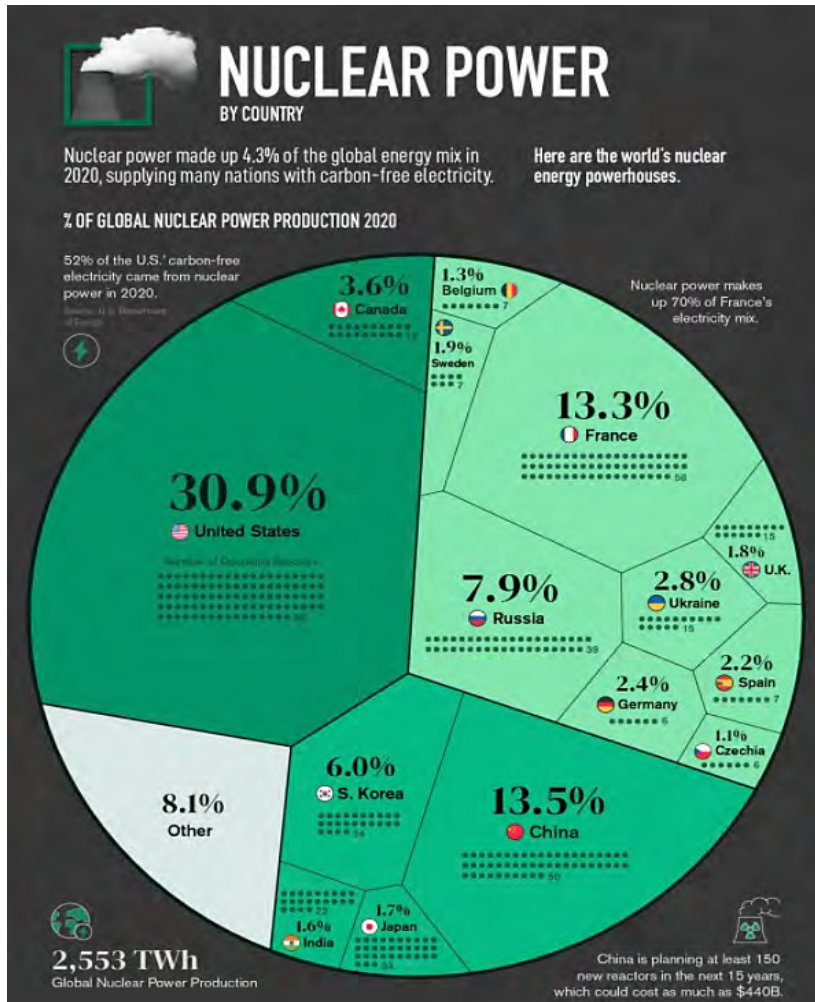
## MEDICAL: PFIZER REVENUE BOOSTED BY COVID-19 DRUGS

Pfizer reported its 4<sup>th</sup>Qtr and full-year results in February, beating profit estimates and falling just short of consensus revenue expectations. The U.S. pharmaceutical giant reported \$21.98 billion in net profit on revenue of \$81.29 billion for 2021, mainly due to its COVID-19 vaccine. **BNT162b2 or Comirnaty, as the drug is officially called, accounted for 45% of Pfizer's revenue last year, dwarfing any other drug in the company's vast portfolio.** Pfizer, who developed the vaccine in cooperation with German biotechnology company BioNTech, manufactured more than 3 billion doses of the mRNA vaccine last year, which ended up contributing \$36.8 billion to the company's record revenue. For 2022, Pfizer currently expects \$32 billion in COVID-19 vaccine sales plus \$22 billion in sales of its oral COVID-19 antiviral drug Paxlovid. Both estimates are based on supply contracts signed or committed to as of late January, meaning that the figures could be adjusted upwards over the course of the year. "In the early days of the COVID-19 pandemic, we committed to use all of the resources and expertise we had at our disposal to help protect populations globally against this deadly virus, as well as to offer treatments to help avoid the worst outcomes when infections do occur," Dr. Albert Bourla, Pfizer's Chairman and CEO, said in a statement. "We put billions of dollars of capital on the line in pursuit of those goals, not knowing whether those investments would ever pay off. Now, less than two years since we made that commitment, we are proud to say that we have delivered both the first FDA-authorized vaccine against COVID-19 (with our partner, BioNTech) and the first FDA-authorized oral treatment for COVID-19."





## ENERGY: NUCLEAR POWER PRODUCTION BY COUNTRY



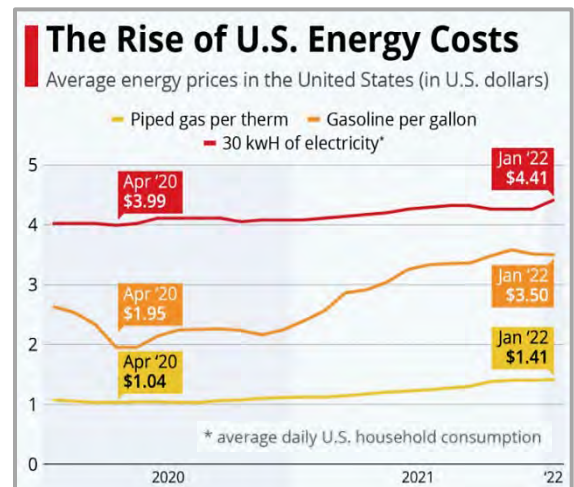
Nearly 450 reactors around the world supply various nations with nuclear power, combining for about 10% of the world's electricity, or about 4% of the global energy mix. But while some countries are turning to nuclear as a clean energy source, nuclear energy generation overall has seen a slowdown since its peak in the 1990s. This infographic breaks down nuclear electricity generation by country in 2020 using data from the Power Reactor Information System (PRIS).

**The Top 15 Countries for Nuclear Power:** Just 15 countries account for more than 91% of global nuclear power production. In the U.S., nuclear power produces over 50% of the country's clean electricity. Additionally, 88 of the country's 96 operating reactors in 2020 received approvals for a 20-year life extension. The U.S. ranks 17<sup>th</sup> by share of nuclear power in its mix, despite producing 31% of global nuclear electricity in 2020. This discrepancy is largely due to size and population. China, the world's second-largest nuclear power producer, is investing further in nuclear energy in a bid to achieve its climate goals. The plan, which includes building 150 new reactors by 2035, could cost as much as \$440 billion. On the other hand, European opinions on nuclear energy are mixed. Germany is the eighth-largest on the list but plans to shutter its last operating reactor in 2022 as part of its nuclear phase-out. Meanwhile, France plans to expand its nuclear capacity.

**The Future of Nuclear Power:** The nuclear power landscape is constantly changing. There were over 50 additional nuclear reactors under construction in 2020 and hundreds more are planned, primarily in Asia. As countries turn away from fossil fuels and embrace carbon-free energy sources, nuclear energy might see a resurgence in the global energy mix despite the phase-outs planned in several countries around the globe.

## ENERGY: HIGHER U.S. COSTS ARE ONE CONSEQUENCE OF THE CONFRONTATION WITH RUSSIA

Rising energy costs are an immediate consequence for Americans of the confrontation between Russia and Western powers over Ukraine. With Russia being a major energy supplier, sanctions against the country have affected energy prices in Europe, the U.S. and around the world. The prospect of even higher energy costs is sure to dismay many Americans, as prices have already risen quite a bit in the current pandemic-induced high-inflation environment. Numbers from the Bureau of Labor Statistics show the price increase of different types of energy in the U.S. over the past two years. **Gasoline has proven the most volatile over the pandemic period, reaching a low of \$1.95/gallon in April 2020 before hitting \$3.50 most recently.** Natural gas, which is one of the major energy exports of Russia to Europe, cost just over \$1.00 in early 2020 for one therm, the approximate average daily consumption of a U.S. household in a warmer climate. The same amount of natural gas was around 35% more expensive in Jan 2022, while the average daily electricity use in the U.S. was about 10% pricier.



## INNOVATION: 14 “MOONSHOT” TECHNOLOGY GOALS — WHAT IS NEXT FOR TECHNOLOGY?

COMPUTATIONAL TECH	HUMAN TECH	CONSUMER TECH	GREEN TECH
6G	Bionic Humans	Wireless Electricity	OceanTech
Emotional AI	Immortality	Holograms	Nextgen Batteries
Brain Computer Interfaces	Synthetic Biology	Metaverse	Green Mining
		eVTOL	Carbon Capture & Storage

**Synthetic Biology:** This is a field of science that combines features of molecular biology, genomics, chemistry, engineering, machine learning and computer science. “Synbio” takes advantage of the vast diversity of nature to make biomolecules traditional chemistry can’t.

**Immortality:** Breakthroughs in healthtech, biotech and anti-aging drugs could result in radical life extension that ‘disrupts death’. Aging has not been viewed as a disease that can be treated but this is changing. Actors in this space are increasingly looking to tackle the hallmark of aging via pathways such as genomic instability, telomere attrition, mitochondrial dysfunction and cellular senescence.

**Bionic Humans:** Augmentation technology that seeks to extend and expand physical human capabilities. This could be invasive (e.g., implants) or non-invasive (e.g., exoskeleton). Biohacking is also an associated field which is essentially applying DIY biology to boost oneself, e.g., RFID chip in hand for contactless payments.

**eVTOL:** Electrical vertical takeoff and landing vehicles could provide an alternative mobility transportation solution to outdated infrastructure and overly stressed urban roads.

**Wireless Electricity:** As the IoT takes off, automating and creating near continuous charging solutions could provide convenience for consumers, solve charging problems for EVs and secure electricity supplies for remote communities.

**Holograms:** A technology capable of creating a simulated environment through light imagery projections that will allow everyone to come together in one virtual room, without having to leave their physical location. Unlike virtual/augmented reality, it does not require users to wear glasses or head-mounted devices (HMDs).

**Metaverse:** It describes the concept of a future iteration of the Internet, made up of persistent, shared 3D-shared spaces linked into a virtual universe. It could comprise countless persistent virtual worlds that interoperate with one another, as well as the physical world, transforming markets such as gaming, retail and entertainment.

**Nextgen Batteries:** While lithium batteries are the major EV technology, this does not necessarily need to continue with alternatives such as solid state, vanadium flow and sodium ion provide promising faster charging, greater energy densities and better reusability.

**OceanTech:** Aka Blue Economy, it is focused on products that work in or use the ocean. It seeks to increase sustainability of the ocean economy while harnessing its benefits. Solutions could include ocean energy, land-based aquaculture and precision fishing using AI.

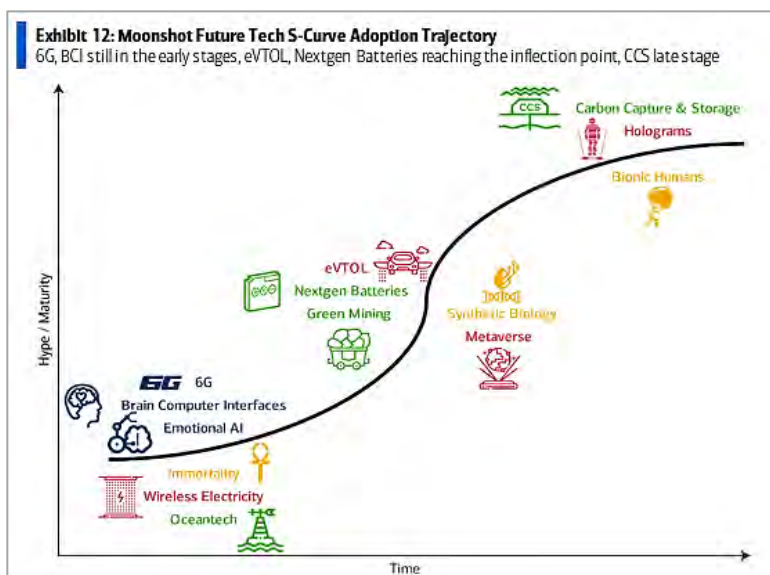
**Green Mining:** Transitioning away from a carbon intensive economy will mean moving to a metal-intensive one. Green mining solutions like deep-sea mining, agromining, mining of wastewater and asteroid mining could provide less polluting and destructive solutions as the green economy’s thirst for metals grows.

**Carbon Capture & Storage (CCS):** All current zero-carbon pathways require some form of CO<sub>2</sub> removal. CCS could act as part of the solution with long-term permanent removal of CO<sub>2</sub> vs. afforestation, a process where new forests are planted across land without trees.

**6G:** The next generation of telecom networks will be needed in less than a decade as data continues to grow exponentially.

**Brain Computer Interfaces:** When humans are unable to keep up with computers and AI, brain computer interfaces could help ‘level up’ humans with computers. Shorter term, brain computer interfaces hold solutions for paralyzed individuals and promise a new wave of innovation in gaming.

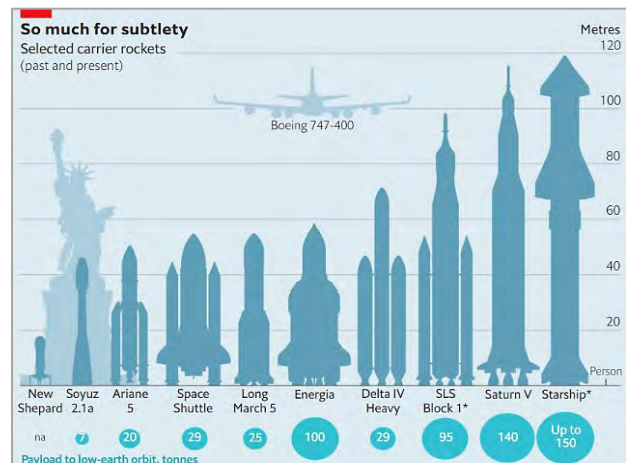
**Emotional Artificial Intelligence:** Emotional AI (EAI) or “Cognitive Computing” is designed to capture, analyze and respond to human emotions and simulate human thoughts. EAI can collect, analyze and respond to completely new varieties of data/situations and predict or simulate human thought, leading people to take action.





## AEROSPACE/STAINLESS: SPACEX'S MONSTROUS, DIRT-CHEAP STARSHIP MAY TRANSFORM SPACE TRAVEL

When it comes to size and spectacle, the peak of the Space Age passed in 1973, with the final flight of the Saturn V rocket that had carried the Apollo astronauts to the moon. Taller than the Statue of Liberty, the Saturn V could lug 140 tonnes into orbit. Despite half a century of

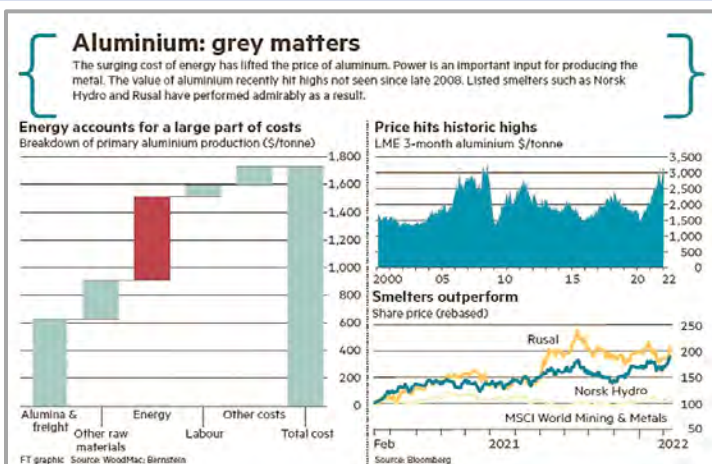


technological progress, nothing as powerful has reached orbit since Saturn V (see chart at left). SpaceX, a rocketry firm founded by Elon Musk, is developing a machine that it hopes will change that. **Built from gleaming stainless steel, with its nose adorned with fins and ten meters taller than even the Saturn V, “Starship” looks like something from the cover of a 1950s pulp science-fiction magazine.** Its planned payload of up to 150 tonnes means that five Starship flights could put more stuff into space than the rest of the world managed with 135 rocket launches in 2021. Its upper stage contains more pressurized volume than the International Space Station, which took a decade, dozens of launches and perhaps \$100bn to assemble. When a Saturn V took off to send men to the moon, the only bit of the 2,800 tonnes of hardware which came back was a cramped five-tonne capsule with three men inside. Each new mission meant a new Saturn V. With

Starship, the idea is that all the hardware will come back. Starship was originally going to be built from high-tech carbon-fibre composites, which are both very strong and very light. But in 2019, SpaceX changed its mind and went back to the drawing board. Carbon composites have several disadvantages. They are porous, hard to work with and need to be cured in an autoclave—not easy when making rocket-body segments that are 9 meters across and, at around \$130 per kilogram, composites are expensive. Stainless steel, by contrast, is strong but heavy, not an obvious choice for rocket-building. Some steel alloys get significantly stronger as they cool down, meaning less is required for a given strength and since Starship uses cryogenic propellant, cooling is in abundant supply. Steel is tougher, which can save weight elsewhere. SpaceX hopes to get away with applying a heat shield to only the “windward” part of the upper stage, which feels the full force of re-entry heating, leaving the “leeward” side as bare metal and saving mass. **Stainless steel does not need painting, which cuts weight a bit more. It is much easier to work with and costs mere dollars per kilogram.** For a company that intends to mass-produce its gigantic rocket, that matters. It has served SpaceX well so far. It has pulled off 111 Falcon 9 launches in a row without failure, making it one of the most reliable rockets ever flown. Some individual Falcon-9 first stages have already been launched ten times.

## COMMODITIES: THE SURGING COST OF ENERGY HAS LIFTED THE PRICE OF ALUMINUM

Electricity is an essential input for producing aluminum. Commodities traders describe bars of aluminum as “congealed electricity” because energy is such an important input. **The soaring price of electricity, coupled with strong demand, has pushed aluminum to highs not seen since late 2008, nearly \$3,200/tonne.** With inventories low, and demand unlikely to diminish this year, aluminum has surprisingly good prospects. Transport and construction consume well over half the amount produced. Cars alone represent the second-largest aluminum consumer. A post-pandemic rebound in car sales has yet to tail off. If it does, China’s push into electric vehicles, which depend on aluminum to reduce weight, should ensure that demand persists. EVs use 45% more aluminum than internal-combustion engine cars. By 2035, EVs should make up half of all cars produced. Infrastructure spending also supports aluminum. Demand from construction and electric-cable groups, together a third of consumption, should increase by half by 2040. Forecasts can change and economic expansion waxes and wanes, but aluminum’s role as a lightweight, highly conductive metal will not. Energy makes up 34% of aluminum’s production cost, second only to the alumina ore itself. As natural gas and thermal coal prices rose, power prices have followed. Higher electricity prices in Europe and China, the world’s largest producer, in turn lift the metal’s price. **Now, Russia’s invasion of Ukraine risks disrupting the export of many critical commodities and rupturing supply chains. Russia is a key source of aluminum ingot.**





## COMMODITIES: HOW THE EXPANSION OF MEGACITIES WILL BOOST METAL DEMAND

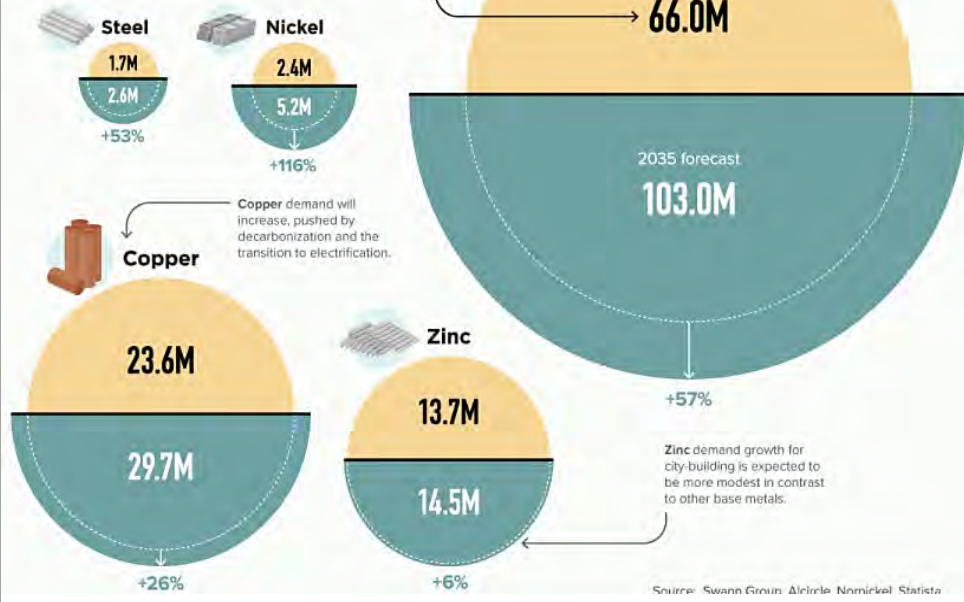
### HOW THE EXPANSION OF MEGACITIES WILL BOOST METAL MARKETS

**By 2035, Asian cities as a group will be richer than European and North American cities combined.**

As countries expand and people get richer, cars get more numerous, electricity and public transport networks expand. All this means more steel, more copper, more aluminum.

**i** This infographic takes a look at what metal demand will be if urbanization and rising incomes continue to 2035, using data from Swann Global.

Note: The unit of measure for steel should be B for billion tonnes.



### Urbanization drives metal demand, and megacities are leading the drive.

As developing economies grow, millions of people are moving to cities to pursue opportunities compounded by proximity and availability to resources. Many of these people see their economic circumstances improve, and consumption increases as a result. Cars get more numerous, electricity and public transport networks expand and consumers buy more electronic products for their homes. All of this means more steel, copper, aluminum and cement are needed. The rise of China's megacities in recent decades embodies this growth of living standards and demand for resources. **By 2035, Oxford Economics forecasts that Asian cities as a group will be richer than European and North American cities combined**, with six Chinese cities on the list of the 10 richest cities globally: Beijing, Chongqing, Guangzhou, Shanghai, Shenzhen and Tianjin. By 2035, these six cities are expected to double their wealth, while global average income per capita is expected to increase by only 37% during the same period. This infographic shows how the growth of megacities will drive metal demand well into the future.

**Megacities Metal Megatrend: Growth in Demand to 2035.** The Swann Index measures the intensity of use of each metal by looking at global consumption in tonnes between 2014 and 2019, dividing by GDP per capita and then forecasting demand to 2035. **Nickel demand is forecast to increase by 116%, from 2.4 million tonnes in 2019 to 5.2 million tonnes in 2035. The drive is fueled by consumer goods, batteries and high-value new applications, such as super alloys and stainless steel.** Aluminum and steel are also expected to see significant growth of 57% and 50%, respectively. Aluminum's growth will be particularly noticeable due to the market size, with an expected demand of 103.6 million tonnes in 2035. Copper's demand growth will largely be pushed by decarbonization and the transition to electrification and automated technology. The metal is expected to see demand increase by 26% to 29.7 million tonnes in 2035. By comparison, zinc is likely to underperform other base metals, with an estimated increase of only 6%. This modest growth reflects strong competition from aluminum in some end-use markets such as diecast alloys.

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