EXECUTIVE SUMMARY

AMERICAS: RETAIL SALES ROSE 8.5% DURING THE HOLIDAY SHOPPING SEASON FROM NOV. 1 TO DEC. 24, powered by soaring e-commerce sales that jumped 11%. **Real U.S. GDP growth** strengthened in the 4thQtr to about 6.5% (annualized), according to the Conference Board. **Production at U.S. factories** increased 0.7% in November to its highest level in nearly three years. Production at auto plants rose 2.2% but motor vehicle output remains 5.4% below its year-earlier level. **Factory orders** rose 1.6%, bolstered by businesses replenishing depleted inventories. **Annual consumer price inflation** rose to 6.8% in November, a 39-year high. The Federal Reserve said it will wind down its bond purchase program faster than initially planned and may raise interest rates three times in 2022. **U.S. employers** added 199,000 jobs in December, leaving the U.S. economy with about 6.4 million more jobs than at the end of 2020—more than in any year on record. **Consumer confidence** improved further, suggesting the economy would continue to expand in 2022, as more consumers indicate plans to buy a house and big-ticket items such as motor vehicles and major household appliances.

OVERSEAS: CHINA'S ECONOMIC ACTIVITY CONTINUED TO DECELERATE amid a prolonged property slump and sluggish consumption recovery. **Japan's factory output** jumped 7.2% in November, as easing global supply chain bottlenecks helped output of cars and other motor vehicles surge 43.1% from the previous month, lifting prospects for a strong 4thQtr economic rebound**. The euro zone's economic recovery** stuttered in December as a renewed wave of COVID-19 infections curtailed growth in the bloc's dominant service industry. **Soaring energy prices** drove up German import prices. A YOY jump of 24.7% was largely due to rising natural gas prices.

STEEL: ULBRICH ACQUIRED THE PICO RIVERA, CA FACILITY FROM ATI SPECIALTY ROLLED PRODUCTS. ATI will continue supplying Ulbrich with the quality nickel, titanium and specialty alloy products their customers rely on. This acquisition provides a West Coast service center for Ulbrich customers, and the addition of the Pico Rivera product line will broaden the range of stainless steel and specialty metal strip products that Ulbrich offers. **Stainless surcharges** rose again in December, driven higher by ferrous scrap, nickel and other alloy increases. Silicon, usually a nominal factor in overall surcharges, is tight and prices spiked in recent months, adding 7¢/lb.

AUTOMOTIVE: NEW CAR SALES IN THE U.S. ARE EXPECTED TO RISE THIS YEAR, driven by pent-up demand as automakers cut production last year due to supply chain issues and semiconductor shortages. Industry consultant Edmunds estimated that 15.2 million new cars will be sold in 2022, a 1.2% increase from its 2021 vehicle sales estimate. **General Motors** is no longer the No. 1 automaker in America after being on top for 90 years. Toyota weathered the chip shortage better than its rivals and outsold GM in America by 114,000 vehicles, with sales up by 10% vs. a 13% slide at GM. **General Motors** will invest $3 billion for two electric-vehicle projects in Michigan.

ENERGY: WIND'S SHARE OF U.S. ELECTRICITY GENERATION WAS EXPECTED TO INCREASE TO 10% IN 2021, after record installations in 2020. Total U.S. wind turbine capacity is now at 118 GW. **A sharp rise in power prices** caused Europe's largest aluminum smelter, Aluminum Dunkerque, to shut down around 3.7% of its production in early December. **Germany** pulled the plug on three of its last six nuclear power stations as it moves towards completing its withdrawal from nuclear power by the end of 2022.

MEDICAL: PEOPLE WITH COVID VACCINATIONS HAVE BEEN LESS LIKELY TO DIE OF OTHER CAUSES. A recent report from the CDC has produced a novel and even mysterious reason to be glad for a COVID-19 vaccination. The CDC data show that people vaccinated with the Pfizer or Moderna COVID-19 shots are one-third as likely to die of other causes too. **Software maker Oracle Corp** is buying electronic medical records company Cerner Corp for $28.3 billion, in a bid to strengthen its presence in the healthcare sector.

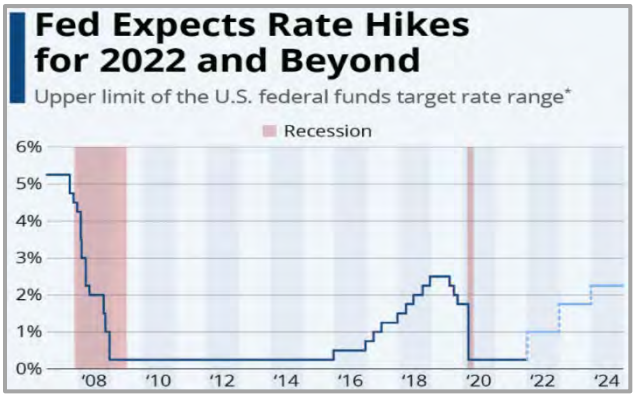
INNOVATION/EMERGING TECHNOLOGIES TO WATCH IN 2022: Mount Pinatubo's eruption in 1991 cooled the Earth by as much as 0.5°C for four years. **Solar geoengineering**, also known as solar radiation management, would do the same thing deliberately. Several startups are pursuing **direct air capture (DAC)** of carbon dioxide. Batteries can only power small aircraft for short flights, but **electricity from hydrogen fuel cells** might do the trick. **Flying taxis** or electric vertical take-off and landing (eVTOL) aircraft are getting attention.

AEROSPACE: THE JAMES WEBB SPACE TELESCOPE LAUNCHED SUCCESSFULLY EARLY XMAS DAY, beginning a 29-day journey to its orbit one million miles from Earth. **American Airlines** will trim international flights this summer because of Boeing's delays in delivering new 787 Dreamliners. **The United Arab Emirates** threatened to pull out of a $23 billion arms deal with the U.S. over issues with security requirements. It may be a negotiation ploy. **The Parker Solar Probe,** launched in 2018 by NASA, has touched the Sun.

COMMODITIES: LITHIUM PRICES ARE RISING AT THEIR FASTEST PACE IN YEARS, setting off a race to secure supplies and fueling worries about long-term shortages of a vital ingredient in the rechargeable batteries that power everything from electric vehicles to smartphones**. Battery prices** may even rise for the first time in 2022, as prices for raw materials soared in the second half of 2021. **Iron ore prices** have collapsed as China's steel production has fallen sharply due to the government's crackdown on emissions.

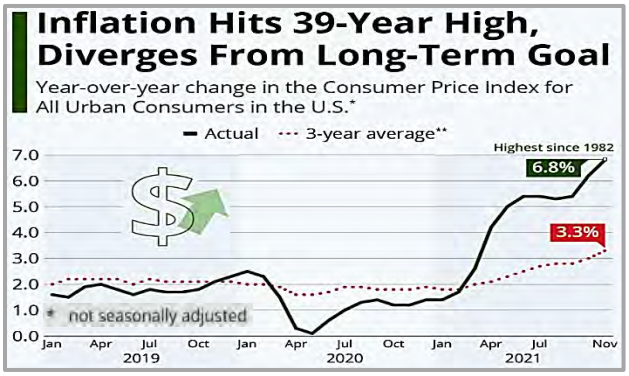
THE AMERICAS

- **U.S. GDP** increased at a 2.3% annualized rate in the 3rd Qtr, up from the 2.1% rate estimated in November. Fourteen out of 22 industries contributed to GDP growth. Output in the goods-producing industries contracted at a 5.5% pace, while services industry output increased at a 3.9% rate.
- **U.S. producer prices** jumped 0.8% for November after advancing 0.6% in October. The broad-based increase in the PPI was led by a 0.7% rise in services and reflected a 2.9% jump in prices for portfolio management. There were also increases in prices for hotel/motel accommodation. In the 12 months through November, the PPI shot up 9.6%.
- **Durable goods orders** accelerated 2.5% in November, boosted by a 6.5% jump in transportation equipment orders. Motor vehicle orders increased 1.0% after rebounding 5.8% in October. Orders for civilian aircraft soared 34.1% after falling 4.1% in October. Boeing received 109 aircraft orders compared to only 10 in October. Business spending on equipment contracted in the 3rd Qtr after four straight quarters of double-digit growth.
  Key Update: *Orders for non-defense capital goods excluding aircraft, a closely watched proxy for business spending plans, dipped 0.1% in November.*
- **The Index of Leading Economic Indicators** increased a strong 1.1% to 119.9 in November. The Conference Board forecasts real GDP growth strengthened in the fourth quarter to about 6.5% (annualized), before moderating to a still healthy 2.2% in the 1st Qtr of 2022.
- **U.S. import price** growth slowed in November amid a moderation in the costs of petroleum products. Import prices increased 0.7%, while export prices rose 1.0% in November and were up 18.2% YOY.
- **The U.S. trade deficit in goods** mushroomed 19.4% to $80.2 billion in November. Goods imports soared 5.1% to an all-time high $255 billion, as congestion at ports eased. Total imports rose 4.6% to $304 billion. The broad rise in imports was led by industrial supplies and materials. Consumer goods increased strongly as did imports of motor vehicles, parts and engines. Goods exports fell 1.8% to $156 billion. Overall exports increased 0.2% to $224 billion.
- **U.S. retail sales** rose 8.5% during the holiday shopping season from November 1 to December 24, powered by soaring e-commerce sales that jumped 11% . The holiday e-commerce sales made up 20.9% of total retail sales in 2021. Shoppers also rushed to stores amid supply chain concerns as COVID-19 cases surged, sending sales at physical stores up 8.1% compared with 2020.
- **Annual consumer price inflation** rose to 6.8% in November, a 39-year high. Prices jumped by 0.8% from October. A range of factors have fuelled inflation lately, including supply-chain bottlenecks, labor shortages, fiscal stimulus and ultra-loose monetary policy. Given the persistence of high inflation, the Federal Reserve said it will wind down its bond purchase program faster than initially planned and may raise interest rates three times in 2022.



- **Consumer confidence** improved further in December, suggesting the economy would continue to expand in 2022 despite a resurgence in COVID-19 infections and reduced fiscal stimulus. The Conference Board said more consumers planned to buy a house and big-ticket items such as motor vehicles and major household appliances, as well as go on vacation over the next six months. Inflation concerns eased and households remained upbeat about the labor market.
- **U.S. employers** added 199,000 jobs in December, leaving the U.S. economy with about 6.4 million more jobs than at the end of 2020—more than in any year on record but 3.6 million jobs short of pre-pandemic levels. The unemployment rate fell to 3.9% from 4.2% in November.
  Key Update: *A tightening labor market spurred strong wage gains: average hourly wages increased 4.7% in December from a year earlier, holding well above wage growth of roughly 3% preceding the pandemic.*
- **Production at U.S. factories** increased 0.7% in November to its highest level in nearly three years as output rose across the board, providing a powerful boost to the economy as the year ends. Production at auto plants rose 2.2% after advancing 10.1% in October. However, motor vehicle output remains 5.4% below its year-earlier level because of a global shortage of semiconductors.
- **U.S. factory orders** rose 1.6% in November, bolstered by businesses replenishing depleted inventories. There were increases in orders for computers and transportation equipment. There are tentative signs that raw material and labor shortages are starting to abate.

- **U.S. consumer spending** rose more slowly in November, up 0.6% vs. October's gain of 1.4%, raising risks of a broader economic slowdown amid the latest wave of COVID-19 cases. Holiday shoppers snatched up gifts earlier than usual this year in anticipation of product shortages. Inflation is at a 39-year high, but so far, fast-rising costs don't appear to be derailing consumers' appetite to spend.



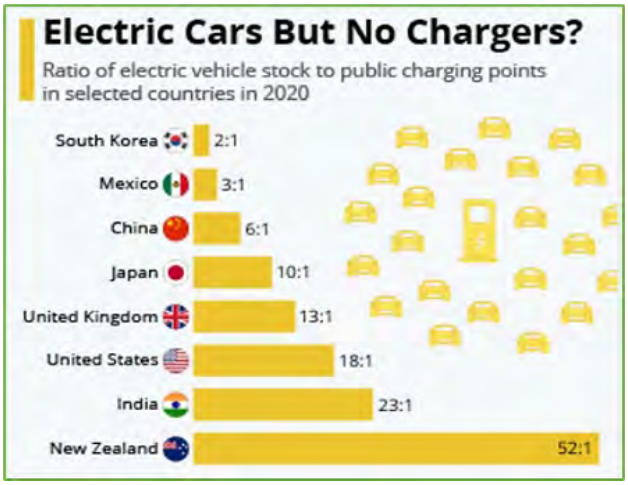
- **November existing home sales** rose 1.9% to an annual rate of 6.46 million units in November, but a severe shortage of homes for sale is keeping house prices elevated and squeezing first-time buyers out. New home sales increased 12.4% to an annual rate of 744,000, a seven-month high. Housing starts increased 11.8% to an annual rate of 1.679 million units. Confidence among single-family homebuilders rose for a fourth-straight month in December, but finding workers, predicting pricing and dealing with material delays remains a challenge.
- **U.S. manufacturing activity** slowed in December amid a cooling in demand for goods, but supply constraints are starting to ease and a measure of prices paid for inputs by factories fell by the most in a decade. The ISM's index of national factory activity fell to a reading of 58.7 from 61.1 in November. A reading above 50 indicates expansion in manufacturing. Manufacturers of fabricated metal products expressed optimism that "we have reached the top of the hill to start down a gentle slope that lets us get back to something that resembles normal."

  Key Update: *The ISM survey's measure of prices paid by manufacturers tumbled to 68.2 last month, a 14.2-point plunge and the biggest since October 2011.*
- **Growth in the U.S. services sector** cooled in December to a still solid pace supported by a rise in new business. IHS Markit's survey of purchasing managers fell to a reading of 62 from a record 69.1 in November.
- **U.S. construction spending** increased 0.4% in November amid strong gains in single-family homebuilding (+1.2%), but outlays on public projects were weak (-0.2%). Construction spending increased 9.3% YOY in November.
- **Steel prices** could climb much higher over the next decade compared with the previous decade, Tata Steel's CEO Narendran said. The long-term average price for hot-rolled coil over the coming years likely will exceed $600/mt, after averaging $400-$450/mt for the last 7-8 years.
- **Steel mills** in the U.S. shipped 8.215 million tons of steel in October, a 1.6% gain from September and a 21.7% increase from a year ago. Shipments YTD through October were 78.954 million tons, a 1.57% increase vs. the same ten month period in 2020. (See **Appendix: Steel**, page 14)
- **Stainless steel** remains in short supply and demand is strong in many sectors, but with inventories rising and prices at record highs, buyers are increasingly reluctant to purchase anything that will not turn quickly. Surcharges rose again in December based on ferrous scrap, nickel and other alloy increases. Silicon, usually a nominal factor on overall surcharges, has been tight and prices spiked in recent months, adding 6-7¢/lb. Mill lead times are extended and demand remains strong from construction, household appliances, food processing and automotive.
- ***Key Update:*** *2021 was an exceptional year for the stainless-steel industry. Most companies throughout the supply chain will post very strong financial results for the period. Steelmakers benefitted from a substantial upturn in selling prices, more than offsetting increases in their input costs.*
- **Steel imports into the U.S.** YTD through November increased 44.6% to 29.681 million tonnes (MT); finished steel imports rose to 21.621 MT, +46.1% vs. the same period last year. Finished steel import market share in the U.S. over the first 11 months of 2021 was estimated at 22%.
- **Iron ore prices** have collapsed and remain relatively cheap due to declining production in China. Chinese steel exports have been cut in half to about 60 million tonnes/year and could fall further as the country pursues its net-zero carbon emissions goals.

- **The global aluminum market** stabilized in December after a volatile year. Primary ingot on the LME traded in a narrow range in December averaging $1.22/lb.
- **U.S. auto sales** were expected to fall in December, as supply shortages and high demand have caused prices to skyrocket. New vehicles sales were estimated at 1,245,600 units, a 20.5% decrease from the year before. Average transaction prices were expected to reach $45,743, nearly 20% higher than a year ago.

- **Shippers** enter 2022 bracing for continued higher ground freight rates amid what one trucking analyst calls "an everything shortage". Those rates can run in the double-digit percentage increases—on top of 2021's increases. Those increased freight rates tended to be upward of 10% for shippers whose freight did not match carriers' needs in this sellers' market. The rate increases are most visible on the LTL side. LTL freight tonnage was up nearly 8% for 2021, compared to a 1.1% decline in 2020.
- **General Motors** plans to source rare earth magnets for its EVs from new U.S.-based manufacturing facilities. Deals with MP Materials and Vacuumschmelze are the latest push by GM to domestically source EV materials for its Ultium platform, a goal it hopes to achieve by 2025. MP Materials will build a neodymium-iron-boron magnet facility in Texas to supply enough magnets to build 500,000 EV motors. The facility should open by 2023. MP will source the rare earths to build those magnets from its California mine. GM and Germany-based Vacuumschmelze will jointly build a U.S. rare earth magnet plant, using locally sourced raw materials when production starts in 2024.

  Key Update: *Much of the recent surge in electric-vehicle investment has gone to Southern and Western states, shifting the center of gravity away from the auto industry's traditional stronghold in the Upper Midwest.*
- **General Motors** will invest $3 billion for two electric-vehicle projects in Michigan. One would convert its Orion Assembly plant in suburban Detroit to serve as its hub for production of electric pickup trucks. The $2 billion renovation would create more than 1,500 jobs at the factory. The automaker also intends to build a battery-cell factory near one of its assembly plants in Lansing. That project, a 50-50 jv between GM and battery partner LG Energy Solutions, would involve more than $2 billion between GM and LG and create 1,200 jobs. (See **Appendix: Automotive**, page 8)



- **New car sales in the U.S.** are expected to rise this year, driven by pent-up demand as automakers in 2021 cut production due to pandemic-driven supply chain issues and semiconductor shortages. Industry consultant Edmunds estimated that 15.2 million new cars will be sold in 2022, a 1.2% increase from its 2021 vehicle sales estimate. IHS Markit said that U.S. new car sales in 2022 will rise to 15.47 million vehicles from an estimated 15.07 million in 2021.
- **EV startup Rivian Automotive** plans to start construction next year on a second U.S. manufacturing facility in Georgia. The $5 billion manufacturing investment follows the company's block-buster IPO, where it raised nearly $13.5 billion in fresh capital. Rivian's new factory will have an annual capacity of 400,000 vehicles and create 7,500 jobs. The upstart auto manufacturer plans to start production at the plant in 2024, building its next generation of vehicles.

  Key Update: *Rivian's announcement comes as competition in the EV market is heating up with established car companies such as GM and Ford getting ready to roll out new plug-in models that will compete with Rivian's offerings.*
- **Toyota** became America's top-selling carmaker in 2021, ousting General Motors, which had held the #1 spot since 1931. The Japanese firm outsold GM in America by 114,000 vehicles, with sales up by 10% vs. a 13% slide at GM. Toyota has weathered the chip shortage better than its rivals.
- **Nuclear-fusion startup Commonwealth Systems** raised over $1.8 billion in the largest private investment for nuclear fusion yet, as startups race to be the first to generate the Holy Grail of the clean energy world.
- **Annual U.S. wind turbine capacity additions** reached record levels in 2020, totaling 14.2 gigawatts and exceeding the previous record of 13.2 GW added in 2012. Total U.S. wind turbine capacity is now at 118 GW. Wind's share of electricity generation was expected to increase to 10% in 2021, and many of the turbines added in late 2020 contributed to increases in wind-powered electricity generation in 2021. (See **Appendix: Energy**, page 11)
- **The James Webb Space Telescope** launched successfully Xmas Day, beginning a 29-day journey to its orbit one million miles from Earth. The sun-orbiting observatory is the largest, most powerful instrument of its type ever built. One hundred times as powerful as the Hubble, Webb will help astronomers peer at some of the oldest galaxies and stars in the universe, search for signs of habitability in the atmospheres of planets outside our solar system and study mysterious forces like dark energy.

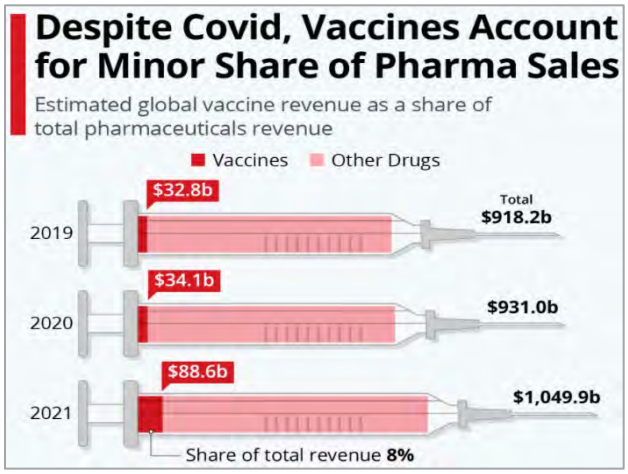
- **The Parker Solar Probe** launched in 2018 by NASA has touched the sun. NASA set an out-of-this-world goal sixty years ago. The probe completed its 10th close approach to the sun, coming within 5.3 million miles of the solar surface. The close approach (known as perihelion), also at a record distance, was conducted at 364,660/mph. The spacecraft will transmit science data from the encounter—largely covering the properties and structure of the solar wind as well as the dust environment near the sun.

- **American Airlines** will trim international flights this summer because of Boeing's delays in delivering new 787 Dreamliners. A schedule cut by the world's largest carrier (by passenger traffic) is the latest sign of broader fallout for Boeing's prolonged Dreamliner production problems that have prevented it from handing over the popular wide-body jets to airlines for more than a year. Deliveries are expected to resume by April, later than previously anticipated. The undelivered inventory, in excess of 100 Dreamliners, is worth more than $25 billion.
- **The Pentagon** has selected Northrop Grumman, Lockheed Martin and Raytheon to research and develop a missile system that would be able to defend the U.S. against a hypersonic weapons attack. The three companies were awarded separate contracts totaling about $60 million to develop a glide phase interceptor that would be guided by a constellation of satellites and sensors to intercept a hypersonic missile inside Earth's atmosphere as it glides.

- **Boeing** delivered over 34 airplanes to carriers in November, while adding 109 jets to its 737 MAX order tally. Again in November, Boeing failed to deliver its advanced carbon-composite 787 Dreamliner, which remains mired in inspections and retrofits likely keeping the jets sidelined until April 2022. Last year through November, Boeing delivered 302 aircraft, more than twice the 118 aircraft it delivered in the first 11 months of 2020.
- **The United Arab Emirates** threatened to pull out of a $23 billion arms deal with the U.S. over issues with its security requirements. It may be a negotiation ploy. The UAE intended to buy American-made F-35 aircraft, Reaper drones and other advanced munitions. Now, Abu Dhabi claims the U.S. security requirements—laid out to safeguard the high-tech weaponry from Chinese espionage—were too onerous, and its national sovereignty would be in jeopardy.
- **Major U.S. air carriers** warned that plans by AT&T and Verizon Communications to use spectrum for 5G wireless services could be highly disruptive to air travel and cost air passengers $1.6 billion annually in delays.The airlines' trade group said if a new FAA directive for addressing potential interference from wireless transmissions had been in effect in 2019, approximately 345,000 passenger flights, 32 million passengers and 5,400 cargo flights would have been delayed, diverted or cancelled. The wireless carriers are set to begin using the spectrum in January.

  Key Update: *Wireless carriers have shown no interest in further delays of the spectrum and the industry paid more than $80 billion to acquire it. The FAA has said the issues can be resolved and spectrum safely used.*
- **Pfizer** agreed to acquire drug developer Arena Pharmaceuticals in a $6.7 billion all-cash deal that is expected to diversify its portfolio and boost current capabilities to develop therapies for immune-mediated diseases. Arena's development-stage therapy, etrasimod, targets diseases related to the stomach, intestine and skin, including late-stage studies for ulcerative colitis. Pfizer is also working on an ulcerative colitis drug. Arena has two cardiovascular therapies in the pipeline.

  (See **Appendix: Medical**, page 12)



- **Software maker Oracle Corp** intends to buy electronic medical records company Cerner Corp for $28.3 billion, in a bid to strengthen its presence in the healthcare sector. Cerner, the biggest seller of software used for electronic recording of healthcare data in the U.S. after Epic Systems Corp, gives Oracle access to data it can use to train and improve its artificial intelligence-based cloud services.

  Key Update: *Since the pandemic began, demand for cloud-based solutions in the healthcare sector has accelerated, including telehealth services and automation of health records.*

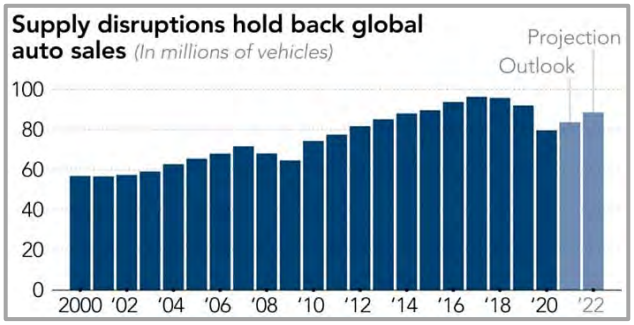
EUROPE, AFRICA & THE MIDDLE EAST

- **The euro zone's economic recovery** stuttered in December as a renewed wave of COVID-19 infections curtailed growth in the bloc's dominant service industry. IHS Markit's PMI index, a good gauge of overall economic health, sank to 53.3 from 55.4 in November.
- **Germany** pulled the plug on three of its last six nuclear power stations as it moves towards completing its withdrawal from nuclear power. Germany aims to make renewables meet 80% of power demand by 2030 by expanding wind and solar power infrastructure.
- **Soaring energy prices** showed up in German import prices, which rose at their fastest pace for almost 50 years in November. The YOY jump of 24.7% was largely driven by rising natural gas prices. Electricity for delivery next year touched record highs in both Germany and France. The rise in power prices led Europe's largest aluminum smelter, Aluminium Dunkerque, to shut down around 3.7% of its production in early December.
- **The world's first fully electric autonomous cargo vessel** was unveiled in Norway, a step toward reducing the maritime industry's climate footprint. By shipping 120 containers of fertilizer from a plant in the southeastern town of Porsgrunn to the Brevik port a dozen kilometers away, the Yara Birkeland will eliminate the need for 40,000 truck journeys a year that are now fueled by polluting diesel. The traditional ship's engine room has been replaced by eight battery compartments, giving the vessel a capacity of 6.8 MWh—the equivalent of 100 Teslas.

  Key Update: *The maritime sector, which is responsible for almost 3% of all man-made emissions, aims to reduce its emissions by 40% by 2030 and 50% by 2050.*
- **Volkswagen** intends to invest an additional €17 billion in the development of electric vehicles, taking the total to €52 billion, as the carmaker sought to mollify unions following clashes over potential job losses.

  (See **Appendix: Automotive**, page 9)
- **Renault** looks set to win union backing for a three-year plan including 1,700 job cuts. Under the deal, which also envisions a 35-hour working week at all French sites, Renault commits itself to developing nine new car models at its French plants between 2022 and 2024. Renault has also said it will hire 2,500 people and offer training to help workers convert to the production of electric vehicles.
- **The International Stainless Steel Forum** data for the first 9 months of 2021 show stainless steel melt shop production increased by 16.9% YOY to 43.0 million tonnes.
- **Volvo Cars and Northvolt** hope to take their battery partnership to the U.S. and Asia to get a headstart on rivals. The newly-listed premium carmaker and its start-up partner are about to open Europe's first giga-factory and plan to set up a joint R&D center in Gothenburg as part of a $3.3 billion investment, which will include another factory in Europe to start production by 2026. Volvo and Northvolt will announce the site for their European battery factory early in 2022. It will produce enough batteries for about 500,000 cars, with construction due to start in 2023.

- **About 7.7 million units of vehicle production** were lost in 2021 because carmakers were unable to secure semiconductors, costing the industry $210 billion in revenue. Disruptions have extended beyond chips to other parts and to assembly, while surges in raw materials prices have become common. The "just-in-time" manufacturing process has been tested in the car industry as never before. COVID-19 has revealed vulnerabilities throughout the chain, suggesting that executives have unwittingly traded resilience for low costs.



- **An Italian supplier** at the center of recent industrial snags on the 787 Dreamliner airplane produced more than 4,000 non-compliant parts destined for Boeing over five years. Manufacturing Process Specification (MPS) produced flawed parts between 2016 and 2021. The suspect titanium parts made it into 35 Boeing 787 fuselages. Prosecutors allege that MPS made 4,189 parts using "titanium and aluminum of different quality and origin" from those ordered by the customer, breaching the relevant technical specifications, resulting in a reduction of additional margins built in to the design to ensure safety.

  (See **Appendix: Aerospace**, page 13)

  Key Update: *The U.S. Air Force didn't comment on whether suspect parts had reached any of its 767-based KC-46 tankers. The first KC-46 tanker was delivered in 2019.*

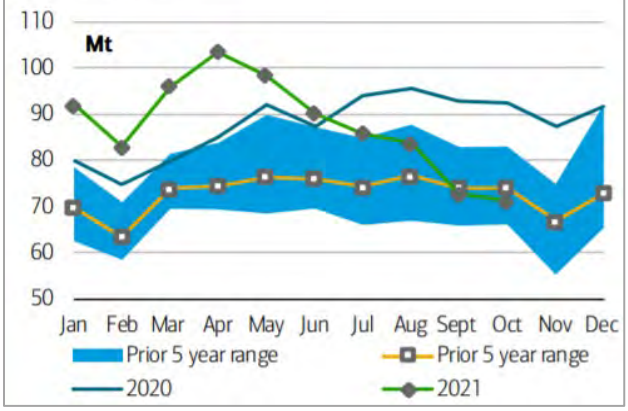
ASIA/PACIFIC, JAPAN, AUSTRALIA & INDIA

- **China's economic activity** decelerated in November amid a prolonged property slump and sluggish consumption recovery. Leading indicators of consumption and investment activity weakened further from October, while factory production rose at a faster pace as a power crunch eased. Industrial production expanded by 3.8% in November from a year ago, accelerating from 3.5% growth in October, a rare bright spot in China's economy as efforts to alleviate electricity shortages led to increased coal output in recent weeks.

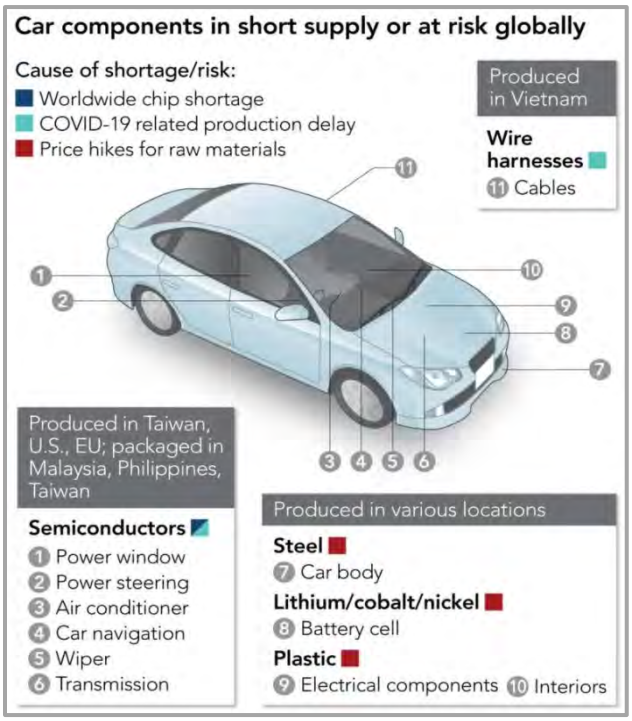
  Key Update: *The detection of more than 200 COVID-19 cases in China's Zhejiang province prompted officials to shut down some factories temporarily, threatening to disrupt output at one of the world's largest production bases.*

- **China's steel production** has fallen sharply due to the government's crackdown on emissions. (See chart below.) Production declines to that degree would normally raise the risk of severe dislocations on the home market. With weak domestic steel demand and inventories stable, this has not been the case so far.

Exhibit 108: China, steel production
Steel production has been falling sharply as the government has cracked down on emissions



- **Japan's factory output** jumped 7.2% in November, as easing global supply chain bottlenecks helped output of cars and other motor vehicles surge 43.1% from the previous month, lifting prospects for a strong 4thQtr economic rebound. Manufacturers expect output to rise 1.6% in December and 5.0% in January.
- **Global coal demand,** including its use in steelmaking, cement and other industrial activities, grew 6% in 2021 to 8.11 billion tonnes. That puts demand on track to reach a new record high in early 2022 and to remain at that level for the following two years. Increases in coal demand in Asia will be offset by falling demand in the U.S. and the EU.
- **Southeast Asia COVID restrictions** have dealt a heavy blow to carmakers, especially the Japanese who built complex local supply chains. Semiconductor shipments from Malaysia, a global hub for chip assembly and testing, were suspended as workers could not commute to plants during that country's lockdown, which began when the Delta variant hit in June and again with Omicron in December. Similar disruptions erupted in Vietnam, a production hub for wire harnesses and other automotive parts.



- **Clean energy in India** received almost three times more funding than coal-fired plants in 2020. Around three-quarters of the money provided by domestic lenders went to renewable energy projects, mostly solar, 6% more than in 2019. Further increases are expected as India—where coal provides 52% of energy—grapples with its emissions.

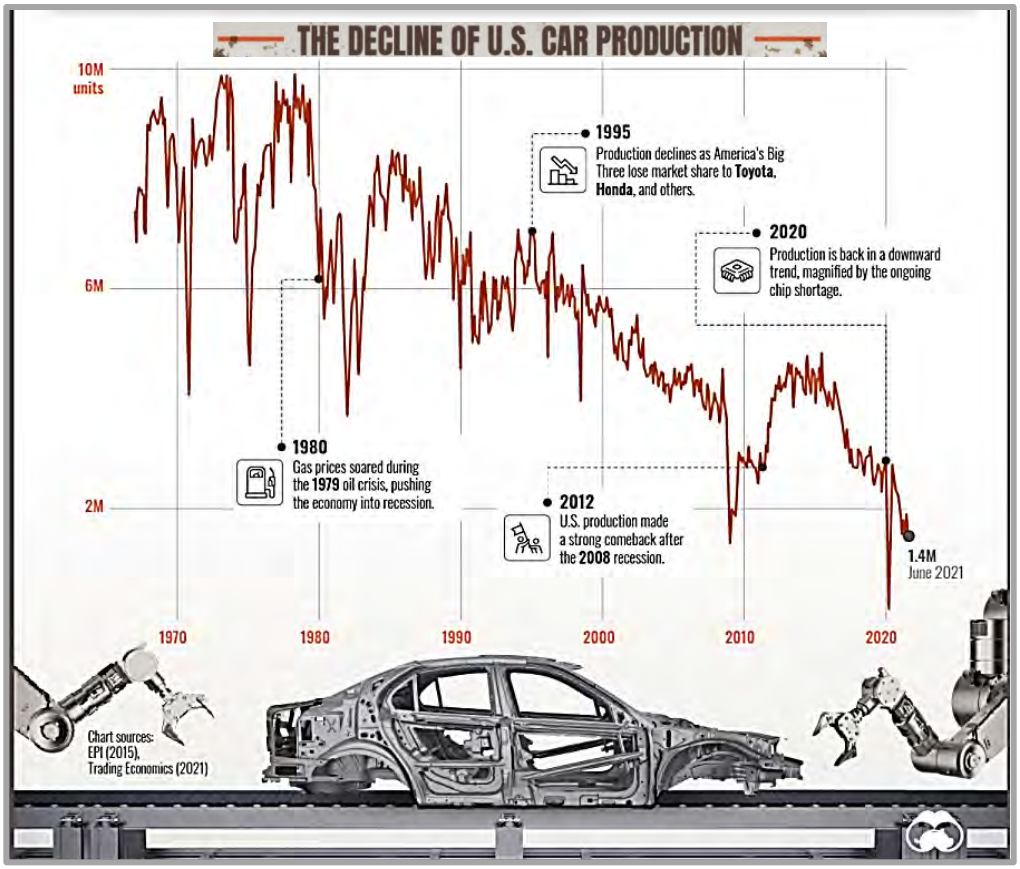
  Key Update: *Power supply was so iffy 10 years ago that many manufacturers had to install generators in their plants to ensure steady supplies. Now it is no longer an issue in virtually all India's states. The cost of power has also fallen to levels at which it is actually competitive with China.*

- **Lithium prices** are rising at their fastest pace in years, setting off a race to secure supplies and fueling worries about long-term shortages of a vital ingredient in the rechargeable batteries that power everything from electric vehicles to smartphones. An index of lithium prices doubled between May and November and is up 240% for the year. The index is at its highest level in five years.

(See **Appendix: Commodities**, page 15)

ECONOMIC UPDATE: APPENDIX TO THE JANUARY 2022 ISSUE

AUTOMOTIVE: U.S. CAR PRODUCTION FALLS TO A NEW LOW



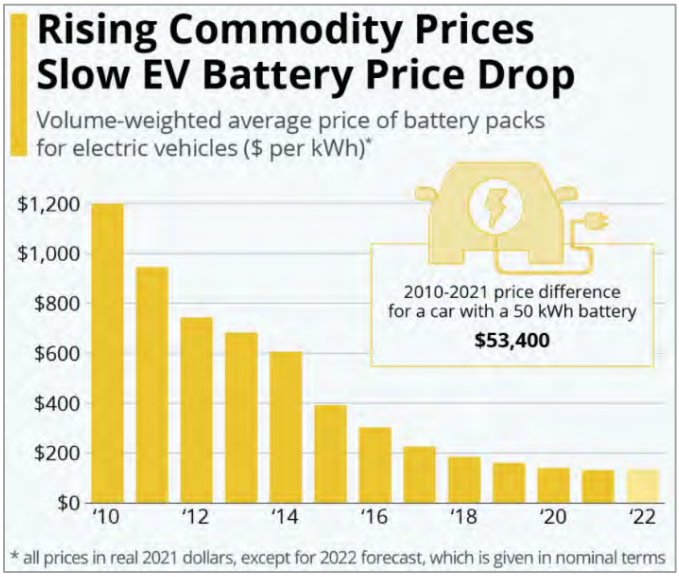
Germany may have been the birthplace of the automobile, but it was America that developed the methods for mass production. Henry Ford's 1913 assembly line innovation greatly reduced the time it took to build a car, making them more affordable. America's auto industry quickly became the world's largest. This dominance wouldn't last forever. From a high of nearly 10 million cars/month in the 1970s, the U.S. produced just 1.4 million in June 2021. Here are reasons why the U.S. produces only a fraction of the cars it once did.

Global Competition: America's Big Three (Ford, GM and Chrysler) have been unable to defend their market share from overseas competitors. **The table shows how Honda and Toyota were able to break into the U.S. market over a span of just five decades.** The 1970s presented an incredible opportunity for Honda and Toyota, which were known for producing smaller, more fuel-efficient cars. First was the Clean Air Act of 1970, which imposed limits on the amount of emissions a car could produce. Then came the 1973 oil crisis with a massive spike in gasoline prices. As consumers switched to smaller cars, American brands struggled to compete. **Production Moves to Mexico:** 2018 was a controversial year for GM as it came under fire by the Trump administration for closing four of its U.S. plants. That same year, GM became Mexico's biggest automaker. The decision to outsource is well-founded from a business standpoint. Mexico offers cheaper labor, lower taxes and close proximity for logistics, roughly $1,200 in savings per car. It's important to note that GM isn't alone in this decision. BMW, Ford and many others have also invested in Mexico to produce cars destined for the U.S. **Shifts in the Market:** Modern cars are much more reliable, meaning Americans don't need to purchase a new one as often. 2020 marks four consecutive years of increase for the average vehicle age in the U.S., which now sits at 12 years old. Rising car prices could also be playing a part. The average price of a new car was $41,000 as of July 2021, up from around $35,700 in May 2018. **Can U.S. Car Production Make a Comeback?** Recent events are a grim reminder of the direction U.S. car production is heading. As part of its plant closures, GM shuttered its Lordstown facility in 2019, breaking a 2008 agreement in which GM pledged to keep 3,700 employees at the location through 2028. The company got over $60 million in tax credits as part of this deal, and $28 million was ordered to be repaid. COVID-19 has presented further issues, such as the ongoing chip shortage impacting the production of more than 1 million U.S.-made vehicles. Not all hope is lost. Tesla now employs over 70,000 Americans across its production facilities in California, Nevada, New York, and soon, Texas.

Year	Ford	GM	Chrysler	Big Three Total Market Share	Honda	Toyota
1960	29.3%	45.7%	10.4%	85.4%	-	-
1970	28.3%	38.9%	14.9%	82.1%	-	2.0%
1980	20.5%	44.2%	9.1%	73.8%	3.3%	6.2%
1990	23.8%	35.2%	12.0%	71.0%	6.0%	7.6%
2000	22.6%	28.0%	13.0%	63.6%	6.5%	9.1%
2010	16.4%	18.8%	9.2%	44.4%	10.5%	15.0%

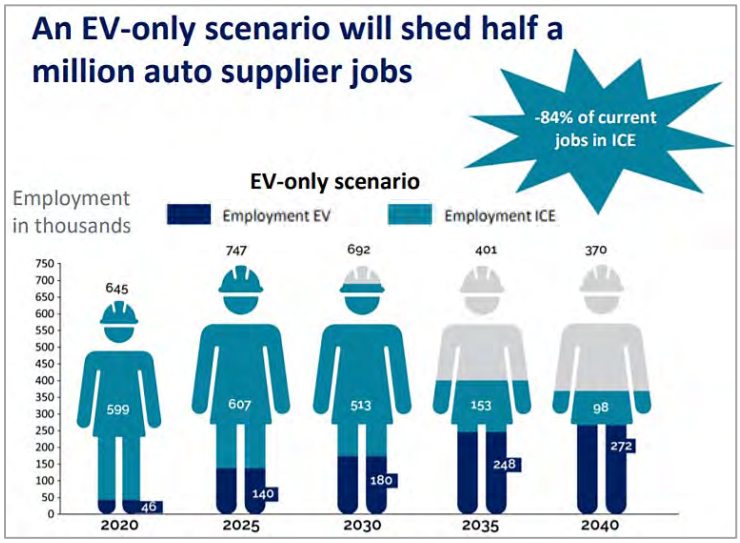
AUTOMOTIVE: RISING COMMODITY PRICES SLOW EV BATTERY PRICE DROP

Would you consider buying an electric car if it were just as expensive as an equivalent model powered by a traditional internal combustion engine? Tesla CEO Elon Musk is betting many people would. At a company shareholder meeting, fittingly called "Battery Day", Musk announced his company's plans to bring a $25,000 electric car to market within the next three years that would be "on par or slightly better than a comparable gasoline car". To achieve that, Tesla counts on its own ability to dramatically cut the costs of battery packs, which are still the main driver behind the relatively high prices for electric vehicles. Tesla's roadmap might be a bit too ambitious, as the latest increase in commodity prices has slowed down the price drop for electric vehicle battery packs. **In fact, battery prices may even rise for the first time in 2022, as prices for raw materials soared in the second half of 2021.** "This creates a tough environment for automakers, particularly those in Europe, which have to increase EV sales in order to meet average fleet emissions standards," James Frith, BloombergNEF's head of energy storage research said. "These automakers may now have to make a choice between reducing their margins or passing costs on, at the risk of putting consumers off purchasing an EV." As the chart shows, the inflation-adjusted average price of battery packs for cars dropped from around $1,200 per kWh in 2010 to just $132 in 2021. How much of a difference does that make to the price of a car? A big one. Consider the Tesla Model 3 for example: The entry-level version comes with a battery capacity of 50 kWh. Assuming an average price of $132 per kWh that battery now costs around $6,600 instead of $60,000 it would have cost in 2010.



AUTOMOTIVE: EUROPEAN SUPPLIERS WARN OF JOBS THREAT FROM E-CAR SHIFT

Half a million jobs would be at risk under EU plans for a de facto ban on combustion-engine cars by 2035, according to European suppliers in the latest warning about the costs of a rapid transition to emissions-free technology. More than two-thirds of those 501,000 positions would disappear in the five years before that date, according to a poll of almost 100 companies for the European Association of Automotive Suppliers, Clepa. It would make it hard to mitigate the social and economic impacts caused by mass unemployment. **The survey also found that 226,000 jobs would be created in the making of electric parts, reducing the net number of job losses to about 275,000 over the next couple of decades.** The European Commission announced its intention earlier this year to eliminate 100% of CO2 emissions from new cars by 2035. The policy in effect bans sale of fossil-fuel powered vehicles after that date. While the commission did not order that these be replaced by battery-powered cars, carmakers such as Volkswagen have all but ruled out other technology, such as hydrogen. Clepa has long argued that the use of interim technology would cushion the blow of the transition to cleaner transport. "Society's needs are far too diverse for a one-fits-all approach," said secretary-general Sigrid de Vries. "The use of hybrid technologies, green hydrogen and renewable sustainable fuels will enable innovation as we redefine mobility in the coming decades." Carlos Tavares, Stellantis chief executive, said that the speed of the transition is "putting the industry on the limits" and the costs of developing the new technology could lead to heavy job losses. Last year, a government-sanctioned report warned that around 400,000 jobs could be lost in Germany due to the shift from combustion engines. VW chief executive Herbert Diess said such scenarios had probably been a bit overstated. "A lot of the car remains the same. It's still seats, paint, bodywork, interiors, wheels and axles. For some, if you work in fuel injection systems or gearboxes, it's probably a bigger transition. I would say that for 70 to 80% of the automotive supply industry, there is no transition."



INNOVATION: WHAT'S NEXT? EMERGING TECHNOLOGIES TO WATCH IN 2022

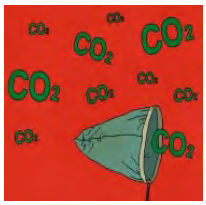
The astonishingly rapid development and rollout of coronavirus vaccines has been a reminder of the power of science and technology to change the world. Although vaccines based on new mRNA technology seemed to have been created almost instantly, they actually drew upon decades of research going back to the 1970s. As the saying goes in the technology industry, it takes years to create an overnight success. So what else might be about to burst into prominence? Here are emerging technologies worth watching in 2022.

Solar geoengineering: It sounds childishly simple. If the world is getting too hot, why not provide it some shade? The dust and ash released into the upper atmosphere by volcanoes is known to have a cooling effect: Mount Pinatubo's eruption in 1991 cooled the Earth by as much as 0.5°C for four years. Solar geoengineering, also known as solar radiation management, would do the same thing deliberately.

Heat pumps: Keeping buildings warm in winter accounts for about a quarter of global energy consumption. Most heating relies on burning coal, gas or oil. If the world is to meet its climate-change targets, that will have to change. The most promising alternative is to use heat pumps—essentially, refrigerators that run in reverse.

Hydrogen-powered planes: Electrifying road transport is one thing. Aircraft are another matter. Batteries can only power small aircraft for short flights, but electricity from hydrogen fuel cells, which excrete only water, might do the trick. Passenger planes due to be test-flown with hydrogen fuel cells in 2022 include a two-seater being built at Delft University of Technology in the Netherlands. ZeroAvia, based in California, plans to complete trials of a 20-seat aircraft and aims to have its hydrogen-propulsion system ready for certification by the end of the year. Universal Hydrogen, also of California, hopes its 40-seat plane will take off in September 2022.

Delivery drones: New rules which came into effect in 2021 will help drone deliveries gain altitude in 2022. Manna, an Irish startup which has been delivering books, meals and medicine in County Galway, plans to expand its service in Ireland and into Britain. Wing, a sister company of Google, has been doing test deliveries in America, Australia and Finland and will expand its mall-to-home delivery service, launched in late 2021. Dronamics will start using winged drones to shuttle cargo between 39 European airports.



Direct air capture: Carbon dioxide in the atmosphere causes global warming, so why not suck it out using machines? Several startups are pursuing direct air capture (DAC), a technology that does just that. In 2022, Carbon Engineering, a Canadian firm, will start building the world's biggest DAC facility in Texas, capable of capturing 1 million tonnes of CO_2 per year. ClimeWorks opened a DAC plant in Iceland in 2021, which buries captured CO_2 in mineral form at a rate of 4,000 tonnes a year. Global Thermostat has two pilot plants. DAC could be vital in the fight against climate change. The race is on to get costs down and scale the technology up.

Flying electric taxis: Electric vertical take-off and landing (eVTOL) aircraft, as the fledgling industry calls them, are getting serious. Several firms around the world will step up test flights in 2022 with the aim of getting their aircraft certified for commercial use in the following year or two. In California, Joby Aviation plans to build more than a dozen of its five-seater vehicles, which have a 150-mile range. Volocopter aims to provide an air-taxi service at the 2024 Paris Olympics. Other contenders include eHang, Lilium and Vertical Aerospace.

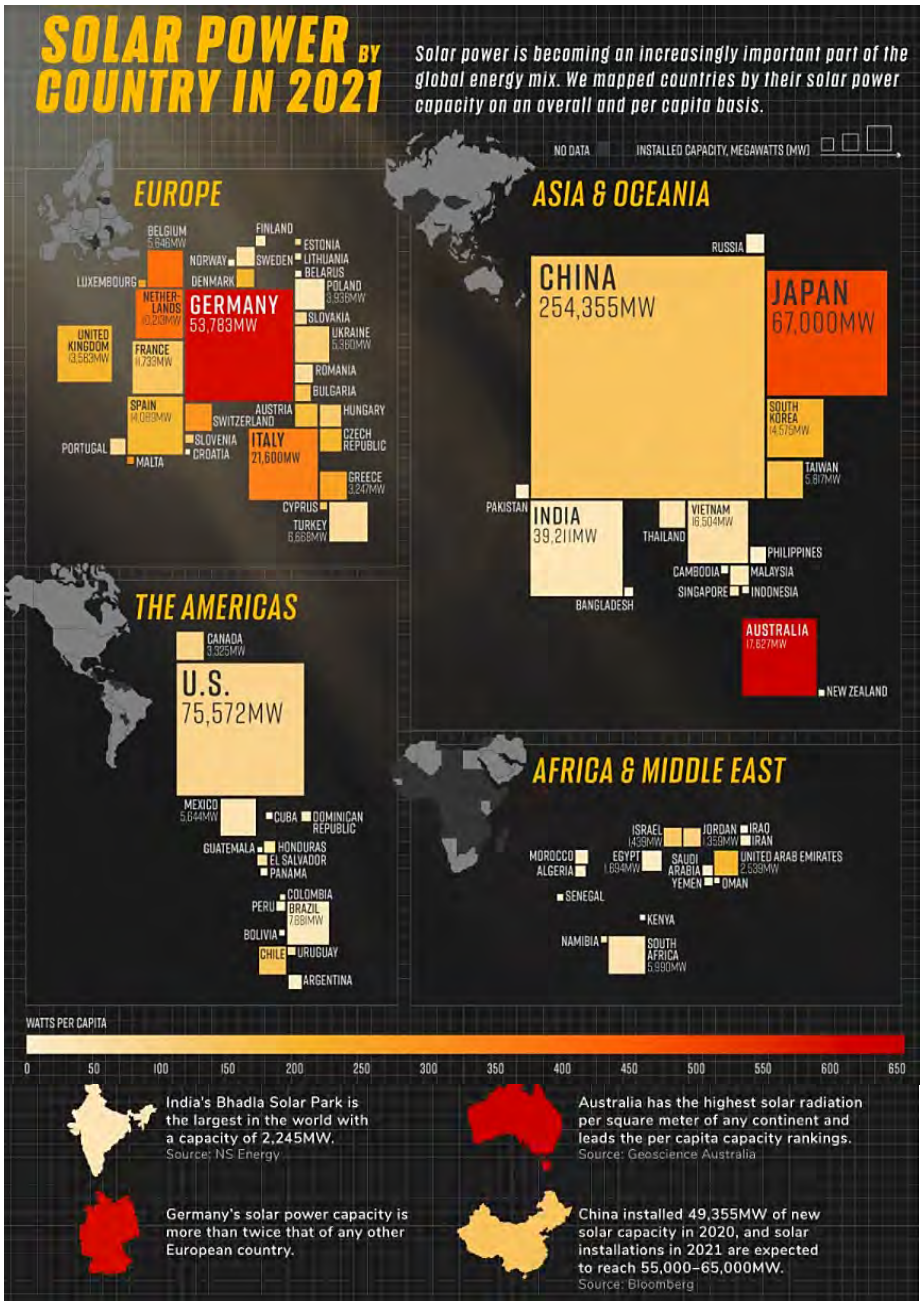
3D-printed bone implants: For years, researchers have been developing techniques to create artificial organs using 3D printing of biological materials. The ultimate goal is to take a few cells from a patient and create fully functional organs for transplantation, thus doing away with long waiting-lists, testing for matches and the risk of rejection.

Wearable health trackers: Remote medical consultations have become commonplace and may transform the prospects for wearable health trackers. They are currently used primarily as fitness trackers, measuring steps taken, running and swimming speeds, heart rates during workouts, etc. However, the line between consumer and medical uses of such devices is now blurring. Smart watches can already measure blood oxygenation, perform EKGs and detect atrial fibrillation. The next version of the Apple Watch, expected in 2022, may include new sensors capable of measuring levels of glucose and alcohol in the blood, along with blood pressure and body temperature.

Quantum computing: An idea that existed only on blackboards in the 1990s has grown into a multi-billion dollar contest between governments, tech giants and startups: harnessing the counter-intuitive properties of quantum physics to build a new kind of computer. For some kinds of mathematics, a quantum computer could outperform any non-quantum machine that could ever be built, making quick work of calculations used in cryptography, chemistry and finance.

ENERGY: GLOBAL SOLAR POWER BY COUNTRY AS OF 2021

The world is adopting renewable energy at an unprecedented pace, and solar power is leading the way. Despite a 4.5% fall in global energy demand in 2020, renewable energy technologies showed promising progress. While the growth in renewables was strong across the board, solar power led from the front with 127 gigawatts installed in 2020, its largest-ever annual capacity expansion. This infographic uses data from the International Renewable Energy Agency (IRENA) to map solar power capacity by country in 2021 and includes both solar photovoltaic (PV) and concentrated solar power capacity.



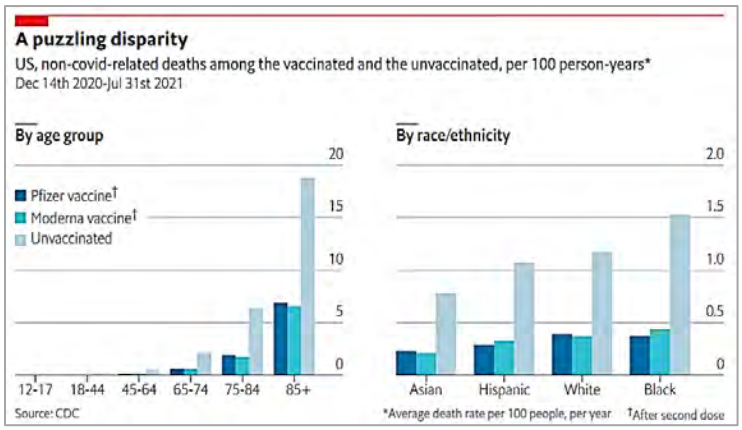
The Solar Power Leaderboard: China is the undisputed leader in solar installations, with over 35% of global capacity and is showing no signs of slowing down. It has the world's largest wind and solar project in the pipeline, which could add another 400,000/MW to its clean energy capacity. Following China is the U.S., which surpassed 100,000/MW of solar power capacity after installing another 50,000/MW in the 1st Qtr of 2021. Annual solar growth in the U.S. has averaged an impressive 42% over the last decade. Policies like the solar investment tax credit, which offers a 26% tax credit on residential and commercial solar systems, have helped propel the industry forward. Although Australia hosts a fraction of China's solar capacity, it tops the per capita rankings due to its relatively low population of 26 million people. The Australian continent receives the highest amount of solar radiation of any continent, and over 30% of households now have rooftop solar PV systems.

China — The Solar Champion: In 2020, President Xi Jinping stated that China aims to be carbon neutral by 2060, and the country is taking steps to get there. China is a leader in the solar industry, and it seems to have cracked the code for the entire solar supply chain. In 2019, Chinese firms produced 66% of the world's polysilicon, the initial building block of silicon-based photovoltaic (PV) panels. Furthermore, more than three-quarters of solar cells came from China, along with 72% of the world's PV panels. It's no surprise that 5 of the world's 10 largest solar parks are in China, and it will likely continue to build more as it transitions to carbon neutrality.

What's Driving the Rush for Solar Power? The energy transition is a major factor in the rise of renewables, but solar's growth is partly due to how cheap it has become over time. Solar energy costs have fallen exponentially over the last decade, and it's now the cheapest source of new energy generation. Since 2010, the cost of solar power has seen a 85% decrease, down from $0.28 to $0.04 per kWh. Economies of scale have been the single-largest factor in continuing the cost decline for the last decade. This year, solar costs are rising due to supply chain issues, but the rise is likely to be temporary as bottlenecks are resolved.

MEDICAL: PEOPLE WITH COVID VACCINATIONS HAVE BEEN LESS LIKELY TO DIE OF OTHER CAUSES

It was almost a year ago that Pfizer and BioNTech announced the first promising results from a clinical trial of a COVID-19 vaccine. Since then, studies from around the world have confirmed that vaccinations are safe and provide good protection against severe forms of the virus. Now a recent report from the Center for Disease Control has produced a novel reason to be glad for a COVID-19 vaccination. **The CDC data show that people vaccinated with the Pfizer or Moderna COVID-19 shots are one-third as likely to die of other causes too.** The result is bewildering. The study started with the health records of more than 11 million Americans. Researchers followed these people from December 2020 to July 2021, recording any deaths and their causes. During this period around 6 million people in the cohort received vacines for COVID-19. Those who had been double-jabbed with either Pfizer or Moderna vaccines had an average non-COVID-related mortality rate of roughly 0.35 per 100 person-years, meaning that between three and four people would be expected to die out of 1,000 monitored for a year. For the unvaccinated, the mortality rate was more than three times as high, at 1.11 per 100 person-years. The pattern held across all races and ethnicities, and in most of the age groups.

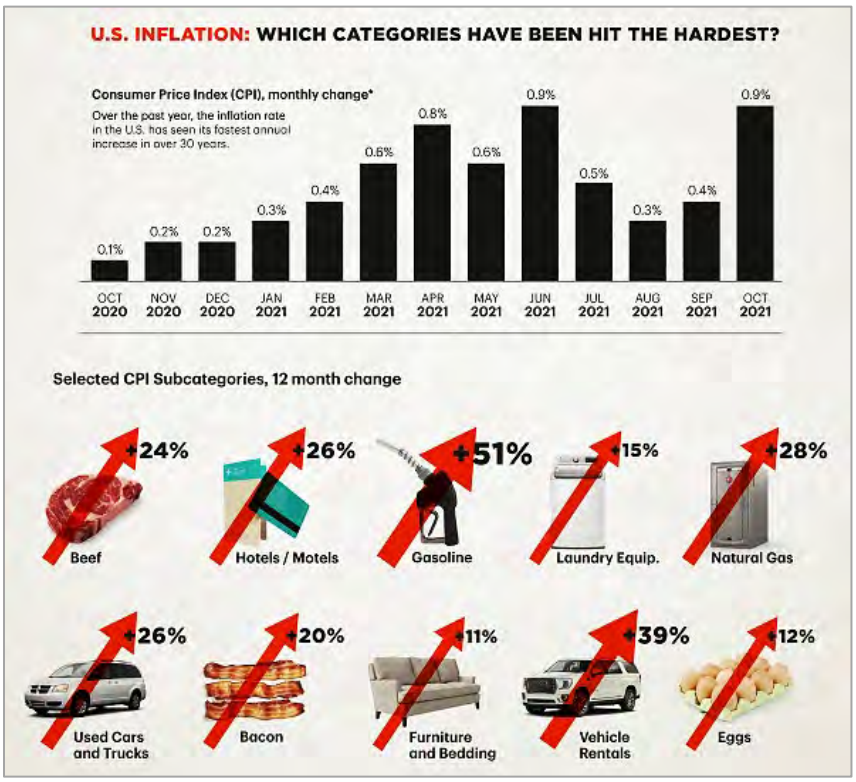


This is not the first time scientists have found that vaccines designed to prevent one disease would seem to protect against other causes of death. Even though seasonal influenza is only responsible for around 5% of winter mortality, several large studies have found that the mortality rate due to any cause is around 50% lower in people who have been vaccinated against flu. One reason for this pattern is that people who get vaccines may tend to be healthier than those who opt out. Real-world data is never perfectly controlled. It seems all but certain that some still-invisible difference between people who get the vaccine and those who do not (rather than some unknown benefit of the vaccination) is the reason for the vaccine's correlative effects.

U.S. ECONOMY: WHICH CATEGORIES HAVE BEEN HIT THE HARDEST BY INFLATION?

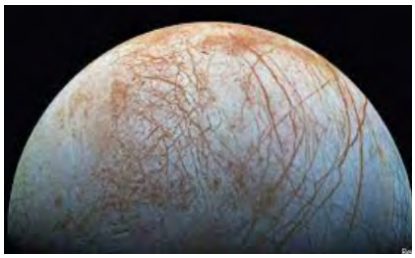
Since 1996, the Fed oriented its monetary policy around maintaining 2% annual inflation. For 20 years, the U.S. has typically hovered within a percentage point or two of that target. Now, most price categories are exceeding that target, some quite dramatically. **Here's how various categories of consumer spending have fared over the past 12 months:**

CPI Category	One-Year Change
Energy commodities	49.5%
Used cars and trucks	26.4%
Energy services	11.2%
New vehicles	9.8%
Tobacco and smoking products	8.5%
Food at home	5.4%
Food away from home	5.3%
Transportation services	4.5%
Apparel	4.3%
Shelter	3.5%
Alcoholic beverages	2.2%
Medical care services	1.7%
Medical care commodities	-0.4%



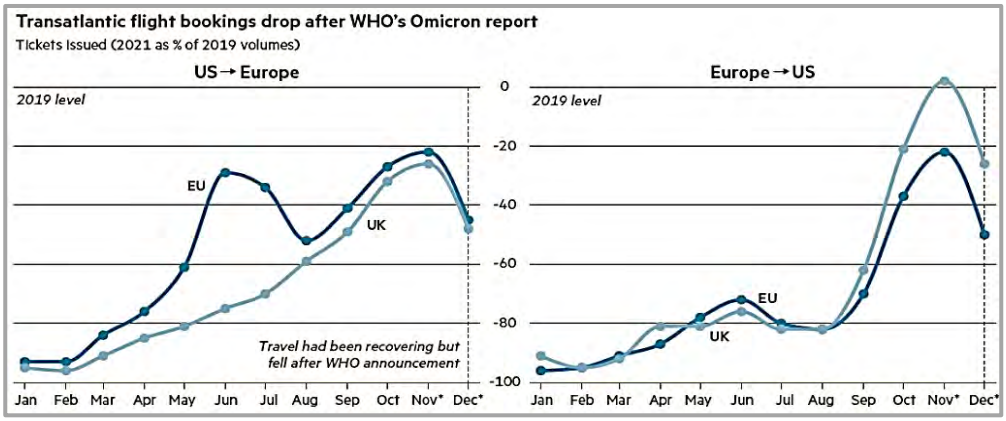
AEROSPACE: SEVERAL AMBITIOUS SPACE MISSIONS WILL BLAST OFF IN 2022

A European Space Agency (ESA) probe is due to blast off for Jupiter's icy moons later this year, reaching Jupiter in about eight years. Once it arrives, maneuvring among Jovian moons that are 45 light-minutes from Earth will be complex. The probe will not be able to establish whether one of those moons (Europa) harbors life, but scientists hope to find clues in the vapors it ejects. If a maneuver near Ganymede succeeds in 2032, the spacecraft will become the first to orbit another planet's moon. Earth's Moon will also see lots of action. Countries planning to launch lunar craft in 2022 include India, Japan, Russia and South Korea. **NASA is sponsoring an astonishing 18 missions in 2022, as it paves the way for a return to the Moon by astronauts as part of a lunar program called Artemis.** A Franco-Italian firm, is expected to deliver the shell of Gateway, a space station to be put in lunar orbit by the U.S. Later this year, **ESA plans to launch ExoMars from Kazakhstan, which includes a Russian-built lander that will disgorge a rover on Mars in 2023, enabling scientists to deepen the search for signs of past or present life.** NASA plans to launch three probes to study asteroids between Mars and Jupiter. NASA will also conduct a "hypervelocity test crash" with a small asteroid named Dimorphos. Experts will study how a collision with a car-sized spacecraft alters the harmless rock's path, lest another threaten Earth one day. Upcoming missions will entail much nail-biting for engineers. India's first lunar lander, Vikram, crashed into the surface in 2019. Russia last landed a probe on the Moon in 1976; its new lander Luna 25 has suffered lengthy delays. Starliner, a capsule which Boeing hopes will make its first crewed mission in 2022, has been plagued by setbacks. The stakes are also high for two huge new rockets. NASA's wildly over-budget Space Launch System may suffer additional embarrassing delays. Europe's ArianeGroup is still struggling to pull off the maiden launch of Ariane 6**. As for space tourism, Blue Origin and Virgin Galactic made their maiden suborbital flights in 2021.** Both hope to pick up the pace with regular, predictable and reliable flights in 2022, but with Virgin's vehicle grounded for safety checks, Blue Origin has the edge. **For Russia's space agency, 2022 could be a make-or-break year as it pursues funding via tourism and participation in international missions**. Russia's space industry has been hobbled by corruption, underinvestment and technical problems. As a result, the success of a big expansion of Russia's Vostochny Cosmodrome in 2022 has become a question of credibility. **A Chinese space station (Tiangong) could become fully operational this year,** according to an American intelligence report that describes it is part of China's efforts to "match or exceed" America's military power, with systems that include anti-satellite weapons. Other countries are also worried. Some strategists think it is no coincidence that in 2022 South Korea will be getting busier in space. The perceived threat from China will also push India to use its space program for military messaging and other purposes of foreign policy. That is one motivation for a possible 2022 maiden launch of Indian astronauts. Much of the progress of modern space technologies is driven by geopolitical competition.



AEROSPACE: FRESH BORDER CURBS DELAY TRAVEL INDUSTRY'S HOPES OF TAKE-OFF

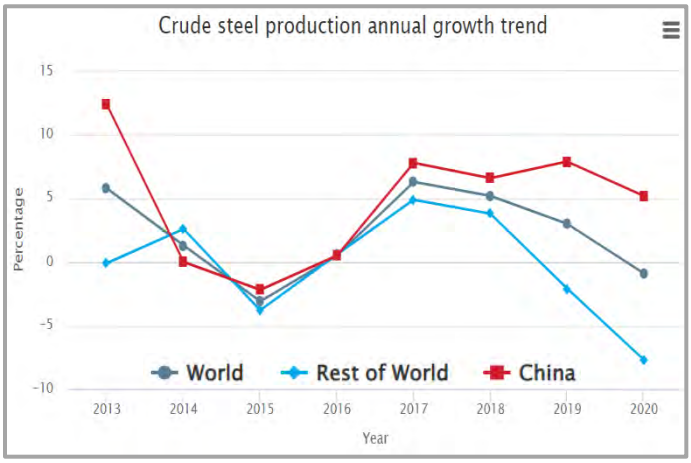
The tentative revival in the travel industry has stalled, with airline and hotel bookings dropping in December due to new border restrictions after the emergence of the Omicron variant. Although travel bosses said it was too early to gauge the variant's impact, data suggest the worst may not be over, almost two years since the first coronavirus outbreak. Areas hit include lucrative transatlantic airline routes, while data from hotel industry tracker STR show a drop-off in room occupancy in Europe. The impact on transatlantic routes has been severe. After recovering since the Biden administration announced it would open its borders to travellers in November, the revival in demand for these long-haul flights has been snuffed out. **The recovery had been so rapid that by November 24, the day Omicron was reported to the WHO, bookings between the UK and the U.S. had risen 2% above 2019 levels, but flight bookings made between November 25 and December 7 were 26% below 2019 levels. Bookings from the EU dropped from 22 to 50% below 2019 levels over the same period.** All countries have suffered a decline as consumer confidence has waned. Forward bookings for hotels in London, Paris and Madrid have all fallen in recent weeks.

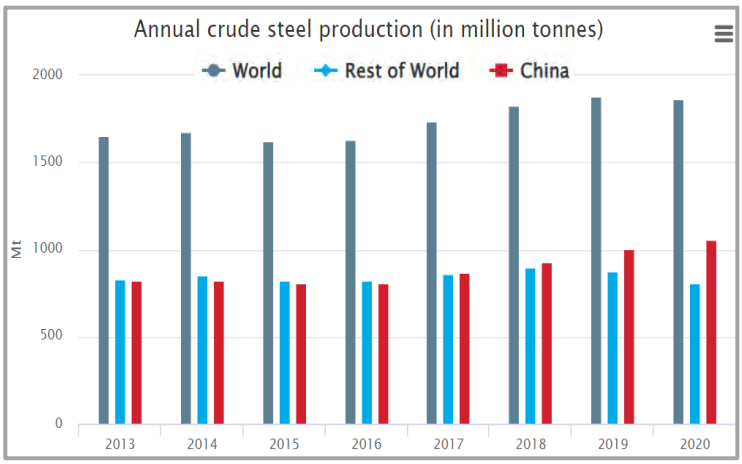


STAINLESS STEEL: FIRST-EVER COVID-KILLING STEEL INACTIVATES 99.9% OF THE VIRUS WITHIN HOURS

Researchers in Hong Kong claim they have developed the world's first stainless steel that kills the COVID-19 virus within hours, adding to the arsenal of products being created globally to curb the pathogen that triggered the worst pandemic of the past century. **The newly-developed alloy can inactivate 99.75% of the SARS-CoV-2 virus within three hours and 99.99% within six hours, according to a study published in November by a team of researchers at the University of Hong Kong.** The university researchers are also liaising with industrial partners to test this material in creating steel products such as lift buttons, doorknobs and handrails that are among most-commonly touched surfaces in public areas. The innovation — if proved effective and cheaply scalable — may significantly reduce the costs of regularly disinfecting mass-transit public areas such as airports and train stations, as well as other venues where crowds congregate such as movie theaters and sports stadiums. As pandemic fears return with the Omicron variant, the new product may potentially help people return to their normal lives after the disruption of the past two years. The antimicrobial property in the alloy is long-term, even if it is continuously damaged during service, the researchers said in the published study, and it can be produced using existing powder metallurgy technique keeping costs low. Under ordinary circumstances, the COVID-inducing virus can stay on surfaces for more than two days. **The new alloy, which adds copper to the stainless steel mix, can protect against other disease-causing microbes too, according to the university team**. They added that the anti-pathogen stainless steel also exhibits an excellent inactivation ability for H1N1 influenza A virus and the Escherichia coli bacteria, they added. The COVID pandemic has so far infected over 266 million people globally, killed more than 5.2 million and left survivors with long-term side effects. The virus itself has undergone multiple mutations, five of which have been declared variants of concern by the WHO and kept drugmakers and vaccine makers on their toes. The U.S. Center for Disease Control says the risk of coronavirus transmission via contaminated surfaces – as opposed to breathing in an infected person's respiratory droplets – is "generally considered to be low".

STEEL: WORLD CRUDE STEEL PRODUCTION ANNUAL GROWTH TREND





worldsteel ASSOCIATION

Every December, the Worldsteel Association publishes a summary of the previous year's crude steel production. **Global crude steel production reached 1.864 billion tonnes for the year 2020, down by 0.9% compared to 2019.** China's share of total global crude steel production increased from 53.3% in 2019 to 56.5% in 2020. India's crude steel production for 2020 was 99.6 million tonnes (Mt), down by 10.6% on 2019. Japan produced 83.2 Mt in 2020, down 16.2%. South Korea produced 67.1 Mt, down 6.0%. Crude steel production in North America was 101.1 Mt in 2020, down 15.5%. **The United States produced 72.7 million tonnes in 2020, down 17.2% compared to 2019 output.**

Top 10 steel-producing countries

Rank	Country	2020 (Mt)	2019 (Mt)	%2020/2019
1	China	1053.0	1001.3	5.2
2	India	99.6	111.4	-10.6
3	Japan	83.2	99.3	-16.2
4	Russia (e)	73.4	71.6	2.6
5	United States	72.7	87.8	-17.2
6	South Korea	67.1	71.4	-6.0
7	Turkey	35.8	33.7	6.0
8	Germany	35.7	39.6	-10.0
9	Brazil	31.0	32.6	-4.9
10	Iran (e)	29.0	25.6	13.4

COMMODITIES: WHERE IN THE WORLD ARE THE RARE EARTH RESERVES?

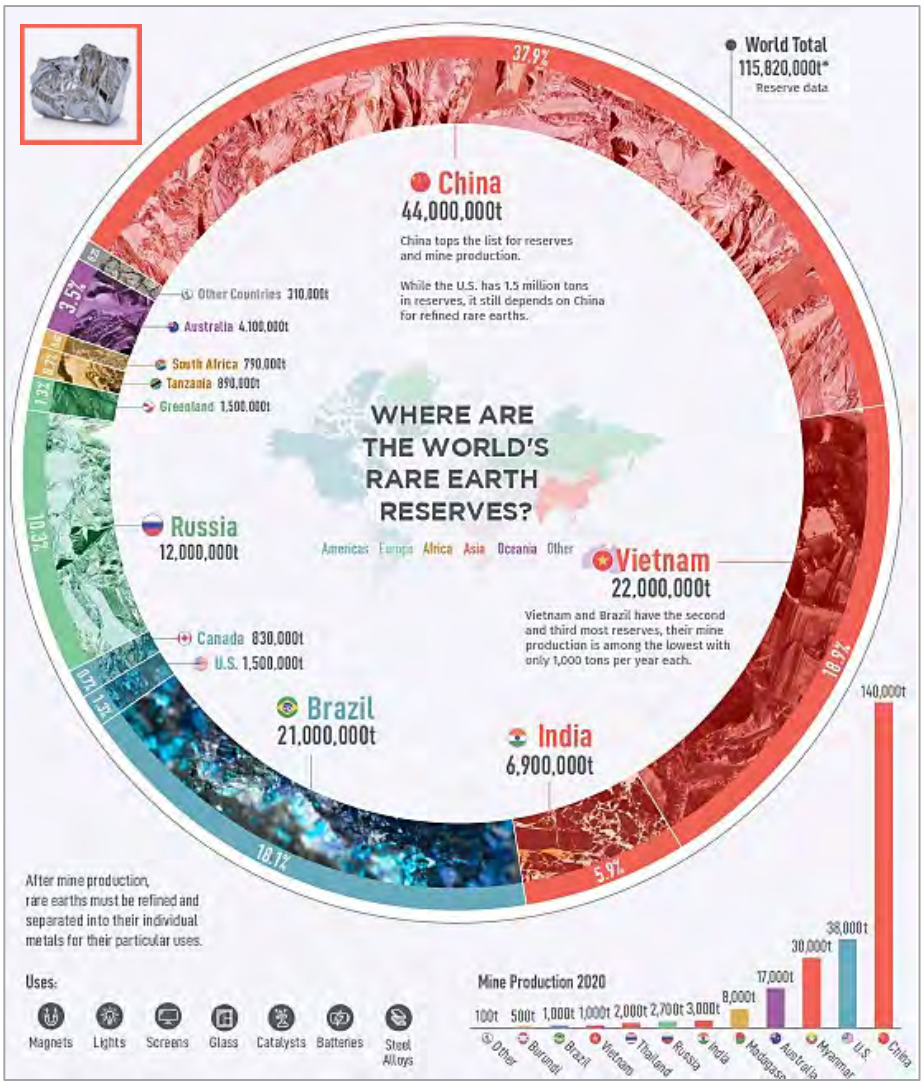
Rare earth elements are a group of metals that are critical ingredients for a greener economy, and the location of the reserves for mining are increasingly important and valuable.

What are Rare Earth Metals?

REEs are a set of 17 silvery-white soft heavy metals. The term "rare earth" is a misnomer as rare earth metals are actually abundant in the Earth's crust. They are rarely found in large, concentrated deposits on their own, but rather among other elements. Most rare earth elements find their uses as catalysts and magnets in traditional and low-carbon technologies. Other important uses of rare earth elements are in the production of special metal alloys, glass and high-performance electronics. Wind turbine generators, hard disks, cell phones and EV and hybrid engines require these magnets and elements.

Global Reserves of Rare Earth Minerals

China tops the list for mine production and reserves of rare earth elements, with 44 million tons in reserves and 140,000 tons of annual mine production. Vietnam and Brazil have the second and third most reserves of rare earth metals, but their mine production is among the lowest of all the countries at only 1,000 tons per year each. While the United States has 1.5 million tons in reserves, it is largely dependent on imports from China for refined rare earths.



COMMODITIES: NICKEL DEMAND FROM EVS WILL INCREASE STEADILY, KEEPING THE MARKET TIGHT

Nickel Overview: Stainless steel production, historically the most important sector for nickel demand, is slowing as the post-COVID rebound is tailing off. A relentless increase of EV production means that consumption from the transportation sector is increasing exponentially. Even if Indonesia is pushing more units into the market, this means that Class 1 nickel will increasingly be in short supply. A rebound of stainless steel production in the wake of the COVID-19 pandemic has been a key driver of the nickel market, but as the recovery fades activity at steel mills is slowing. EV manufacturers will become the marginal nickel buyers in the coming years.

Exhibit 47: Nickel supply and demand balance
Nickel differentiation between refined and non-refined essential
BofA SECURITIES

'000 tonnes	2020	2021	2022E	2023E	2024E
Global production	**2615**	**2789**	**3197**	**3483**	**3630**
YoY change	8.6%	6.6%	14.6%	9.0%	4.2%
Global consumption	**2413**	**2827**	**3075**	**3284**	**3588**
YoY change	-0.2%	17.2%	8.8%	6.8%	9.3%
Balance, incl. NPI oversupply	203	-38	122	200	42
Balance, excl. NPI oversupply	**72**	**-76**	**-33**	**-22**	**-279**
Market inventories	377	392	359	337	58
Weeks of world demand	8.1	7.2	6.1	5.3	0.8
LME price ($/t)	**13783**	**18607**	**22125**	**25000**	
LME price (c/lb)	625	844	1004	1134	

ULBRICH ACQUIRES PICO RIVERA FACILITY FROM ATI SPECIALTY ROLLED PRODUCTS

Effective Jan 31, 2022, this service center facility will operate under the name ***Ulbrich of California***. On this date, all shipments from the Pico Rivera operation will become orders serviced by Ulbrich. ATI will continue supplying Ulbrich with the quality Nickel, Titanium and Specialty alloy products their customers rely on. Ulbrich and ATI are committed to a seamless transition and are working together to ensure the product quality & service from this location continues to exceed customer expectations. The Ulbrich family is excited to operate a facility once again on the West Coast!

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Ulbrich Stainless Steels & Special Metals, Inc., has highly trained and experienced engineers, product managers, metallurgists, and sales executives available to assist you in all aspects of material selection and production of your stainless steel or special metals requirements.

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Ulbrich's Economic Update is prepared monthly by Charles Finnegan for the exclusive use of Ulbrich Stainless Steels & Special Metals, Inc. This issue and previous Economic Updates are archived on Ulbrich's website: **www.ulbrich.com/blog**

Charles was a Senior Vice President of procurement in the metal container industry, with a career spanning nearly four decades. He specializes in steel and aluminum procurement and utilizes his expansive knowledge of the steel and aluminum industry in the production of this detailed monthly update for Ulbrich and the company's valued employees and partners.

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