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# ECONOMIC UPDATE

Number 18 • NOVEMBER 2021

## EXECUTIVE SUMMARY

**AMERICAS: U.S. GDP GREW BY AN ANNUALIZED 2.0% IN THE 3<sup>RD</sup> QTR**, a marked slowdown from earlier this year. It was the weakest quarter of growth since the recovery began in mid-2020. **Consumer confidence** rose in October as high inflation concerns were offset by improving labor market prospects. **Consumer prices** accelerated at the fastest pace in 30 years in September, while workers saw their biggest compensation boosts in 20 years. **U.S. manufacturing** activity slowed in October, with all industries reporting record-long lead times for raw materials. **Durable goods orders** fell 0.4% in September, as manufacturers continued to confront higher material costs and parts and labor shortages. There were gains in orders for primary metals and fabricated metals products. Orders for motor vehicles and parts fell. **The economy** added 531,000 jobs in October, and the unemployment rate fell to 4.6%. **Existing home sales** increased 7.0% in September, the largest increase in a year, while confidence among homebuilders in October rose by the most in nearly a year.

**OVERSEAS: EUROZONE BUSINESS ACTIVITY GREW AT ITS SLOWEST PACE FOR SIX MONTHS IN OCTOBER.** Further worsening of the global supply chain problems is causing huge factory order backlogs, growing port congestion and widespread shortages. **A shortage of magnesium** may force European carmakers and other users of aluminum to shut down production within weeks unless China restarts its smelters. **China's economy** grew 4.9% in the 3<sup>rd</sup> Qtr from a year earlier, slowing sharply from the previous quarter's 7.9% rate. China's factory sector is hamstrung by widespread power outages across the country as coal prices have soared.

**STEEL: THE CLASH WITH THE EU OVER U.S. TARIFFS ON STEEL AND ALUMINUM IMPORTS WAS EASED** by a deal reached at the G20 meeting. The European Union will be allowed to ship 3.3 million tonnes of steel annually into the U.S. duty-free; any volume above that would be subject to a 25% tariff. The EU will drop retaliatory tariffs in return. **Nucor** is launching a line of net zero carbon steel products called Econiq. General Motors will be the first to use the product early next year. **Stainless mills** lifted base prices for CR commodity grades and alloy surcharges for nickel, manganese and molybdenum, more than offsetting the decline in scrap prices.

**AUTOMOTIVE: SALES AT AUTO DEALERSHIPS ROSE 0.5% IN SEPTEMBER AFTER DROPPING 3.3% IN AUGUST.** With unit sales declining, the increase in receipts likely reflected higher prices amid severe shortages. The average price of a new motor vehicle topped \$45,000 for the first time ever. **General Motors** will install 40,000 electric-vehicle charging stations in the U.S. and Canada, part of the automaker's \$750 million commitment to bolster its presence in the sector. **Fast 5G cellular networks** are rolling out and automakers have teamed up with telecom carriers to build small, local 5G networks to try out the technology as they develop new car models.

**ENERGY: FRANCE WILL INVEST €1 BILLION IN NUCLEAR POWER BY THE END OF THIS DECADE** as Europe's energy crisis spurs renewed interest in that source of power. **A plan to develop large-scale wind farms** along nearly the entire coastline of the U.S. was announced by the administration. **U.S. power usage** will rise about 3% this year as the economy recovers. Natural gas' share of power generation will slide from 39% last year to 36% this year and 35% in 2022 as gas prices rise. Renewables will hold at 20% this year.

**MEDICAL: JOHNSON & JOHNSON'S REVENUES CLIMBED 11% IN THE 3<sup>RD</sup> QTR COMPARED TO A YEAR AGO.** Medical-device sales grew 7.6% amid a higher level of surgical procedures. **New techniques** offer the possibility of introducing them to pathogens not yet evolved, but which are likely to do so in the future. Due to a combination of high-throughput DNA-sequencing technologies and modern machine-learning, it is now possible to observe which variants of a virus are circulating and suggest how they are likely to change.

**INNOVATION: A SWEDISH START UP HAS DEVELOPED A NEW PROCESS FOR DESIGN AND MANUFACTURE** using an innovative steel-forming technique developed by Outokumpu. Stilride AB has carried out further development covering the whole value chain from digital design of tools to production, ultimately developing a new "industrial origami" for designing and manufacturing. **Northwestern University engineers** added a new capability to electronic microchips: flight. About the size of a grain of sand, the new "microflier" catches flight on the wind, like a maple tree's propeller seed, and spins like a helicopter through the air toward the ground.

**AEROSPACE: THE PRICE OF JET FUEL HAS DOUBLED TO ALMOST \$750/TONNE OVER THE PAST YEAR**, threatening the airline industry's slow recovery from the coronavirus crisis. **Lockheed Martin** dramatically cut its sales expectations for this year and 2022, as the COVID-19 pandemic severely hobbled the top U.S. defense contractor's supply chain. **U.S. airlines** are buoyed by the administration's decision to reopen to fully vaccinated air travelers from 33 countries, including most of Europe, in November.

**COMMODITIES: METALS PRICES HAVE SURGED TO MULTIYEAR HIGHS** after smelters, facing soaring energy bills and pressure to cut their carbon emissions, curtailed production. **A price rally for uranium** pushed the price of yellowcake to its highest level since 2012 at \$50/lb. **October LME zinc prices** jumped to \$3,533/tonne after Nyrstar, a major producer, said it was reducing output by half at three of its European plants. **Aluminum** hit a three-month low of \$2,510 in early November, 20% below its peak in October.



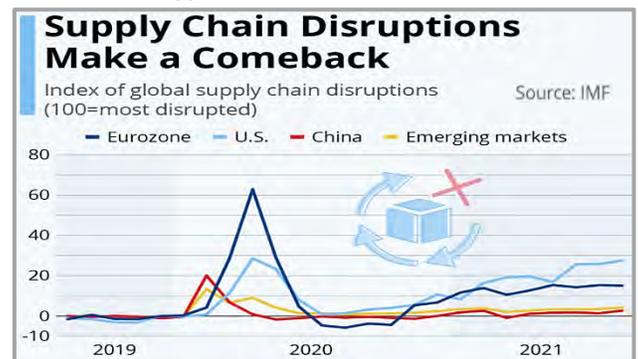
## THE AMERICAS

- **U.S. GDP** grew by an annualized 2.0% in the 3<sup>rd</sup>Qtr, a marked slowdown from earlier this year. It was the weakest quarter of growth since the recovery began in mid-2020.
- **U.S. producer prices** rose by 0.5% in September following a 0.7% increase in August. Energy prices climbed 2.8%, while food prices were up 2%. The core PPI rose by 0.2%, following a 0.6% gain in August. The PPI was up 8.6% YOY in September and core PPI rose by 6.8% YOY, both above their August rates due to continued low pandemic induced base effect that should diminish in the coming months.
- **Nonfarm payrolls** increased by 531,000 jobs in October, and the unemployment rate fell to 4.6%. Employment remains 4.2 million jobs below its peak in February 2020. Manufacturing added 60,000 jobs, with 28,000 of the positions at motor vehicle manufacturers.
- **Durable goods orders** fell 0.4% in September, as manufacturers continued to confront higher material costs and parts and labor shortages. Orders for non-defense capital goods excluding aircraft rose 0.8%. There were gains in orders for machinery, primary metals and fabricated metals products. Orders for motor vehicles and parts, electrical equipment, appliances and components fell, as did orders for computers and electronic products, likely because of a global semiconductor shortage.
- **The Index of Leading Economic Indicators** climbed 0.2% to 117.5 in September. The Conference Board said the slower rate of increase suggests the economy remains on a more moderate growth trajectory compared to the first half of the year and continues to forecast strong growth ahead: expanding 5.7% YOY for this year and 3.8% for 2022.
- **U.S. import prices** rebounded in September, climbing 0.4% after falling 0.3% in August, lifted by higher food and energy costs. Imported fuel prices increased 3.7%, as petroleum prices rebounded 3.9%. The price of Brent crude has shot above \$80 a barrel. In the 12 months through September, import prices rose 9.2%, excluding tariffs. Export prices nudged up 0.1% in September and were up 16.3% YOY.
- **The U.S. trade deficit** soared 11.2% to a record high of \$80.9Bn in September. Exports slumped by 3.0%. American demand for industrial supplies and fuels continues to surge. The value of imports of iron and steel were up 93% in the first 9 months of 2021 compared with the same period last year. Wood rose 79% and copper rose 82%.

**Key Update:** *The trade deficit is being driven wider by shifting patterns of demand for the raw materials and inputs for American factories and retailers.*

- **U.S. retail sales** rose 0.7% in September, boosted in part by a jump in receipts at auto dealerships due to higher motor vehicle prices. Supply-chain disruptions and microchip shortages appear to be spreading, limiting selection and tamping down goods demand. The Ports of Los Angeles and Long Beach, two of the country's busiest, are expanding round-the-clock operations to unload an estimated 500,000 containers on cargo ships offshore.

**Key Update:** *Sales at auto dealerships rose 0.5% in September after decreasing 3.3% in August. With unit sales declining, the increase in receipts likely reflected higher prices amid severe shortages. The average price of a new motor vehicle topped \$45,000 for the first time ever.*



- **Inflation** remained at its highest rate in over a decade in September, with prices rising 5.4% on an annual basis. Inflation is starting to have a broader impact on the cost of living, wages and social-benefits programs. On a monthly basis, the CPI rose 0.4% in September from August. Unusually high demand is also driving higher inflation. The shortage of workers is also pushing up wages, putting pressure on companies to raise prices.
- **Consumer confidence** rose in October as high inflation concerns were offset by improving labor market prospects, suggesting resurging economic growth. The Conference Board survey showed consumers eager to buy a home and big-ticket items over the next six months. The share of Americans planning to go on vacation was the largest since the first wave of COVID-19 infections hit in February 2020.
- **Production at U.S. factories** fell 0.7% in September, but manufacturing output did increase 5.3% for the 3<sup>rd</sup>Qtr. September production at auto plants tumbled 7.2% after dropping 3.2% in August. The global shortage of microchips is forcing automakers to cut production. There is also a shortage of workers at ports, which is causing congestion and holding up the delivery of raw materials. The decline in manufacturing output combined with a 2.3% decrease in mining and a 3.6% drop in utilities to pull down September's industrial production by 1.3%.



- **U.S. consumer spending** rose 0.6% in September, down from a 1% increase in August. Personal incomes fell 1% driven by a 72% decline in unemployment insurance benefits that offset a 0.7% increase in wages and benefits. Services spending increased 0.6%, offsetting a 0.2% drop in outlays on long-lasting manufactured goods, which largely reflected a drop in new motor vehicle sales.

**Key Update:** *The National Retail Federation forecast holiday sales this year to increase as much as 10.5% to \$859 billion vs. a previous high of \$777 billion last year.*

- **Existing home sales** increased 7.0% in September, the largest increase in a year. The median existing house price increased 13.3% from a year ago to \$352,800. New home sales rose 14%, a six-month high. Housing starts tumbled to their lowest level since April, and permits fell to a one-year low amid labor and material shortages. Confidence among homebuilders in October rose by the most in a year.
- **U.S. manufacturing activity** slowed in October, with all industries reporting record-long lead times for raw materials. The ISM survey indicted moderation in demand amid surging prices, with a measure of new orders dropping to a 16-month low. Worker shortages remain a constraint.
- **U.S. factory orders** rose 0.2% in September, led by machinery, primary metals and fabricated metal products. Orders for computers, electronic products, transportation equipment, appliances and components fell.
- **U.S. services industry activity** surged to a record high in October (ISM survey). Declining COVID-19 cases boosted demand, but businesses remained burdened by snarled supply chains and the resulting exorbitant prices.
- **U.S. construction spending** unexpectedly fell 0.5% in September amid declines in outlays for both private and public projects. Shortages and more expensive building materials are holding back homebuilding.
- **Freight bellwether J.B. Hunt** expects bottlenecks at West Coast ports to intensify heading into the holidays, with strong shipping demand extending into 2022. The company attributed much of the broader supply-chain upheaval to a shortage of truck drivers and rail workers, along with labor scarcity at customer warehouses.
- **The U.S. and the EU** reached a deal to ease a clash over U.S. tariffs on steel and aluminum imports. To qualify for duty-free treatment, steel and aluminum products must be entirely made in the EU. Under the new terms, the EU will be allowed to ship 3.3 million metric tons of steel annually into the U.S. duty-free; any volume above that would be subject to a 25% tariff. The U.S. imported 3.9 million tonnes in 2019, and 2.5 million in 2020. (See **Appendix: Metals**, page 11)



- **Steel mills** in the U.S. shipped 8.404 million tons of steel in August, a 1.5% improvement from the prior month and up 28.7% from a year ago. Shipments YTD through August were 62.653 million tons, a 16.5% increase vs. the same eight month period in 2020. (See **Appendix: Steel**, page 10)
- **The stainless market** experienced another month of stable demand and gradual price increases in October. Mills lifted base prices for CR commodity grades and alloy surcharges for nickel, manganese and molybdenum, which more than offset the decline in scrap. Surcharges will increase again in November, driven by chrome and manganese. Overall demand is strong relative to domestic production since ATI's desertion of the commodity sheet market. Distributors and end-users supplement supply with imports, but foreign mill prices are also high, with 4 to 5-month lead times. \*\*
- **Nucor Corp.** is launching a line of net zero carbon steel products called Econiq, utilizing 100% renewable electricity and carbon offsets to negate emissions. GM will receive the Econiq steel in the 1<sup>st</sup>Qtr of 2022 and all steel purchased from Nucor will be carbon neutral by the end of 2022.  
**Key Update:** *GM isn't the only automaker looking at using green steel. Mercedes-Benz plans to introduce it in models by 2025, saying that steel makes up 30% of the emissions in its production. Volvo is working with Swedish steelmaker SSAB to use steel that isn't made from fossil fuels by 2026.*
- **U.S. Steel** posted record 3<sup>rd</sup>Qtr profits, earning \$2 billion compared with a loss of \$234 million in the same quarter last year when the global COVID-19 pandemic depressed prices and slashed demand. USS sales more than doubled to \$5.96 billion, up from \$2.34 billion a year ago.
- **Steel imports into the U.S.** YTD through September increased 34.9% to 23.806 million tonnes (MT); finished steel imports also rose 34.9% to 16.684MT vs. the same period last year. Finished steel import market share in the U.S. over the first 9 months of 2021 was estimated at 21%.
- **The Midwest aluminum transaction price** averaged \$1.70/lb. (LME+MWP) in October, up 7¢ over September. The Midwest premium has been trending at historically high prices due to supply snags, tariffs and rising ocean transit and trucking costs and remains firm at 35¢/lb. Mill prices were also affected by spikes in the costs of alloying metals. Rolling mills raised fabrication charges for 5xxx by 10-20¢. Service center shipments of aluminum rose 8.2% in Sept.



- **Fast 5G cellular networks** are rolling out and automakers are figuring out what they can do with all that speed. Porsche is one of a few who have teamed up with telecom carriers to build small, local 5G networks to try out the technology as they develop new car models. They aim to use 5G networks to download crucial software updates on the go, update digital maps with greater speed and sound alerts about road conditions.



- **Tesla** reported a \$1.6 billion 3<sup>rd</sup>Qtr profit, up from \$331 million a year earlier, on record revenue of \$13.8 billion. Tesla delivered 73% more vehicles than a year-ago. Underpinning that growth was an uptick in sales of vehicles made in China, now home to Tesla’s largest auto plant by output. Tesla will lay the groundwork for further growth by starting to produce vehicles at two new factories by the end of the year, one in the Austin area, where the company is moving its headquarters; the other outside Berlin.

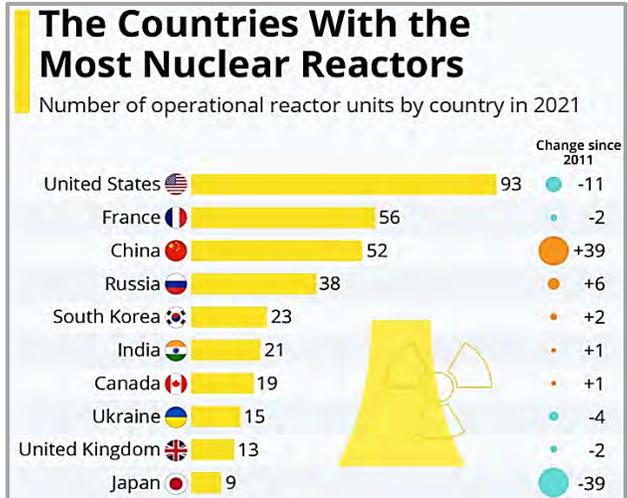
- **Key Update:** *Tesla and Hertz are reportedly negotiating over how quickly Hertz will receive deliveries from a bulk order of 100,000 Tesla electric cars for its rental fleet. Hertz said, “Deliveries of the Teslas already have started.”*

- **Stellantis**, as part of its \$35 billion electrification plan, entered into a preliminary agreement with battery maker LG Energy Solution to produce battery cells and modules for North America, where the world's No. 4 automaker expects more than 40% of its U.S. sales will be EVs by 2030. That follows a recent announcement that Daimler will take a 33% stake in battery cell manufacturer Automotive Cells Co., founded last year by Stellantis and TotalEnergies.

- **Battery maker LG Chem** will reimburse GM \$1.9 billion of the \$2 billion in EV recall charges, following a series of incidents between 2017 and 2019 in which Bolts caught fire as a result of battery flaws. Meanwhile, GM will install 40,000 electric-vehicle charging stations in the U.S. and Canada, part of the automaker's \$750 million commitment to bolster its presence in the rapidly growing sector. GM’s 3<sup>rd</sup>Qtr profit was hit by the global chip shortage that it sees continuing until late 2022. (See **Appendix: Automotive**, page 13)

- **Delays in semiconductor manufacturing** are hitting vehicle production, with more than one million vehicles delayed in North America alone. Ford, Stellantis and GM are taking the hardest hit, combining for a delay of 855,000 vehicles as of October. Modern cars have smart and complex entertainment systems, navigation and sensors with 500-1,500 different chips powering its functions.

- **U.S. power usage** will rise about 3% in 2021 as the economy grows following last year's coronavirus hit to demand, the U.S. Energy Information Administration said. Natural gas' share of power generation will slide from 39% last year to 36% this year and 35% in 2022 as gas prices rise. Coal's share will rise to 24% this year, from 20% in 2020, and contribute 23% next year. Nuclear generation will ease from 21% last year to 20% this year and next, while renewables will hold at 20% in 2021, before rising to 22% in 2022.



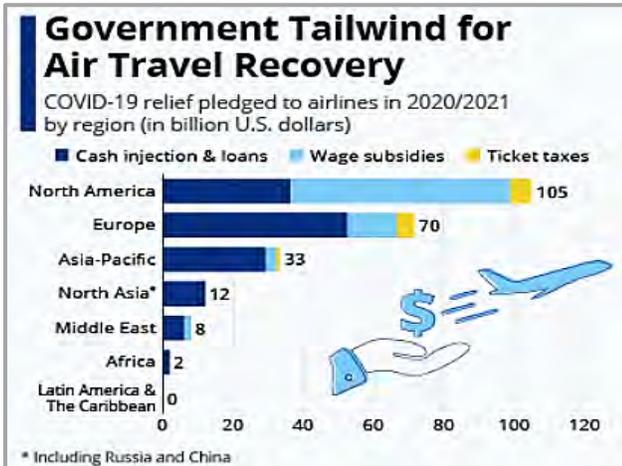
- **A plan to develop large-scale wind farms** along nearly the entire U.S. coastline was announced by the Biden administration, the first long-term strategy from the government to produce electricity from offshore turbines. The Department of the Interior will begin to identify, demarcate and eventually lease federal waters in the Gulf of Mexico, Gulf of Maine and off the coasts of the Mid-Atlantic States, North Carolina and South Carolina, California and Oregon to wind power developers by 2025.

**Key Update:** *President Biden has pledged to cut the nation’s fossil fuel emissions 50% from 2005 levels by 2030 by designing policies to promote the use of electric vehicles and clean energy. In particular, the administration has pledged to build 30,000 megawatts of offshore wind in the U.S. by 2030.*

- **ExxonMobil and Chevron** reported their best quarterly profits in years, powered by surging energy demand and a commodity-price boom. ExxonMobil’s net income in the 3<sup>rd</sup>Qtr was \$6.8 billion, up \$2.1 billion from the 2<sup>nd</sup>Qtr; Chevron’s net was \$6.1 billion, an increase of \$3 billion.

- **Private business jets** once provided refuge from airport waiting lines for the few that could afford them, but now demand is so strong that even wealthy travelers face cancellations and delays. To protect service, NetJets Inc, the world's largest private jet company is investing \$2.5 billion for 100 new aircraft to be delivered by end of 2022.

- **United Airlines** will expand its transatlantic service in 2022, adding 5 new destinations to capitalize on pent-up travel demand. U.S. carriers are buoyed by the administration's decision to reopen to fully vaccinated air travelers from 33 countries, including most of Europe, in November. Before the pandemic, transatlantic routes accounted for up to 17% of passenger revenues for the top three U.S. carriers. They have seen a surge in bookings since the announced lifting of the travel restrictions. UA expects the transatlantic route to have the busiest ever summer next year.



- **A sharp rise in the price of fuel** is threatening the airline industry's slow recovery from the coronavirus crisis. Oil prices climbed to their highest levels in seven years by mid-October, triggering new concerns over carriers' costs as patchy passenger demand persists after 18 months of travel restrictions. The price of jet fuel has doubled to almost \$750/tonne over the past year.  
*Key Update: Making the fuel situation worse, many airlines gave up hedging their future fuel requirements when chaos ripped through the oil market last year, leaving them more exposed to the subsequent sharp rise in crude prices.*
- **Boeing** eked out a small operating profit but recorded a net loss for the 3<sup>rd</sup>Qtr. Changes on its problem-plagued 787 and Starliner spacecraft programs dampened a ramp-up in 737MAX deliveries amid rebounding air travel. A new defect on its Dreamliner involves titanium parts that are weaker than specified on 787s built over the past 3 years, leaving Boeing stuck with \$25 billion of the jets in inventory.
- **Boeing** is aiming for a test flight of its unmanned CST-100 Starliner capsule in the first half of next year and a potential launch of its crewed spacecraft at the end of 2022. The CST-100 was scheduled to fly to the International Space Station from Cape Canaveral in August but the flight was aborted because of problems with propulsion system valves. (See **Appendix: Aerospace**, page 11)

- **Lockheed Martin** dramatically cut its sales expectations for this year and 2022, as the COVID-19 pandemic severely hobbled the top U.S. defense contractor's supply chain. The pandemic has crippled many companies' ability to send and receive the parts and supplies they need. Lockheed said the problem worsened over the last two months, as the maker of the F-35 fighter jet lowered its 2021 revenue expectations by 2.5% to \$67 billion and said next year's revenue could fall to \$66 billion. It expects sales to recover in 2023 and increase steadily through 2026.



- **Johnson & Johnson's revenues** climbed 11% to \$23.34 billion in the 3<sup>rd</sup>Qtr compared to a year ago, reflecting a return of more doctor's visits and medical procedures after the pandemic disrupted the industry. Medical-device sales grew 7.6% amid a higher level of surgical procedures. Pharmaceutical sales were up 14%, the result of more prescriptions of drugs for multiple myeloma, inflammatory diseases and other conditions. Of the 189 million Americans fully vaccinated, about 8% received J&J's vaccine.
- **BioNTech/Pfizer and Moderna** will dominate the COVID-19 vaccine market next year, generating \$93 billion in combined sales according to new forecasts, almost double the amount in 2021. The bullish projections suggest the two producers of messenger RNA jabs will control three-quarters of the non-Chinese COVID-19 vaccine market in 2022. Rivals AstraZeneca, Johnson & Johnson, Russia's Sputnik V and new entrants such as Novavax make up the rest of the market, which is forecast to double in value to \$124 billion next year. (See **Appendix: Medical**, page 14)

- **BHP is seeking direct engagement** with Native American communities living near a vast proposed copper mine in Arizona, as its partner on the project, Rio Tinto, struggles to build trust among native landowners. Resolution Copper, which has enough of the metal to satisfy 25% of projected U.S. demand for 40 years, is 55%-owned by Rio and 45% by BHP. The San Carlos Apache tribe, which has always opposed the project, claims Resolution's proposed underground mine will cause a huge crater, 2 miles wide and 1,000 ft. deep, that would swallow Oak Flat, a site of special religious significance for the tribe.  
*Key Update: Rio badly damaged its credibility among indigenous peoples last year when it destroyed a 46,000-year-old sacred Aboriginal site in Australia for a mine expansion.*



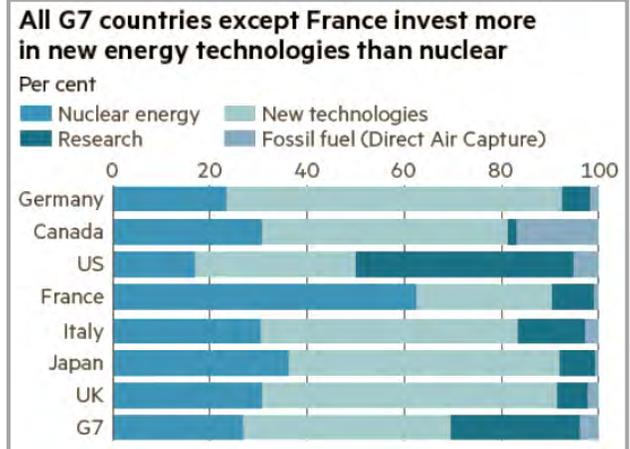
## EUROPE, AFRICA & THE MIDDLE EAST

- **Eurozone business activity** grew at its slowest pace in six months in October. Further worsening of the global supply chain problems is causing huge factory order backlogs. Inflation rose to a 13-year-high of 4.1%, driven by a 23.5% spike in energy prices. Manufacturing and services companies' costs rose at their sharpest-ever rate. Selling prices rose at their fastest pace in almost two decades.
- **A shortage of magnesium** may force European carmakers and other users of aluminum to shut down production within weeks unless China restarts its smelters. Magnesium is a vital component of aluminum alloys used in cars, packaging and other products. About 87% of global supply and 95% of European consumption comes from China, which has cut output to save power as energy prices rise. Prices of magnesium imports into Europe are \$10,000-\$14,000/tonne, up from \$2,000/tonne earlier this year.
- **Outokumpu and Gasum** signed a new 10-year power supply agreement for renewable wind power, which will begin in 2023. The contract covers almost the entire electricity consumption of Outokumpu's Kemi chrome mine and is one of the most important ways for Outokumpu to achieve its goal of carbon neutrality by 2050.
- **The World Steel Association** released an update of its Short Range Outlook for this year and 2022. Worldsteel forecasts steel demand will grow by 4.5% in 2021 and reach 1.855 billion tonnes after only 0.1% growth in 2020. In 2022, steel demand will see a further increase of 2.2% to 1.896 billion tonnes. The current forecast assumes that with the progress of vaccinations across the world, the spread of variants of the COVID virus will be less damaging and disruptive than seen in previous waves.
- **ArcelorMittal** temporarily stopped production at some of its steel plants at peak times "in response to high energy prices, which are making it very challenging to produce steel at economical costs". The steelmaker was forced to implement short, selective production pauses at some of its electric arc furnaces that make products typically used in the construction sector. ArcelorMittal does not expect the pauses to have a meaningful impact on production.



**Key Update:** This news underlines the strains facing Europe's steelmakers, as high energy costs and supply chain disruptions offset what had been one of the strongest years for the industry driven by soaring commodity prices.

- **France will invest €1 billion in nuclear power** by the end of this decade, as Europe's energy crisis spurs renewed interest in that contentious source of power. "The number one objective is to have innovative small-scale nuclear reactors in France by 2030 along with better waste management," president Macron said. France, a bastion of nuclear power in Europe, derives more than 70% of its electricity from reactors. (See **Appendix: Energy**, page 8)

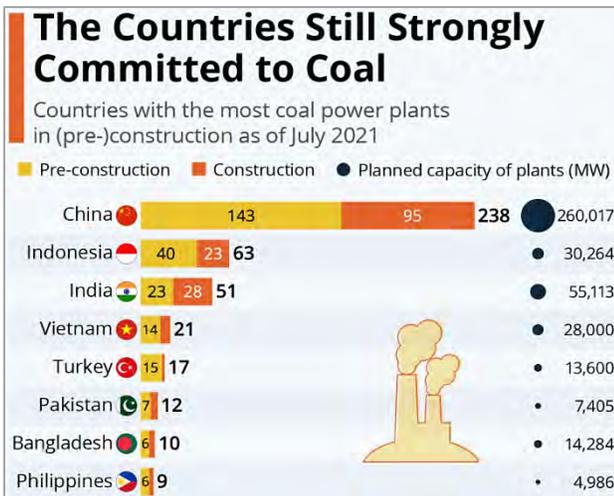


- **Daimler's** hopes to stabilize its supply chain for semiconductors during this quarter, but real relief from chip shortages won't arrive until 2023, the company said. Daimler is managing supply-chain disruptions on top of planning for a split of the company into a stand-alone luxury car company and a separate commercial truck business.
- **Maersk** said there was no end in sight to the supply chain crisis as the world's largest container shipping group enjoyed the most profitable quarter in its 117-year history and made a \$1 billion push deeper into air freight. Operating profits climbed to \$5.9 billion. CEO Soren Skou said that congestion at ports such as Los Angeles and Long Beach was getting worse as retailers and manufacturers struggled to meet post-pandemic surging demand.
- **Coca-Cola** is conducting a trial of refillable containers at Swedish convenience stores to test consumers' response and the potential to reduce waste and CO<sub>2</sub> emissions. The trial is in collaboration with the Swedish company Glacial, a manufacturer of reusable stainless steel tumblers that keep drinks cold up to 12 hours.



## ASIA/PACIFIC, JAPAN, AUSTRALIA & INDIA

- **China's economy** grew 4.9% in the 3<sup>rd</sup>Qtr from a year earlier, slowing sharply from the previous quarter's 7.9% growth rate, as power shortages and supply-chain problems added to the impact of Beijing's efforts to rein in the real-estate and technology sectors. China's factory sector was held back by widespread power outages across the country as coal prices soared and officials attempted to hit more stringent carbon emission targets. On the plus side, retail sales rose 4.4% in September from a year ago.
- **Desperate factory owners in China** are increasingly turning to diesel generators to keep their businesses going during a power crisis, which is threatening both the country's economic growth and its green ambitions. With the winter heating season fast approaching, China has instructed coal mines to expand output and allowed energy producers to raise the amount they charge for electricity. **Key Update:** *Beijing has instituted power rationing favoring residential consumption over industrial use to minimize disruption for Chinese citizens. Limited power resources for manufacturers are likely to raise the costs of construction materials, including steel, glass and aluminum.*



- **The COP26 climate summit** is taking aim at the coal sector, as 65 countries pledged to quit coal. The pact includes 18 new countries that for the first time are promising to either phase out or stop investing in new coal-fired power plants both domestically and internationally, including Poland, Vietnam and Chile. (See **Appendix: Energy**, page 8)
- **World crude steel production** was 144.4 million tonnes (Mt) in September, an 8.9% decrease from a year ago. China produced 73.8 Mt, down 21.2% on September 2020. India produced 9.5 Mt, up 7.2%. Japan produced 8.1 Mt, up 25.6%. The U.S. produced 7.3 Mt, up 22.0% from 2020.

- **A global parts and chip shortage** is taking a heavy toll on Japanese firms with seven of eight automakers seeing global output drop in September and casting doubt on the central bank's view that the impact of supply constraints will be temporary. Toyota global output slumped 39% vs. a year earlier to 512,765 units. Nissan global output fell 28%, the third-straight monthly decline Honda Motors dropped 30%, the fourth month in a row.

**Key Update:** *Output disruptions may deal a severe blow to Japan's economy, which has relied on exports to offset the weakness in consumption as the pandemic fallout lingers.*

- **Boeing** announced plans to build a new type of drone military aircraft in Australia. It has selected Toowoomba in Queensland state as the final assembly point for its unmanned Loyal Wingman



- The first test flights were completed earlier this year. The announcement came after the U.S., Australia and Britain announced a new security alliance that will supply Australia with nuclear-powered submarines.
- **Iron ore** futures extended gains as improved rebar margins at Chinese steel mills buoyed demand prospects. October iron ore prices jumped 10% in Singapore at \$137.25/tonne, taking the raw material's surge from a low in September to about a 50% recovery. Steel output was expected to increase in October in some parts of China after those regions exceeded steel production cuts in September.
- **A 37% rally in prices for nuclear fuel uranium** has pushed the price of raw uranium or yellowcake to its highest level since 2012 at \$50/lb. Investment funds have been positive on this raw material as a global energy crunch highlights the role of nuclear power in a transition away from fossil fuels. The rise in natural gas and coal prices to fresh highs has exacerbated an energy crisis in Europe and China and has placed uranium back in the speculative spotlight.
- **Metals prices** surged to multiyear highs after smelters, facing soaring energy bills and pressure to cut their carbon emissions, curtailed production. October zinc prices on the LME jumped to \$3,533/tonne, their highest level in more than three years after Nyrstar, a major producer, said it was reducing output by half at three of its European plants. Expectations that Russia will remove taxes on aluminium exports and boost global supplies have triggered an inventory sell-off that has slashed prices of the metal on the physical market in Europe and the United States. (See **Appendix: Commodities**, page 15)

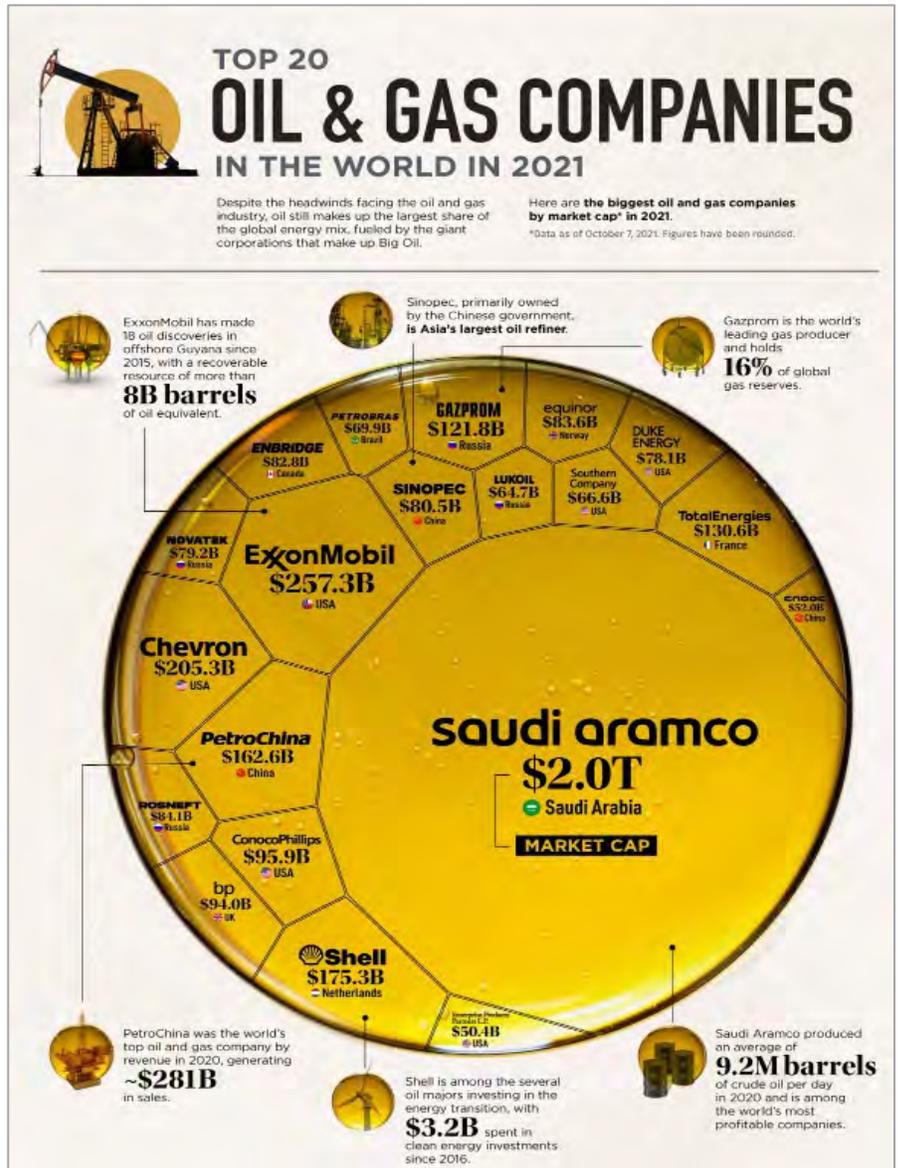
## ECONOMIC UPDATE: APPENDIX TO THE NOVEMBER 2021 ISSUE

### ENERGY: OIL RESURFACES AS THE ENERGY CRISIS DEEPENS; THE WORLD'S LARGEST OIL/GAS COMPANIES

The pandemic brought strong headwinds for the oil and gas industry, and oil majors felt the blow. Global primary energy consumption fell by 4.5% relative to 2019 and oil demand declined by 9%. For a brief period in April 2020, the price of West Texas Intermediate (WTI) crude futures went subzero, marking the largest one-day price plunge since 1983. Some expected the demand crash to have a lasting impact on the industry, but it's safe to say that 2021 has proved otherwise.

**Oil Resurfaces as Energy Crisis Deepens:** The world is facing a shortage of energy and peak winter is yet to hit most parts of the globe. Pandemic-induced supply restraints from producers and rising energy demand from recovering economies, have sent nations scrambling for petroleum products. Now, oil prices are resurfacing to pre-pandemic levels. As of late October, prices of WTI crude futures are at their highest levels in the last five years at over \$80 per barrel. Furthermore, U.S. natural gas prices hit a 7-year high of \$6.5 per million BTU. European benchmark natural gas futures have surged 1,300% since May 2020. The largest oil and gas companies are riding this wave of resurgence. This infographic ranks the top 20 oil and gas companies by market cap as of October 7, 2021. Saudi Aramco is one of the five companies in the trillion-dollar club as the world's third-largest company by market cap. Its market cap is nearly equivalent to the combined valuation of the other 19 companies on the list. Even more astounding is the fact that the company went public less than two years ago in December 2019. However, the oil giant's valuation doesn't come out of the blue. Aramco was the world's most profitable company in 2019, raking in \$88 billion in net income. Apple took this title in 2020, but high oil prices could propel Aramco back to the top in 2021. Although Standard Oil was split up a century ago, its legacy lives on today in the form of Big Oil. ExxonMobil and Chevron—the second and third-largest companies on the list—are direct descendants of Standard Oil. Furthermore, Shell and BP both acquired assets from Standard Oil's original portfolio on the road to becoming global oil giants. The top 20 oil and gas companies come from 10 different countries. The U.S. hosts six of them and four are in Russia. The other 10 are located in China, Brazil, Saudi Arabia and Europe.

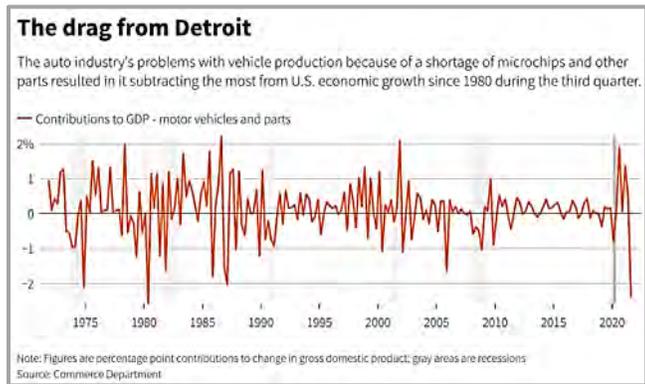
**Big Oil, Bigger Emissions:** Due to the nature of fossil fuels, the biggest oil and gas companies are also among the biggest greenhouse gas (GHG) emitters. In fact, Saudi Aramco is the world's largest corporate GHG emitter and accounts for over 4% of the entire world's emissions since 1965. Chevron, Gazprom, ExxonMobil, BP and several other oil giants join Aramco on the list of top 20 GHG emitters between 1965 and 2017. Shifting towards a low-carbon future will undoubtedly require the world to rely less on fossil fuels, but completely shunning the oil and gas industry isn't possible at the moment, as shown by the global energy crisis.





## ECONOMY/AUTOMOTIVE: DETROIT'S CHIP WOES DRAG DOWN U.S. ECONOMIC GROWTH

The U.S. auto sector's production slump this year is more than a big minus for Detroit — it's a major drag on the entire economy. Gross domestic product growth slowed to the weakest pace in more than a year during the 3<sup>rd</sup>Qtr at just 2% annualized, less than a third of the growth rate in the preceding quarter. While the Delta variant of COVID-19 played a big role as it swept through the country during the summer and put a lid on growth in consumer spending, the biggest soft spot in the weak GDP reading was the car industry — by a wide margin. **In all, the auto sector subtracted 2.4 percentage points from economic growth in that period.** That was the biggest drag Detroit has had on U.S. output in four decades, and one rarely seen outside of a recession. The contraction caused by COVID-19 officially lasted just two months in the spring of 2020, and the economy has been in recovery mode since. The main culprit behind the auto industry's difficulties is a worldwide shortage of microchips, which are needed to run all of a modern vehicle's complex systems. However, with the world economy rebounding from last year's shutdowns, it is not just the car



business that is chasing those chips, and they have become a global scarcity. **As a result, U.S. motor vehicle production has fallen in six of the last nine months and is running at a level more typically associated with a recession.** September's run rate of 7.51 million vehicle assemblies was the lowest, excluding the short-lived dive to near zero during the COVID shutdowns, since 2010 when the industry was making a wobbly recovery from the financial crisis. It's also playing out in the U.S. inflation picture. The chip shortage is just one component of a complex jigsaw puzzle of the forces driving inflation to its highest level in decades, but in the car space, it has upended pricing dynamics like never before. With new cars so hard to come by, consumers in need of a vehicle bid up used car prices. At one point this spring, used car prices rocketed by more than 10% per month for three straight months. That has driven the difference in inflation rates between new and used cars and light trucks to the widest on record in favor of used vehicles.

## STAINLESS STEEL: INDUSTRIAL ORIGAMI, RELEASING THE FULL POTENTIAL OF FLAT SHEET STEEL

A Swedish start up developed a new process for design and manufacture using an innovative metal forming technique developed by Outokumpu. Stilride AB completed further development work covering the whole value chain from digital design tools to production, ultimately developing a new process for designing and manufacturing they call *LIGHT.FOLD*. Stilride started out with the vision to build a sustainable electric scooter. CO<sub>2</sub> levels are skyrocketing, and climate change is a big problem. More scooters than cars are sold annually, and the old ones are more polluting than vans. Only 0.5% of the world's population can afford to buy a car. Stilride set out to create clean energy powered personal mobility devices. The company's engineers challenged the traditional view of manufacturing by using a robotic industrial origami to fold structures from a flat sheet of metal, compatible with the material's characteristics and geometric nature. The manufacturing technique is based on the ancient art of origami or folding paper into a 3D object. With this technique, it is possible to achieve significant benefits compared to traditional forming technologies, resulting in savings in material use and labor costs. **To maximize weight reduction, high strength stainless sheet material was chosen as the main construction material, but this also meant overcoming challenges related to folding of very high strength stainless steels.** A system to locally heat treat the folding lines with lasers was developed. The first prototypes of the Stilride electric scooter are now complete. Next steps involve industrial pilot trials for fully automated production. Compared to the industry leader in electronic scooters, Niu, Stilride reduced the number of components approximately 75%, resulting in 25% lighter weight and decreased labor cost of 25-45% due to less need for welding and riveting. These improvements will create estimated cost savings of 20% to 50%. By successfully demonstrating an innovative way of processing metallic flat sheet material into complex geometries that would be costly to realize with traditional forming operations, Stilride has the potential to create a new cost efficient value chain based on sheet metallic material that allows manufacturers and mechanical engineering companies to design products with a substantially lower weight, using fewer components, resulting in cost savings on materials through large surface-to-volume ratios, high yield stresses and high fatigue resistance. The potential of this is huge for manufacturing in a more flexible way with metallic materials, especially for e-mobility and lightweight applications.





## STAINLESS STEEL/ENERGY: WORLD'S LARGEST SOLAR POWER PLANT DELIVERS 24-HOUR ENERGY

Noor Ouarzazate



**The Noor power station in Morocco is the largest concentrated solar power plant on the planet and it uses molten salt storage to produce electricity at night.** Known as the gateway to the Sahara, the city of Ouarzazate is located in the Agadir district of southern Morocco, where the region has some of the highest amounts of sunlight in the world – up to 2635 kWh/m<sup>2</sup> annually. A few kilometres north of the city a dazzling ring made from hundreds of thousands of mirrored surfaces make up a sprawling, 2,500-hectare solar power plant. Called Noor after the Arabic word for ‘light’, the gigantic solar complex allows Morocco to provide



nearly half of its energy from renewable sources. Consisting of three distinct facilities, Noor I, Noor II and Noor III, the site is able to power more than a million homes and is estimated to save 760,000 tonnes of carbon emissions every year. The Noor I site alone features 537,000 parabolic mirrors that are controlled by computers so that they constantly face the sun. These mirrors focus the sun’s rays, heating a special thermal oil that runs through stainless steel pipes throughout the facility. This synthetic oil, which can be heated to around 390°C, travels to the central power plant, where it produces steam to drive the main turbine and generate electricity. While the scale and output of Noor is impressive, it is the third and most recent power plant to come online that represents a significant technological leap that could herald a bright future for sustainable energy generation.

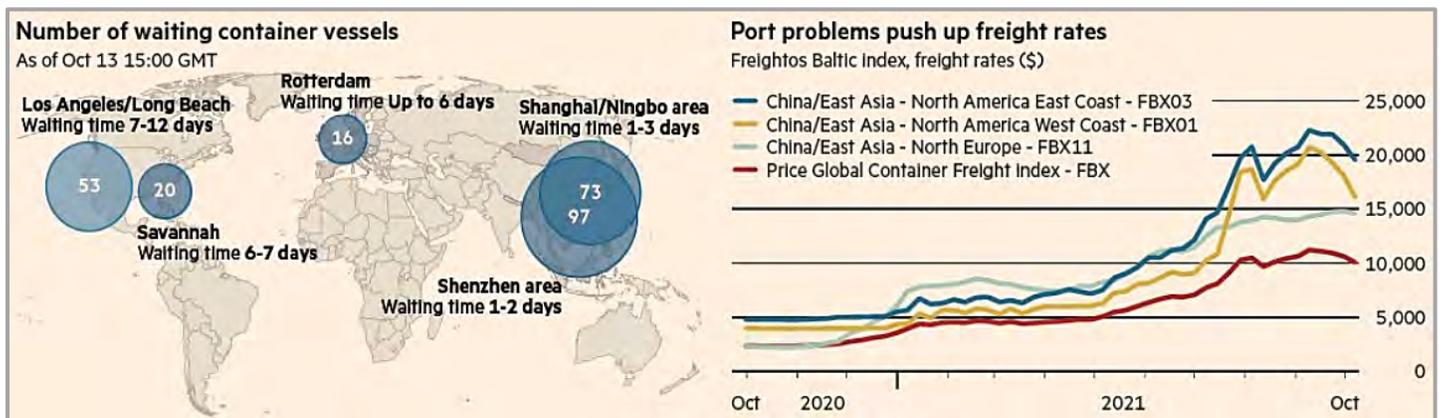
**Storing sunshine with stainless steel and salt.** The facility’s solar thermal power plants convert energy from the sun into electricity, but the Noor III complex combines its solar power tower with a central receiver that super heats molten salts to more than 500°C. These molten



salts can store heat and allow the plant to produce power at full capacity even during hours of darkness. For this to work, huge quantities of these special salts, which are a mixture of potassium and sodium nitrate, are held in massive steel tanks. Special grade stainless steel is used throughout the site’s heat exchangers, pipework, generators and energy storage facility. Each of the huge tanks is made from specialised UR 347 stainless steel grade. Due to the highly corrosive nature of the salts contained within, it would be impossible to operate this innovative heat storage method without this niobium-stabilized austenitic steel. Steel underpins the entire facility as it was used for the production of the heat exchangers, steam

generators, high temperature pipes and molten salt storage tanks. This is due to its incredible corrosion resistance, combined with its flexibility of use, as this special grade can be easily formed and welded. With the molten salt storage tanks able to provide enough heat to maintain operation of the plant for seven hours after dark, the Noor complex is able to provide 24-hour energy and represents a game changer for solar as part of the future renewable energy mix. **With countries in the ‘sunbelt’ that stretches 40 degrees north and south of the equator investing heavily in solar power, Noor represents a vision of the future. A future where glistening stainless steel mega structures are able to renewably power entire regions round the clock.**

## LOGISTICS: PORT CONGESTION PUSHES SUPPLY CHAINS CLOSE TO BREAKING POINT





## METALS: U.S. AGREES TO ROLL BACK TARIFFS ON EUROPEAN STEEL AND ALUMINUM

The Biden administration reached a deal to roll back tariffs on European steel and aluminum, an agreement that officials said would lower costs on goods like cars and washing machines, reduce carbon emissions and help get supply chains moving again. The deal, which came as world leaders met at the Group of 20 summit in Rome, is also aimed at easing trans-Atlantic trade tensions.

**The agreement leaves some protections in place for the American steel and aluminum industry, by transforming the current 25% tariff on European steel and 10% tariff on aluminum into a so-called tariff rate quota, an arrangement in which higher levels of imports are met with higher duties.**

The accord will put an end to retaliatory tariffs that the European Union had imposed on American products including power boats, bourbon and Harley-Davidson motorcycles. It will also avert additional tariffs on American products that were set to go into effect on December 1. The new deal is reported to allow the EU to ship 3.3 million metric tons of steel (in addition to 1.1 million tonnes of additional exclusions that the U.S. will extend for two years) into the U.S. duty-free but will impose a 25% tariff on additional volumes. The U.S. imported 4.8 million tons of EU steel in 2018, 3.9 million in 2019 and 2.5 million in 2020. The 10% aluminum tariffs will return after 18,000 metric tons of unwrought aluminum and 366,000 metric tons of semi-finished aluminum are imported.



In practice, the system isn't a single quota for steel and aluminum, but rather 54 distinct quotas for different types of steels and 16 quotas for different types of aluminum. Each EU member country will have its own quota for each category based on historical trade levels. Importers will need to carefully track shipments to ensure they arrive before quotas kick in, giving an advantage to companies with the resources to monitor where quotas are still available, to handle complex documentation rules and to arrange for carefully timed shipments that come in duty free. **“Giant companies are going to have the clout and financial capability where they can go in and place large orders and suck up the quota,” said Gregg Boucher, the president of the distribution division of Ulbrich Stainless Steel & Specialty Metals, a New Haven, Connecticut-based metal processing firm that imports some raw materials from Europe.** Scott Lincicome, an international trade lawyer and senior fellow at the Cato Institute, noted that most smaller companies don't have teams of trade lawyers to navigate the complex quota system. “It's even more complicated, by far, than just having the tariffs,” he said. “This is just brutal for small and medium steel-consuming companies,” he said. The Coalition of American Metal Manufacturers and Users, a group of companies that use steel and aluminum, cautioned the system could “allow for gaming of the system that could put this country's smallest manufacturers at an even further disadvantage.” Far more companies consume metals than produce them. When the tariffs began, federal data showed there were

around 29,000 steel-consuming firms, compared with only about 900 classified as steel producing and 600 for aluminum. The data, from 2017, include steel consumers that make products such as springs, vehicle parts and wire, but not major manufacturers such as automakers. Many of the steel-consuming companies, which employed over 900,000 workers, are also big buyers of aluminum.

**Significantly, rather than just a simple return to the status quo from 2018, the U.S. and the EU plan to address the existential threat of climate change and production overcapacity in the steel industry, which is one of the biggest CO<sub>2</sub> emitters in the world.**

The future EU-U.S. arrangement will be a challenge for China, which produces more than half of the world's steel and whom the EU and U.S. accuse of creating overcapacity that is threatening the survival of their own steel industries. "Together, the U.S. and EU will work to restrict access to their markets for dirty steel and limit access to countries that dump steel in our markets, contributing to worldwide over-supply," the White House said in a factsheet, without naming China directly. Speaking to the press, President Biden was more explicit, saying the arrangement with the EU would help "restrict access to our markets for dirty steel from countries like China". The global deal is to be worked out over the next two years to promote "green" steel and aluminum production and will be open to other countries that want to join, including China, whose steel sector is responsible for 10%-20% of the country's CO<sub>2</sub> emissions. The Commerce Department said Washington was consulting with Japan and Britain on issues related to steel and aluminum, with a focus on the impacts of overcapacity on the global steel and aluminum markets. "The Global Arrangement will seek to ensure the long-term viability of our industries, encourage low-carbon intensity steel and aluminum production and trade, and restore market-oriented conditions," the EU Commission said in a statement.

## INNOVATION: WINGED MICROCHIP IS SMALLEST-EVER, HUMAN-MADE FLYING STRUCTURE

Northwestern University engineers have added a new capability to electronic microchips: flight. About the size of a grain of sand, the new flying microchip (or “microflier”) does not have a motor or engine. Instead, it catches flight on the wind, much like a maple tree’s propeller seed, and spins like a helicopter through the air toward the ground. By studying maple trees and other types of wind-dispersed seeds, the engineers optimized the microflier’s aerodynamics to ensure that it, when dropped at a high elevation, falls at a slow velocity in a controlled manner. **This behavior stabilizes its flight, ensures dispersal over a broad area and increases the amount of time it interacts with the air, making it ideal for monitoring air pollution and airborne disease.** As the smallest-ever human-made flying structures, these microfliers also can be packed with ultra-miniaturized technology, including sensors, power sources, antennas for wireless communication and embedded memory to store data. “Our goal was to add winged flight to small-scale electronic systems with the idea that these capabilities would allow us to distribute highly functional, miniaturized electronic devices to sense the environment for contamination monitoring, population surveillance or disease tracking,” said Northwestern’s John A. Rogers, who led the device’s development. Most people have watched a maple leaf’s whirling propeller seed spin through the air and gently land on the sidewalk. This is just one example of how nature has evolved clever, sophisticated methods to increase the survival of various plants. By ensuring that seeds are widely dispersed, otherwise sedentary plants and trees can propagate their species over vast distances to populate broad areas. To design the microfliers, the Northwestern team studied the aerodynamics of a number of plants’ seeds, drawing its most direct inspiration from the *tristellateia* plant, a flowering vine with star-shaped seeds. *Tristellateia* seeds have bladed wings that catch the wind to fall with a slow, rotating spin. The microfliers comprise two parts: millimeter-sized electronic functional components and their wings. As the microflier falls through the air, its wings interact with the air to create a slow, stable rotational motion. The weight of the electronics is distributed low in the center of the microflier to prevent it from losing control and chaotically tumbling to the ground. In demonstrated examples, Rogers’ team included sensors, a power source that can harvest ambient energy, memory storage and an antenna that can wirelessly transfer data to a smart phone, tablet or computer. Rogers imagines that large numbers of devices could be dropped from a plane or building and broadly dispersed to monitor environmental remediation efforts after a chemical spill or to track levels of air pollution at various altitudes. But what about all the electronic litter? The lab already develops transient electronics that can harmlessly dissolve in water after they are no longer needed. **Now his team is using the same materials and techniques to build microfliers that naturally degrade and disappear in ground water over time.**



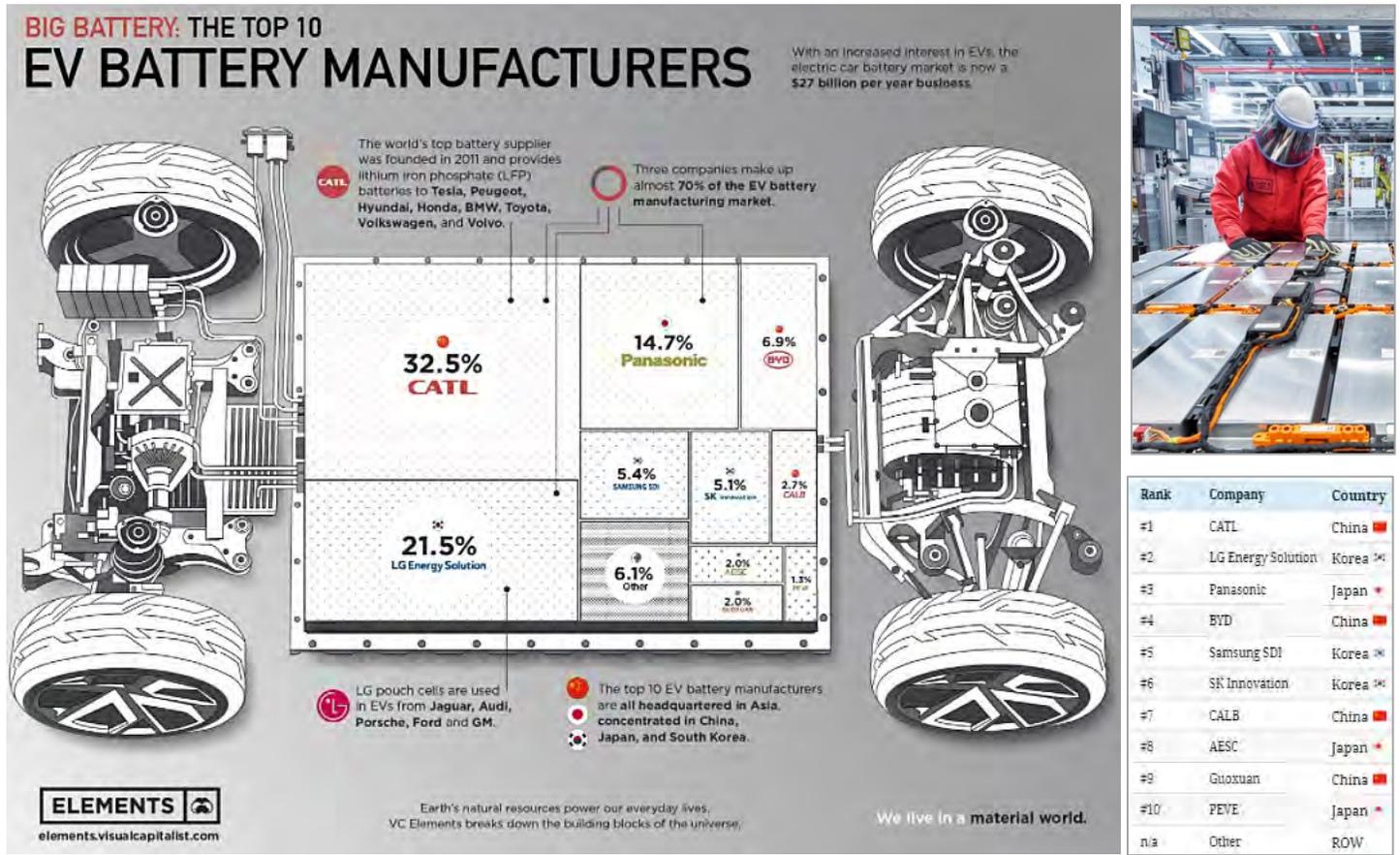
## AUTOMOTIVE: GM, GENERAL ELECTRIC LOOK TO DEVELOP RARE EARTH MATERIALS SUPPLY CHAIN

General Motors and General Electric are looking at developing a supply chain of rare earth materials that help make EVs and renewable energy equipment. The memorandum of understanding between GM and GE Renewable Energy will evaluate options to improve supplies of heavy and light rare earth materials as well as magnets, copper and electrical steel. The agreement is another sign that North American automakers are keen to decrease their reliance on foreign countries for critical minerals. They initially plan to concentrate on making a North America and Europe-based supply chain of magnet manufacturing, as metal alloys and finished magnets made from rare earth materials are critical components used in creating electric motors for automotive and renewable power generation. **GM and GE Renewable Energy will also look to create new supply chains for materials like copper and eSteel—a new alloy that incorporates recycled materials—that are used in automotive traction motors and renewable power generation.**



GM’s vice president for global purchasing and supply chain, explained, “Motors are one of the most important components of our Ultium Platform and the heavy and light rare earth materials are an essential ingredient in our motor magnets.” GE Renewable Energy Chief Technology Officer said, “Working with GM gives us another tool to obtain a reliable, sustainable, and competitive source of key materials going forward that will help us lower the cost of renewable energy and drive more electrification by making EVs a more viable option for consumers. We are also excited to partner with GM to explore opportunities to develop critical supply chains in the U.S. and further reduce CO<sub>2</sub> emissions.” The U.S. is trying to increase its production of rare earth materials, to be less reliant on China. In 2018, China produced some 120,000 tonnes of rare earths, while the U.S. produced 15,000 tonnes. GM announced that it is building a huge new electric vehicle battery lab in Michigan where scientists will work on chemistry to cut costs 60% over current vehicles and allow people to travel 500 to 600 miles per charge. It plans to spend \$35 billion on electric and autonomous vehicles, rolling out 30 new EV models worldwide by 2025 and selling only electric passenger vehicles by 2035.

## AUTOMOTIVE: THE TOP 10 GLOBAL ELECTRIC VEHICLE BATTERY MANUFACTURERS



**The Top 10 Electric Vehicle Battery Manufacturers:** With increasing interest in electric vehicles (EVs) from consumers, the market for lithium-ion EV batteries is now a \$27 billion per year business. According to industry experts, high demand has boosted battery manufacturers' profits and brought heavy competition to the market and by 2027, the market could grow further to \$127 billion as consumers embrace more affordable EVs. Besides being a manufacturing powerhouse of vehicle parts, Asia is fast becoming a hotbed for innovation in the battery sector. No wonder the top 10 EV battery manufacturers by market share are all headquartered in Asian countries, concentrated in China, Japan and South Korea. According to data from SNE Research, the top three battery makers—CATL, LG and, Panasonic—combine for nearly 70% of the EV battery manufacturing market.

**Chinese Dominance:** Based in China's coastal city of Ningde, best known for its tea plantations, Contemporary Amperex Technology Co. Limited (CATL) has risen in less than 10 years to become the biggest global battery group. The Chinese company provides lithium iron phosphate (LFP) batteries to Tesla, Peugeot, Hyundai, Honda, BMW, Toyota, Volkswagen and Volvo. Shares in the company gained 160% in 2020, lifting CATL's market capitalization to almost \$186 billion. CATL counts nine people on the Forbes list of global billionaires. Its founder, Zeng Yuqun, born in a poor village in 1968 during the Chinese Cultural Revolution, is now worth almost as much as Alibaba founder Jack Ma. China also hosts the fourth-biggest battery manufacturer, Warren Buffett-backed BYD.

**Competition for CATL Outside China:** Outside China, CATL faces tough competition from established players LG and Panasonic, respectively second and third on our ranking. With more than 100 years of history, Panasonic has Tesla and Toyota among its battery buyers. LG pouch cells are used in EVs from Jaguar, Audi, Porsche, Ford and General Motors.

**U.S. and Europe's Plans for Battery Production:** President Biden's strategy to make the United States a powerhouse in electric vehicles includes boosting domestic production of batteries. European countries are also looking to reduce decades of growing reliance on China. As Western countries speed up, new players are expected to rise. A host of next-generation battery technologies are already being developed by U.S. companies, including Ionic Materials, QuantumScape, Sila Nanotechnologies, Sion Power and Sionic Energy. Any direction the market moves, the forecast is bright for battery producers.

**MEDICAL: VACCINE PATCH PROTECTS AGAINST COVID-19 WITH A SINGLE, PAIN-FREE “CLICK”**

For some people, the fear of medical procedures involving injections or hypodermic needles can be extreme. An estimated one in 10 people struggle with trypanophobia or “needle phobia.” It matters because vaccine injections campaigns are negatively affected by these stress-related responses. While people delay or refuse vaccines for various reasons, the fear of needles need not be one of them. One way to cope is to find a way to get treatment without injections. A needle-free COVID-19 vaccination is in development at the University of Queensland, where scientists developed a “patch” to administer a U.S.-developed vaccine candidate in mice. **The University of Texas Hexapro vaccine candidate—delivered via the UQ-developed and Vaxxas-commercialized high-density microarray patch (HD-MAP)—provided protection against COVID-19 disease with a single, pain-free “click” from a pocket-sized applicator.** The patch is touted as being more user-friendly than the needle. “You simply ‘click’ an applicator on the skin, and 5,000 microscopic projections almost imperceptibly deliver vaccine into the skin,” said Dr. David Muller, from UQ’s School of Chemistry and Molecular Biosciences. The vaccine, dry-coated on the patch and thermostable, produced strong immune responses that were shown to be effective when the mice were exposed to the virus that causes COVID-19. “When the Hexapro vaccine is delivered via HD-MAP applicator—rather than a needle—it produces better and faster immune responses,” he said. Muller noted that it also neutralized variants of the coronavirus, including the U.K. and South African variants. The UQ researchers are looking for funding opportunities to accelerate to clinical trials. Muller said the benefits of delivering the high-density microarray patch could effectively assist the global vaccine rollout effort, “particularly for billions of vulnerable people in low and middle-income countries”. It can be self-administered and it does not have the cold chain requirements of some of the current options. When dry-coated on a patch, the vaccination by HD-MAP remains stable for at least 30 days.



Immune systems mount responses only against pathogens that have already infected the bodies they are protecting, but science can shorten the path to immunity by vaccination, which presents the immune system with harmless versions of dangerous pathogens so that it may create antibodies and killer cells hostile to the real thing in advance of any actual infection. Vaccination generally has to wait for the appearance of the pathogen in question before it can do its job, so there is a delay between a pathogen’s arrival and the deployment of a vaccine against it. That delay costs lives. Even in the case of COVID-19 and the fastest vaccine-development program ever, millions died by the time vaccinations began at the end of 2020. **New techniques have come to the fore during the current pandemic that offer the possibility of introducing them to pathogens that have not yet evolved, but which are likely to do so in the future.** Due to a combination of high-throughput DNA-sequencing technologies and modern machine-learning, it is now possible to observe which variants of a virus are circulating and suggest how they are likely to change. Understanding what a virus might look like in the future gives those designing vaccines and therapies a leg up, enabling them to prime more immune systems sooner, so that fewer people die. Dr. Jesse Bloom, a virologist at the Hutchinson Cancer Research Center in Seattle, and his team grow variants of coronavirus spike protein in Petri dishes. They then scan through these to discern which mutations have what effects. Named deep mutational scanning, it uses an array of yeast cells that have been genetically modified to express a part of the spike protein called the receptor-binding domain (RBD). As the yeast cells churn out their RBDs, many emerge with slight deviations in their structures from that of the original wild-type virus. The team then tests the RBDs from each yeast cell to see how tightly they bind to ace2, a receptor protein found on the surfaces of some human cells, to which the coronavirus attaches itself before entering those cells. RBDs that bind tightly have their underlying genomes sequenced, to determine which mutations are present. When they ran this scan in the summer of 2020 on a spike from a version of the virus then circulating, they spotted a mutation called N501Y which appeared to confer a binding advantage. A few months later, that mutation appeared in the Alpha variant, which for several months was dominant across much of the world. It was by no means the only mutation of interest to turn up, but having a limited set of such mutations to focus on is useful for narrowing the field of research. One firm taking advantage of that narrowing is Flagship Labs 77, a company based in Boston that has until recently been working in secret. FL77 is a spin-off from Flagship Pioneering, a biotechnology incubator. Moderna, a trailblazer of the messenger-RNA-based technology that helped speed up the production of coronavirus vaccines, was a Flagship Pioneering company. FL77’s researchers are trying to combine experimental data with computation to predict how viruses may evolve, information to be used to develop vaccines and therapeutic antibodies pre-emptively.

**MEDICAL: COMBATING FUTURE VIRUSES – VACCINES MAY BE PREPARED IN ADVANCE**

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## COMMODITIES: ALL THE INDUSTRIAL METALS THE WORLD MINES IN A YEAR

### Industrial metals 207,478,486 tonnes

Aluminum is the world's second-most used metal after iron, found in everything from electronic devices to aircraft parts.

Copper production is one-third that of aluminum, though it has several uses ranging from wiring to construction.



### All the Metals We Mined IN ONE CHART

Manganese is mainly used in iron and steel manufacturing and is a key ingredient in lithium-ion batteries.

Chromium enhances the hardenability and corrosion resistance of stainless steel.

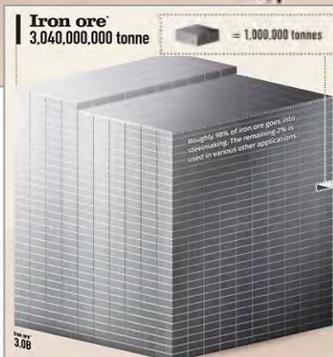
**Total Metals** 2249,814,334 tonnes  
Metals are the building blocks of the global economy. From iron ore to rare earths, here are all the metals we mined in 2019.

### Tech and precious metals 1,335,848 tonnes

Niobium is a rare metal used in superalloys for jet and rocket engines.

Lithium and cobalt are critical ingredients of lithium-ion batteries for electric vehicles.

Indium is used to make indium tin oxide, an important part of touch screens, TVs, and solar panels.



### All the Metals We Mined in One Visualization

Metals are all around us, from our phones and cars to our homes and office buildings.

While we often overlook the presence of these raw materials, they are an essential part of the modern economy. But obtaining these materials can be a complex process that involves mining, refining, and then converting them into usable forms.

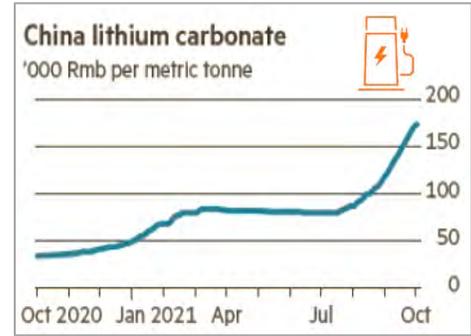
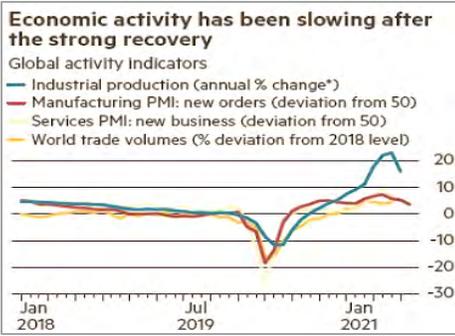
So, how much metal gets mined in a year?

### Metals vs Ores

Before digging into the numbers, it's important that we distinguish between ores and metals.

Ores are naturally occurring rocks that contain metals and metal compounds. Metals are the valuable parts of ores that can be extracted by separating and removing the waste rock. As a result, ore production is typically much higher than the actual metal content of the ore. For example, miners produced 347 million tonnes of bauxite ore in 2019, but the actual aluminum metal content extracted from that was only 62.9 million tonnes.

## COMMODITIES: COMMODITY PRICES HAVE SURGED, ESPECIALLY METALS



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# Ulbrich Economic Update Feedback Survey



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Ulbrich has proudly published our monthly Economic Update electronically since September 2019 for our six stakeholders: Customers, Vendors, Employees, Shareholders, Community & Creditors. The news and ideas presented in these reports are reflections of what is currently happening in the economy with special focus on the metals industry. We hope you have found this information to be valuable to your daily business, in addition to assisting you in making informed future decisions based on the data. Please take our quick survey to help us make improvements for your overall experience. Thank you in advance for your feedback! We appreciate your continued support.

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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](http://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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