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ECONOMIC UPDATE

Number 15 • AUGUST 2021

EXECUTIVE SUMMARY

AMERICAS: U.S. GDP ROSE SLIGHTLY IN THE 2ND QTR TO 6.5% ON AN ANNUALIZED BASIS, a smaller than expected increase, as strong consumption was partly offset by weak property investments and inventory drawdowns. **June output at America's factories** fell 0.1%. Motor vehicle production dropped 6.6% amid an unrelenting global semiconductor shortage. For the 2nd Qtr, motor vehicle and parts production contracted at a 22.5% rate. **Factory orders** advanced 1.5% in June. **Retail sales** climbed 0.6% in June and were up 18% compared with February 2020, just before the pandemic took hold. Auto sales, which have shown signs of slowing amid supply-chain disruptions that have limited the number of vehicles for sale, dropped by 2%. **Producer prices** rose 1.0%, as an 0.8% jump in the cost of services accounted for nearly 60% of the June increase. **Nonfarm payrolls** increased by 943,000 jobs in July. Employment is still 5.7 million jobs below its February 2020 peak. The unemployment rate fell to 5.4%, even as 261,000 people entered the labor force.

OVERSEAS: EUROZONE BUSINESSES REPORTED THEIR FASTEST EXPANSION in activity for more than two decades. **Disruption of steel shipments** due to the intense flooding in Germany's Rhine-Ruhr region has further intensified logistics problems for that country's steel businesses, with Thyssenkrupp the latest to declare force majeure citing transport disruptions. **Deadly floods in the Chinese province of Henan** curtailed the production of non-ferrous metals, with lead and aluminum the most severely hit.

STEEL: NORTH AMERICAN STAINLESS RECALLED THE FORCE MAJEURE NOTIFICATION IT ISSUED in July, but the recall changes little with regard to the tight availability of stainless steel in the North American market. **Inventory levels** across the U.S. stainless steel sector are extraordinarily low. Many service centers and distributors have no incoming material until later in the year. **U.S. Steel** will not be lured by high prices and rising profits into increasing capacity to make more steel, according to CEO David Burritt. USS reported 2nd Qtr net earnings of \$1.012 billion vs. a net loss of \$589 million a year ago. **ArcelorMittal** signed an MoU with the Spanish government for a €1 billion investment to build the world's first large-scale zero-carbon steel plant. It will process iron ore using green hydrogen.

AUTOMOTIVE: STELLANTIS, THE WORLD'S NO. 4 AUTOMAKER, PLANS TO INVEST MORE THAN \$35 BILLION through 2025 on electrifying its vehicle lineup. It aims to make the total cost of owning an EV equal to that of a gasoline-powered model by 2026. **Europe's new car market** sold 1.5 million fewer vehicles in the first half of this year compared to the same period in 2019. The **Electric vehicle startup Rivian** is exploring building a second U.S. assembly plant, which will include battery cell production.

ENERGY: THE WORLD'S LARGEST FUSION REACTOR NOW HAS THE WORLD'S MOST POWERFUL MAGNET. The "Central Solenoid," is truly massive at 59 feet tall, 14 feet wide and 1,000 tons. It will be shipped to France and installed at the core of the International Thermonuclear Experimental Reactor, soon to be the world's largest fusion reactor. **Singapore** unveiled one of the world's biggest floating solar power farms, covering an area the size of 45 football fields, as part of its push to cut greenhouse gas emissions.

MEDICAL: WORLD'S FIRST HEART VALVE REPLACEMENT USING AN EXTENDED REALITY PLATFORM was pioneered at a Montreal hospital. It was the first application of the Microsoft HoloLens for use in real-time, extended reality (XR) clinical support of a minimally invasive heart procedure. **The biggest private health insurers** (UnitedHealth, Cigna, Anthem and Humana) collectively made \$31.8bn in profits last year, up 20% from 2019. **Amazon Care** has approached Aetna, owned by CVS Health, and several other regional insurers in a bid to join their networks and expand coverage but has encountered resistance regarding the payment arrangements.

INNOVATION/MEDICAL: BLOOD SUGAR TESTS USING SWEAT, NOT BLOOD, COULD BE ON THE WAY. A new, quick and painless sensor may mean far fewer finger pricks for millions of diabetics. A touch-based test measures blood sugar in sweat and applies a personalized algorithm that correlates it with glucose in blood. You place your finger on the sensor for one minute and the hydrogel absorbs tiny amounts of sweat and undergoes a reaction that results in a small electrical current detected by a hand-held device.

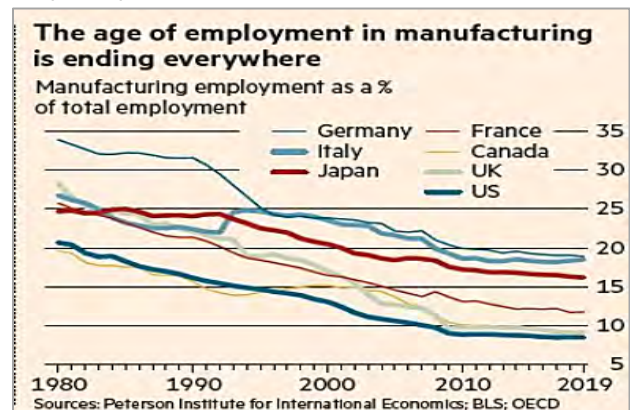
AEROSPACE: CHINA'S RIVAL TO BOEING AND AIRBUS POISED TO JOIN BATTLE FOR THE SKIES. China's first passenger jet is nearing Beijing's approval to start commercial flights. With the launch of the single-aisle C919, an industry dominated by Airbus and Boeing faces a deep-pocketed and politically connected competitor in state-backed aerospace champion Comac. **Lockheed Martin's space business** profits in the 2nd Qtr of this year rose 33% to \$335 million due to progress on space-based sensor platforms.

COMMODITIES: ALUMINUM PRICES SURGED ON CONCERNS ABOUT REDUCED SUPPLIES FROM CHINA after more power cuts in the metal-producing Yunnan province. Producers received notice from local authorities at the end of July to restrict their power consumption. Iron ore prices remain higher than at any point in the last 10 years. Supply won't increase significantly in the months ahead, as the biggest producers grapple with a range of problems from labor shortages to bad weather. **Tin prices** achieved the highest level on record as a boom in consumer electronics and fears of supply disruptions have fuelled a 65% price rally since January.

THE AMERICAS.

- **U.S. gross domestic product** grew 1.6% in the 2ndQtr from the previous quarter and 6.5% on an annualized basis. Fueled by several rounds of stimulus checks, personal consumption expenditure was the main driver behind the upswing, as private domestic investment and the negative trade balance pulled in the other direction.
- **Durable goods orders** rose 0.8% in June, boosted by a 2.1% increase in transportation equipment orders. Civilian aircraft orders climbed 17%. Boeing received 219 aircraft orders, compared with May's 73 orders. Motor vehicles and parts orders slipped 0.3% after rising 2.0% in May. Core capital goods orders were lifted by demand for machinery and primary metal products.
Key Update: Orders for non-defense capital goods excluding aircraft, a closely watched proxy for business spending plans, rose 0.5% in June. Business spending on equipment has recorded three-straight quarters of double-digit growth.
- **U.S. retail sales** climbed 0.6% in June and were up 18% compared with February 2020, just before the pandemic took hold. Sales were robust at restaurants and bars (+40% compared to June 2020). Auto sales, which have shown signs of slowing amid supply-chain disruptions that have limited the number of vehicles for sale, fell by 2%. Excluding autos, retail sales expanded 1.3% in June.
- **U.S. import prices** increased 1.0% in June as bottlenecks in the global supply chain persisted. The eighth-straight monthly gain left the year-on-year increase at 11.2%. Petroleum prices gained 4.6%, while the cost of imported food increased 1.9%. U.S. export prices climbed 1.2% in June and 16.8% YOY. Prices for the nation's agricultural exports advanced 1.5%.
- **The U.S. trade deficit** surged to a record high in June as efforts by business to rebuild inventories to meet robust consumer spending drew in more imports. The trade gap increased 6.7% to \$75.7 billion. Goods imports rose 1.8% to \$239.1 billion, also a record high. Exports of goods gained 0.2% to \$145.9 billion in June, an all-time high.
- **U.S. consumer confidence** hovered at a 17-month high in July, suggesting the economy maintained its strong growth clip at the start of the 3rdQtr.
- **Consumer prices** increased 0.9% in June, the largest gain since June 2008. Used car and truck prices accelerated 10.5%, accounting for more than one-third of the surge in prices. Consumers also paid more for food, gasoline, rents and apparel. In the 12 months through June, the CPI jumped 5.4%. The core CPI surged 4.5% on a YOY basis.

- **Nonfarm payrolls** increased by 943,000 jobs in July after rising by 938,000 in June. Employment is now 5.7 million jobs below its peak in February 2020. Manufacturing payrolls increased by 27,000 jobs, construction by 11,000. The unemployment rate fell to 5.4% from 5.9% in June and reached the lowest level since March 2020. The decline came even as 261,000 people entered the labor force, lifting the participation rate to 61.7% from June's 61.6%.



- **Output at U.S. factories** fell 0.1% in June as motor vehicle production dropped 6.6% amid an unrelenting global semiconductor shortage. Motor vehicle and parts production contracted at a 22.5% rate in the 2ndQtr. Output at factories grew at a 3.7% annualized rate in the 2ndQtr after increasing at a 2.3% pace in the 1stQtr. Capacity utilization for the manufacturing sector fell 0.1% to 75.3% in June.
- **U.S. manufacturing** continued to grow in July but the pace slowed for the second straight month as spending rotates back to services from goods and shortages of raw materials persist. The ISM index of national factory activity fell to 59.5 in July from 60.6 in June. Production at factories slowed, leading to a rise in the backlog of uncompleted work.
- **U.S. factory orders** rose 1.5% in June and 18.4% YOY. The increase in factory goods orders in June was broad, with notable gains in machinery, computers and electronic products, appliances and components. Orders for transportation equipment increased 2.0%.
- **Service sector activity** jumped to a record high in July, boosted by the shift in spending to services from goods, but businesses continued to face rising prices because of supply chain constraints. The ISM non-manufacturing activity index raced to 64.1 from 60.1 in June.
- **U.S. producer prices** rose 1.0% in June, as an 0.8% jump in the cost of services accounted for nearly 60% of the increase. Goods prices climbed 1.2%. In the 12 months through June, the PPI has surged 7.3%. Higher commodity prices and increased labor costs due to a shortage of workers are driving inflation at the factory gate.

- **The U.S. government** posted a June deficit of \$174 billion, about a fifth of the June 2020 deficit of \$864 billion. The fiscal YTD deficit fell to \$2.238 trillion from \$2.744 trillion for the first nine months of the prior fiscal year. Year-to-date receipts rose 35% from a year earlier to \$3.056 trillion, while outlays grew 6% to \$5.294 trillion.
- **The Index of Leading Economic Indicators** rose 0.7% in June to 115.1, topping its previous peak reached in May. The Conference Board said June's gain in the LEI was broad-based and, despite negative contributions from housing permits and average workweek, suggests that strong economic growth will continue in the near term.
- **U.S. household spending** rose 1.0% in June as consumers spent more on services at the start of the summer, but part of the increase reflected higher prices. The current upswing in COVID cases related to the Delta variant is spreading uncertainty about the economic outlook. Personal income rose 0.1%, as wages and salaries barely increased.
- **U.S. existing-home sales** rose 1.4% in June to an annual rate of 5.86 million; sales were up 22.9% from a year earlier. The median existing-home price rose to \$363,300, up 23.4% from a year earlier, setting a record high. New single-family home sales tumbled to a 14-month low. Housing starts rose 6.3% to an annual rate of 1.643 million units. Permits for future homebuilding fell 5.1%. Lagging starts suggest that homebuilding will slow in the coming months.
- **U.S. construction spending** rose 0.1% in June as an increase in private projects was offset by a dip in public sector building. Spending on public construction projects dropped 1.2% in June, after declining 0.8% in May. Single-family homebuilding spending surged 1.8% in June.
- **Steel mills** in the U.S. shipped 7.987 million tons of steel in May, a 1.8% increase from the previous month and a 46% improvement from May 2020. Shipments through May YTD were 37.938 million tons, a 7.8% increase vs. the same period in 2020. (See **Appendix: Steel**, page 14)
- **U.S. Steel** will not be lured by high prices and rising profits into increasing capacity to make more steel, CEO David Burritt said. USS reported 2ndQtr net earnings of \$1.012 billion vs. a net loss of \$589 million a year ago. USS recently announced an investment in a non-grain oriented electrical steel line that will allow the company to partner with auto OEMs on their own decarbonization goals.
Key Update: Commenting on its markets, USS said automakers are expected to accelerate their 2ndHalf build schedules to double the current 27 days of vehicle inventory.
- **Global crude steel production** was 167.9 million tonnes (Mt) in June, a 12% increase compared to June 2020.

- **Kaiser Aluminum** reported a net loss of \$22 million for the 2ndQtr vs. a \$6.6 million loss a year ago, although revenues grew 168% due to its recent acquisition of the Alcoa Warrick rolling mill. Kaiser expects the aerospace market to recover to record 2019 levels by 2023/2024 and over 5% CAGR in automotive demand, driven by light weighting and fuel efficiency amid a shift to EVs.



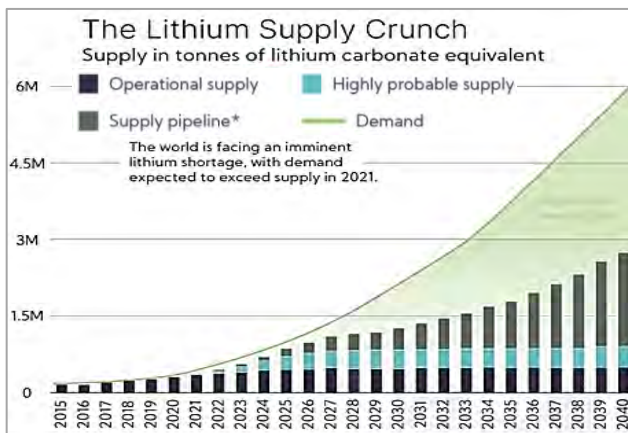
- **Stainless steel** demand in the 2ndHalf is expected to stay strong and material will remain difficult to source domestically. Outokumpu and NAS have struggled to match output with demand. Buyers are now placing orders for deliveries in the final few months of this year. The severe shortage of material continues to drive prices upwards. Cold-rolled 304 and 316 basis values have increased by more than 20% since January. Upward adjustments have been made to the mills' price extras. Further increases in basis values are predicted during the 3rdQtr. Stainless prices are forecast to remain high for the remainder of 2021.

Key Update: Inventory levels across the U.S. stainless steel sector are extraordinarily low. Buyers report that no material is available in several grades and sizes of stainless flat products. Many service centers and distributors have no incoming material until later in the year. Several buyers are purchasing from overseas, but imports are hampered by poor container availability and high shipping costs.



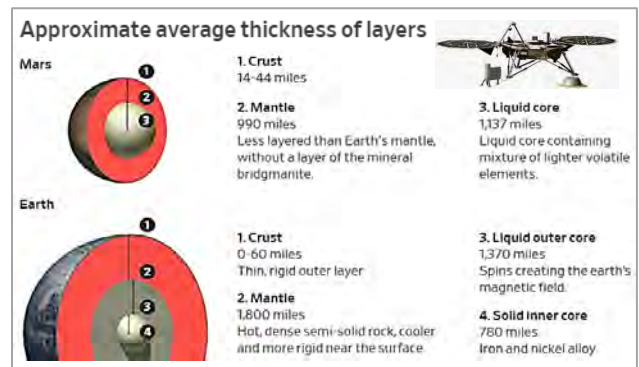
- **North American Stainless** is planning to exit a number of speciality melted chemistries in the U.S. at year-end. More standard chemistries will be melted to increase overall capacity. This will cause more displacement for the stamping and spring markets already impacted by ATI's exit from standard sheet products, the imposition of global steel quotas and tariffs, and transportation bottlenecks.

- **Steel imports into the U.S.** were 2.897 million tons (MT) in June, including 2.018MT of finished steel. Total steel imports YTD through June compared to last year increased 18.5% to 14.688MT and finished steel imports rose 15.6% to 9.995MT. Finished steel import market share in the U.S. over the first six months of 2021 was estimated at 20 percent.
- **A resolution of the EU's dispute** with the U.S. over steel and aluminum tariffs may fall short of removing all the barriers sheltering the industries. The EU's trade enforcer said that while the ideal solution would be the mutual suspension of tariffs, he could look at other possible solutions. He didn't reveal what such alternatives might be. One might be some kind of licensing or monitoring deal allowing EU exporters controlled access to the U.S. market.
- **U.S. new vehicle retail sales** were expected to slow further in July because of a limited supply of automobiles caused by a global microchip shortage. Sales are expected to reach 1.2 million units, a 3.7% increase from a year ago when adjusted for selling days, but a slump in expectations when compared to the preceding months.
- **Stellantis, the world's No. 4 automaker,** plans to invest more than \$35 billion through 2025 on electrifying its vehicle lineup. The company, formed from the merger of Fiat Chrysler and France's PSA in January, said its strategy will be supported by five battery plants in Europe and North America, as it gears up to compete with EV leader Tesla and other automakers globally. Stellantis is targeting more than 70% of sales in Europe and over 40% in the U.S. to be low-emission vehicles—either battery or hybrid electric—by 2030. It aims to make the total cost of owning an EV equal to that of a gasoline-powered model by 2026.



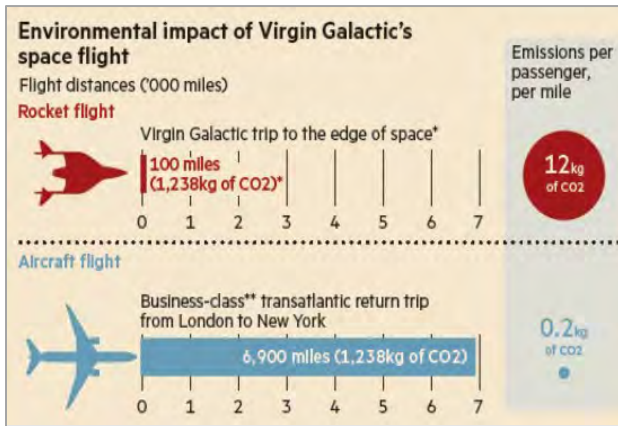
Key Update: Increasing EV adoption raises the demand for critical ingredients for lithium-ion batteries. With governments tightening emission standards and some planning to ban gas-powered vehicles completely, securing the supply of these minerals is increasingly important.

- **Electric car startup Rivian** closed a \$2.5 billion fundraising round led by investors Amazon, Ford and T. Rowe Price. The California-based company is exploring building a second U.S. assembly plant, which will include battery cell production. Automakers are racing to develop EVs as China, Europe and other countries and regions mandate lower carbon emissions. Rivian aims to compete when it rolls out its R1T pickup and R1S SUV, as well as a delivery van for Amazon. (See **Appendix: Automotive**, page 12)
- **NASA-funded researchers** have mapped the interior of Mars, using seismic data collected by the agency's Mars InSight lander to reveal a planet with a molten core whose size and composition came as major surprises. The interior map—the first ever created of another planet—shows that the internal structure of Mars differs dramatically from Earth's. Mars has a thicker crust and a thinner underlying mantle layer as well as a core that is bigger, less dense and more liquid than the researchers had expected.



- **United Airlines** reported its sixth consecutive quarterly loss due to the pandemic, though revenue quadrupled from a year ago as speedy U.S. vaccinations fueled a domestic travel rebound. Operating revenue in the 2ndQtr rose to \$5.47 billion and its adjusted net loss narrowed to \$1.26 billion, from \$2.6 billion. Excluding extraordinary items, the company lost \$434 million in the 2ndQtr but said it expects to be profitable in the third and fourth quarters.
Key Update: Corporate and international travel remains depressed. U.S. airlines have played down concerns over the impact of a resurgence in COVID-19, spurred by the more contagious Delta variant of the coronavirus, which has become dominant in the U.S. and many other nations.
- **Lockheed Martin's** space business profits in the 2ndQtr rose 33% to \$335 million due to progress on space-based sensor platforms. Sales at Lockheed's aeronautics unit, which makes the F-35 fighter jet, rose 2.5% to \$6.6 billion, but performance issues led to a \$225 million loss on a highly classified program that Lockheed has been working on for a couple of years. Overall company revenue was \$17 billion.

- Richard Branson and Jeff Bezos** rode their own spacecrafts to the edge of space in July, proving that space tourism is a viable business. Bezos' Blue Origin's reusable New Shepard uses a liquid hydrogen-fueled engine to travel more than 60 miles above Earth. Hydrogen may not emit carbon, but its production does. Branson's VSS Unity rocket plane is air-launched and burns solid fuel for one minute to fly 50 or so miles above Earth. Virgin Galactic likens a passenger's carbon footprint to a transatlantic business-class return flight. A modest CO2 footprint for space flights results because rocket flights remain rare. If space tourism takes off, more scrutiny may follow.



- Boeing's core operating profit** was \$755 million in the 2ndQtr, compared with a loss of \$3.32 billion a year earlier. The commercial airplane division reported a quarterly loss of \$472 million, but its defense business earned \$958 million and its services division took in \$531 million. Revenue rose 44% to about \$17 billion. Boeing booked 146 jet orders in June, including 71 737 MAX jets. Meanwhile, the company cut its 787 production rate as it works through a new structural defect in its troubled twin-aisle airliner program. (See [Appendix: Aerospace](#), page 8)
- American Airlines** expects positive cash flow in the 2ndQtr for the first time since the pandemic began, reversing a trend of cash burn of about \$100 million a day when global travel had ground to a halt. The company flew more than 44 million passengers in the quarter, over five times higher than last year. Daily cash build was forecast at \$1 million for the period and American ended with more than \$21 billion of total available liquidity. The company said it expected to report a quarterly net loss of between \$1.1 billion and \$1.2 billion, excluding net special items.

Key Update: *Flights in the U.S. are 84% full, on average, amid a surge of summer travel. The number of people passing daily through airport security checkpoints has neared 2 million recently—a level last reached in March 2020.*

- The world's biggest wind energy companies** told global leaders that efforts to meet world climate goals are "condemned to fail" if they do not step up turbine installation. CEOs of Vestas, Orsted, Siemens Gamesa, SSE and RWE Renewables wrote to the G20 heads of state warning that they would fall short by 43% of the wind capacity required for carbon neutrality by 2050, based on current growth forecasts. Wind energy is expected to form the backbone of global electricity generation by 2050.

Key Update: *A record 93 gigawatts was installed in 2020 despite the pandemic, largely in China and the U.S., but annual deployment must quadruple in the next decade to set big economies on the path to reach climate targets.*

- Canadian Solar** was awarded a 45MW/45MWh battery storage project by Colombia's Ministry of Energy and Mines to help alleviate system constraints and boost reliability of the grid in northern Colombia. It will also facilitate the addition of greater shares of renewable energy onto the network. The company said it was granted a 15-year revenue structure, indexed to Colombia's PPI. The project is expected to reach commercial operation by June of 2023.
- The biggest private health insurers** (UnitedHealth, Cigna, Anthem and Humana) collectively made \$31.8bn in profits last year, up 20% from 2019. Premiums collected far exceeded medical outlays as Americans deferred medical care during the pandemic. Now that patients are returning to the healthcare system, that profitable spread has begun to narrow. Anthem reported a 21% drop in net income for the 2ndQtr even as revenues rose 16% to almost \$34bn. The profit decline was driven primarily by the rise in its medical-loss ratio, a measure of insurer's premiums paid out to medical providers, increased 890 basis points to 86.8%. At UnitedHealth, the ratio rose more than 12 percentage points to 82.8% during the June quarter compared to the previous year. (See [Appendix: Medical](#), page 11)

- Amazon Care** has approached Aetna, owned by CVS Health, and several other regional insurers in a bid to join their networks and expand coverage. However, Amazon Care has encountered resistance during these conversations regarding the payment arrangements.



Amazon Care currently works with firms, including Amazon itself, that directly pay for its services. It was reported that the Amazon Care virtual health pilot program would be made available for all U.S. employees of the tech giant by this summer.

EUROPE, AFRICA & THE MIDDLE EAST

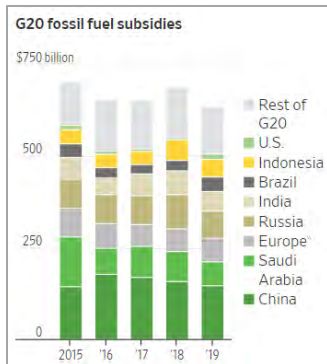
- **Eurozone businesses** reported their fastest expansion in activity for more than two decades, but UK companies lost momentum due to supply constraints and labor shortages. IHS Markit's July eurozone flash composite purchasing managers' index rose to 60.6 in July from 59.5 in June, bolstering economists' hopes of a rapid rebound this summer despite the Delta variant.
- **Disruption of steel shipments** due to the intense flooding in Germany's Rhine-Ruhr region has further intensified logistics issues for that country's steel businesses, with Thyssenkrupp the latest to declare force majeure citing transport disruptions. The floods came at a time when the market started to slow for the summer with little spot buying activity, but the intensified shipment delays could bring upward pressure to prices once the steel buyers return from the summer holiday in early September.
- **ArcelorMittal** signed a MoU with the Spanish government for a €1B investment to build the world's first large-scale zero-carbon steel plant. It will process iron ore using green hydrogen at its Gijón plant to supply a mill in Sestao that will use renewable electricity to produce 1.6M tonnes annually of carbon-free steel. The Gijón DRI would enable Sestao to become the world's first full-scale zero carbon-emissions steel plant. The investment will cut Spanish emissions by 4.8M tons, or 50%, within the next five years.
- **Europe's most polluting businesses** accused the EU of jeopardizing investment and innovation after Brussels unveiled ambitious plans to halve the bloc's emissions by 2030 to curb global warming. Carmakers, airlines and heavy industry attacked the proposals, which include a de facto ban on new diesel and gas-powered cars in 2035, a tax on aviation and maritime fuel and the phasing out of free pollution credits starting in 2026 under the EU's Emissions Trading System. Energy companies were largely positive about the road map spurring the growth of renewable energy. (See **Appendix: Automotive**, page 12)
Key Update: The European Steel Association said phasing out free carbon allowances would add to industry costs and reduce the financial resources available to invest in decarbonisation technologies in the medium term.
- **European emissions rules** due to come into force as soon as 2025 are likely to make gasoline-powered cars less profitable than EVs, signifying a landmark moment for the auto industry. The new engine standards, called Euro 7, pose a tremendous challenge for gas-based vehicles which will need more expensive technology to ensure compliance.

- **Airbus** forced its customers to honor jetliner contracts, despite the pandemic, which allowed it to take the No. 1 position in its longtime rivalry with Boeing, which was hobbled by the grounding of the MAX, among other production problems.
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- **OPEC and a Russia-led group of big producers** agreed to increase production by 400,000 barrels a day through the latter part of 2022. The deal seeks to unwind all the cuts the two groups, collectively called OPEC+, agreed to make at the start of the pandemic, when economies were shuttering and demand sputtering. The group agreed to add new oil in modest installments over many months, underscoring the still-uncertain speed of the world's economic recovery. (See **Appendix: Energy**, page 10)
 - **A U.S./German agreement** on the Nord Stream 2 pipeline includes a provision that Germany will act to curb Russia's ability to export energy if Moscow takes aggressive actions against Ukraine or uses energy as a weapon. The pact aims to mitigate the strategic dangers of the \$11 billion pipeline, now 98% complete, being built under the Baltic Sea to carry gas from Russia's Arctic region to Germany.
 - **Volkswagen** is continuing to benefit from the bumper recovery in car sales, forecasting that it will make about €11bn in operating profits for the first six months of the year but warned that the bottleneck in semiconductors has shifted and will impact VW in the second half of the year. VW deliveries between January and May increased by 33% worldwide compared with the previous year.
Key Update: The German car lobby VDA expects 400,000 fewer cars to be produced in the country in 2021, largely because of the semiconductor chip shortage.
 - **Europe's new car market** sold 1.5 million fewer vehicles in the first half of this year compared to the same period in 2019. With 5.4 million units moved off dealers' lots, the market did gain 25.2% from the COVID-hit first half of 2020. The Volkswagen group accounted for 26.4% of the market, while Stellantis was close behind at 23.1 percent.
 - **U.S. chipmaker Intel** said investment to support its planned European \$20 billion semiconductor factory could be spread across several EU member states, as it lobbies to win the bloc's financial and political support for the project. The EU signaled that funds could be made available to help the bloc meet a target to double semiconductor production to 20% of the global market by 2030, including making the most advanced chips used in autos.

ASIA/PACIFIC, JAPAN, AUSTRALIA & INDIA

- The pace of China’s economic recovery** rose modestly in the 2ndQtr after signs of sluggishness in the economy had stoked expectations of greater financial policy support. China’s GDP grew 1.3%, up from a revised 0.4% expansion in the previous quarter. China’s exports have for much of this year outperformed market expectations, boosted by the U.S. and parts of Europe easing social distancing measures and returning to growth. Now, the COVID-19 Delta variant’s rapid spread has cast doubt over external demand in the 2ndHalf of the year. Expansion in China’s factory sector in July hit the lowest level in nearly a year and a half.
- The Delta variant** has devastated parts of Asia and prompted many nations to cut off land access for sailors. Ship captains are unable to rotate weary crews and about 100,000 seafarers are stranded at sea beyond their stints. Since ships transport around 90% of the world’s trade, the crew crisis is disrupting the supply of everything from oil and iron ore to food and electronics.
- The world’s 20 largest economies** spent \$3.3 trillion in direct support for fossil fuels from 2015 to 2019, according to a new Bloomberg report, enough to build a solar electricity system 3½ times the size of the current U.S. grid. Most of it went to oil and gas. Fossil-fuel support is likely to come under growing scrutiny as the pressure rises to convert long-term climate promises into concrete near-term plans. It is a focus of the UN Climate Conference in Glasgow in November. Bumper profits from recent higher oil and gas prices will make industry subsidies trickier to defend.

Key Update: Some countries such as Russia and Saudi Arabia seem unlikely to commit to cutting their net greenhouse gas emissions to zero. China, Brazil, the U.S. and the European Union have all pledged to do just that by around mid-century.
- Taiwan Semiconductor Manufacturing Co.,** the world’s largest contract chip maker, said it expects the chip shortage that has hampered car makers to start easing in the next few months after it ramped up its production of auto chips. The company is on track to increase output of microcontrollers used in cars by about 60% this year compared with 2020. However, the broader semiconductor shortage could persist until 2022, the company said.



- South Korea’s Energy Solution** plans to invest \$5.2B to start producing the chemicals and materials used in EV batteries, as it urgently tries to cut its dependence on China. LG Chem, parent of the battery unit, intends to diversify its production of materials including those used in cathodes, anodes and separators. LG will hunt for investments and partnerships across mining, smelting and refining companies to improve its metal sourcing. The battery materials market is forecast to more than double to \$87 billion by 2026.

Key Update: The four-year investment by the biggest EV battery maker comes as plans by countries and carmakers to pivot from fossil-fuel-powered vehicles are complicated by the industry’s heavy reliance on refineries and factories in China. The country is by far the largest processor of most of the minerals needed for battery production.
- Prices to ship containers from Asia** to the U.S. and Europe are rising at a historic pace as cargo owners bid up rates in a search for ocean transportation capacity that is expected to remain tight for the rest of the year. The average price world-wide to ship a 40-foot container has more than quadrupled from a year ago to \$8,399 as of July. The price has surged 53.5% since the first week of May. Listed prices to ship from China to major ports in Europe and the U.S. West Coast are closer to \$12,000 a container.
- China’s multipronged campaign** to roll back rising commodity prices has been mostly unsuccessful. LME copper is up about 4% from mid-June and is still at its highest levels in a decade. Iron-ore prices fell as demand weakens in the face of Chinese policy to reduce steel output as a means to cut emissions. China has told mills to limit this year’s output to no more than the 2020 volume.
- Aluminum prices** surged on concerns about reduced supplies from China after more power cuts in the metal-producing Yunnan province. Producers received notice from local authorities at the end of July to restrict their power consumption. LME 3-month aluminum touched \$2,642/tonne, the highest since April 2018. Deadly floods in the province of Henan curtailed the supply of non-ferrous metals, with lead and aluminum the most severely hit.
- Tin prices** hit the highest level on record as a boom in consumer electronics and fears of supply disruptions have fuelled a 65% price rally since January. The metal, which is used in solder in circuit boards, has risen by 133% since its low in March 2020, as sales of smartphones, laptops and iPads have surged. (See [Appendix:Commodities](#), page 15)

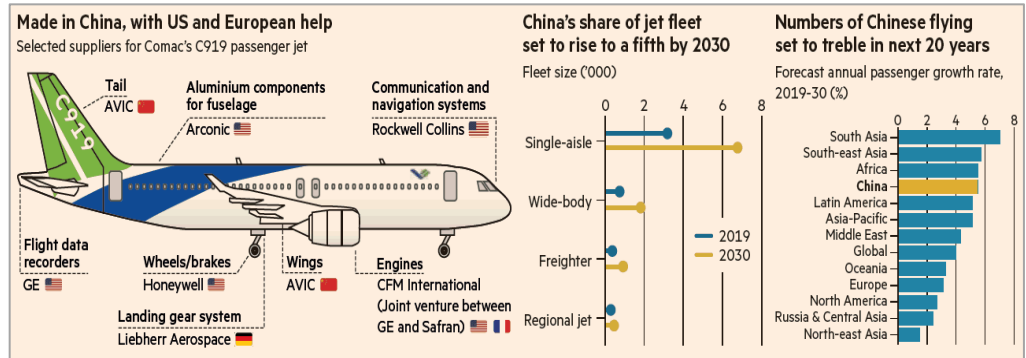


ECONOMIC UPDATE: APPENDIX TO THE AUGUST 2021 ISSUE

AEROSPACE: CHINA'S RIVAL TO BOEING AND AIRBUS POISED TO JOIN BATTLE FOR THE SKIES

After more than a decade in development and tens of billions of dollars of state support, China's first passenger jet is nearing Beijing's approval to start commercial flights. With the launch of the single-aisle C919, an industry dominated by Airbus and Boeing faces a deep-pocketed and politically connected competitor in state-backed aerospace champion Comac. **Spun out of China's military aviation industry in 2008, Comac has announced close to 1,000 orders and options for the plane, mainly from domestic customers.** The first delivery, to China Eastern Airlines, is due to take place by the end of this year. Beijing has made no secret of its desire to break the Western

duopoly, helping to smooth the C919's development with US\$72bn in state-related support. The project's strategic importance has driven the early orders. While there was no explicit obligation for Chinese airlines to buy the plane, there are "strong suggestions" from the state, according to analysts. Airbus and Boeing have fought for decades for



market share and over the extent of each other's government support. It took a common threat from a new competitor to put aside their differences and end a 17-year WTO dispute on subsidies. Despite repeated delays to the Comac program, there are signs that Beijing's investment is paying off. Guillaume Faury, Airbus chief executive, recently acknowledged Comac's rise, saying, "We will probably go from a duopoly to a triopoly, at least on the single aisle, by the end of the decade." The C919 is no match in fuel efficiency or range for the newest versions of the Airbus A320 or Boeing's 737 family, but the big worry for the Western companies is that future iterations could make a large dent in orders from China, which is on course to become the largest aviation market. **Boeing projects that China's airlines will acquire 8,600 new planes over the next 20 years alone.** Trade tensions could become a complication for Comac's Western suppliers, which are providing most of the C919's critical components. Companies related to Comac are among dozens of Chinese defense and surveillance technology groups on a U.S. sanctions list due to take effect in August. The C919 is still some way from taking to the skies. Once certified by the Chinese regulator, there are questions over whether Comac has the ability to support the aircraft while in service. For the C919 to become globally competitive, it will require approval from the U.S. FAA and the EU Aviation Safety Agency. The U.S. and EU have yet to agree the details of a unified front concerning China, including issues such as protection of intellectual property. For now, Comac needs the expertise of Western suppliers, but that could change as the country builds up its domestic capabilities. Most analysts believe China's market will be big enough in the next 20 years to support reasonable deliveries of C919s, as well as Airbus A320neos and Boeing 737 Max.

AEROSPACE: KEPLER TELESCOPE GLIMPSES POPULATION OF FREE-FLOATING PLANETS

Tantalizing evidence has been uncovered for a mysterious population of "free-floating" planets that may be alone in deep space. A study currently underway at the University of Manchester used data obtained in 2016 during the K2 mission phase of NASA's Kepler Space



Telescope. During this two-month campaign, Kepler monitored a crowded field of millions of stars near the center of our Galaxy every 30 minutes in order to find rare gravitational microlensing events. The study team found 27 short-duration candidate microlensing signals that varied over timescales of between an hour and 10 days. Many of these had been previously seen in data obtained simultaneously from the ground. **However, the four shortest events are new discoveries that are consistent with planets of similar masses to Earth.** These new events do

not show an accompanying longer signal that might be expected from a host star, suggesting that these new events may be free-floating planets. Such planets may have originally formed around a host star before being ejected by the gravitational tug of other, heavier planets in the system. Predicted by Albert Einstein 85 years ago as a consequence of his General Theory of Relativity, microlensing describes how the light from a background star can be temporarily magnified by the presence of other stars in the foreground. This produces a short burst in brightness that can last from hours to a few days. Roughly one out of every million stars in our Galaxy is visibly affected by microlensing at any given time, but only a few percent of these are expected to be caused by planets. Confirming the existence and nature of free-floating planets will be a major focus for upcoming missions and possibly the European Space Agency's Euclid mission.



ENERGY: THE ROLE OF NUCLEAR ENERGY IN THE CLEAN ENERGY TRANSITION



The world's population is projected to increase to 9.7 billion by 2050 and as the population grows, so will our energy needs. According to the International Atomic Energy Agency (IAEA), global energy consumption will rise 40% by 2050, and electricity consumption will more than double. Meeting the rising demand for energy while protecting the environment will require clean energy sources that are powerful and reliable. This infographic from Standard Uranium highlights the advantages of nuclear energy and its role in the clean energy transition.

The Advantages of Nuclear Energy

From cleanliness and reliability to safety and efficiency, seven factors make nuclear power essential to a clean future.

1. Carbon-free Energy: Nuclear power plants generate energy through fission, so nuclear power has one of the lowest lifecycle carbon dioxide emissions among other energy technologies. The use of nuclear power has reduced over 60 billion tonnes of carbon dioxide emissions since 1970.

2. Low Land Footprint: Due to the high energy density of uranium, nuclear power plants can produce large amounts of electricity without taking up much space. A 1,000 megawatt nuclear facility requires just 1.3 square miles of land. For context, solar and wind farms with equal generating capacity can occupy up to 75 times and 360 times more space, respectively.

3. Reliability: Of all the advantages of nuclear energy, reliability is one of the most important. Nuclear facilities can generate electricity round the clock, contrary to solar and wind farms that depend on the weather. In 2020, U.S. nuclear power plants were running at maximum capacity 92.5% of the time, surpassing all other energy sources.

4. Resource Efficiency: All sources of energy use raw materials that help build them or support them, besides the fuels. These can range from metals such as copper and rare earths to materials like concrete and glass. Nuclear power plants have the lowest structural material requirements of all low-carbon energy sources. They're not only powerful but also efficient in their material consumption.

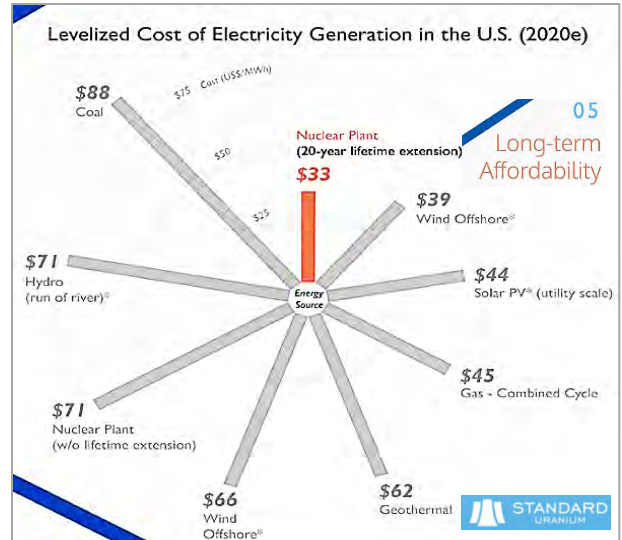
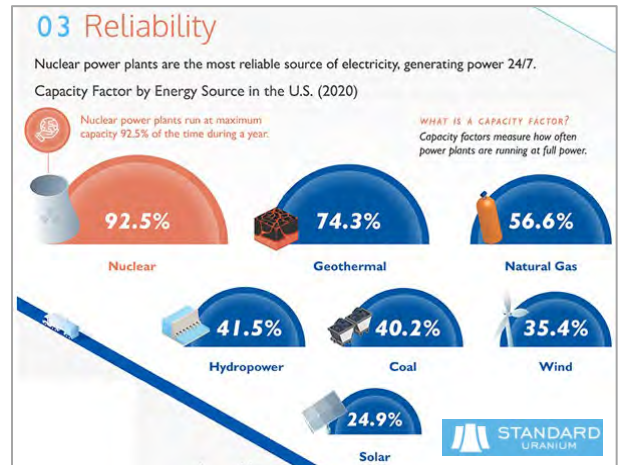
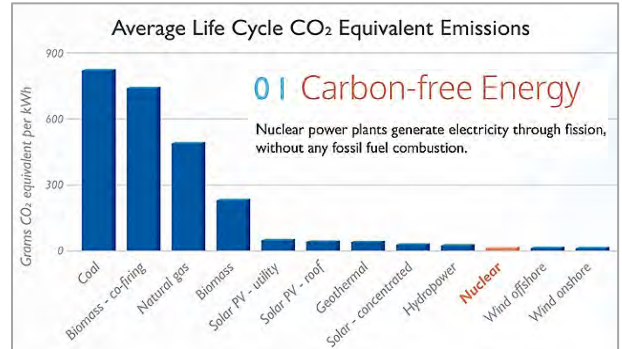
5. Long-Term Affordability: The high capital costs of nuclear facilities are often cited as a potential issue. However, this can change over time. In fact, nuclear reactors with 20-year lifetime extensions are the cheapest sources of electricity in the United States. Furthermore, the average U.S. nuclear reactor is 39 years old, and 88 of the 96 reactors in the country are approved for 20-year extensions.

6. Safety: Although conventional beliefs might suggest otherwise, nuclear is one of the safest sources of energy. Even including disasters and accidents, nuclear energy accounts for one of the lowest number of deaths per terawatt-hour of electricity.

7. Economic Contribution: Apart from the above advantages of nuclear energy, the U.S. nuclear industry also plays a significant role in the economy.

The nuclear industry directly employs 100,000 people and creates thousands of indirect jobs. A typical nuclear power plant generates \$40 million in annual labor income. The nuclear industry adds \$60 billion to U.S. GDP annually, with positive ramifications for the economy.

Nuclear Power for the Future: Transitioning to a cleaner future while increasing energy production may be difficult without new nuclear sources—largely because other renewable energy sources aren't as powerful, reliable or efficient. As the energy shift ramps up, nuclear power will be an essential part of our clean energy mix.



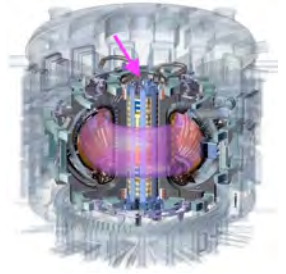
ENERGY: THE WORLD'S LARGEST FUSION REACTOR NOW HAS THE WORLD'S MOST POWERFUL MAGNET

The world's most powerful magnet, the "Central Solenoid," is finally here. At 59 feet tall, 14 feet wide and 1,000 tons, the decade-in-the-making magnet is truly massive. Appropriately, it will soon find a home at the world's largest fusion reactor. General Atomics completed construction of the magnet's first module earlier this year. In July, the company began the process of shipping it to southern France, where engineers will install it at the core of the International Thermonuclear Experimental Reactor (ITER), soon to be the world's largest fusion reactor, if all goes to plan. ITER's 35 partner nations, including the U.S., EU, China, the UK and India, have been supplying various parts to the colossal fusion reactor project over the past 15 months. To split up the financial burden, each partner nation is responsible for a piece of technology



and the underlying research and development. **The Central Solenoid is the U.S.'s largest contribution to-date. (A mockup of ITER shows the magnetic core in the center at right.)**

The gigantic ITER reactor is a means of proving that fusion is a feasible energy solution for a carbon-free future. So far, no existing fusion reactor has even come close to producing more energy than it uses. This is a huge sticking point because the reactors use an enormous amount of electricity and if that energy is sourced from coal power plants, for example, it renders the fusion reactor a giant step backward in carbon emissions. While this giant reactor will not generate electricity, it "will be a critical testbed for the integrated technologies, materials and physics regimes necessary for the commercial production of fusion-based electricity. The lessons learned at ITER will be used to design the first generation of commercial fusion power plants. The superconducting Central Solenoid electromagnet is key to this mission because it's the "beating heart" of the ITER tokamak—a magnetic confinement device that produces controlled thermonuclear fusion power. Inside the fully assembled



tokamak, the Central Solenoid will induce and contain the sun-hot plasma that actually generates the power. **For context, the Central Solenoid is so powerful that its magnetic force is strong enough to lift an aircraft carrier 6 feet into the air. At its core, it will reach a magnetic field strength of 13 Tesla, about 280,000 times stronger than the earth's magnetic field.** The support structures for the Central Solenoid will have to withstand forces equal to twice the thrust of a space shuttle lift-off. General Atomics has only begun shipping the first of six total modules that will comprise the Central Solenoid. Each one weighs 110 tons and ITER will stack and link them together at the center of the reactor. The transport process is a bit tricky and will involve specialized heavy transport vehicles along multiple legs of the journey. After loading each module, General Atomics will ship the pieces to Houston, where a transport ship will pick them up. The company sent Module 1 to sea in late July, and it will arrive in France by late August. ITER estimates that ground transit to the reactor site will take place in early

September. Engineers have already constructed a special road to the facility in the south of France, allowing workers to bring immensely heavy items overland—not dissimilar to the special roads that move space vehicles from preparation spaces to the launchpad. Once the Central Solenoid electromagnet is ready, we'll be one (massive) step closer to the future of clean energy.

ENERGY: SINGAPORE UNVEILS ONE OF WORLD'S BIGGEST FLOATING SOLAR FARMS

Singapore unveiled one of the world's biggest floating solar power farms, covering an area the size of 45 football fields, as part of the city-state's push to cut greenhouse gas emissions. The project is the country's most ambitious yet, comprising 122,000 panels on Tengah Reservoir that will produce enough electricity to run its five water treatment plants. **Singapore is among the biggest per capita carbon dioxide emitters in Asia and its land scarcity makes boosting renewable energy sources a challenge.** The prosperous financial hub has turned to setting up plants off its coasts and in reservoirs and aims to quadruple solar energy production by 2025. The new farm can produce up to 60 megawatts of electricity and will lead to carbon emissions reductions equivalent to removing 7,000 cars from roads, according to Sembcorp Industries and national water agency PUB. Sembcorp built the project, which covers about 110 acres, with backing from the agency. "Solar energy is plentiful, clean and green, and is key to reducing PUB's and also Singapore's carbon footprint," said the water agency's chief executive Ng Joo Hee. Singapore has also built a solar farm in the Johor Strait, which separates the island state from Malaysia, as well as plants on land. The government in February unveiled a "green plan" that included steps such as planting trees, reducing waste sent to landfills and building more charging points to encourage electric car use. Singapore has pledged to achieve net-zero emissions "as soon as viable" in the second half of the century. However, critics say the city-state's goals are behind that of other developed economies.



MEDICAL: WORLD'S FIRST HEART VALVE REPLACEMENT USING EXTENDED REALITY PLATFORM

The Jewish General Hospital (Montreal), together with Auger Groupe Conseil and Medtronic Canada, have pioneered the first application of the Microsoft HoloLens for use in real-time, extended reality (XR) clinical support of a minimally invasive heart procedure. **This novel partnership completed the first end-to-end remotely guided transcatheter aortic valve implant/replacement (TAVI/TAVR) – a minimally invasive procedure to replace a heart valve.** Dr. Sam Radhakrishnan, the proctor or teaching specialist in Toronto, was able to remotely guide the JGH TAVI team of doctors, using the intra-operative extended reality platform. It is comprised of three key elements: (1) The Microsoft HoloLens, a headset which enables bi-directional remote viewing in real time. The use of extended reality headsets and glasses has grown during the pandemic because of the limitations on travel to and within a hospital. (2) A modular system that allows the remote proctor to view the cardiac event monitors in real-time, without requiring the active clinician wearing the HoloLens to look up at the screens. (3) A three-dimensional clinical pathway overlay depicting step-by-step instructions for a specific surgical procedure. "We think of it as bringing the operating room to the surgical specialist. Rather than coordinating resources to bring a specialist to another hospital for training, now we can greatly simplify the process, which can help improve the timeliness of patient care, especially in an emergency," said Dr. Lawrence Rudski, director of the Azrieli Heart Center. "There are significant advantages to using a real-time, extended-reality system for both the proctor and the clinician on the receiving end, such as having the same view, which is almost better than being in the same, often crowded, room. In addition, this platform has the flexibility to be expanded to many other types of procedures." During the initial peak of the pandemic in spring 2020, the JGH was designated as a lead COVID-19 treatment site. The ensuing staffing challenges, combined with travel restrictions, required effective and remote training solutions. In collaboration with Quebec engineering firm AGC, the JGH piloted the use of the Microsoft HoloLens to help train and redeploy staff. "We chose to work with Microsoft mainly because of the HoloLens's unmatched performance and in part because of the security offered by their encryption design," said the CEO of AGC. "We are very proud of our work in combining the mixed reality experience of voice, video and a 3D overlay with no lag time. This is a unique plug-and-play solution, and we're very excited to see it deployed in such an impactful way for clinicians, and ultimately for patients." The initial success of this project led to developing remote support in a complex clinical pathway and connectivity to medical imaging with the help of leading medical device company Medtronic.



INNOVATION/MEDICAL: BLOOD SUGAR TESTS USING SWEAT, NOT BLOOD, COULD BE ON THE WAY



A new quick and painless sensor that measures blood sugar in human sweat may mean far fewer finger pricks for the millions of people who live with diabetes. Monitoring blood sugar to make sure it remains in the target range is the cornerstone of diabetes management, but the pain and inconvenience of daily finger pricks can be a deterrent for many. **Now, an investigational, touch-based test measures blood sugar in sweat and applies a personalized algorithm that correlates it with glucose in blood.** It's more than 95% accurate at predicting blood glucose levels before and after meals, according to a new proof-of-concept study. The new sweat test isn't ready for prime time yet as large-scale studies are still needed to validate the approach, but diabetes experts not involved in the new study are cautiously optimistic. The search for an alternative to finger-prick testing to improve diabetes control and quality of life for people with this disease has been ongoing, and sweat has many merits. Fingers contain many sweat glands and produce a high amount of sweat, but sweat has lower levels of glucose than blood. What's more, readings may vary with other skin characteristics, resulting in inaccurate blood sugar measurements. The new sensor includes a sweat-absorbing polyvinyl alcohol hydrogel that sits on a flexible plastic strip. **You place your finger on the sensor for one minute and the hydrogel absorbs tiny amounts of sweat and undergoes a reaction that results in a small electrical current detected by a hand-held device.** To make sure that the reading is accurate, researchers also measured volunteers' blood sugar with a standard finger-prick test and developed a personalized mathematical formula that could translate each person's sweat glucose to their blood glucose levels. To calibrate the device, a person with diabetes would need a finger prick just once or twice per month. Many questions remain. Researchers would need to explore the interference of things like soap from hand-washing, lotions, dirt and food residue on blood sugar readings from sweat, and then there is the question of cost and complexity. Will a commercial version require special wipe, three minutes of sweat accumulation and one-minute touch? Dr. Minisha Sood, an endocrinologist at Lenox Hill Hospital in New York City said, "If the algorithm is accurate and scalable, it would be a game changer for a glucose monitoring. Needle-free testing is much more attractive for people with diabetes, but this is a proof of concept and bringing this to widespread reality is likely years off."



AUTOMOTIVE: THE MASSIVE IMPACT OF ELECTRIC VEHICLES ON COMMODITIES IN A 100% EV WORLD

What would happen if you flipped a switch, and suddenly every new car that came off assembly lines was electric? It's a thought experiment, since right now EVs have close to just 1% market share worldwide. We're still years away from EVs even hitting double-digit demand on a global basis, and the entire supply chain is built around the internal combustion engine. However, the scenario is interesting to consider. One recent projection put EVs at a 16% penetration by 2030 and then 51% by 2040. This could be conservative depending on the changing regulatory environment for manufacturers – big markets like China, France and the U.K. have recently announced that they plan on banning gas-powered vehicles in the near future.

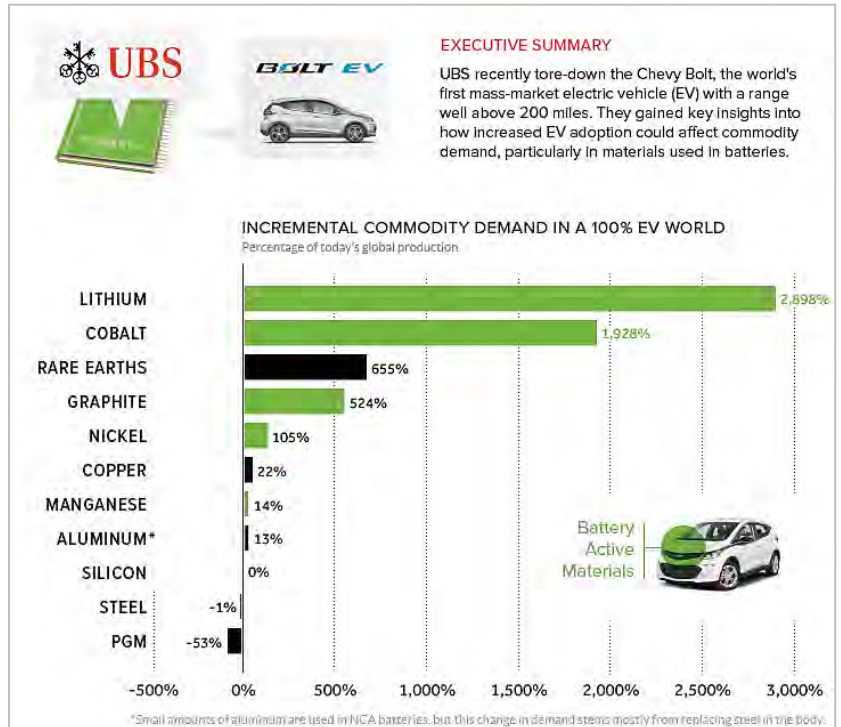
The Thought Experiment

There is a "100% EV world" thought experiment in a recent UBS report. As a part of their UBS Evidence Lab initiative, they tore down a Chevy Bolt to see exactly what is inside, and then had 39 of the bank's analysts weigh in on the results. After breaking down the metals and other materials used in the vehicle, they noticed a considerable amount of variance from what gets used in a standard gas-powered car. It wasn't just the battery pack that made a difference – it was also the body and the permanent-magnet synchronous motor that had big implications. As a part of their analysis, they extrapolated the data for a potential scenario where 100% of the world's auto demand came from Chevy Bolts, instead of the current auto mix.

The Implications

If global demand suddenly flipped in this fashion, here's what would happen and some caveats worth noting: **The Bolt is not a**

Tesla: The Bolt uses an NMC cathode formulation (nickel, manganese, and cobalt in a 1:1:1 ratio), versus Tesla vehicles which use NCA cathodes (nickel, cobalt, and aluminum in an estimated 16:3:1 ratio). Further, the Bolt uses an permanent-magnet synchronous motor, which is different from Tesla's AC induction motor – the key difference there being rare earth usage. **Big Markets, small markets:** Lithium, cobalt, and graphite have tiny markets and they will explode in size with any notable increase in EV demand. The nickel market, which is more than \$20 billion per year, will also more than double in this scenario. It's also worth noting that the Bolt uses low amounts of nickel in comparison to Tesla cathodes, which are 80% nickel. Meanwhile, the 100% EV scenario barely impacts the steel market, which is monstrous to begin with. The same can be said for silicon, even though the Bolt uses 6 to 10x more semiconductors than a regular car. However, the market for platinum and palladium gets decimated in this hypothetical scenario because their use as catalysts in combustion engines are a primary source of demand.



Material differences in EVs will have a big impact on demand.

STEEL

Batteries are heavy, so aluminum must be substituted for steel where possible.

NICKEL

Used in both NCA and NMC cathodes, the >\$20 billion nickel market would more than double.

PGMs

Used to reduce emissions in gas powered vehicles, PGMs could be the biggest casualty of mainstream EV adoption.

LITHIUM/COBALT

In a 100% EV world, these metals are essential. Better supply chains will be necessary, as well.

Material	Demand increase	Notes
Lithium	2,898%	Needed in all lithium-ion batteries
Cobalt	1,928%	Used in the Bolt's NMC cathode
Rare Earths	655%	Bolt uses neodymium in permanent magnet motor
Graphite	524%	Used in the anode of lithium-ion batteries
Nickel	105%	Used in the Bolt's NMC cathode
Copper	22%	Used in permanent magnet motor and wiring
Manganese	14%	Used in the Bolt's NMC cathode
Aluminum	13%	Used to reduce weight of vehicle
Silicon	0%	Bolt uses 6-10x more semiconductors
Steel	-1%	Uses 7% less steel, but fairly minimal impact on market
PGMs	-53%	Catalytic converters not needed in EVs



INNOVATION/AUTOMOTIVE: VW WILL USE A NEW 3D PRINTING PROCESS IN VEHICLE PRODUCTION

Volkswagen is pressing ahead with the use of innovative 3D printers in car production. For the first time, the newest process – known as binder jetting – is being used to manufacture components at the company’s main plant in Wolfsburg, Germany. **While conventional 3D printing uses a laser to build a component layer by layer from metallic powder, the binder jetting process uses an adhesive. The resulting metallic component is then heated and shaped.** Using the binder jetting component reduces costs and increases productivity – e.g., the components weigh only half as much as those made from sheet steel. VW is currently the only car maker using this 3D printing technology in the production process. To achieve this innovative advance, VW has invested an amount in the mid-double-digit million euro range over the past five years. The company has entered into a software partnership with Siemens and expanded its existing collaboration with printer manufacturer HP. With the first full-scale use of binder jetting, they intend to acquire important experience and learn which components can be produced economically and quickly or how additive manufacturing can support the digital transformation of production at Volkswagen. HP is providing the high-tech printers needed and Siemens the special software for additive manufacturing. One key process step that has been worked on jointly by Siemens and VW is optimizing the positioning of components in the build chamber. Known as nesting, this technique makes it possible to produce twice as many parts per print session. This summer, the three companies intend to establish a joint expert team at the high-tech 3D printing center, which opened in Wolfsburg at the end of 2018 and enables the manufacture of complex automotive components using 3D printing. The center also trains employees in the use of these technologies. **By 2025, the aim is to produce up to 100,000 components by 3D printing in Wolfsburg each year.** The first components made using the binder jetting process have gone to VW’s Osnabrück assembly plant for certification: components for the A pillar of the T-Roc convertible. These weigh almost 50% less than conventional components made from sheet steel. This reduction alone makes the process especially interesting for automotive production applications. VW has already successfully conducted crash tests on 3D-printed metallic vehicle components. Until now, the production of larger volumes was not cost-effective enough. However, the new technology and the collaboration will now make production-line use economically viable. VW has been using 3D printing for 25 years. Currently, there are 13 units at the Wolfsburg plant using various printing processes to manufacture both plastic and metal components. Typical examples are plastic components for prototypes, such as center consoles, door cladding, instrument panels and bumpers. Printed metal components include intake manifolds, radiators, brackets and support elements.



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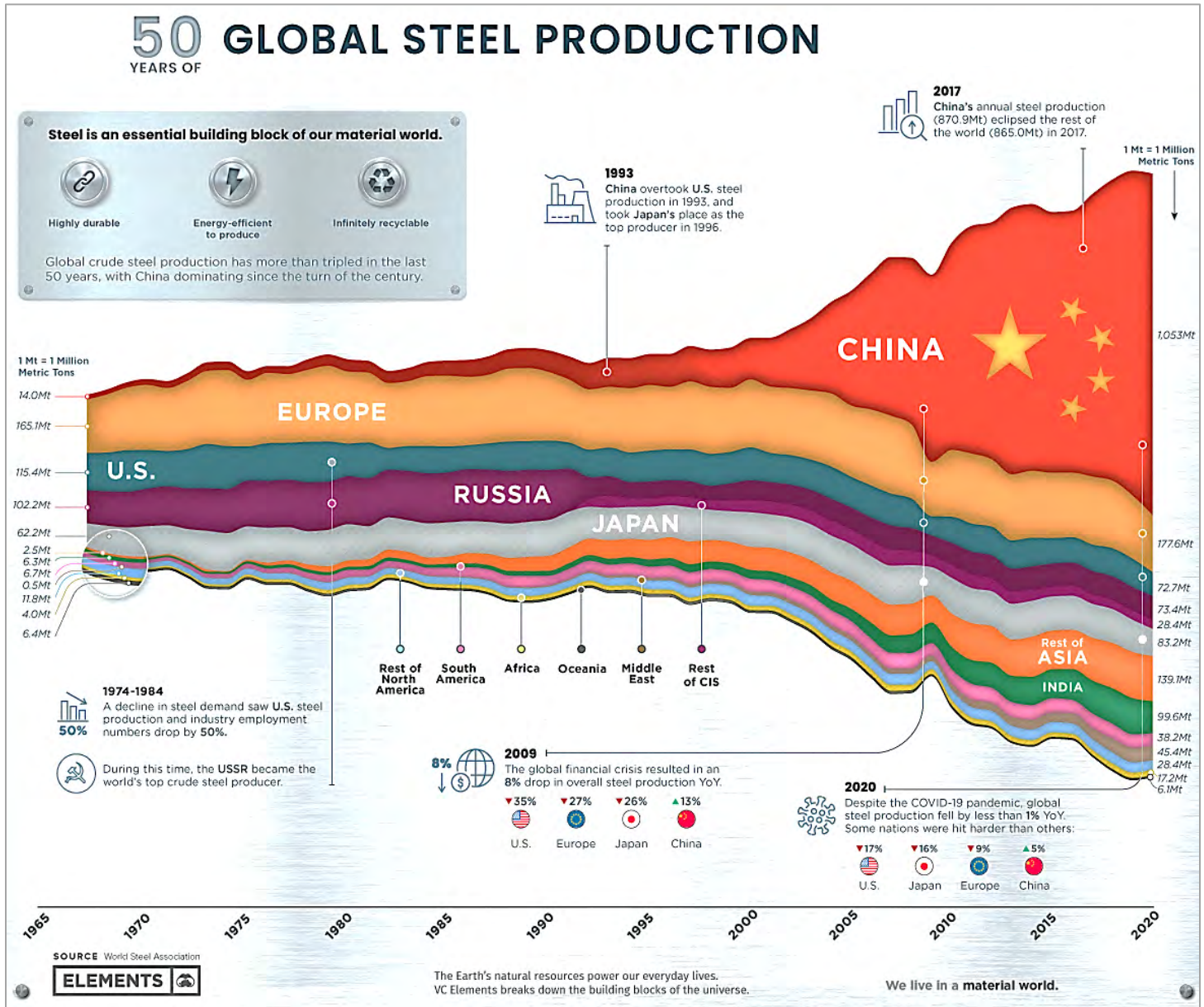
AUTOMOTIVE: INTERNAL COMBUSTION ENGINE VEHICLES VS. ELECTRIC VEHICLES

As governments across the globe advance greener transport legislation to meet climate targets, **a question that continues to surface is how much cleaner are electric vehicles (EVs) than traditional automobiles with an internal combustion engine (ICE).** Estimates exploring the carbon gap have to cover thousands of parameters, such as the extraction and processing of minerals for EV batteries and the production of power cells. Other considerations are based on "after-sale" elements like the type of power used to charge an EV or the fuel dynamics and upkeep of a gasoline car. It's complex to delve into all the variables, so it may be easier to divide them between the *building* of the vehicles and their *maintenance*. Compared to gasoline cars, EVs are not as green when it comes to manufacturing due to the mining of rare earth metals that are needed for their batteries. Once they hit the road, the only thing that contributes to their carbon footprint is the sourcing of their energy, giving them an advantage over gas-powered cars. The framework created by the Argonne National Laboratory, called the *Greenhouse Gases, Regulated Emissions and Energy Use in Technologies*, is being used to help shape policy at the EPA and the California Air Resources Board. Reuters recently took a test drive of the model, stacking up a Tesla Model 3 versus a Toyota Corolla, with the assumption that both vehicles would travel 173,151 miles during their lifetimes. The scenario also took place in the U.S., where 23% of electricity comes from coal-fired plants. Even before hitting the road, the analysis showed that the production of a mid-sized EV generated 8.1M grams of CO2 during the extraction and manufacturing process, more than the 5.5M grams for a comparable gasoline vehicle. One would also have to drive another 13,500 miles in a Model 3 - the average mileage motorists drive each year - before breaking even with the Corolla in terms of emissions. Tesla then pulls ahead. **At Year 5, the Model 3 has emitted a total of 17M grams of carbon emissions (vs. 30M for the Corolla) and at Year 10, it has released 25M grams (compared to the 52M produced by the Toyota vehicle).** Not every country is the same: If the Model 3 was being driven in Norway, which gets most of its electricity from renewable hydropower, the breakeven point would come after 8,400 miles. Compare that to the 78,700 miles needed to reach carbon parity in nations like China and Poland, which generate the majority of their power from coal.





STEEL: GLOBAL STEEL PRODUCTION – THE RISE OF THE STEEL AGE



The Rise of the Steel Age: From the bronze age to the iron age, metals have defined eras of human history. If our current era had to be defined similarly, it would undoubtedly be known as the steel age. Steel is the foundation of our buildings, vehicles and industries, with its rates of production and consumption often seen as markers for a nation's development. Today, it is the world's most commonly used metal and most recycled material, with 1.864 billion metric tons of crude steel produced in 2020.

The State of Steel Production: Global steel production has more than tripled over the past 50 years, despite nations like the U.S. and Russia scaling down their domestic production and relying more on imports. Meanwhile, China and India have consistently expanded their production to become the top two steel producing nations.

Steel's Secret – Infinite Recyclability: Made up primarily of iron ore, steel is an alloy which also contains less than 2% carbon and 1% manganese and other trace elements. While the defining difference might seem small, steel can be 1,000x stronger than iron. However, steel's true strength lies in its infinite recyclability with no loss of quality. No matter the grade or application, steel can always be recycled, with new steel products containing 30% recycled steel on average. The alloy's magnetic properties make it easy to recover from waste streams and nearly 100% of the steel industry's co-products can be used in other manufacturing or electricity generation.



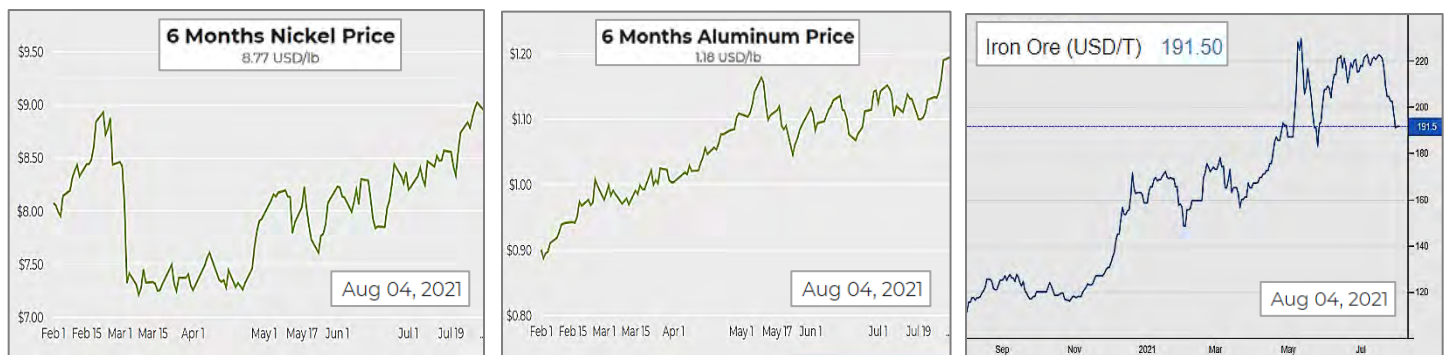
COMMODITIES: THE TOP 20 METALS AND MINING BILLIONAIRES – RUSSIAN OLIGARCHS DOMINATE

<p>1</p>  <p>ALEXEY MORDASHOV</p> <p>\$29.1B</p> <p>COMPANY: Severstal OPERATIONS: Steel</p> <p>FORBES RANK: 51 +3 1 year change: The son of mill workers, Mordashov is a majority shareholder in steel company Severstal. He resigned as CEO in 2015, after 19 years in the role.</p>	<p>2</p>  <p>VLADIMIR POTANIN</p> <p>\$27.0B</p> <p>COMPANY: NORILSK NICKEL OPERATIONS: Palladium, Platinum, Nickel</p> <p>FORBES RANK: 55 -14 Potanin acquired a stake in the world's largest palladium producer during Russia's privatization in 1995.</p>	<p>3</p>  <p>VLADIMIR LISIN</p> <p>\$26.2B</p> <p>COMPANY: NLMK OPERATIONS: Steel</p> <p>FORBES RANK: 59 -14 Lisin started out as an electrical fitter in a coal mine in Siberia. Today, he is the chairman of NLMK Group, a leading manufacturer of steel products.</p>	<p>4</p>  <p>GERMÁN LARREA MOTA-VELASCO</p> <p>\$25.9B</p> <p>COMPANY: Grupo Mexico OPERATIONS: Copper</p> <p>FORBES RANK: 61 +57 Velasco owns the majority of Mexico's largest copper mining company, Grupo Mexico, which also has operations in Peru and the U.S.</p>
<p>5 Australia's richest citizen</p>  <p>GINA RINEHART</p> <p>\$23.6B</p> <p>COMPANY: HANCOCK PROSPECTING OPERATIONS: Iron Ore</p> <p>FORBES RANK: 70 +15</p>	<p>6</p>  <p>IRIS FONTBONA</p> <p>\$23.3B</p> <p>COMPANY: ANTOFAGASTA OPERATIONS: Copper</p> <p>FORBES RANK: 74 +50</p>	<p>7</p>  <p>ANDREW FORREST</p> <p>\$20.4B</p> <p>COMPANY: HANCOCK PROSPECTING OPERATIONS: Iron Ore</p> <p>FORBES RANK: 87 +134</p>	<p>8</p>  <p>ALISHER USMANOV</p> <p>\$18.4B</p> <p>COMPANY: METALLOINVEST OPERATIONS: Steel, Iron Ore</p> <p>FORBES RANK: 99 -16</p>

The Top 20 Billionaires in Mining: Metals and mining can be a very profitable business for the individuals at the top, but success can also come and go based on volatile commodity prices. Eight of the 100 richest people in the world are in the metals and mining industry. The graphic shows the top 8 metals and mining billionaires, based on the *Forbes Billionaires List*. Steel producers dominate the list, followed by copper miners. **Russia's Mining Billionaires:** Russia's huge geographic area is filled with rich mineral resources providing a fertile ground for mining billionaires. It is the largest miner of diamonds and palladium, the second-largest miner of platinum and nickel and hosts 8 of the 20 richest people in the industry. Alexey Mordashov, son of steel mill workers, is the first on the list. He is the majority shareholder in steel company Severstal and ranks first among all Russian billionaires. Next on the metals billionaire list is Vladimir Potanin, the owner of Norilsk Nickel, the world's largest producer of palladium and nickel. **Women at the Top:** The first woman on the mining billionaires list is Australia's Gina Rinehart, Executive Chairman of Hancock Prospecting. She is the only child of legendary explorer Lang Hancock, who discovered the world's largest iron ore deposit in 1952. Hancock died in 1992, leaving a bankrupt estate to Gina. She rebuilt and expanded the company over the following decade and

became a billionaire in 2006 during the iron ore boom. The list also includes the wealthiest person in Chile, Iris Fontbona. Iris is the widow of Andrónico Luksic, who built a fortune in the mining, financial and beverages sectors, including the top copper miner Antofagasta. **New Era for Mining Fortunes:** As demand for most minerals increases due to new technologies and the energy transition, the world needs metals and mining more than ever and soon there will be a new list of billionaires who built their fortune on the minerals of tomorrow.

COMMODITIES: IRON-ORE PRICES DIVE AS CHINESE DEMAND WEAKENS; NICKEL, ALUMINUM CLIMB



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