EXECUTIVE SUMMARY

AMERICAS: THE NEWS LAST MONTH OFFERED SOME POSITIVE SIGNS that China and the U.S. may finally be getting closer to a formal trade deal with a tentative agreement on a "phase one" step. **The overall U.S. trade deficit** widened in the first nine months of 2019, a sign that the administration's approach to trade has so far done little to make a dent in the imbalance. **Employment numbers** in October were not bad, as the job market remains strong even in the face of labor strikes and trade disputes. General Motors and the UAW settled their costly contract dispute, and Ford agreed to a new deal with similar provisions. **The ISM nonmanufacturing index activity** reflected growth for the 123rd consecutive month in the non-manufacturing sector and at a faster rate. However, negative data continued to flow from the housing and manufacturing sectors, with factory activity down for the third straight month. **Durable goods orders** fell sharply, experiencing its biggest setback since May. Warnings of a downturn flashed again from the Conference Board **leading economic indicators** report. Consumer confidence wavered again and retail sales declined for the first time in seven months.

OVERSEAS: BUSINESS ACTIVITY CONTINUED TO SLOW AROUND THE WORLD headed into the fall. IHS Markit said the overall outlook remained subdued, as new work at the businesses surveyed fell to the slowest pace since October 2009. Business activity in the eurozone was close to stagnation, while it declined in Japan. **China's 3rdQtr economic growth** slowed to its weakest pace in almost three decades. **India's manufacturing activity** continued to weaken; factory orders and production rose at the weakest rates in two years.

STEEL: AMERICAN STEEL COMPANIES REPORTED LOWER 3RDQTR EARNINGS as realized prices faded and shipments declined, partly due to the UAW strike at GM. **U.S. Steel** posted its first quarterly loss since 2017. **Allegheny Technologies** reported lower third quarter revenues and net income including previously announced sales of non-core assets. **Steel imports** into the U.S. for the first nine months of 2019 were down 13.7% compared to the same period in 2018, but imports continued to capture 20% of the U.S. market.

METALS/COMMODITIES: INDUSTRIAL METALS' PRICES ARE MOVING IN DIFFERENT DIRECTIONS. Nickel prices wavered after Indonesia decided to resume nickel ore exports after halting shipments to investigate reports of export rule violations. Aluminum prices reached two year highs and copper continued to recover. **Iron ore prices** collapsed as supply improved and China's slowdown continued into October. Iron ore futures in China touched a three-week low at the start of November and posted their second consecutive weekly decline, as prospects of tepid steel demand over the winter weighed on prices of the key steelmaking raw material.

AEROSPACE: BOEING SALES, EARNINGS AND AIRPLANE DELIVERIES FELL SHARPLY for the 3rdQtr as the company continued to struggle with the fallout from the deadly crashes of two 737 MAX jets. **Lockheed Martin** expects its order backlog to reach a record $140 billion by year-end. The company expects to add $17 billion in orders this year, reflecting the big ramp-up in F-35 production. **Blue Origin** is partnering with industry giants to land humans back on the surface of the Moon under NASA's Artemis program.

AUTOMOTIVE: U.S. AUTOMAKERS SAW A SALES GAIN IN OCTOBER of about 2.5% following a steep drop the previous month, even as new-vehicle prices hit record highs. **U.S. Sen. Schumer** proposed a $454 billion plan over 10 years to help shift the U.S. away from gasoline-powered vehicles by offering cash vouchers to help Americans buy cleaner vehicles. Ford, GM and the UAW all said they appreciated Schumer's efforts. **Tesla** was approved by China's industry ministry to begin production at the $2 billion giga factory it is building in Shanghai, the first fully-foreign-owned car plant in China. **Daimler** reported higher 3rdQtr earnings and sales.

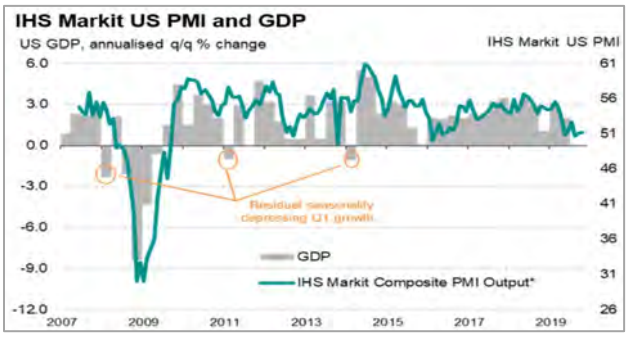
MEDICAL: THE OFFICE OF THE U.S. TRADE REPRESENTATIVE EXEMPTED ANOTHER 18 MEDICAL DEVICES or device components from the 25% tariffs imposed on Chinese goods. Sky Medical Technology won **FDA clearance for a device that stimulates calf muscles** to prevent venous thrombosis in non-surgical patients at risk for venous thromboembolism. The future of nanotechnology in medicine includes smart pills; ingestible capsules containing sensors, cameras and more are already changing the face of medicine.

ENERGY: LOS ALAMOS ENGINEERS HAVE SYNTHESIZED MAGNETICALLY-DOPED QUANTUM DOTS that capture the kinetic energy of electrons created by UV light before it's wasted as heat. This discovery could make it possible to make more efficient solar cells, light detectors, photocathodes and light-driven chemical reactions. The U.S. is poised to become a net energy exporter. **Commonwealth Fusion Systems is collaborating with MIT to build a fusion reactor** and has planned a fusion experiment dubbed Sparc. They hope to overcome the biggest technical hurdle in the field—positive net energy from fusion.

INNOVATION: MIT DEVELOPED A MICRONEEDLE PILL THAT COULD REPLACE INSULIN SHOTS. The capsule is swallowed and passes through the stomach whole, then opens in the small intestine to reveal "microneedles" that attach to the intestine surface and deliver drugs to the bloodstream. **Tata Steel joined forces** with Dutch companies Gasunie, EBN and Port of Amsterdam to complete a feasibility report into an innovate project which could reduce the steelmaker's CO2 emissions.

THE AMERICAS

- **U.S. employers** added 128,000 jobs in October, as the job market remains strong even in the face of labor strikes and trade disputes. October's figure would have been stronger had it not been for the GM strike, which shaved close to 50,000 workers from the employment rolls, and for the layoff of some 20,000 temporary census workers. The jobless rate ticked up 0.1% to 3.6% from September.
- **The U.S. economy** slowed to a modest growth rate of 1.9% in the 3rdQtr as consumer spending downshifted and businesses continued to trim their investments in response to trade war uncertainty and a weakening global economy.
- **The overall U.S. trade deficit** widened in the first nine months of 2019 to nearly $500 billion, a sign that the administration's approach to trade has so far done little to make a dent in the imbalance. The trade gap for both goods and services in the first three quarters of the year jumped by 5.4% to $481.3 billion from the same period last year. Total American exports fell by $7 billion from last year, while imports grew by $17.8 billion.
- **U.S. import prices** increased 0.2% in September, driven by a 2.3% increase in petroleum costs. Otherwise, import prices fell 0.1%. In the 12 months through September, import prices decreased 1.6%. Export prices fell 0.2% in September and declined 1.6% on a year-on-year basis.
- **U.S. consumer confidence** dropped for a third consecutive month in October. The Conference Board consumer confidence index edged down to 125.9, compared with 126.3 in September. Perceptions about the present situation improved, but future expectations dampened.
- **U.S. retail sales** fell for the first time in seven months in September, suggesting that manufacturing-led weakness could be spreading to the broader economy. Retail sales dropped 0.3% weighed down by a 0.9% drop in auto sales. That was the biggest drop in eight months. Receipts at service stations fell 0.7%, reflecting cheaper gasoline.
- **U.S. consumer prices** were unchanged in September but for the 12 months through September they increased 1.7%. The core CPI climbed 0.1%, restrained by moderated gains in healthcare costs as well as declines in apparel, new motor vehicles and communications prices. In the 12 months through September, the core CPI increased 2.4 percent.
- **The U.S. Leading Economic Index** slipped 0.1% in September due to weakness among U.S. manufacturers whose sales have suffered from sluggish exports and disruptions in their supply chains caused by the U.S. trade war with China, according to the Conference Board.
- **U.S. manufacturing output** dropped for the third straight month in October. The ISM manufacturing index blipped up to 48.3 last month from 47.8 in September, the first uptick since March, but anything below 50 signals a contraction and manufacturing has been on a three-month losing streak. New orders, production and hiring all contracted, but export orders increased.

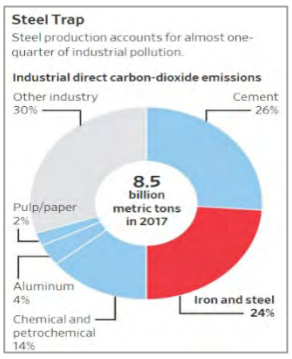


- **U.S. industrial production** dropped 0.4% in September and 0.1% from a year ago. Manufacturing output fell 0.5% from August and 0.9% over the past 12 months. However, the figures showed some stability, as factory output increased during the 3rdQtr after having declined for the first half of this year. Mining output fell 1.3% due to less crude oil being extracted and fewer wells being drilled. Production at utilities improved 1.4% as warm weather boosted demand for electricity. The nation's industrial capacity utilization rate was 77.5%, down from 77.9% in August

  Key Update: *The GM strike that began on September 16 led to a 4.2% decline in auto output in September.*
- **Durable goods orders** dropped 1.1% in September, the biggest setback since a 2.3% decline in May. Orders in a category that serves as a proxy for business investment spending dipped 0.5% following a 0.6% decline in July. Demand for commercial aircraft fell 11.8% in September after a 17.2% decline in August. Auto production fell 1.6% in September, reflecting in part a strike at General Motors.
- **U.S. factory orders** decreased 0.6% to $496.7 billion in September. Excluding transportation, factory orders were down 0.1% in September from the previous month. Orders excluding defense fell 0.6%. Overall, durable goods orders were down 0.3% during the first nine months of the year compared to the same period in 2018.
- **The producer-price index** declined 0.3% in September, driven down by an unusually large 1% drop in trade services, a volatile measure of margins received by retail and wholesale businesses. Producer prices were up 1.4% from September 2018. The core PPI was flat in September but up 1.7% from a year earlier. Prices for goods fell 0.4% from August, partly due to lower energy prices.

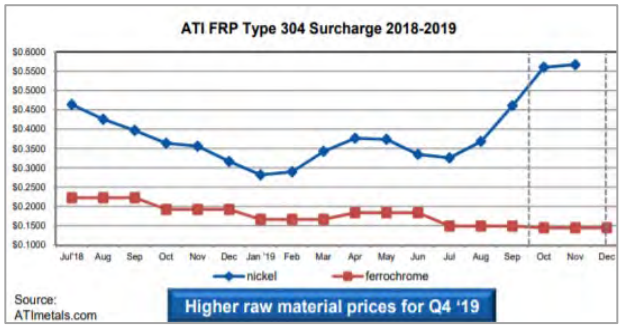
- **The ISM nonmanufacturing index activity** registered 54.7 in October, 2.1 points above the September reading. This reflects growth for the 123rd consecutive month in the non-manufacturing sector and now at a faster rate. Of the 18 non-manufacturing industries reporting, five industries reported a decrease: educational services, other services, retail trade, wholesale trade and mining.
- **U.S. consumer spending** increased 0.2% in September from August, a sign consumers remained on steady—though more cautious—footing heading into the 4thQtr. The personal saving rate was 8.3% in September, up from 8.1% in August. Incomes grew 0.3%. The personal saving rate was 8.3% in September, up from 8.1% in August.
- **The U.S. housing market** sputtered in September as a lack of homes for sale and high prices disrupted what was shaping up as a second half rebound. The median sales price for an existing home in September was $272,100, up 5.9% from a year earlier. Existing-home sales fell 2.2% to an annual rate of 5.38 million. Housing starts declined 9.4% to an annual rate of 1.256 million units as construction in the volatile multi-family housing segment sagged. Sales of new homes fell 0.7% to an annual rate of 701,000, following a big 6.2% surge in sales in August.
- **U.S. construction spending** increased more than expected in September as investment in homebuilding rose to its highest level in nine months. Construction spending rebounded 0.5%. Data for August was revised down to show construction outlays falling 0.3% instead of ticking up 0.1% as previously reported. Spending on private residential projects increased 0.6% to $511.4 billion, the highest level since December 2018, after advancing 0.8% in August.

  Key Update: *Investment in residential construction rebounded in the third quarter after contracting for six straight quarters, thanks to declining mortgage rates.*
- **A smaller percentage of Connecticut manufacturers** than other businesses reported sales growth in 2018, according to the 2019 Connecticut Manufacturing Report. The survey said 35% of Connecticut manufacturers reported sales growth in 2018, with 48% holding steady and 17% posting declines. In comparison, 43% of all businesses posted growth, 44% said they saw no change and 13% reported declining sales. The most significant factors explaining losses are shrinking Connecticut markets and growing costs, particularly state taxes, labor and energy. Trade tariffs also were factors for exporters and companies that import raw materials. The survey found that 34% said the top priority of lawmakers next year should be to reduce government spending and enact pension reform.
- **U.S. businesses and consumers** paid an additional $34 billion in tariffs from the time the trade war started in February through August 2019. The Treasury Department said it collected roughly $7 billion in customs duties in August. Tariff collections are expected to increase in the coming months as the Trump administration attempts to pressure China to change unfair trade practices.
- **The U.S. budget gap** widened 26% in the fiscal year that ended Sept. 30 to $984 billion, as rising government outlays continued to outpace tax collection. Annual deficits have risen 68% since 2016 during a period of historically low unemployment and stronger wage gains. Tax cuts restrained revenue growth last year, and a bipartisan budget deal ramped up government spending. Deficits are on track to exceed $1 trillion a year over the coming decades and would rise higher if the economy weakens.
- **Brazilian miner Vale's** 3rdQtr net income was $1.65 billion, compared with a loss of $133 million in the 2ndQtr and income of $1.4 billion in the 3rdQtr of last year. Sales rose to $10.2 billion, while Ebitda rose to $4.6 billion. The increase in output in the quarter came after Vale resumed operations at its Brucutu mine at the end of June. The company said the reference price for iron ore 62% Fe was 2% higher compared with the 2ndQtr and jumped 53% from the 3rdQtr of 2018. (See **Appendix: *Commodities***, page 15)
- **Steel mills** in the U.S. shipped 8.4 million tons of steel in August, a 4.4% increase over July and a 0.4% increase from August 2018. Steel mill product shipments year-to-date through August were 64.8 million tons, a gain of 1.8% over 2018 shipments for eight months.



- **U.S. raw steel production** for the year-to-date through November 2nd was 81.6 million tons at a capability utilization rate of 80.3%, an increase of 2.5% from the same period last year at a utilization rate of 77.5%.
  (See **Appendix: *Steel***, page 9)
- **Steel imports into the U.S.** were 1.896 million tons in September, including 1.528 million tons of finished steel, down 6.2% and 14.8% respectively vs. August's numbers. For the first nine months of 2019, total and finished steel imports were 22.587 million and 16.860 million tons, down 13.7% and 16.1% respectively vs. the same period in 2018. Finished steel import market share was estimated at 18% in Septmber and 20% year-to-date through September.

- **Nucor and U.S. Steel** increased base prices by a minimum of $40/ton on all new flat-rolled steel products orders effective immediately in October, mirroring an initial increase made by ArcelorMittal. The U.S. unit of Russian producer NLMK also hiked base prices by $40/ton.
- **U.S. Steel** posted its first quarterly loss since 2017 in the 3rdQtr as the company contends with significant market challenges. The Pittsburgh steelmaker lost $84 million vs. a profit of $291 million in the 3rdQtr of 2018. Sales were lower at $3.1 billion from $3.7 billion during the same quarter a year ago, a reflection of average realized prices for flat-rolled steel dropping by nearly 15% over that period.
- **Allegheny Technologies** reported third quarter revenues of $1.02 billion and net income of $111 million including previously announced sales of non-core assets valued at $68.2 million. Net income excluding these asset sales was $44.9 million. This compares to ATI's 3rdQtr 2018 sales of $1.2 billion and net income of $50.5 million. ATI reported lower jet engine material and component sales.



- **Caterpillar** reported a drop in sales in the U.S. and China in the 3rdQtr, leading it to cut its outlook for the year. Total sales and revenue fell 5.6% from a year ago to $12.76 billion. Profit attributable to common stockholders fell 13.9% to $1.49 billion. Sales in Asia-Pacific fell 13% as Caterpillar faced falling demand in China and competition from cut-price domestic rivals, while revenue in its main developed world market in North America fell almost three percent.
- **GM and the UAW** reached a deal covering more than 46,000 workers which includes key union wins along with a pledge to invest $7.7 billion into U.S. factories. That move would create or preserve 9,000 jobs, and an additional plan to invest $1.3 billion near its Lordstown, Ohio, plant would create another 1,000. The deal also includes wage hikes, bonuses and other worker demands, along with plans to shutter idle plants. (See **Appendix: *Automotive***, page 11)

  Key Update: *The damage to GM's bottom line is likely to exceed $3 billion with most of the hit to be reported in the 4thQtr. The new union contract is also expected to tack on $100 million or more a year in higher labor costs.*

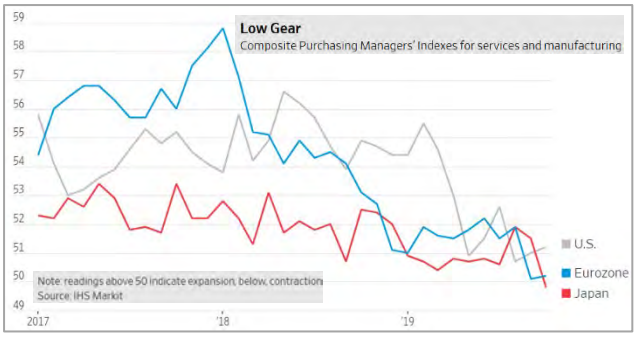
- **General Motors** plans to build a new family of premium electric pickup trucks and SUVs at its Detroit Hamtramck plant beginning in late 2021, possibly reviving the imposing Hummer brand on some of them. The BT1 electric truck/SUV program is the centerpiece of a planned $3 billion investment in the plant to make electric trucks and vans, and it is part of a broader $7.7 billion investment in GM's U.S. plants over the next four years, according to the new labor deal between the automaker and the UAW union.
- **The Shinhwa Group** will open a $42 million manufacturing operation in Auburn, AL, expected to create 95 jobs. The South Korean company's first U.S. manufacturing plant will make drive shafts for Hyundai in Montgomery and Kia in West Point, GA. The company plans to expand the Auburn production site to provide parts for other auto makers. Alabama is home to more than 150 auto suppliers.
- **U.S. Senator Schumer** proposed a $454 billion plan over ten years to help shift the U.S. away from gasoline-powered vehicles by offering cash vouchers to help Americans buy cleaner vehicles. Schumer's plan would provide rebates of $3,000 or more to individual buyers and would help transition 25% of the U.S. fleet, or 63 million vehicles, away from traditional internal combustion-engine vehicles within ten years. The plan would be key for reducing the impact of climate change since the transportation sector accounts for nearly one-third of U.S. carbon output. Ford, GM and the UAW all said they appreciated Schumer's efforts, with General Motors praising the effort to promote American electric vehicle manufacturing.
- **Harley-Davidson's revenue** from motorcycles and related products fell 4.9% from a year ago to $1.07 billion in the 3rdQtr. Motorcycle shipments were down 5.8% to 45,387. Gross margin fell one point to 29.9% of sales and operating margin fell 140 bps to 4.4% of sales. The company expects to ship 212,000 to 217,000 bikes for the full year 2019.
- **U.S. automakers** saw a sales gain in October of about 2.5% following a steep drop the previous month, even as new-vehicle prices hit record highs. Total deliveries were estimated at 1.39 million, benefiting in part from one extra selling day. The forecast works out to a seasonally adjusted annualized rate of 17.3 million vehicle sales, down about 200,000 units from a year ago. With buyers shifting from sedans to more expensive SUVs and pickups, the average transaction price for new models is expected to top $34,000 for the first time ever, rising almost $1,300 from a year ago. Hyundai Motor had a banner month with sales up 8.4% to 57,094 vehicles.

- **Ford Motors'** operating profit rose 7.5% to $1.8 billion in the 3rdQtr. Still, the company lowered its full-year profit forecast, citing continued weakness in China, higher warranty costs and tougher competition in North America. Net income sank to $425 million from $991 million a year ago. Ford attributed the decline to one-time charges related to its global restructuring efforts, including $800 million in costs related to its joint venture in India. Sales revenue was $37 billion vs. $37.6 billion in the 3rdQtr of 2018.
- **BMW** told U.S. trade representatives that intensifying a global trade war could threaten jobs in South Carolina. An imposition of trade barriers would hamper the ability of BMW's largest car factory in Spartanburg to export around 70% of its production across the globe as it does currently.
- **Tesla** reported $143 million in net income in the 3rdQtr as cost reductions more than offset a slight decline in revenue to $6.3 billion. Tesla's Shanghai factory ramp-up is ahead of schedule and trial production had started. Its next vehicle, the Model Y, a roomier version of the Model 3, is now expected to be in production by next summer. Tesla had said earlier the model would not arrive until late next year.
- **Boeing** reported sharp drops in sales, earnings and airplane deliveries for the 3rdQtr as it continued to struggle with the fallout from the deadly crashes of two 737 MAX jets. Sales fell 21% from a year ago to $20 billion. Earnings fell 43% to $1.26 billion. The commercial airlines division lost $40 million after earning more than $2 billion in the same period a year ago. Commercial airline deliveries plummeted 67% in the quarter, with Boeing delivering just 62 planes. Boeing's costs related to MAX production increased by $900 million.
- **An unpiloted Air Force X-37B spaceplane**, one of two winged orbiters used to carry out classified research, made a surprise landing at the Kennedy Space Center in late October to close out a record 780-day mission. It was the fifth flight in the secretive Orbital Test Vehicle (OTV) program, pushing total time aloft to 2,865 days. The spacecraft are believed to fly as orbital test beds for advanced technology sensors and other systems, but the Air Force program is classified.

- **Lockheed Martin** expects its order backlog to reach a record $140 billion and to add $17 billion in orders this year, reflecting the big ramp-up in F-35 production, with deliveries set to climb to 140 next year from 131 in 2019. A final deal for the sale of more than 400 jets is imminent, which at $35 billion would be the largest-ever military contract. (See **Appendix:*Aerospace***, page 10)
- **Blue Origin** is partnering with industry giants to land humans back on the surface of the Moon under NASA's Artemis program. Jeff Bezos' company is the new group's prime contractor and will provide its lunar lander called Blue Moon. Lockheed Martin is building the reusable vehicle that will then return astronauts from the surface of the Moon, known as the 'Ascent Element', Northrop Grumman will supply the 'Transfer Element' and landing gear, while Draper will provide flight avionics.
- **Commonwealth Fusion Systems** is collaborating with MIT to build a fusion reactor and has planned a fusion experiment dubbed Sparc. The experimental reactor will generate about 100MW of heat energy in pulses of about ten second bursts big enough to power a small city. The Sparc team anticipates that the output will be more than twice the power used to heat the plasma, thus overcoming the biggest technical hurdle in the field—positive net energy from fusion. The Sparc team has set an ambitious target to have the reactor running in just 15 years.
- **Metals producers** are grappling with increasingly tough and costly environmental demands imposed by banks seeking cleaner investments with heightened awareness of climate change amid public protests. Metals and mining are responsible for 10% of the total impact on climate change. Large mining groups like BHP and Anglo American are investing in solar power, automation and water-saving technologies, betting that substantial up-front investment will burnish their green credentials and raise efficiency. For example, BHP took a big hit to cancel its coal contracts in Chile but new renewable power contracts will cut energy costs by 20%. (See **Appendix: *Commodities*** page 15)
- **The U.S. SEC** is investigating three of the world's largest medical device makers for their alleged participation in a bribery scheme in China. The probe involves Siemens, Royal Philips and GE Healthcare, who allegedly used local middlemen to bribe Chinese government and hospital officials to buy their medical equipment. The companies allegedly benefited from the initial sales and from larger profit margins from longterm service contracts, software updates, spare parts and materials.
  (See **Appendix: *Medical***, page 13)
- **The Office of the U.S. Trade Representative** has exempted another 18 medical devices or device components from the 25% tariffs imposed on Chinese goods. The new list includes ultrasound, X-ray, MRI and infusion equipment. On July 6, 2018, tariffs on more than $34 billion in imports from China went into effect. U.S. medtech makers originally faced $836 million in tariffs.

EUROPE, AFRICA & THE MIDDLE EAST

- **Business activity** continued to slow around the world headed into the fall. IHS Markit said the overall outlook remained subdued as new work at the businesses surveyed fell to the lowest pace since October 2009. The U.S. survey data showed "a near-stalling of new order growth to the lowest lrvel for a decade suggests that risks are tilted toward growth remaining below trend in coming months," said HIS Markit. Business activity in the eurozone was close to stagnation in October, and it declined in Japan.



- **The new leaders of the IMF and World Bank** warned of a deteriorating global economic outlook. "The global economy is now in a synchronized slowdown," said Kristalina Georgieva, who took the helm of the IMF in October. David Malpass, the World Bank's president said in June the World Bank had forecast 2.6% global growth in 2019—the slowest in three years. "We now expect growth to be even weaker than that, hurt by Brexit, Europe's recession and trade uncertainty."

  ***Key Update**: According to IMF research, the cumulative economic loss from the current trade war could amount to $700 billion by 2020, or about 0.8% of global GDP.*

- **Eurozone manufacturing activity** contracted sharply in October as demand was again stifled by the U.S. trade war with China and lack of clarity over Britain's departure from the EU. IHS Markit's manufacturing PMI for October was 45.9, barely above September's seven-year low reading of 45.7 and its ninth month below the contraction mark.
- **The eurozone's economy** grew by 0.2% over the quarter ending September, slightly above the level forecasters had predicted. However, GDP data for Germany, the eurozone's biggest economy, is not due until November 14, so the Eurostat estimate for the whole euro zone could be revised downwards if market expectations of negative 3rdQtr growth in Germany are confirmed.

  ***Key Update:** Eurostat said that unemployment in the euro zone in September was stable at 7.5% of the workforce, the lowest level since July 2008.*

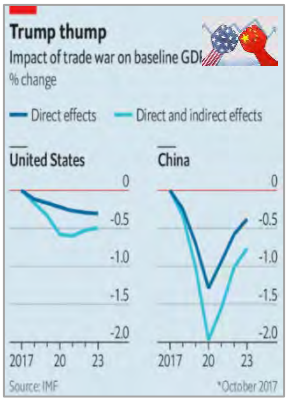
- **ArcelorMittal** is withdrawing from a deal to buy Italy's struggling steel mill in Taranto from Ilva after the government removed previously agreed guarantees of legal immunity over its operations. The promised legal shield would have given ArcelorMittal's managers immunity from prosecution related to a clean-up plan for the plant. The ruling 5-Star Movement party has opposed handing the firm legal carte blanche, saying it was unfair to Taranto locals who might have suffered from the pollution.
- **ArcelorMittal** reported a net loss of $539 million for the 3rdQtr, a second-straight quarter in the red. MT now expects a reduction of U.S. steel demand due to a weak auto sector and a slowdown in demand for machinery, although non-residential construction remains healthy. It also said the contraction in steel demand in Europe would be worse than expected due to a sluggish auto sector and slowing construction. (See **Appendix: *Steel***, page 9)

  ***Key Update:** The company said global steel consumption, including the impact of inventory changes, would grow in 2019 by 0.5% - 1.0% this year, towards the lower end of its previous guidance of 0.5%-1.5%.*

- **Daimler** reported higher 3rdQtr earnings and sales even as its Mercedes-Benz unit continued to struggle with high investments in electric cars and new technology and lingering criminal investigations in the U.S. and Europe. Daimler's 3rdQtr net profit was €1.72 billion following a steep €1.2 billion loss in the 2ndQtr. Sales rose 8% from a year ago to €43.27 billion. Daimler's flagship Mercedes-Benz Cars division rose 8% to 604,655 vehicles, but the return on those sales dropped to 6% from 6.3%. Mercedes sales fell 1% to 1.74 million vehicles in the first nine months, and the return on sales plunged to 3.1% from 7.9% a year ago.
- **Outgoing EC President** Juncker does not believe President Trump will impose tariffs on imported European cars in November. The previous tariffs have already provoked retaliation from the EU, and auto tariffs could significantly escalate tensions. "Trump is going to complain, but there won't be any auto tariffs," Juncker said.
- **Italy's Fiat Chrysler and Peugeot** have reached a deal to merge that if sealed will drive a fresh wave of industry consolidation. The 50-50 share swap would create the world's 4th-largest car giant with a $50 billion valuation and annual synergies of €3.7 billion, but it needs to be waved through by investors and to clear regulatory hurdles.
- **Fiat Chrysler** will build a new battery assembly complex in its Mirafiori plant in Turin with an initial investment of $56 million. Batteries produced in the new complex will be used by the new generation of full electric models.

ASIA/PACIFIC, JAPAN, AUSTRALIA & INDIA

- **China's 3rdQtr economic growth** slowed to its weakest pace in almost three decades as the bruising U.S. trade war hit factory production. GDP rose just 6.0% year-on-year, marking a further loss of momentum for China's economy from the 2ndQtr's 6.2% growth. Contrasting with the disappointing GDP number, China's industrial output grew 5.8% in September, faster than the 17-year-low posted in August.



Key Update: *The IMF has warned the U.S.-China trade war will cut 2019 global growth to its slowest pace since the 2008-2009 financial crisis, but said output would rebound if their dueling tariffs were removed.*

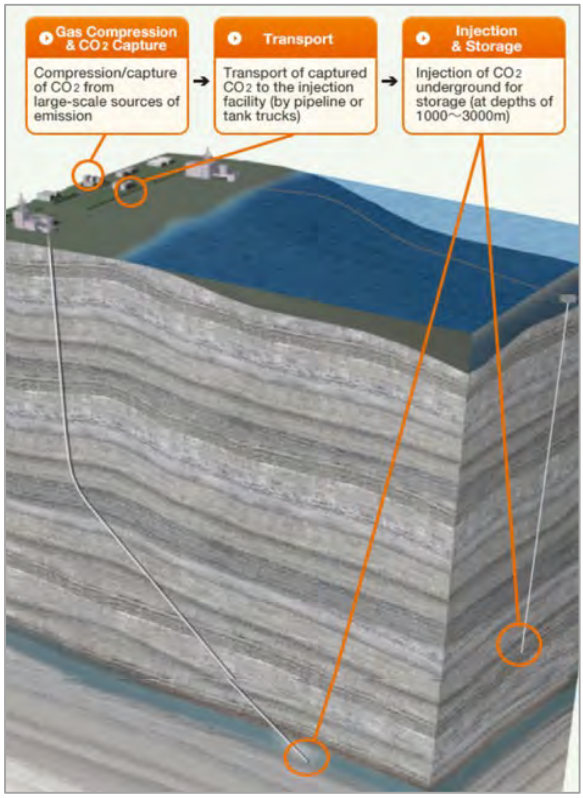
- **China's factory activity** unexpectedly expanded at the fastest pace in well over two years in October as new export orders rose and plants ramped up production. The Caixin/Markit Manufacturing PMI for October rose to 51.7 from 51.4 in September, marking the third straight month of expansion. New export orders for Chinese manufacturers bounced back into expansionary territory for the first time in five months. This was likely due to the U.S. choosing to temporarily exempt more than 400 types of Chinese products from additional tariffs in September.
- **Hong Kong's economy** shrank 3.2% in the 3rdQtr, the worst quarter-to-quarter drop since 2009. On a year-over-year basis, the economy shrank 2.9%. With this second straight quarter of contraction, the city is now in recession undermined by months of antigovernment protests, the U.S.-China trade war and weaker global growth.
- **5G networks** were turned on in China at the end of October, ahead of schedule after initially targeting a 2020 launch, despite an ongoing trade war with the U.S. that has turned into a battle over tech supremacy. China Telecom, China Unicom and China Mobile all unveiled 5G plans that start at around $18 per month, though experts have warned of challenges to adoption, including price and a lack of 5G capable handsets.
- **Manufacturing activity in India** continued to weaken in October with factory orders and production rising at the weakest rates in two years. The IHS Markit India Manufacturing PMI fell to a two-year low of 50.6 in October from 51.4 in September.
- **Indonesia** decided on November 7 to resume nickel ore exports after halting shipments to investigate reports of export rule violations. The government ordered a temporary halt to exports of nickel ore on Oct. 28 following reports that exports had surged after Indonesia said an export ban would be implemented from January 2020, bringing it forward from 2022. The export surge reportedly included large sales of high-grade nickel ore from Indonesia, which only allows exports of ore with less than 1.7% nickel content. Indonesia's nickel miners association said at least 20 nickel ore vessels were being held in ports, each carrying an average of 50,000 tonnes.
(See **Appendix: *Metals***, page 15)
- **World crude steel production** was 151.5 million tonnes (Mt) in September, a 0.3% decrease vs. September 2018. In the first nine months of this year, world crude steel output was 1,391.2 Mt, up by 3.9% compared to the same period in 2018. Asia produced 1,000.1 Mt of crude steel, an increase of 6.3% over the first nine months of 2018.
- **China's steel sector fragmentation** is worsening as unplanned new capacity at small mills is undermining government efforts to restructure and merge companies. Beijing has been trying to consolidate its steel market to curb excess capacity and pollution and has set a goal for its top 10 steelmakers to own 60% of production capacity by 2020. In the first eight months of 2019, China churned out 665 million tonnes of crude steel, up 9.1% on the year. Production by members registered with the China Iron and Steel Association (CISA), mostly state-owned firms, grew at 5.9% year-on-year during that period. Production by non-members, mostly private firms, surged 19.4 percent.
- **Toyota's Lexus** will launch its first all-battery electric vehicle next year as the Japanese automaker catches up with rivals, which have marketed battery EVs for years. The company also confirmed it will be launching its first plug-in hybrid model. By 2025, Lexus says that it will have electrified versions of all Lexus vehicle models.
- **Tesla** was approved by China's industry ministry to begin production at the $2 billion giga factory it is building in Shanghai, the first fully-foreign-owned car plant in China. Tesla plans to produce at least 1,000 of its Model 3s per week from the factory, which could be running within weeks. The new factory will give Tesla access to the world's biggest car market and help the company avoid tariffs.
- **Nissan Motor** named the head of its China business, Makoto Uchida, as its next CEO. The automaker has been battered by plunging profits, scandals, and tensions with top shareholder Renault.

ECONOMIC UPDATE: APPENDIX TO NOVEMBER 2019 REPORT

STEEL: VICTORINOX STAINLESS STEEL GIVES ICONIC SWISS ARMY KNIFE ITS EDGE

Swiss knife maker, Karl Elsener, opened his workshop in Ibach in 1884. The multifaceted tool he created become a Swiss icon, taken into space by NASA astronauts and even exhibited at New York's Museum of Modern Art. This unique tool was the Swiss Army Knife, a foldable steel utility instrument that gained renown as a precision cutting tool for Switzerland's soldiers. The main blade, alongside other tools such as screwdrivers and can openers, is compactly stowed inside the handle and unfolds through a pivot point mechanism. Elsener's company was named Victorinox in memory of his mother Victoria and after the French term for stainless steel, 'acier inoxydable', and the company became the first manufacturer of the Swiss Army Knife. **The power of steel has always remained at its heart, with Victorinox's standard steel said to be an exclusive blend from Germany and France.** Elsener delivered the first major supply of knives to the Swiss army in 1891. Originally intended to help soldiers disassemble rifles and open canned food, the knives' increasing production was subsequently split between Victorinox and its Swiss rival, Wenger. In 2017, Victorinox, now the sole supplier to the Swiss military, hit a production milestone of 500 million 'Original Swiss Army' knives. **The martensitic stainless steel alloy used for the cutting blades is utilized for toughness and corrosion resistance and has a composition of 15% chromium, 0.60% silicon, 0.52% carbon, 0.50% molybdenum, and 0.45% manganese.** In 1931, Carl Elsener II, Karl Elsener's son, set up the world's first all-electric hardening plant, to ensure all knives were of consistent high quality. More recently, Victorinox has routinely issued limited editions of its Swiss Army knives in sought-after 'Damast' or 'Damascus' steel, with its distinctive watery fine-line pattern. Today, the company's product family continues to grow. There are bespoke pocket knives for every persona, from the 'Adventurer' and the 'Explorer' to the 'Winemaster' and 'Picknicker', boasting up to 42 different features, including a removable USB. Whatever the combination of tools tucked away may include, **it is Victorinox steel which continues to be the irrefutable core of the Swiss Army Knife's ongoing success.**

STEEL: TATA STEEL EXPLORES CARBON CAPTURE TO REDUCE CO2 EMISSIONS FROM STEELMAKING

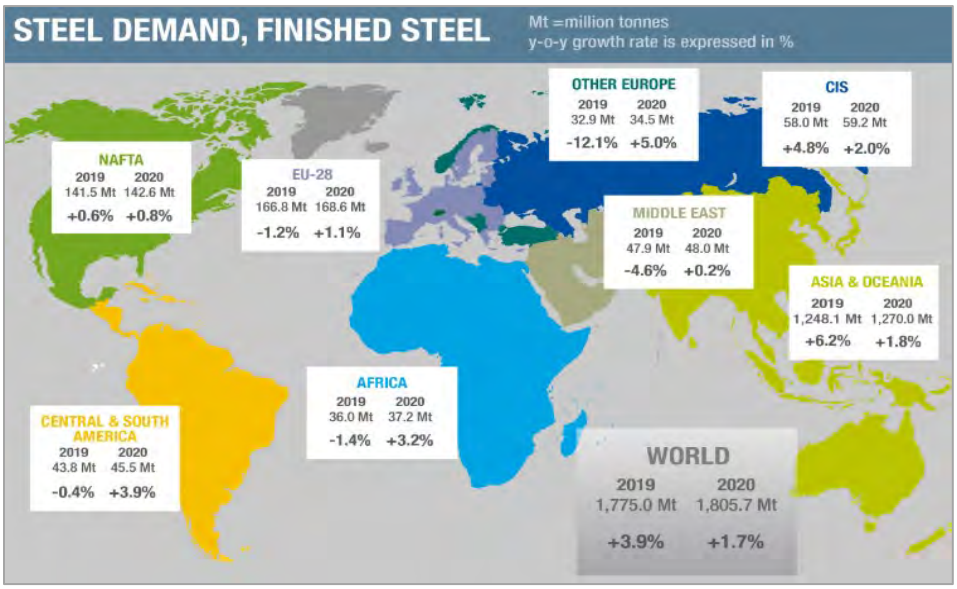


Tata Steel joined forces with Dutch companies Gasunie, EBN and Port of Amsterdam to complete a feasibility report into an innovate project which could reduce the steelmakers' CO2 emissions. Tata announced last year that it aims to be a carbon neutral steelmaker in Europe by 2050. **Capturing CO2 from the company's steelmaking operations and either reusing it or storing it in empty gas fields under the North Sea could play an important role in helping to achieve that ambition.**

A new report confirmed there are sufficient opportunities for capturing, storing and reusing CO2 in the North Sea Canal area, which is home to Tata Steel's integrated steelmaking site in IJmuiden, the Netherlands. It showed a CCUS (Carbon Capture Utilization and Storage) network is technically feasible and has **the potential to reduce emissions of CO2 by 7.5 million tonnes a year by 2030.** The study will be followed by more detailed research. Known as the Athos Project, it is just one of the ways Tata Steel said it is exploring in order to reach its ambitions around decarbonization. There are many empty gas fields under the North Sea to store the captured CO2.

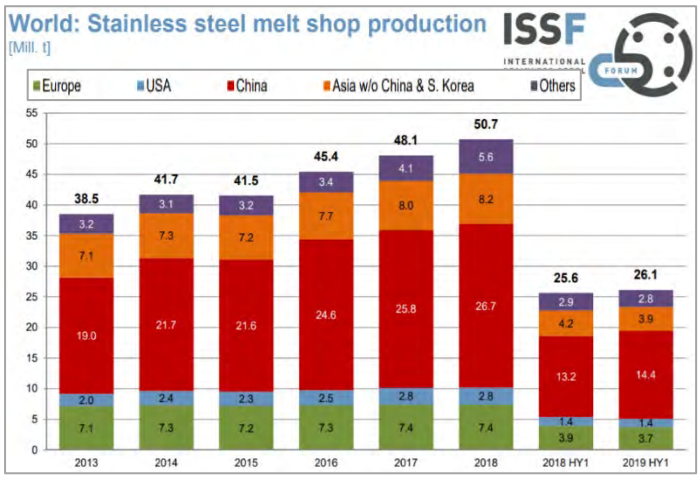
The study showed there are no technical barriers to the project and that no new technologies need to be developed. The CCUS technology is already being used worldwide. There are various initiatives and plans for reusing CO2 in the North Sea Canal area, including the reuse of CO2 in greenhouse horticulture or conversion for reuse in the form of synthetic fuels.

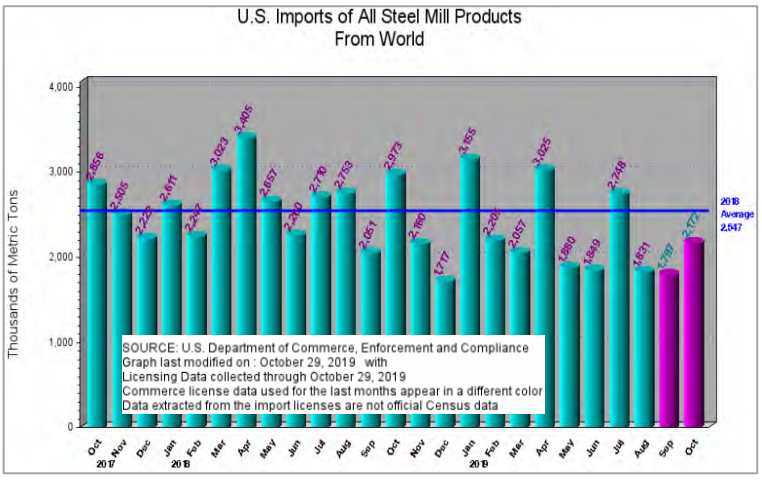
STEEL: WORLD STEEL DEMAND, FINISHED STEEL FORECASTS FOR 2019 & 2020



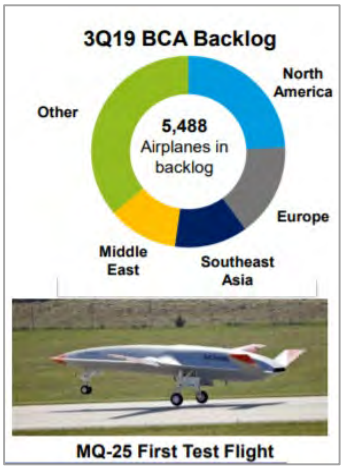
The World Steel Association in October released its Short Range Outlook (SRO) for 2019 and 2020. In 2019, worldsteel forecasts that steel demand in China will grow by 7.8% to reach 900.1 Mt and the rest of the world is expected to record 0.2% growth to 874.9 Mt. In 2020, Chinese steel demand is expected to grow by 1.0%, while steel demand in the rest of the world will grow by 2.5%, driven by 4.1% growth in the emerging and developing economies excluding China. **Global steel demand will grow by 3.9% to 1,775.0 Mt in 2019 and will grow by another 1.7% in 2020, reaching 1,805.7 Mt.**

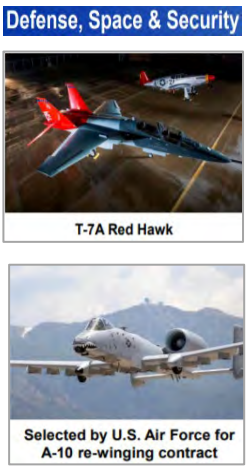
STEEL: STAINLESS STEEL MELT SHOP PRODUCTION; U.S. IMPORTS OF STAINLESS STEEL PRODUCTS





AEROSPACE: BOEING SAYS FUNDAMENTALS STRONG, BUSINESS ENVIRONMENT SUPPORTIVE OF GROWTH





AEROSPACE: ELON MUSK'S AMBITIOUS PLAN TO PUT SPACEX'S STARSHIP INTO ORBIT IN SIX MONTHS

SpaceX founder and CEO Elon Musk believes the company is on the cusp of achieving "the holy grail of space" travel with its planned reusable Starship rocket system. He aims to put a prototype in orbit in as little as six months. Musk recently laid out the ambitious timeline during a presentation at the company's launch facility in Cameron County, Texas. The presentation was delivered 11 years to the day after SpaceX's first rocket, the Falcon 1, first delivered a payload into space. The planned Starship system, unlike the Falcon 1, is designed to be fully reusable. Rapidly reusable orbital rocket systems will be key to making space travel practical and affordable, Musk said. Just as cars and planes can make more than one trip per day, he believes rockets will need the ability to make multiple trips to space and back. **After two years of Starship development, SpaceX switched to 301 stainless over aluminum-lithium or carbon fiber because of its strength at cryogenic temperatures, high melting point which requires less shielding for atmospheric reentry and its relatively low cost.**

"Unlike most steels which get brittle at low temperature, 301 stainless gets much stronger. Its strength-to-weight ratio at cryogenic temperatures is equivalent to, or even perhaps slightly better than, advanced composites or aluminum lithium, said Musk. Stainless steel's ability to withstand heat led to design decisions that reduce the overall weight of Starship, with the net result being that a 301 stainless steel rocket is the lightest possible, reusable architecture. Using steel is helping to cut Starship development costs, now estimated to be $2 to 3 billion. Musk previously projected development costs of $2 to $10 billion. SpaceX pays about $130,000 per ton for carbon fiber, while stainless steel runs $2,500 a ton. Steel is also easy to weld and resilient to the environment which is allowing SpaceX to construct the prototypes outdoors without a factory in the high heat and humidity of Texas and Florida. Musk said constructing assembly buildings would take too long. Musk aims to launch the Starship system, which includes a 164-foot stainless-steel rocket, into orbit by early next year. "This is going to sound totally nuts, but I think we want to try to reach orbit in less than six months," Musk said. "Provided the rate of design improvement and manufacturing improvement continues to be exponential, I think that is accurate to within a few months." Musk ultimately intends for the system to be able to ferry people back and forth between Earth and space.

AEROSPACE: NASA SENT PROBES TO OTHER PLANETS, NOW IT'S TRYING TO GO THE OTHER WAY

NASA and the European Space Agency are planning an audacious mission to gather samples of rock and soil from the surface of the red planet and transport them across 34 million miles of space—giving scientists an unprecedented opportunity to study what Mars is made of and to search for evidence that the planet once harbored life. Because past missions have revealed signs of Martian lakes and river deltas, the scientists believe they may find the fossils of microscopic organisms that thrived in those lakes and rivers before the planet became the frigid desert that it is today. Next July, the three-part mission to return samples from Mars will begin with the launch of the Mars 2020 rover. **While the rover is exploring and collecting soil, NASA engineers will continue developing the technology for the other two phases of the mission—launching a rocket lifting the samples to Martian orbit, where it will rendezvous with a waiting return vehicle that will ferry the precious cargo to Earth.** For each of the steps in that process, the engineers at NASA's Jet Propulsion Laboratory are confronting a series of daunting challenges. For starters, nobody has ever launched a rocket from the surface of another planet. This is a very different scenario from the one that brought Apollo astronauts home from the Moon, just 238,900 miles away. Unlike the ascent stage of the Apollo Lunar Module, the planned Mars Ascent Vehicle (MAV) will have to free itself from a planet's gravity, even if the pull is only 38% of the surface gravity of Earth. Before the ascent vehicle launches for home, it will have had to endure a gauntlet of physical punishments. First, as a payload aboard a lander headed to Mars, the MAV will be subjected to the rough ride of a launch from Earth, followed by a six- to nine-month flight through deep space, which will culminate in a fiery entry into the atmosphere surrounding Mars, a supersonic descent, and a not-so-soft landing. After that, the craft will sit on the surface for half a Mars year (equal to a full year on Earth), exposed to dust storms, ultraviolet radiation, and temperatures as low as minus 40 degrees Fahrenheit.

NASA is designing a small rocket (artist's impression) that will launch from Jezero Crater, bringing soil samples back to Earth. (NASA)

AUTOMOTIVE: FOR GM, THE NEW DEAL MAY BE LABOR-COST SETBACK

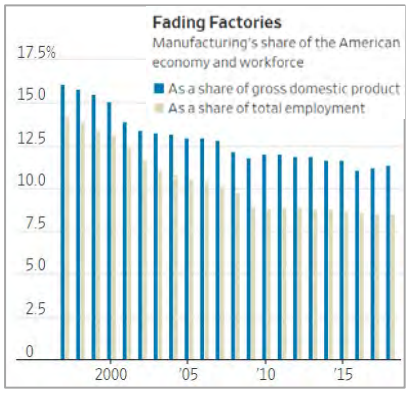
General Motors' new contract with the UAW gives the automaker what it wanted: the closure of three underutilized plants, a key piece of its restructuring plan, but the win comes with a trade-off. The sweeteners offered to secure workers' approval, including a record $11,000 ratification bonus and hourly wages topping out at more than $32, could put the automaker at an even greater cost disadvantage compared with nonunion competitors. Late last year, GM outlined a restructuring plan designed to slash $6 billion in costs by 2020. The strategy included closing four plants and cutting 15% of its North American salaried jobs. The UAW agreed to let GM close three of the four, including the Lordstown plant in Ohio. The one survivor is Detroit-Hamtramck Assembly, where GM will spend $3 billion retooling to make electric vehicles. Still, **GM will spend more overall on labor under the contract and has lost as much as $1.75 billion since workers went on strike September 16, according to Anderson Economic Group, a Michigan consulting firm.**

AUTOMOTIVE: DRIVERLESS TRUCKS WITH NO CABIN AND INTERCHANGEABLE CONTAINER AREAS

In Japan, trucks are being designed for a driverless future with no cabin and interchangeable container areas that would allow vehicles to be highly customized for parcel delivery or even serve as mini-hotels or beauty salons. At the recent Tokyo Motor Show, **Hino Motors, the truck making arm of Toyota Motor showcased the futuristic "Flatformer", which had no driver's cabin and where the low-riding bed is fixed but the cargo or container section can be swapped out.** On display was a concept battery-electric model with a cargo hold divvied up into stacked storage boxes that would help parcel delivery companies to sort, load and deliver goods more efficiently. The idea is to produce a standardized truck bed upon which customers can customize according to the services they offer. Explosive growth in online shopping and increased demand for same-day deliveries have heaped pressure on courier companies and their drivers - particularly in Japan where the sector has borne the brunt of a worsening labor shortage. Toyota's mini-vehicle brand Daihatsu also showed off its "Tsumu Tsumu" model with a removable cargo hold that can be adapted to suit the needs of farmers transporting vegetable harvests, or as a food truck, or for businesses that need to deliver food to restaurants. Such flexibility may be critical for the future of mini-trucks in Japan. The number of farmers, a core customer base for Daihatsu's no-frills affordable vehicles, is dwindling as the country ages rapidly.

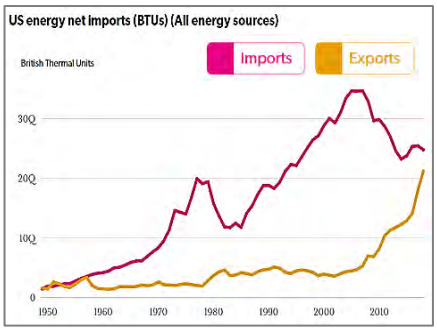
MANUFACTURING: U.S. COMPANIES INCREASING THEIR FOCUS ON AUTOMATION

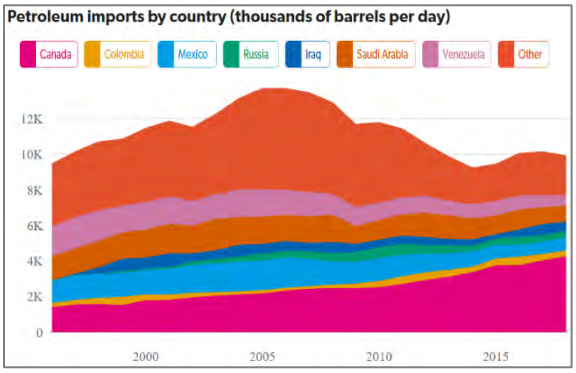
U.S. companies are responding to the lowest unemployment rate in almost 50 years by increasing their focus on automation to maintain healthy margins as labor costs tick higher. The attempt to save money through technology does not come down to just installing more robots in factories. **Instead, companies appear to be confronting the lack of low-cost workers by investing in software and machines that can perform tasks ranging from human resources management to filling prescriptions.** For instance, Citigroup said it is expanding its cloud infrastructure to replace routine tasks that used to require human labor. UnitedHealth Group told investors that its automation efforts should save the company over $1 billion next year. Corona beer brewer Constellation Brands said that its spending on automation should increase the efficiency in which it packs bottles in a variety pack, shaving costs. Those investments are helping keep wage growth in line despite historically-low unemployment. Overall, companies have discussed automation on quarterly earnings calls more than 1,110 times so far on 2019, a 15% increase from this time last year and nearly double the mentions by this time in October 2016. Corporate orders of robotics alone rose 7.2% over the first half of this year compared with 2018, totaling $869 million. The fastest-growing sectors of automation are in logistics and healthcare, said Jeremie Capron, head of research at ROBO Global. Capron sees the greatest opportunity in companies like Zebra Technologies Corp, which makes radio-frequency identification device readers and real-time location systems that are used in hospitals and e-commerce fulfillment centers. Declining costs and a new generation of smaller systems should continue to push revenue growth in the sector, he said. "We've hit the level where you don't need great engineering skills to deploy automation because the software has made it so much easier to use. You're seeing not only large multi-national groups automate, but those technologies are increasingly available to smaller and mid-sized businesses."



ENERGY: HOW ENERGY INDEPENDENT IS THE U.S.? A LOOK AT OIL IMPORTS, EXPORTS AND PRODUCTION

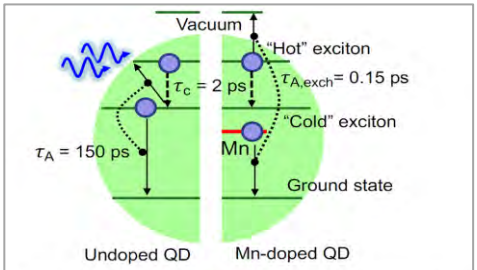
Since 1952, the U.S. has imported more energy than it exported, but now the U.S. is poised to become a net exporter. Net imports hit a high in 2005 when the U.S. imported more than 30 quadrillion BTUs, mostly in the form of crude oil. For perspective, the 2005 net imports could also power 391 million American homes, meaning every home in the country and then some. Net imports in 2005 were also slightly more than the 28.3 quadrillion BTUs consumed by the entire transportation sector in 2018. **Between 2005 and 2018, net energy imports fell 88% to 3.6 quadrillion BTUs, partially due to a rise in domestic oil production and a significant increase in exports.** During the first six months of 2019, the net imports for the year stood at 0.1 quadrillion BTUs. Based on data available back to 1949, the U.S. has always been a net exporter of coal. In 2017, the U.S. became a net exporter of natural gas, the first time in 60 years. Exports for both of these fossil fuels are higher than in 2005. Exports for coal are rising even as domestic production decreases. The role of these fuels in the U.S. energy trade is small compared to petroleum products, all of which are created from crude oil. Petroleum products made up 87% of all energy imports in 2018. Between 2005 and 2018, the amount of petroleum energy imported fell 26%, from 29.1 quadrillion BTUs to 21.5 quadrillion BTUs. The drop in net imports of petroleum products is driven by the U.S. exporting more petroleum products between 2005 and 2018. Exports of petroleum products increased more than 500% from 2.3 quadrillion BTUs to 14.4 quadrillion BTUs. Crude oil imports dropped from 22.1 quadrillion BTUs to 17.2 quadrillion BTUs during this period. Between 2005 and 2018, Canada, the largest exporter of petroleum products to the U.S., saw its exports double from 2.1 million barrels a day to 4.3 million. Saudi Arabia, the second-largest exporter, saw its exports to the U.S. drop 42% from 1.5 million barrels a day to 900,000 barrels a day.





ENERGY: DOPED QUANTUM DOTS HAVE POTENTIAL TO BOOST THE PERFORMANCE OF SOLAR CELLS

Los Alamos National Laboratory engineers have synthesized magnetically-doped quantum dots that capture the kinetic energy of electrons created by UV light before it's wasted as heat. **This discovery could make it possible to make more efficient solar cells, light detectors, photocathodes and light-driven chemical reactions.** In standard solar cells, a large amount of sunlight energy is wasted as heat because they lack an effective way to capture the kinetic energy of "hot" electrons generated by photons in the green to UV portion of the sun's light. These hot electrons lose energy quickly due to interactions with solar cell's crystal lattice. Instead, the energy is converted to vibrations known as phonons. This process typically takes just a few picoseconds (trillionths of a second). At Los Alamos, researchers discovered that adding magnetic ions into quantum dots greatly enhances the useful, energy-producing interactions so as they become faster than wasteful phonon scattering. To implement this idea, the team prepared manganese-doped quantum dots based on cadmium selenide. The photon absorbed by the cadmium selenide quantum dot creates an electron-hole pair, or an exciton. This exciton is quickly trapped by the dopant, creating an excited state that stores energy much like a compressed spring. When the second photon is absorbed by the quantum dot, the stored energy is released and transferred to the newly created exciton promoting it to a higher-energy state. The energy release by the manganese ion is accompanied by the flip of its magnetic moment, known as spin, so the process was called spin-exchange Auger energy transfer. One intriguing observation of team involved the extremely short time scale of the spin-exchange Auger interactions. To their surprise, these interactions were quicker than phonon emissions, which were generally believed to be the fastest process in semiconductor materials. To prove the new effect could beat phonon-assisted cooling, Los Alamos researchers showed that properly designed magnetically doped quantum dots could extract a hot electron created by an UV photon before it loses its energy to heating the crystal lattice. **These paradigm-shifting findings open exciting opportunities for the newly discovered process in boosting the performance of solar cells or driving unusual photochemical reactions.** Interesting opportunities are also envisioned in areas of high sensitivity, high-speed light detection and new types of light-driven electron sources.



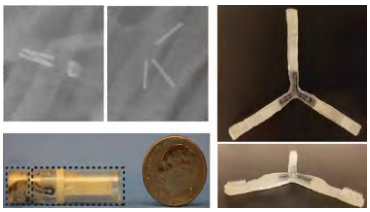
Doping a quantum dot with manganese (right half of graphic) speeds the capture of energy from a hot electron to 0.15 picoseconds, outpacing losses to phonons in the crystal lattice.

MEDICAL: SKY MEDICAL TECHNOLOGY NABS FDA CLEARANCE FOR VTE DEVICE

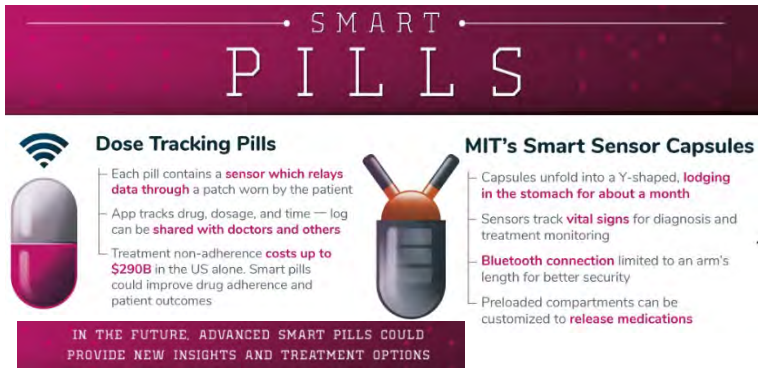
Sky Medical Technology won FDA clearance for a device that stimulates calf muscles to prevent venous thrombosis in non-surgical patients at risk for venous thromboembolism. The Daresbury, England, company said the geko device is the first muscle pump activator of its kind to be cleared by FDA for VTE prevention across all patients. Sky Medical Technology's geko is a non-invasive battery-powered, wearable therapy device that is about the size of wristwatch. The technology is worn at the knee. **Geko works by gently stimulating the common peroneal nerve, activating the calf and foot muscle pumps, resulting in increased blood flow in the deep veins of the calf.** A study of the geko device to prevent VTE in acute stroke patients reported 0% VTEs in patients wearing geko device alone, compared to VTEs in the various control groups prescribed sequential compression devices (SCDs) at 2.4% or pharmacological prophylaxis at 1.1%. The investigators also determined that 30% of patients are contraindicated or became intolerant to SCDs (discomfort or dislike of SCDs). It is to this unmet need cohort that the geko device was fitted, reporting a zero VTE incidence and good patient tolerance. The data has driven rapid adoption across multiple NHS trusts and international markets, as well as the expanded FDA clearance. Commenting on FDA's clearance, Sky CEO Bernard Ross said, "This latest 510(k) (premarket submission) builds on our previous FDA indications to address life-threatening blood clots and complications related to swelling after orthopedic surgery, conditions experienced by more than one million U.S. patients with unmet need every year."

MEDICAL: A MICRONEEDLE PILL THAT CAN BE SWALLOWED COULD REPLACE INSULIN SHOTS

People with some forms of diabetes have to inject themselves with insulin two to four times a day just to stay alive. A new kind of pill developed at MIT could change all that. The capsule is swallowed and passes through the stomach whole, then opens in the small intestine to reveal "microneedles" that attach to the intestine surface and deliver drugs to the bloodstream. This makes it possible to swallow protein drugs like insulin that would normally be destroyed by stomach acids. The new capsule system passes through the acidic environment of the stomach unharmed due to a special polymer coating. As it enters the small intestine, the higher pH triggers a spring to push open the capsule, releasing a microneedle patch. **The patch adheres to the intestinal walls and delivers drugs into the bloodstream via one-millimeter long needles. It then dissolves, passing harmlessly through the rest of the digestive tract.** The small intestine is an ideal spot for drug delivery, since it has an enormous surface area—about the size of a tennis court—and lacks pain receptors. The researchers have successfully delivered insulin to pigs using the microneedle capsules. The amount of insulin that reached the bloodstream was comparable to that of an injection. Working with the drug company Novo Nordisk, the team is continuing to test the system's safety and efficacy in large animals, including dogs and pigs. They plan to move to human trials in the next two or three years. The system has the capacity to transform how we deliver peptides, proteins—including mono-clonal antibodies—and nucleic acids, according to the researchers. "This could change drug delivery science." The kind of protein drugs that could be transformed by the microneedle system include hormones, like those used in fertility treatments, antibodies, like those used to treat cancer and autoimmune disorders, enzymes used to treat genetic diseases and many more.

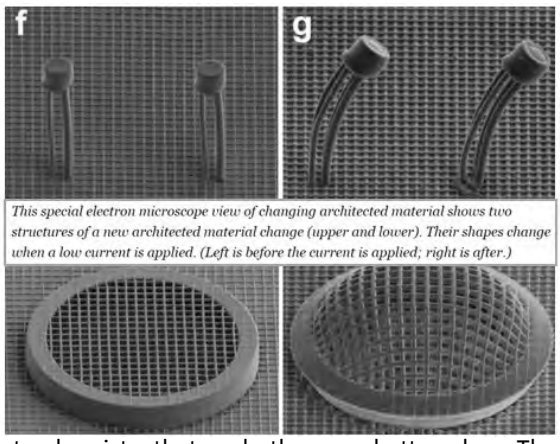


MEDICAL: THE FUTURE OF NANOTECHNOLOGY IN MEDICINE INCLUDES MORE SMART PILLS



INNOVATION: NANOPARTS THAT CHANGE SHAPE AND HOLD IT

Researchers at Georgia Tech have developed an "architected" material that transforms its structure almost immediately to change several physical properties. Alternately, it can transition smoothly between the properties of the first and second shapes. Architected materials are comprised of micron and nanoscale structures such as crossbeams, arches, domes, and spirals, much like the elements of a building's architecture. Researchers from the California Institute of Technology, the Georgia Institute of Technology and ETH Zurich have concocted one that can be commanded to change its shape. When a small current is applied, nanoscale beams thicken and bend into arches that increasingly bow as the current is boosted. The material maintains the new shape even when the current is off, and the shape can be changed back by reversing the current—two characteristics unique to this material. Most materials that change their internal structure require a persistent external stimulus to remain in the new form. **Georgia Tech's new nanomaterial, however, deforms through an electrochemical silicon-lithium alloy reaction that holds its form without applied current.** "At the core of this accomplishment, the researchers changed the geometry by a lot, and variably, by electrochemistry that works the way a battery does. The Georgia Tech research team modeled the architectures' nanoscale mechanics, which are driven by lithium ions and silicon, for research by a Caltech materials science professor. Her lab then created the material using an innovative ultra-high-resolution 3D printing process called two-photon lithography and tested it. In the future, materials like this this could be used in making batteries and other energy storage devices lighter, safer and more durable. Further, waves of phonons (special excitations in certain materials that help determine their conductivity) propagate through the material but then shifts in architecture block those waves. While this was not the study's main achievement, it is still a promising feature and possible opportunity for expanded research.

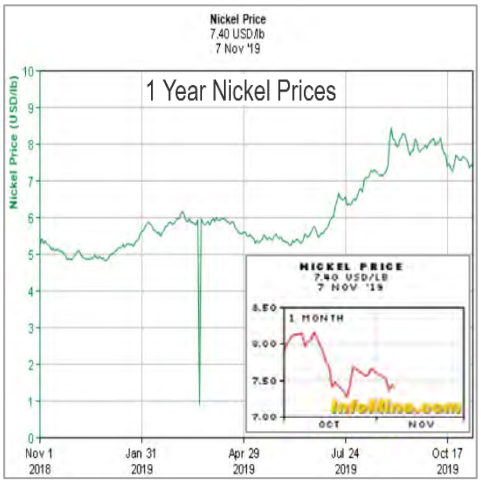


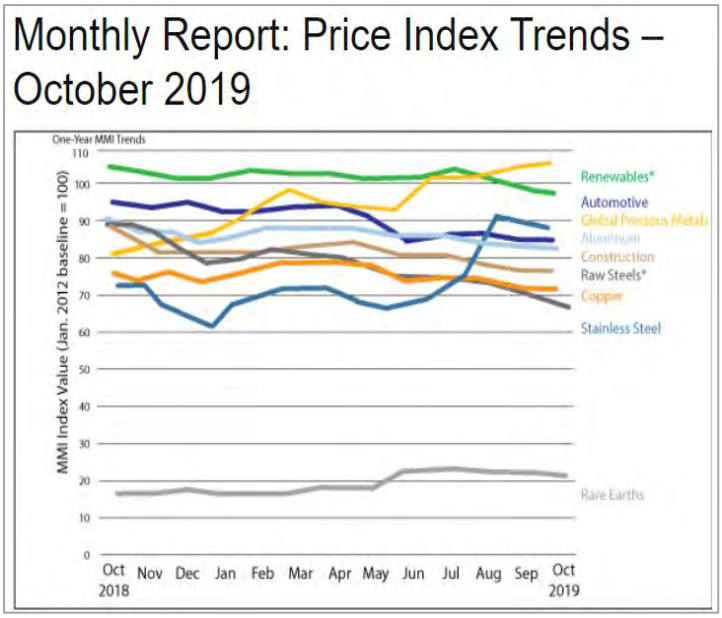
This special electron microscope view of changing architected material shows two structures of a new architected material change (upper and lower). Their shapes change when a low current is applied. (Left is before the current is applied; right is after.)

INNOVATION: GOOGLE CLAIMS TO HAVE ACHIEVED "QUANTUM SUPREMACY" BREAKTHROUGH

Google said it has achieved a long-sought breakthrough called "quantum supremacy," which could allow new kinds of computers to do calculations at speeds that are inconceivable with today's technology. The Silicon Valley giant's research lab in Santa Barbara reached a milestone that scientists had been working toward since the 1980s: Its quantum computer performed a task that isn't possible with traditional computers. **A quantum machine could one day drive big advances in areas like artificial intelligence and make even the most powerful supercomputers look like toys.** The Google device did in 3 minutes 20 seconds a mathematical calculation that supercomputers could not complete in under 10,000 years, the company said. Scientists likened Google's announcement to the Wright brothers' first plane flight in 1903 — proof that something is really possible even though it may be years before it can fulfill its potential. Many of the tech industry's biggest names, including Microsoft, Intel and IBM as well as Google, are jockeying for a position in quantum computing. Venture capitalists have invested more than $450 million into start-ups exploring the technology. China is spending $400 million on a national quantum lab and has filed almost twice as many quantum patents as the U.S. in recent years. The Trump administration launched its own National Quantum Initiative, promising to spend $1.2 billion on quantum research, including computers. A quantum machine, the result of more than a century's worth of research into a type of physics called quantum mechanics, operates in a completely different manner from regular computers. It relies on the mind-bending ways some objects act at the subatomic level or when exposed to extreme cold, like the metal chilled to nearly 460 degrees below zero inside Google's machine. One day, researchers believe, these devices could power advances in artificial intelligence or easily overwhelm the encryption that protects computers vital to national security. The U.S. and China consider quantum computing a national security priority. Google's paper became a bit of an internet mystery after it was published and then quickly unpublished online in late September. That brief appearance was enough to raise the hackles of researchers at competing companies who believe the Silicon Valley giant is inflating its accomplishment. In late October, IBM fired a pre-emptive shot with a blog post disputing Google's claim that its quantum calculation could not be performed by a traditional computer. The calculation, IBM argued, could theoretically be run on a current computer in less than two and a half days — not 10,000 years. Though IBM disputed that Google had really accomplished all that much, it agreed that quantum computers were getting closer to reality. "By 2020, we will be able to use them for commercial and scientific advantage."

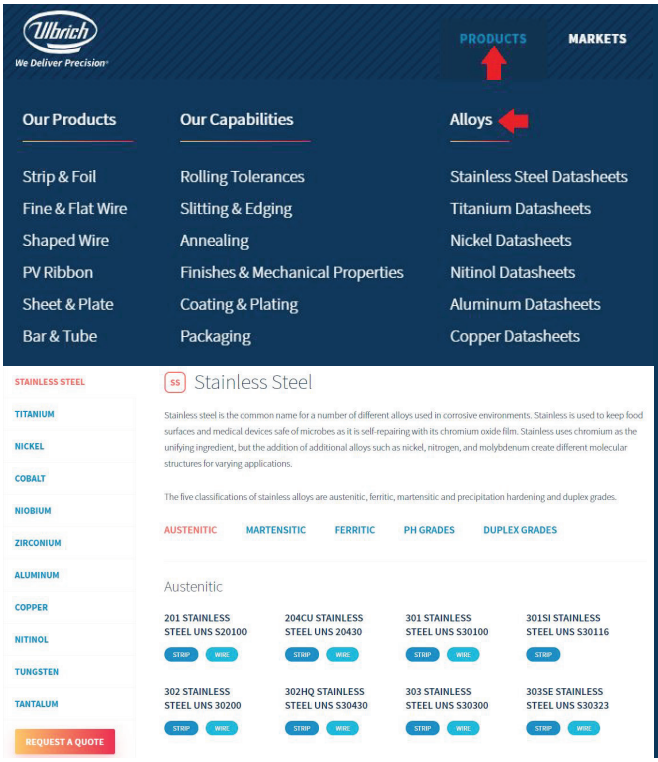
METALS: COMMODITY PRICES — NICKEL, ALUMINUM, COPPER & IRON ORE; MONTHLY PRICE TRENDS





COMMODITIES: THE U.S. COAL INDUSTRY EXPECTS ANOTHER WAVE OF WIDESPREAD JOB LOSSES

U.S. coal mining productivity is at the lowest level in eight years, sliding 11% this year alone and underscoring the intense pressure facing American coal producers. For years, they relied on exports and metallurgical coal used for steel making to offset shriveling demand from U.S. utilities. Now even those markets are suffering as the global economy slows, liquefied natural gas becomes cheap and plentiful in Asia and the trade war churns away. Global prices for coal shipped to power plants have plunged by more than one-third in the past year in both Europe and Asia. **Met coal prices fell in September to the lowest since January 2017, and there's little sign of a recovery.** Production in the U.S. is expected to slide 10% this year, and jobs are at risk. Cutbacks are already underway.



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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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