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A Virus to Kill Energy Demand: Coronavirus' Impact

Barış Sanlı & Gökberk Bilgin

February 2020

Bilkent Energy Notes

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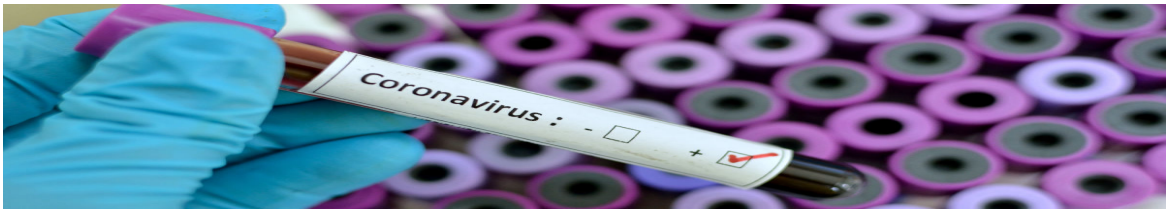

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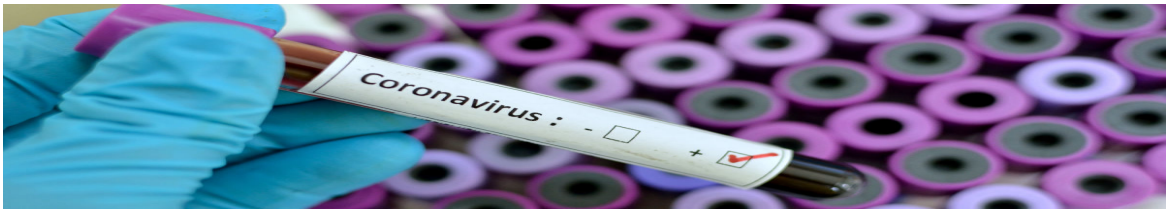

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A Virus to Kill Energy Demand: Coronavirus' Impact

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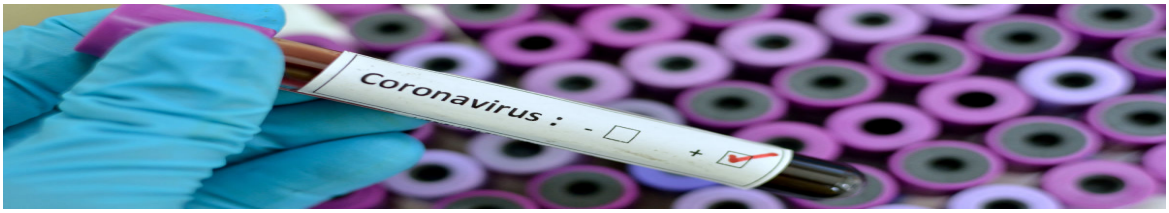
Abstract

As of February 18, there were nearly 73,337 confirmed Coronavirus cases and 1,875 deaths. A cruel death rate calculation is 2.5 percent. The estimates of Case Fatality Rates (CFR) range from 2.2% to 14%. The slowdown due to economic inactivity affects commodity demands. Since China has one of the major economies in the world, any shock in the country has global impacts. In this study, we investigate two sides of the epidemic: One of them is the asymmetric effect of such an outbreak on near term economic activities, prices, and expectations. These asymmetric effects can be an upward price movement of coal while oil prices dip to lower levels, also how the impact can be different between export-oriented and import oriented economies. The other is the long term chain of events resulting from such an epidemic. An economic recession triggered by an epidemic may increase unemployment, result in more marginal or radical political sentiments.

Acknowledgements

The authors thank Cüneyt Kazokoğlu from FGE for his valuable feedbacks and suggestions.



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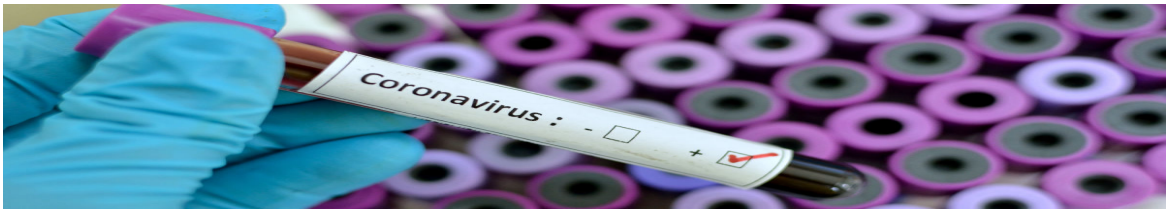


Introduction

World population growth is around 1.2%. In 2019, world oil demand was little over 100 million barrels per day (mb/d). Assuming the population growth is reflected in oil and energy demand, world oil demand should grow at least 1.2 mb/d. On February 13, 2020, International Energy Agency revised its 2020 oil demand growth estimates to 825,000 b/d form 1.2 mb/d due to Coronavirus.

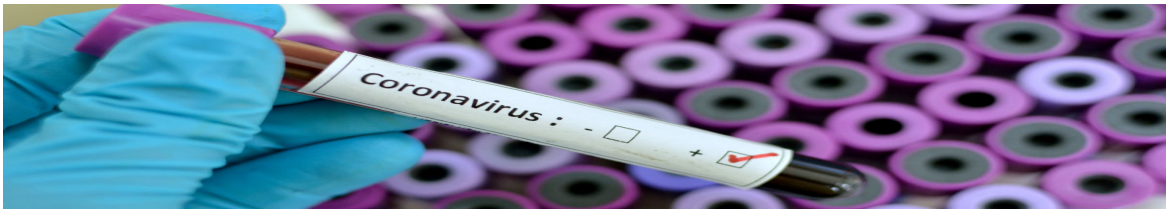
According to The New York Times "Residential lockdowns of varying strictness — from checkpoints at building entrances to hard limits on going outdoors — now cover at least 760 million people in China, or more than half the country's population, according to analysis of government announcements in provinces and major cities". [1] That means 1/10th of the world population's movements and economic activities are somehow restricted.

Economic growth is an increase in economic activity. Economic activity is not just a number derived from money flows, but it is also highly influenced by fear and narratives. Coronavirus is becoming the perfect storm for the world economy in ambiguity. In the 19th century was "When France sneezes, Europe catches a cold." [2] Later on, it became "When the U.S. sneezes, the world catches a cold." As the world's economic gravity moved to the east, it is now "When China sneezes, the whole world catches a cold."

A virus may be a health-related issue. But if it limits human activity, then the economic activity will be limited. It will impact mining operations, travel activity, demand patterns, oil consumption, and economic growth.

The world is no stranger to epidemics. Recently, Severe Acute Respiratory Syndrome's (SARS) effect on economies is well documented. But Coronavirus is unique in terms of its timing (trade wars, Chinese new year), regional impact (Asia), and economic outcome. From the Chinese point of view, it is undoubtedly an impediment to human and economic activity. But from a global point of view, it is a mixed picture with a negative bias.

There are two sides to this epidemic. One of them is the asymmetric effect of such an outbreak on near term economic activities, prices, and expectations. These asymmetric effects can be an upward price movement of coal while oil prices dip to lower levels, also how the impact can be different between export-oriented and import oriented economies. The other is the long term chain of events resulting from such an epidemic. An economic recession triggered by an epidemic may increase unemployment, result in more marginal or radical political sentiments.



Chronology

The chronology of the epidemic started with Chinese authorities warning of several unknown pneumonia cases to the World Health Organization (WHO) on December 31, 2019. [3] On January 7, 2020, it was identified as 2019-nCov virus. Four days later came the first death related to the epidemic. By January 20, Beijing, Shangai, and Shenzen have been effected. [4] On January 23, 2020, Wuhan has been quarantined. Air and rail travel have been suspended.

The spread of the disease has been increasing since its first identification. There are also numerous confirmed cases around the world. Controlling such an epidemic can take months, and in the worst-case scenario, it may spread to 1 billion people. [5] Below you can find the detailed timeline. [6]

Table 1: Coronavirus Timeline

Date	Incident
December 31, 2019	Chinese authorities were treating dozens of cases of pneumonia of unknown cause.
January 11, 2020	China reported its first death.
January 20, 2020	Other countries, including the United States, confirmed cases.
January 23, 2020	Wuhan, a city of more than 11 million, was cut off by Chinese authorities.
January 30, 2020	The World Health Organization declared a global health emergency.
January 31, 2020	Airlines suspended service to China, while the Trump administration restricted entry into the U.S.
February 2, 2020	The first coronavirus death was reported outside China.
February 5, 2020	Hundreds, mostly Americans, were evacuated from Hubei Province.
February 5, 2020	A cruise ship in Japan quarantined thousands.
February 7, 2020	A Chinese doctor, who tried to warn others, died from the coronavirus.
February 10, 2020	The death toll in China surpassed the number SARS killed worldwide.
February 11, 2020	The death toll in China topped 1,000.
February 13, 2020	The Communist Party fired top officials of Hubei Province and Wuhan.
February 13, 2020	There were more than 14,000 new cases in Hubei Province.
February 14, 2020	France announces the first coronavirus death in Europe.

Source: The New York Times

Initially, it was assumed that Chinese authorities could control the outbreak in a given timeline. But in the second week of February, there were still a growing number of identified cases. As of February 18, there were nearly 73,337 confirmed cases and 1,875 deaths. A cruel death rate calculation is %2.5 percent. The estimates of Case Fatality Rates (CFR)s range from 2.2% to 14%.

An online page for confirmed cases and total deaths shows the scale of the epidemic. [7]

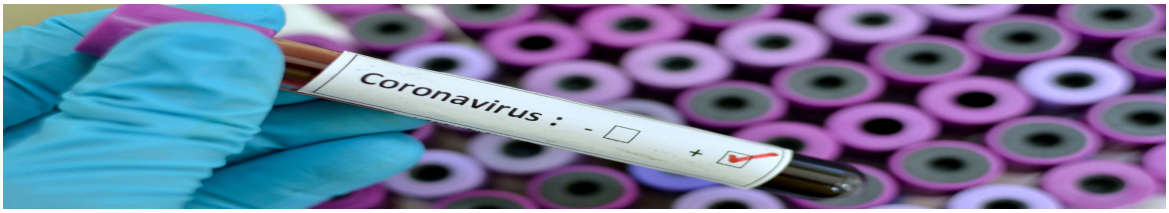


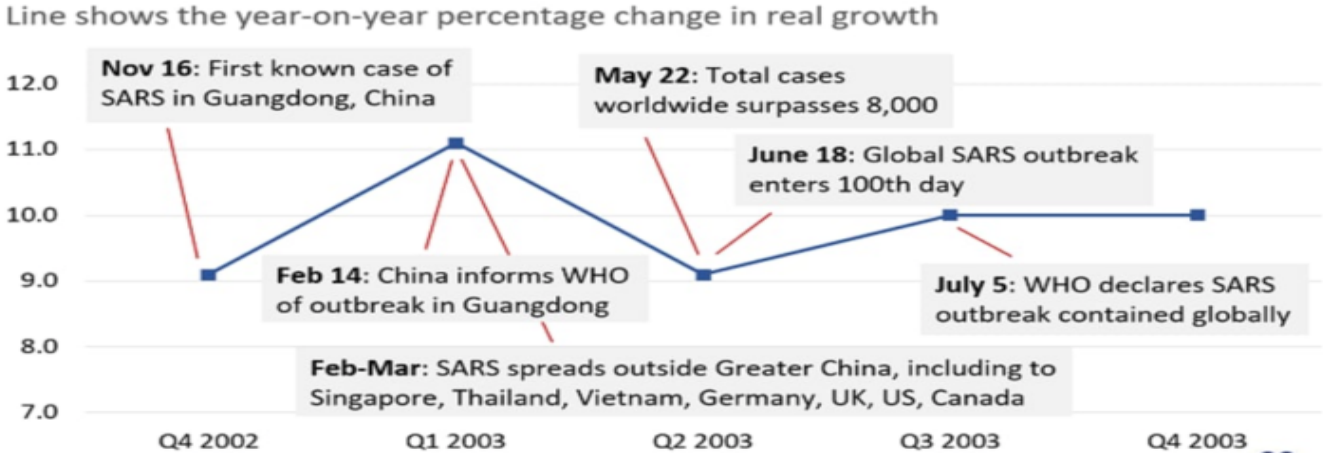
Figure 1: Current Spread of Coronavirus as of February 18, 2020

Source: GIS Data

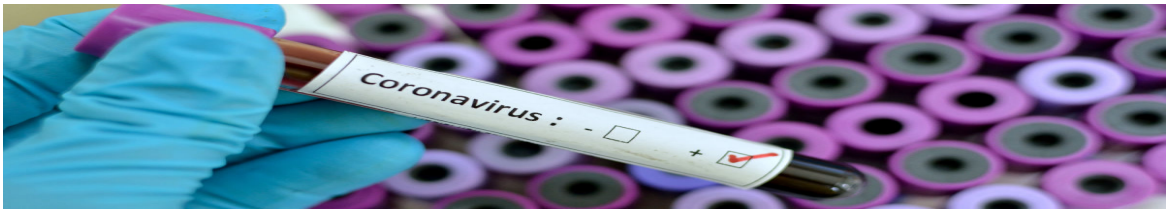
Previous Epidemics: MERS and SARS

SARS has been spread from China to 30 countries, resulting in 813 deaths among 8437 cases. In 2012, Middle East Respiratory Syndrome (MERS) had been identified in Saudi Arabia, spread to 27 countries, and killed 858 people with 2494 confirmed cases.Among these syndromes, Coronavirus is mostly compared with the SARS. SARS has impacted Chinese and global economic growth visibly. Chinese quarterly economic growth dropped from 11% to 9%, later on, rebounded to 10%

Figure 2: China's Economic Growth During SARS



Source: CNBC [8]



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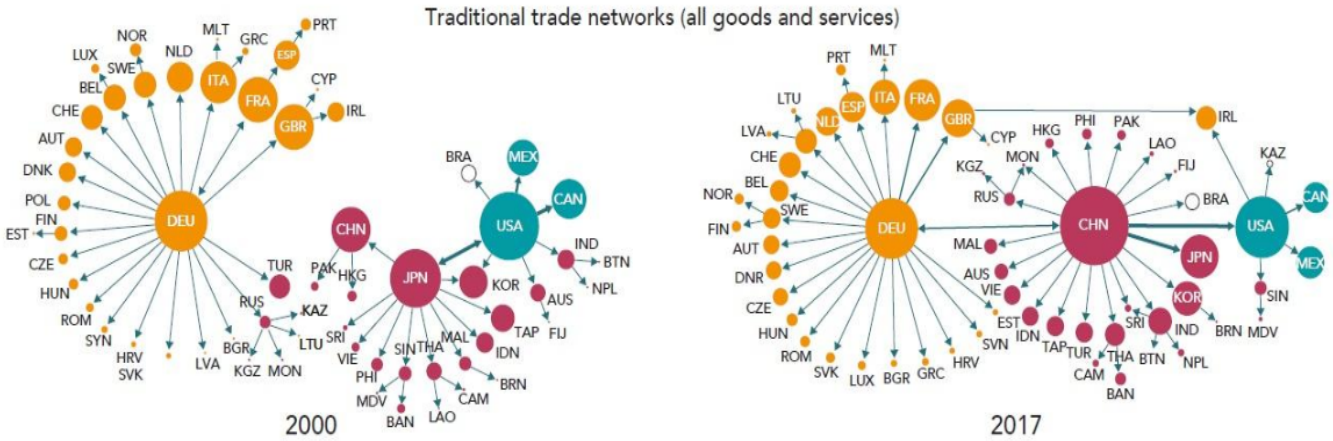
Both retail sales and industrial output has declined as the epidemic spread. Retail sales dropped to 4.3% from 8-10% range, industrial output's year on year change has seen a dramatic drop from 20% to 13.7%.

In terms of impact, Coronavirus has reached a scale that is at least two times of SARS. But more importantly, China in 2002 was constituting 4.3% of world GDP. However, China's share of the world economy has reached 15.2%. So despite impacting the same region, SARS and Coronavirus are affecting different economic scales. [9]

As Cüneyt Kazokoğlu from FGE argues, "China has moved to the very center of the global value chain." So the latest epidemic is closer to the heart of the world economic system than 2003 despite being in the same country, China.

Figure 3: China's Position in the Traditional Trade Networks



Source: World Trade Organization [10]

IEA also highlights the change in oil demand from 2003. IEA's February 2020 Oil Market Report says, "In 2003, China's oil demand was 5.7 mb/d, and by 2019 it had more than doubled to 13.7 mb/d (14% of the global total). Moreover, last year China accounted for more than three-quarters of global oil demand". [11] Both in terms of growth and demand, the Chinese slowdown is very bad news for oil producers, but for oil importers, this may mean a relief from higher oil prices assuming economic activity will not be impacted globally.

Energy Impacts

In terms of abstraction, the biggest economy of the world and its proximity is experiencing a limitation on human activity. This human activity slowdown is hitting households, industries, commerce, and international movements. Generally, in such epidemics, the first impact is felt in aviation.

Previously SARS has resulted in a major drop in aviation activity. Especially the regional airlines have been impacted severely. Just like industrial activity, tourist activity, and the impact of China has been changed.

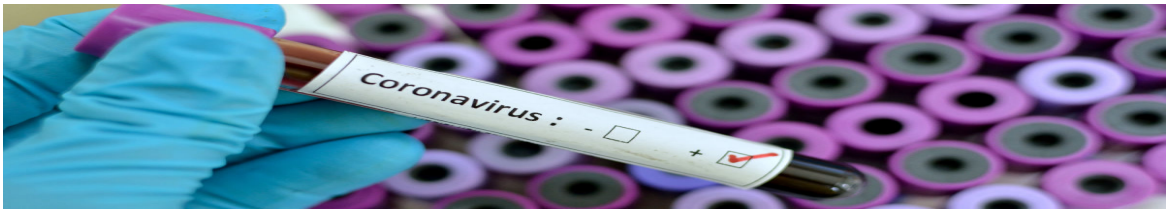
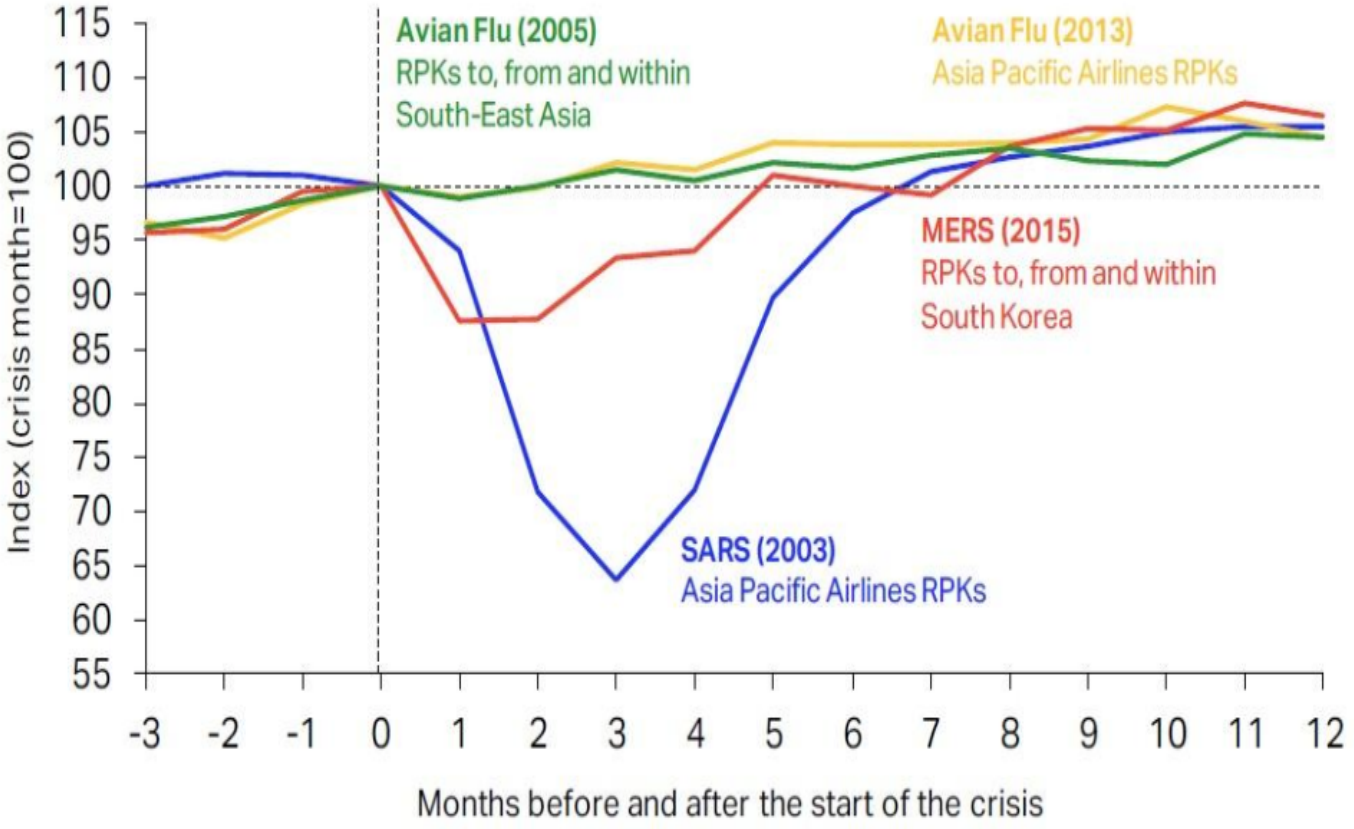


Figure 4: Impacts of Past Outbreaks on Aviation



Source: Cüneyt Kazokoğlu - LinkedIn [12]

According to the International Tourism Highlights 2019 Edition, Chinese are the top tourism spenders at $277 billion. [13] Around 140 million people, 10% of China's inhabitants, travel internationally. In terms of tourism earnings, China receives 40 billion $'s of global tourism earnings. Considering the seasonality of the touristic travel patterns, the impact on the tourism industry may not be that high. Still, if the virus' impact outlasts the 1st half of 2020, then a substantial erosion in the tourism earnings may be seen.

According to Aviation consultancy firm Cirium, "85,000 flights to, from and within China, equal to a third of scheduled flights, have been canceled between Jan. 23 and Feb. 11". [14] There are more than 35 million flights per year across the globe. Daily, there are 96,000 flights every day. The global aviation fuel market size is little over $300 billion. [15] According to IEA, Chinese jet fuel demand may drop by 14%. [16]

ICAO (International Civil Aviation Authority) claims the virus can wipe out $4-5 billion in airline revenues in the first quarter. That is equivalent to a passenger capacity decline of 39-41%, 16.4 to 19.6 million passengers, respectively. [17]

The airline capacity to/from China has dropped dramatically in a matter of weeks. [18]

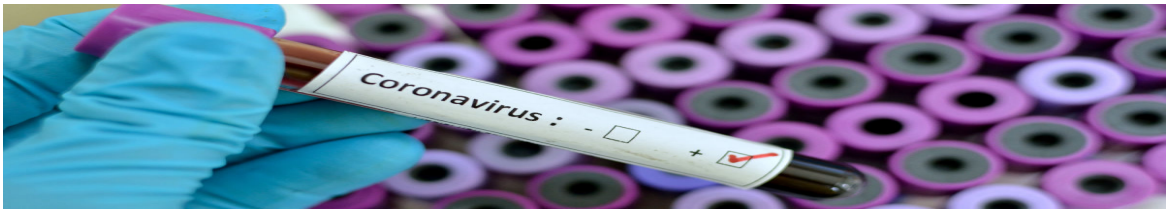


Table 2: International Scheduled Airline Capacity from China Top 10 Markets

Arriving Country	20 Jan.	27 Jan.	03 Feb.	10 Feb.	Difference 20 Jan.-10 Feb.	% Change
Japan	328,554	328,120	249,233	131,211	197,343	-60.1%
Thailand	307,586	303,741	202,666	113,833	193,753	-63.0%
Rep. of Korea	244,176	243,898	198,577	111,243	132,933	-54.4%
Malaysia	81,424	81,146	74,920	52,264	29,160	-35.8%
Taiwan	133,895	127,398	95,169	49,878	84,017	-62.7%
Cambodia	59,268	56,988	38,211	33,543	25,725	-43.4%
Hong Kong	152,250	149,618	103,347	30,017	122,233	-80.3%
Russia	35,288	34,502	26,989	18,309	16,979	-48.1%
Canada	25,176	26,774	27,088	13,499	11,677	-46.4%
France	22,754	23,208	20,147	13,166	9,588	-42.1%

Source: OAG Schedules Analyser

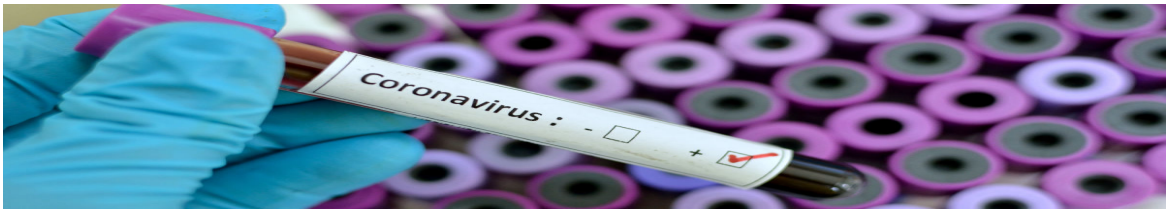
Table 3: Top 10 Airlines from China, International Capacity

Airline	20 Jan.	27 Jan.	03 Feb.	10 Feb.	Difference 20 Jan.-10 Feb.	% Change
Spring Airlines	91,440	91,980	86,940	86,040	5,400	-5.9%
Air China	199,227	202,812	155,252	70,603	128,624	-64.6%
China Eastern Airlines	264,496	267,573	181,866	64,837	199,659	-75.5%
China Southern Airlines	246,386	236,002	233,591	50,073	196,313	-79.7%
Asiana Airlines	47,771	46,804	45,709	25,225	22,546	-47.2%
Korean Air	48,173	47,627	38,703	22,181	25,992	-54.0%
Thai Lion Air	36,634	35,990	24,543	20,355	16,279	-44.4%
Airasia X	20,358	20,358	20,358	19,227	1,131	-5.6%
Thai AirAsia	34,200	34,920	22,860	17,460	16,740	-48.9%
All Nippon Airways	32,882	32,776	30,254	15,816	17,066	-51.9%

Source: OAG Schedules Analyser

Meanwhile, Japan has also been severely impacted. Tokyo 2020 Olympics is 165 days away, and currently scheduled airline capacity has dropped by "some 200,000 per week compared to the week of the 20th January, a 60% fall in capacity in 4 weeks". [19]

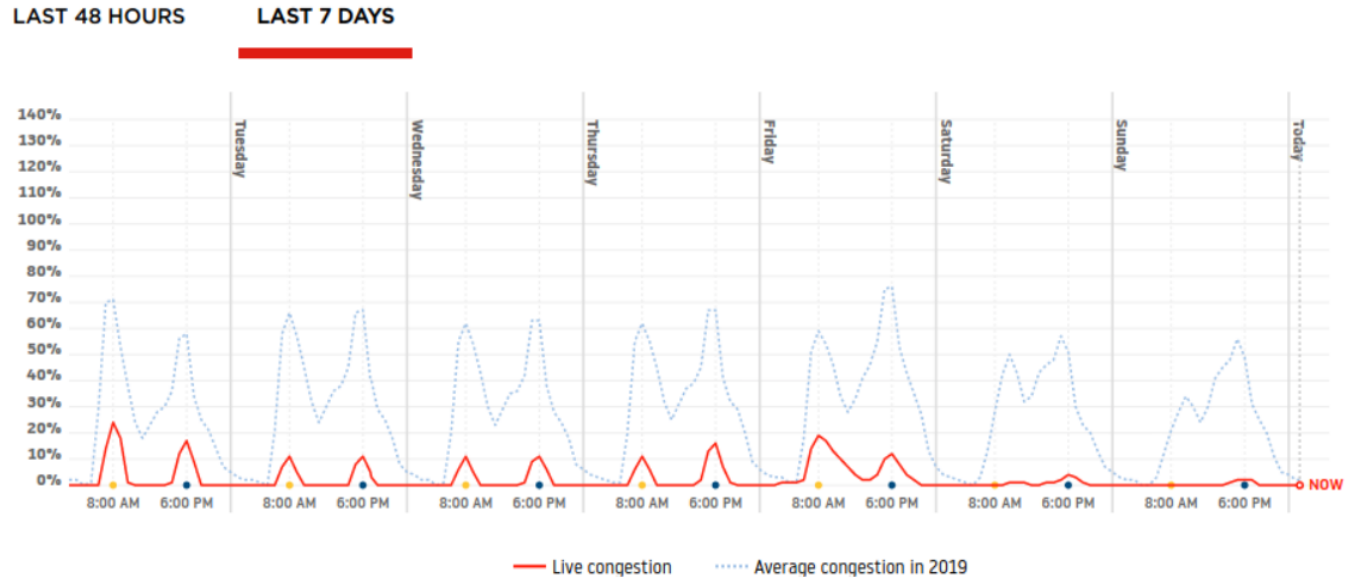
Citi analysts state that the Chinese share in global jet fuel demand has increased from "3.8% in 2003 to 12% in 2017". Therefore, just stated previously, the impact of China and Chinese aviation on the global economy will be much bigger. [20]



Road Traffic

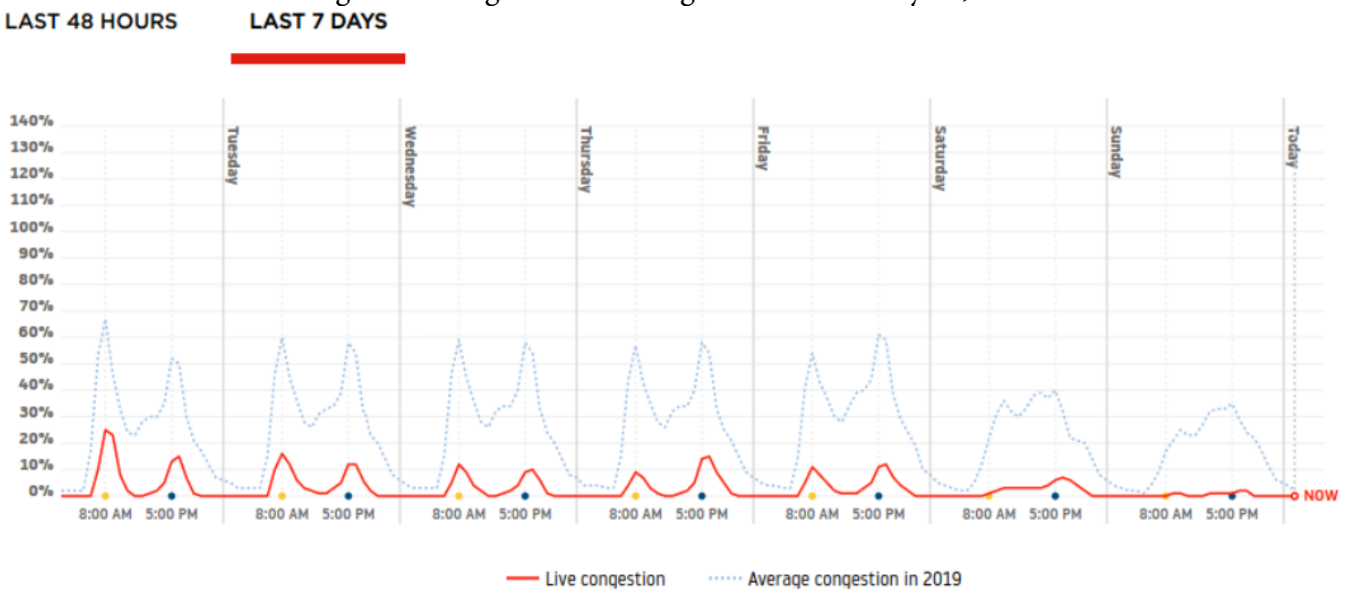
Tomtom's congestion level statistics compare live congestion for the last seven days with the same period in 2019. As the graphs below show, the traffic activity has dropped enormously. China's Hubei province, as the main region impacted by the virus, has banned all vehicle traffic. [21]

Figure 5: Congestion in Beijing as of February 16, 2020

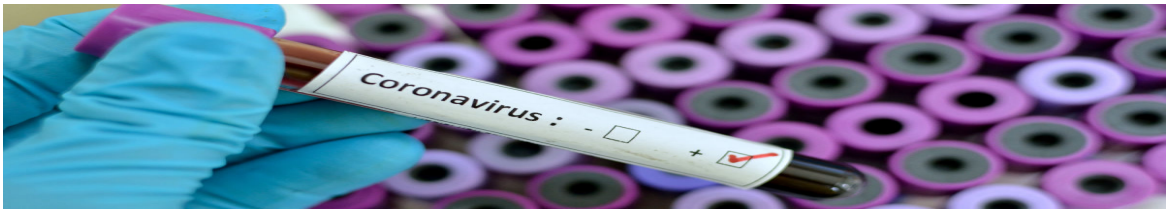


Source: Tomtom Traffic Index [22]

Figure 6: Congestion in Shanghai as of February 16, 2020



Source: Tomtom Traffic Index [23]



Chinese Ministry of Transportation claimed that air passenger statistics dropped 36.5% year-on-year for the period between 10th January and 10th February. But road transportation has fallen 44.1% to 1.12 billion people in January. [24]

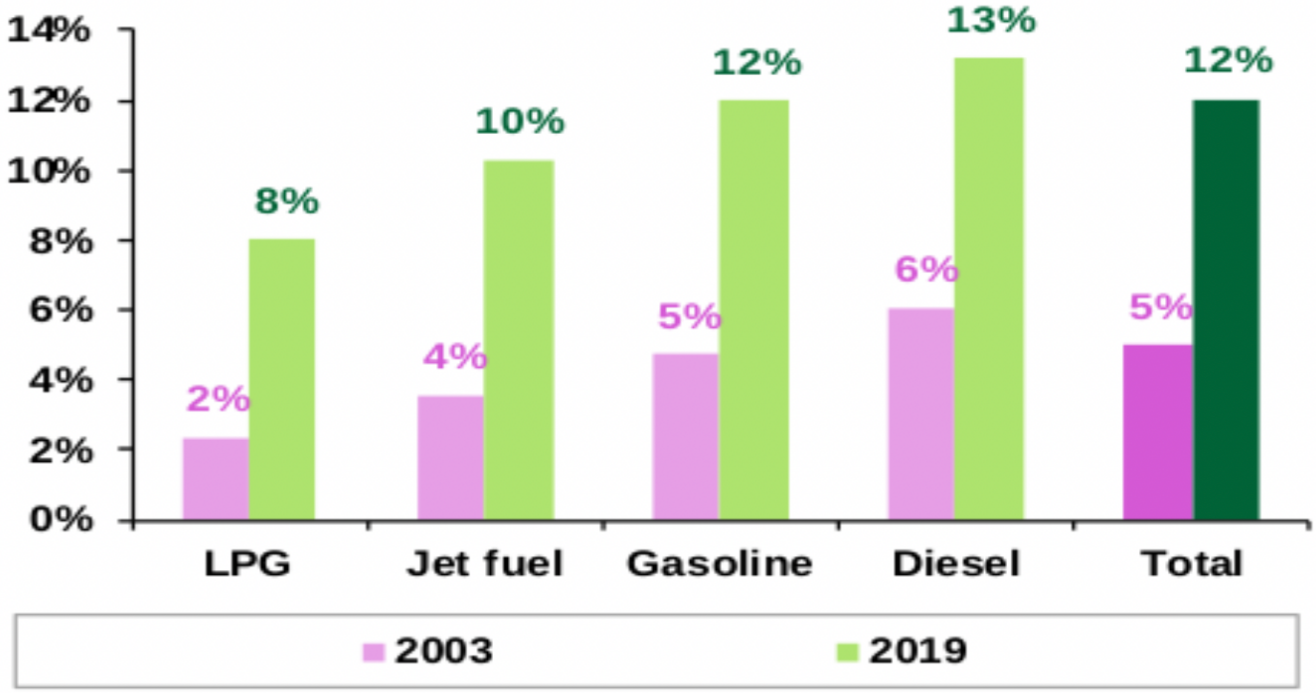
Oil Demand Impact

IEA has dedicated a special part for the impact of Coronavirus with a title "All eyes on China" in its montly flagship "Oil Market Report". IEA expects the demand for global oil to contract by 435kb/d in 2020's 1st quarter (1Q20). Oxford Energy Studies expects this number to be close to 500 kb/d. IEA also assumes the growth will rebound in the rest of the year.

Refinery runs have been revised downwards by IEA. Chinese crude intakes was cut 1.1 mb/d and now instead of growing the throughputs will contract by 0.5 mb/d.

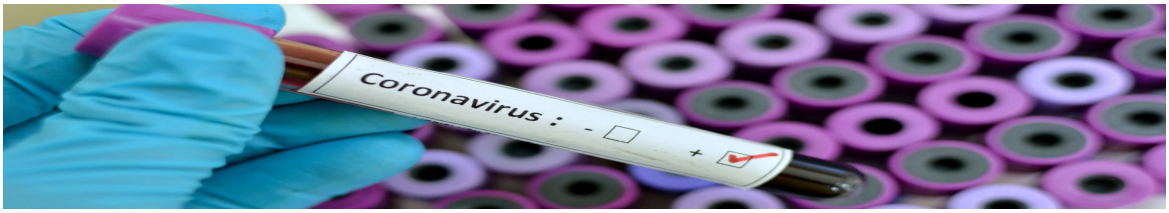
OPEC's monthly oil report also has dedicated analysis for the Chinese situation. One of the most important comparisons was the change of Chinese demand in world demand.

Figure 7: Share of China's Transportation Fuel Demand in Global Transportation Demand



Source: OPEC [25]

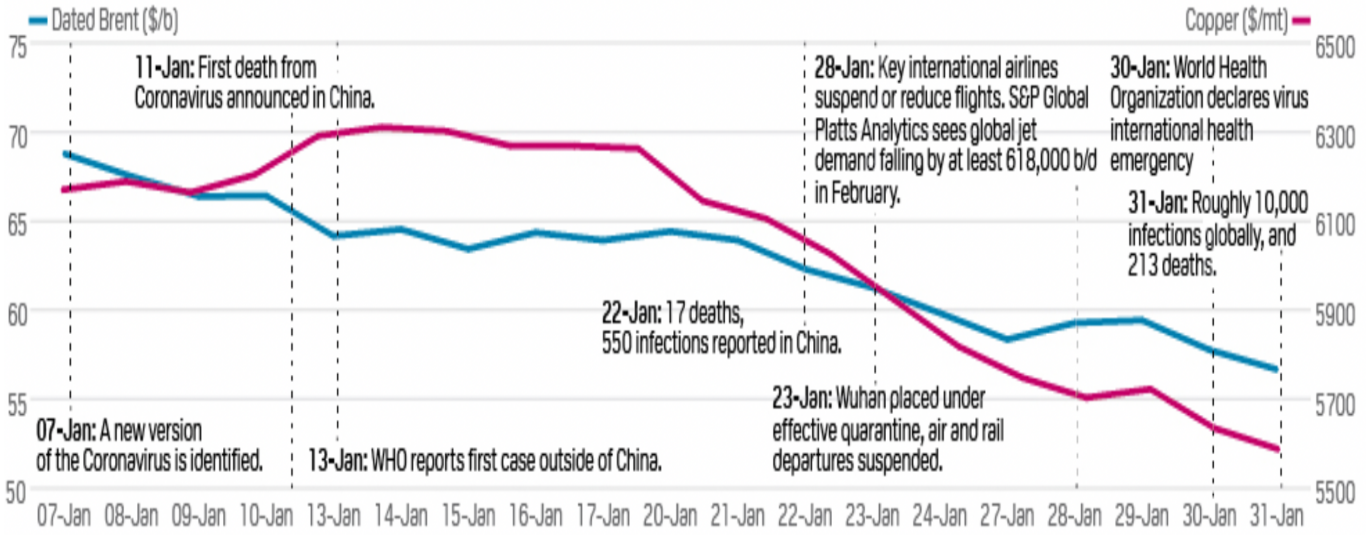
However, OPEC looks more optimistic, and they just revised down by 0.2 mb/d for the first half of 2020. Overall, oil demand growth has been revised downward by 0.4 mb/d. OPEC also dropped the Chinese 2020 GDP growth from 5.9% to 5.4% with a cautious note of "the combined direct and indirect effects of the Coronavirus would be high."



Oil and Commodity Prices

The epidemic's impact on prices can be tracked from two important commodities, namely copper and oil prices. As of February 3, 2020 both prices has followed a downwards trend.

Figure 8: How China's Coronavirus Infected Commodity Markets



Source: S&P Global Platts [26]

This downward trend didn't end there. On February 10, 2020, Javier Blas, Chief Energy Correspondent at Bloomberg, has posted the following graph. From a month ago (green), the oil price structure has turned into contango. In one sense, that means there are more risks in the near term than the future terms. However, the contango like structures is also very common during depressed economic activity and energy demand.

The initial reaction of oil markets has been quite hard. Goldman Sachs Group has cut its 1Q2020 Brent and WTI oil price forecasts by 10$/barrels. [27]

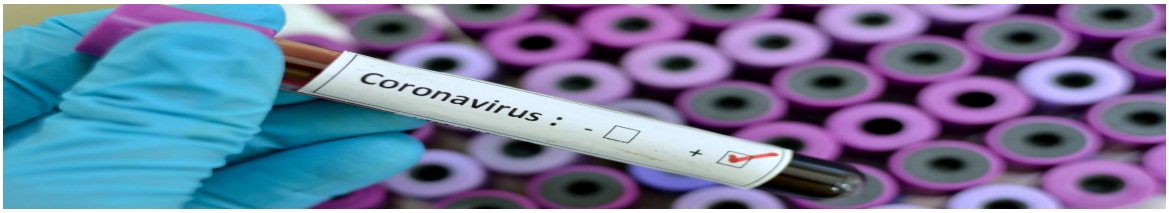
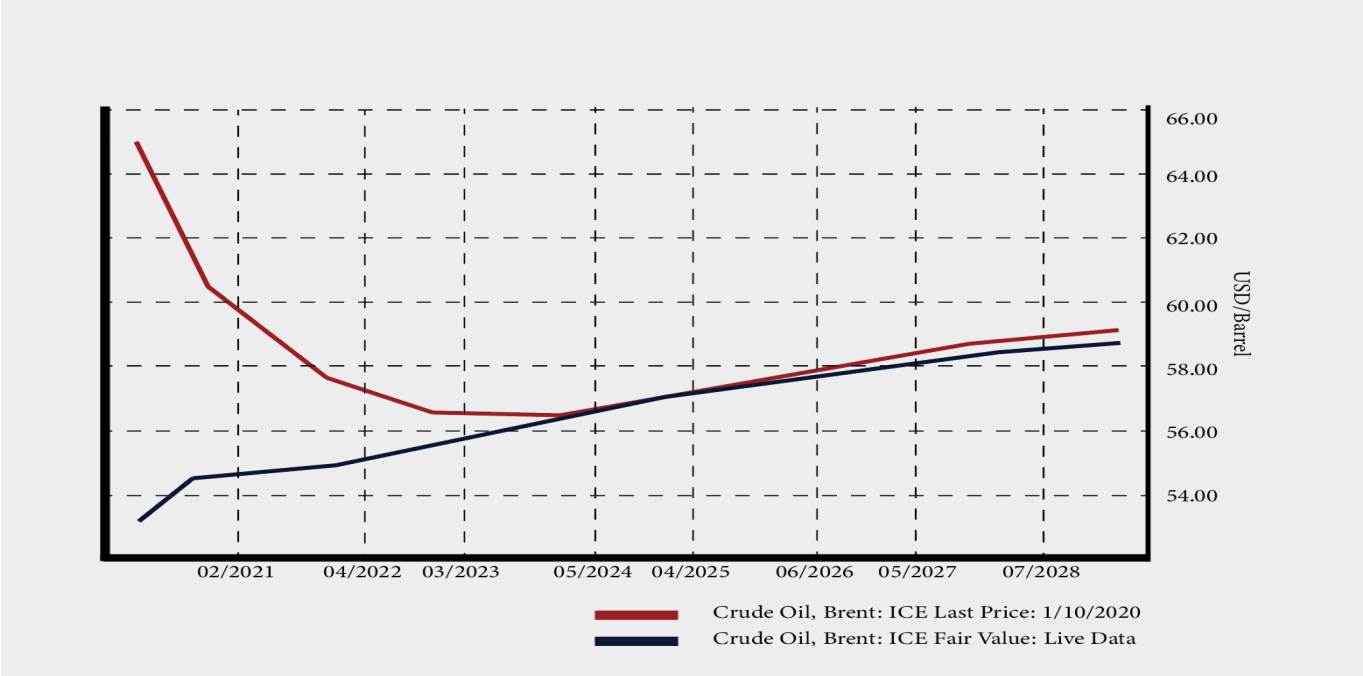


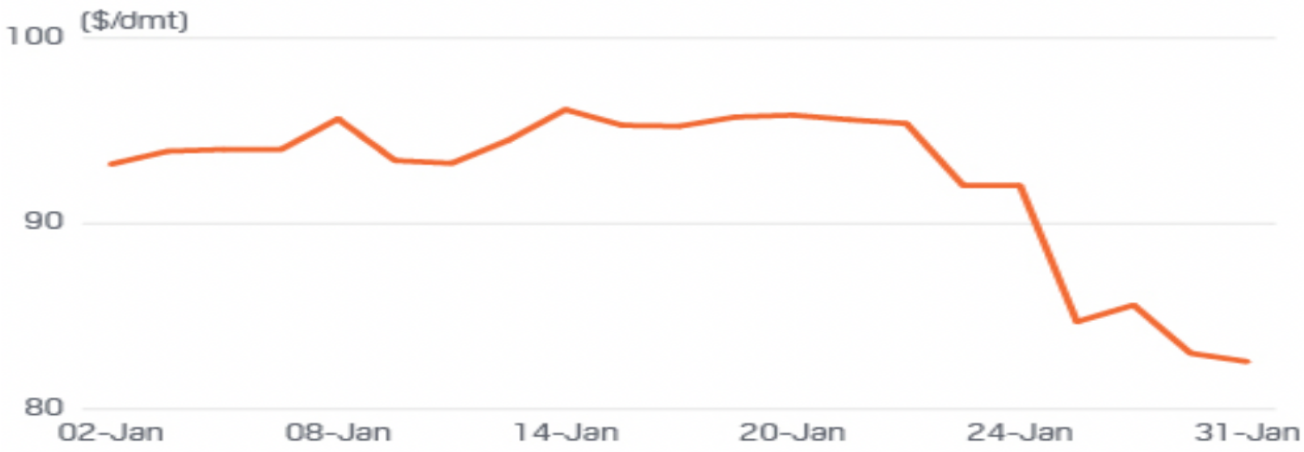
Figure 9: Future Oil Prices Shifted to Contango as of February 10, 2020



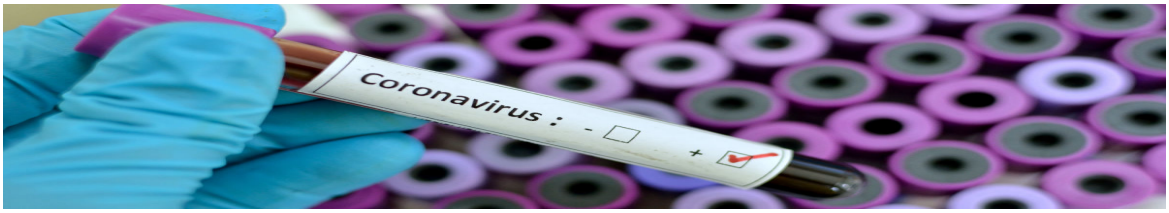
Source: Javier Blas -Twitter [28]

Iron ore prices has also lost 10.3% of their prices as the market conditions deteriote. In Shangdong and Shanxi provinces, production of some of the mills has dropped by 20% in February.

Figure 10: Iron Ore Fines 62% Fe Delivered North China Index (IODEX)

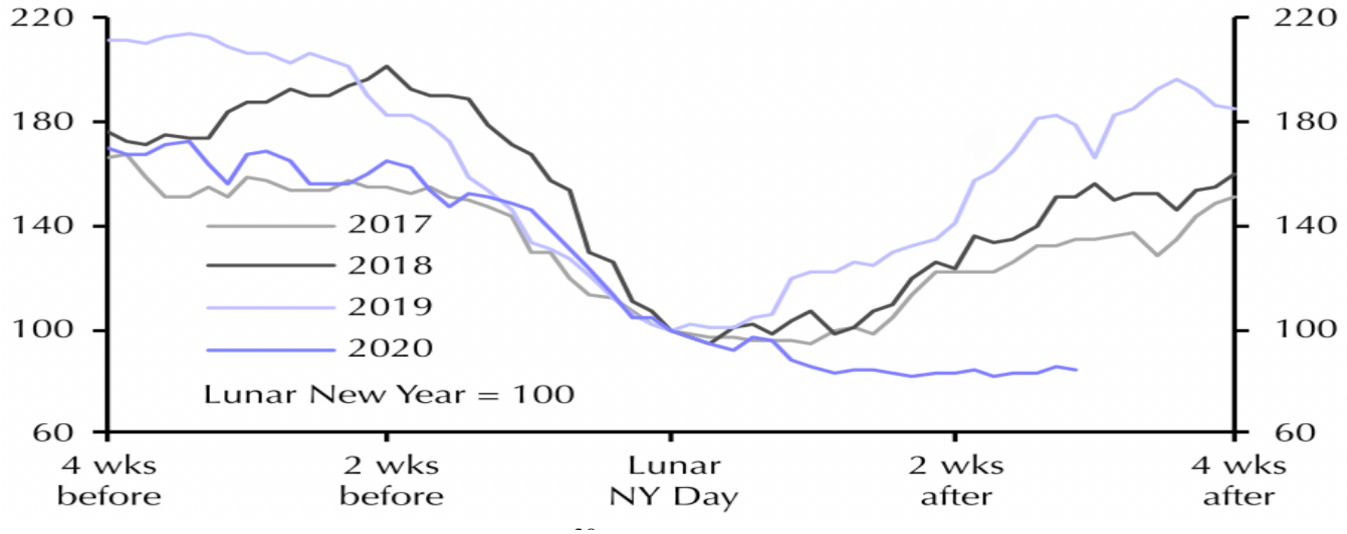


Source: S&P Global Platts [29]



Coal demand is also impacted by the virus. The mines have been closed to stop spreading the virus. This affected coal production and resulted in increased imports. Also, reduced activity in other sectors receded the demand. The graph below shows a bigger drop than expected, and probably a contracting activity more than estimated. The worrying part is the sliding trend after the Chinese holiday.

Figure 11: Coal Consumption at Chinese Coal Plants



Source: Capital Economics [30]

LNG demand is also expected to dampen. According to Rystad Energy, a forecast of 10-13% growth in Chinese LNG demand is revised downward to 4.7%. [31]

LNG prices were already hovering around record low numbers due to warm weather, LNG oversupply, and lower prices in the US. The Asian benchmark price for LNG has fallen to a historic low of 3.15 $/mmbtu. [32] Price was a big part of the problem, but Chinese companies' force majeure on LNG contracts also hit the market sentiment. These force majeurs may mean a cheaper LNG for the European markets.

China's electricity demand is also affected by Coronavirus, according to IHS Markit. The impact on industrial electricity demand can be as big as 73 billion kWh. China's industrial electricity demand was 4.85 trillion kWhs, 67% of the total demand. China's electricity demand growth is expected to reach 4.1% this year, but if the epidemic prolongs to the second quarter, the power demand may drop to a 3.1% growth rate. In Hubei, peak power for January was reduced by 21% by the end of the month, according to Wood Mackenzie. [33]

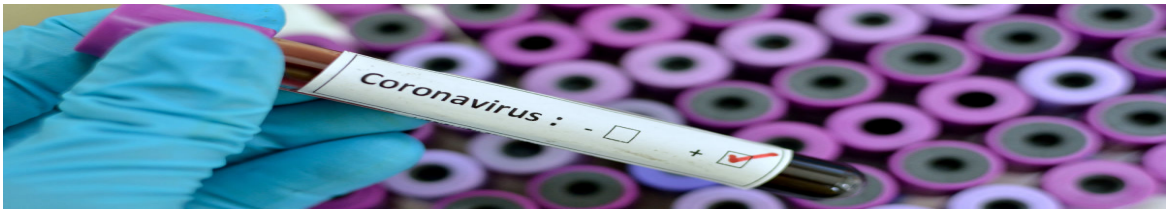
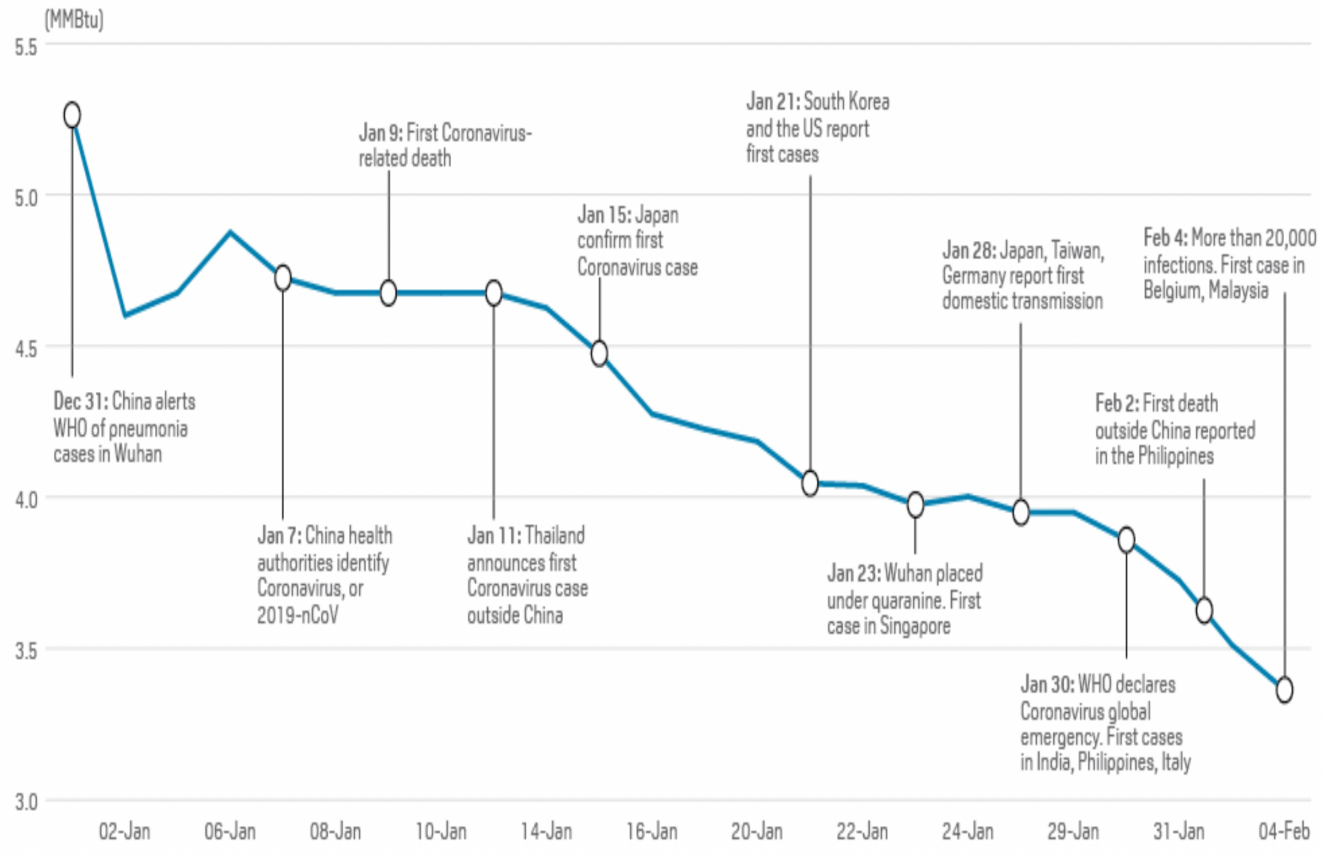


Figure 12: Platts JKM prices have fallen to record lows



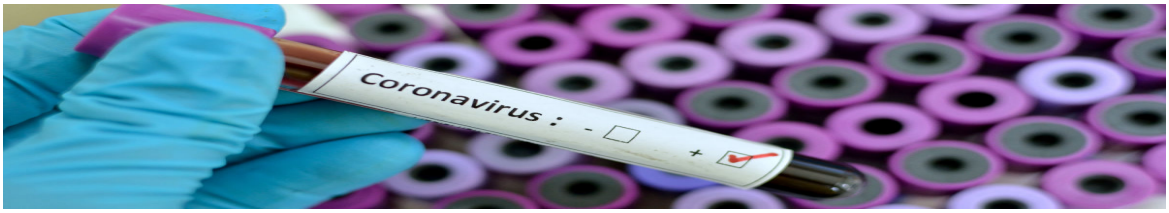
Source: S&P Global Platts [34]

Energy Transition Hit by Coronavirus

China is the world's leading solar PV manufacturer and renewable investor. In 2019, China was the biggest investor in the renewables market, with $83.4 billion. The US is following China with $55 billion, according to BloombergNEF. [35]

The impact of the virus on China has created shortages on PV panels. The key global solar manufacturing areas of Jiangsu, Zhejiang, Guangdong, and Anhui. According to PV Magazine, solar manufacturers reported very low operating rates and do not anticipate normal operation soon. [36]

Due to wafer and glass shortages as well as transportation problems, the price of solar modules may spike. [37] The shortages already took its toll on Australian solar market. The impact can last months, according to PV magazine. 90% of modules in Australia are made in China, and the country is highly dependent on Chinese manufacturers. [38]



Also, in the US, 90% of wafers are originating from China. There is also an expectation for shortage in the US market. One of the major problems with solar is how geographically concentrated it is the major solar manufacturers, especially in China.

When it comes to the wind, the manufacturing locations are more diverse than solar. However, Vestas looks like one of the most exposed manufacturers to coronavirus. According to EENews, "Vestas manufactures wind blades and other components in China near the epicenter of the outbreak."[39] The company has around 3,000 employees in China, and its CEO warned about the global impacts of stoppages on global force majeurs.

The effect of the epidemic on the wind supply chain may result in a 10-50% decrease for 2020 in China, according to Wood Mackenzie. In 2018, China installed 44% of onshore and 37% of offshore wind investments in the world. Currently, 6 GW of new wind investment had been placed in the "at-risk" category. [40]

Tesla was another company impacted by the epidemic. The factory has been shut down since the end of January, and Model 3 deliveries were stated to be delayed. However, by February 10, the company restarted its operation in the Gigafactory 3 at Shanghai. However, Tesla's Chinese rival Nio's sales were down 11.5% year on year, and "reports revealed that Nio is delayed its January salary payments by six days due to difficulties stemming from the coronavirus outbreak." [41] [42]

Forecasts

One of the most important questions is "when the virus could peak?". According to leading Chinese epidemiologist Zhong Nanshan, the virus may peak in the last half of February. [43] He also says, "I hope this outbreak or this event may be over in something like April." The most important line from the interview is perhaps his assessment about the unknowns of the epidemic: "We don't know why it's so contagious, so that's a big problem." In terms of oil price forecasts, Oxford Economics has revised its number downwards by $6/b for the first half of 2020, but for the rest of the year, and they expect a normal trend.

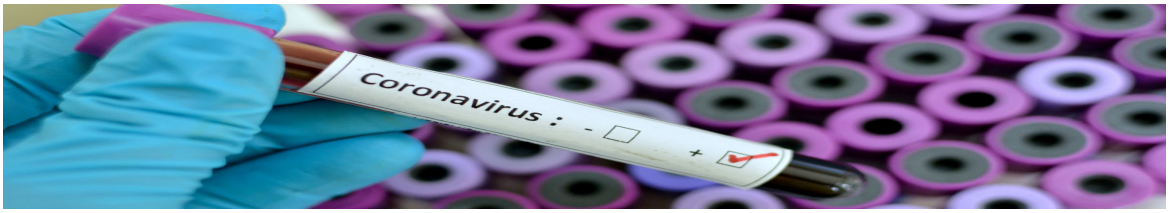
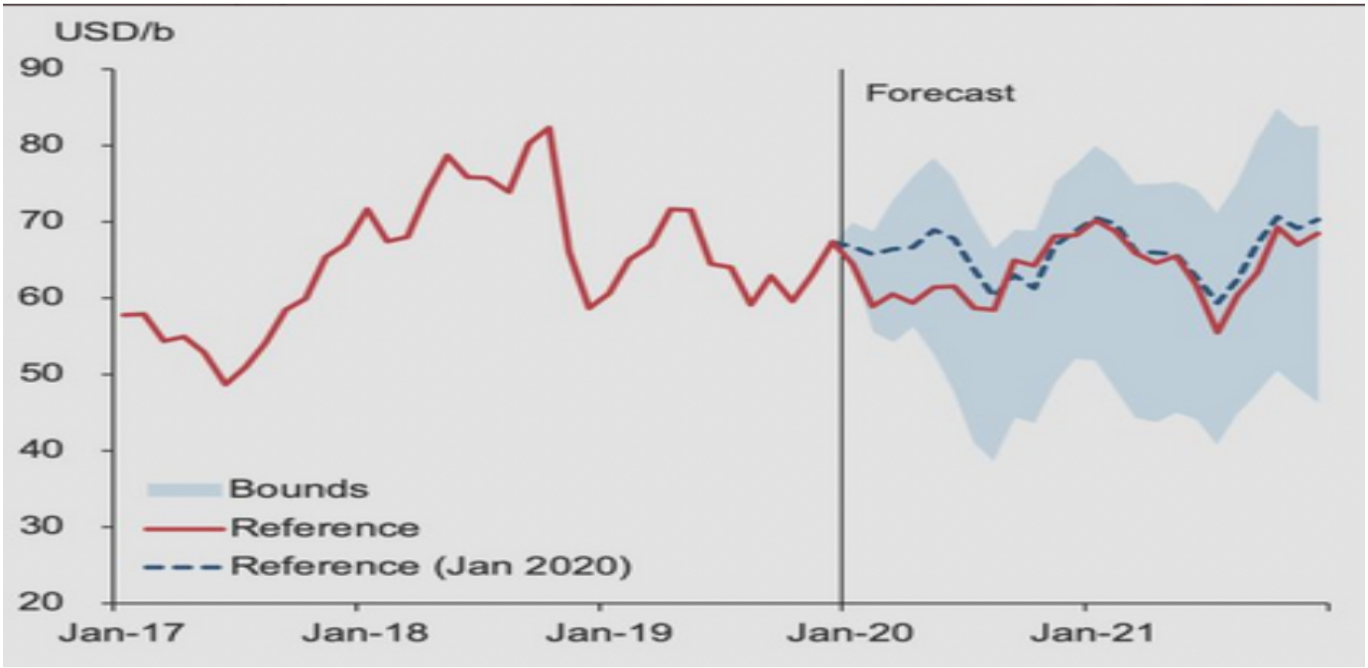


Figure 13: Oxford Economic's Forecast for Brent Prices and Change from Previous Forecast



Source: Oxford Economics - Twitter [44]

The biggest short term question is how this epidemic will affect regional countries and Asian growth. Already there are signs of its impact on Japan, South Korea, Indonesia, and others. So the slowdown is contagious, just like the virus itself.

However, the story may not be that simple. The impact of the epidemic is complicated and not fully understood as of now. In the very general terms, we may summarize the impacts as follows:

- The world economy will slow for the Q12020 for sure, and 2020 growth will be most probably lower than expected,

- Import and export-oriented economies will be impacted differently. South Korea and Japan's economic growth will be hit, but countries like Turkey may see an increase in economic growth.

- Oil, jet fuel, gasoline, and diesel demand will be down for Q12020 and most probably H12020. This fully depends on when the epidemic will peak. However, the airline industry problems should be watched carefully.

- Passenger car sales are down 20% year-on-year in China. This will impact the whole supply chain in automotive production. German auto manufacturers are quite active in the Chinese market, and the slowdown may reduce the earnings and sales of German carmakers.

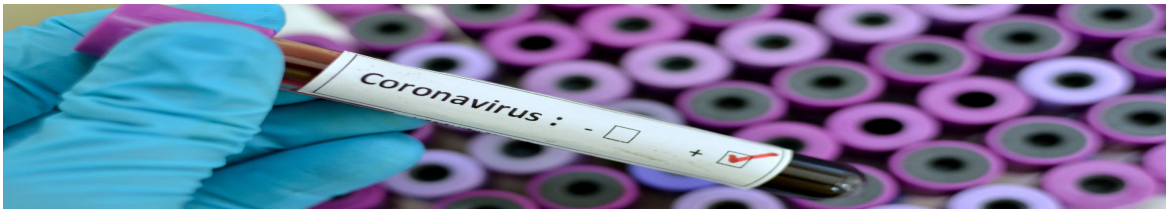
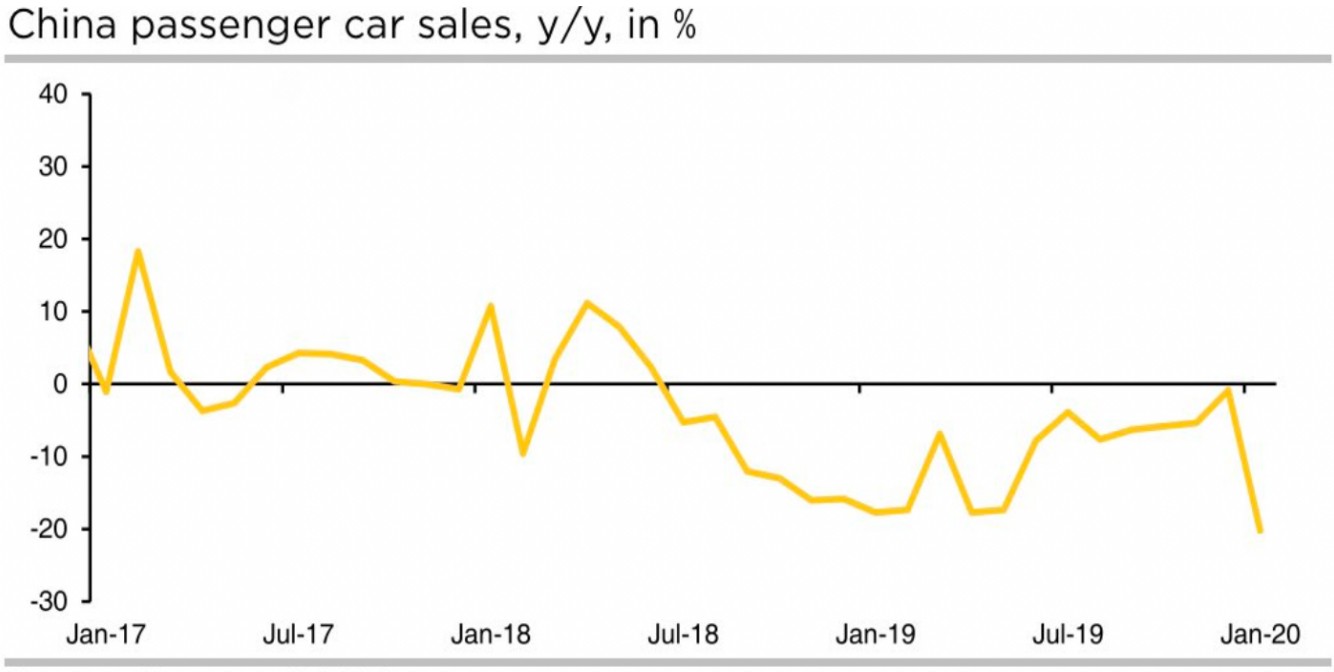


Figure 14: China's Car Sales Slumed by Amid Virus Outbreak

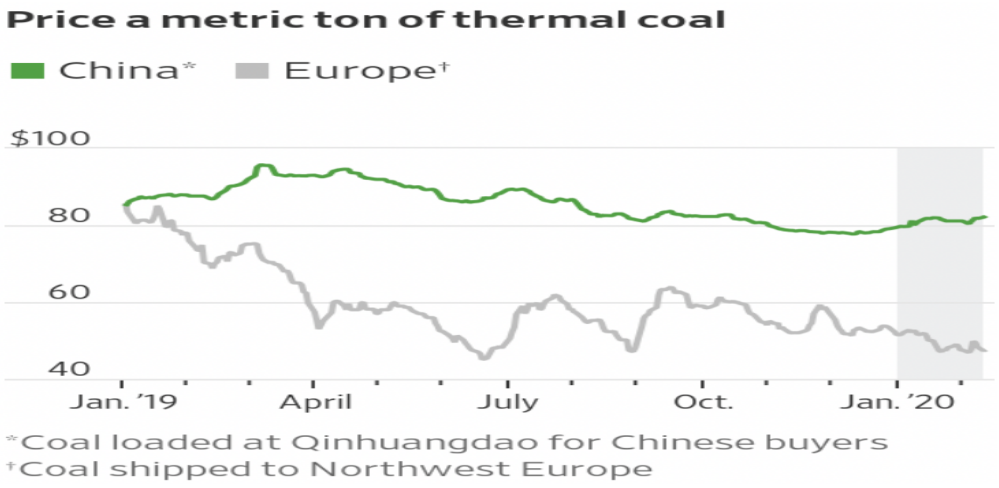


Source: Commerzbank

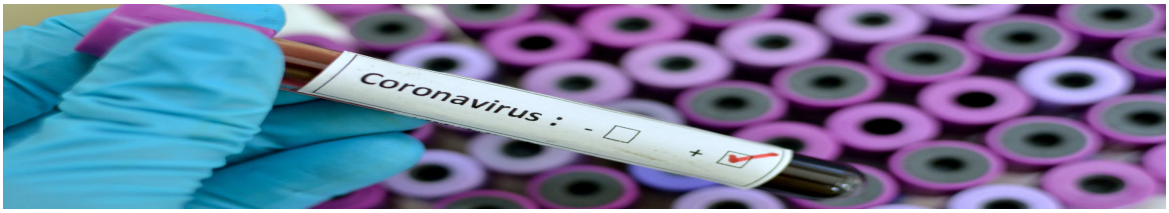
- Transportation bottlenecks and logistic problems are a major part of the problem that is not easy to quantify, but Chinese import and exports as well as retail sales will be lower.

- Coal prices have been quite different than other commodity prices, since China closed its mines due to work restrictions and increased imports. The prices between China and Europe diverged and Chinese coal prices have risen. For the rest of the year, coal stocks will be impacted and coal may remain higher than expected if economic activity rebounds.

Figure 15: Coal Prices Have Risen Despite Falling Commodity Prices



Source: Wall Street Journal [45]



- LNG oversupply will persist. Prices may not rebound until Q3.

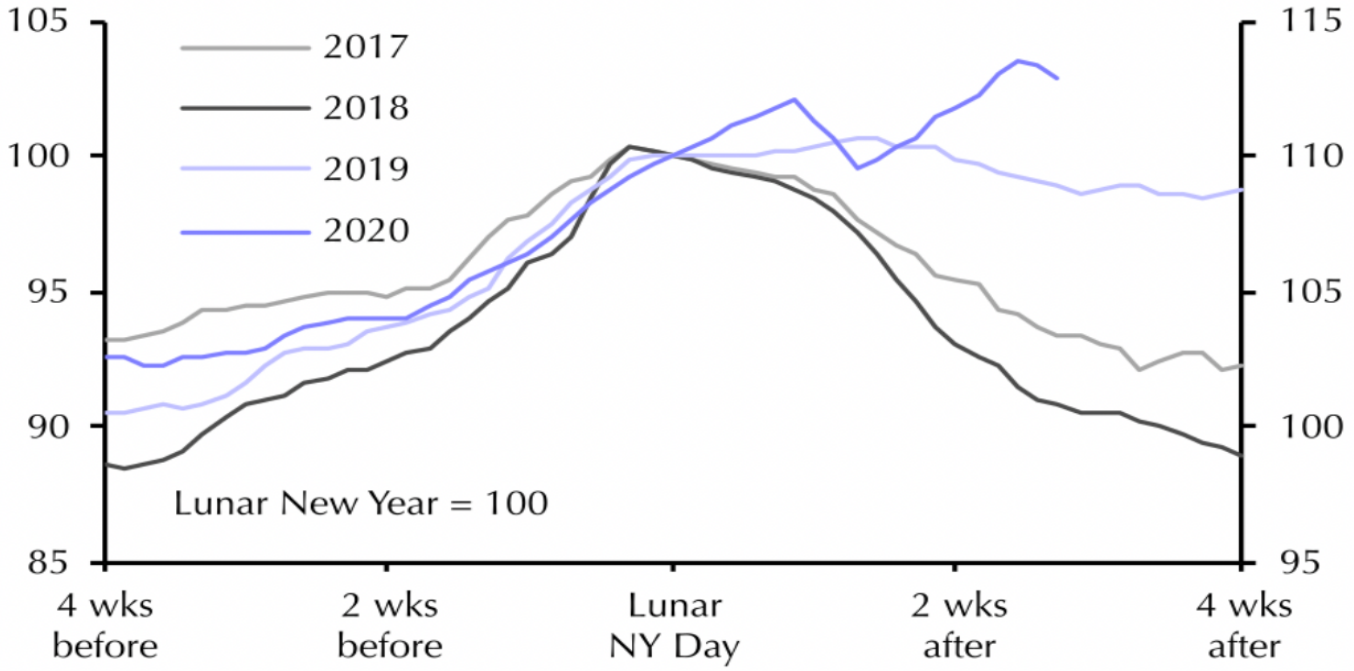
- Solar panel manufacturers will have difficulty for the first half of 2020, and this will be reflected in the prices. The important question is whether regional targets in China will be revised downward or not. If not, solar costs will increase.

- The wind manufacturers' position is mixed. Their Chinese operations and sales will disrupt their balance sheets and deliveries.

- Electric cars may not be having a good year. As Chinese producers face tough times, the slump in the automotive market will impact everyone.

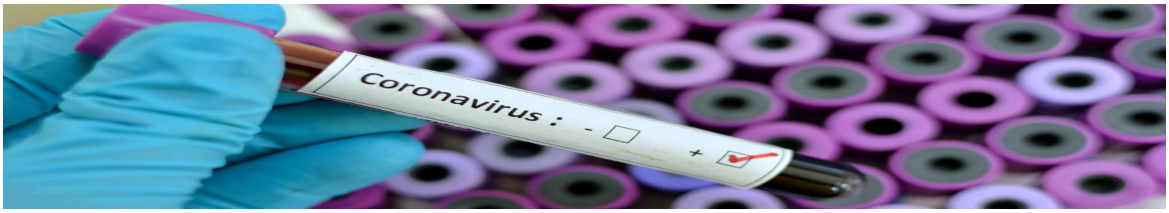
As the last point, I believe there is one final graph to be considered, and that is wholesale food prices. Wholesale food prices are important because unemployment and high food prices do not mix well. The Chinese epidemic is already increasing wholesale food prices. This will have an effect on middle-class budgets.

Figure 16: Chinese Food Wholesale Price Index



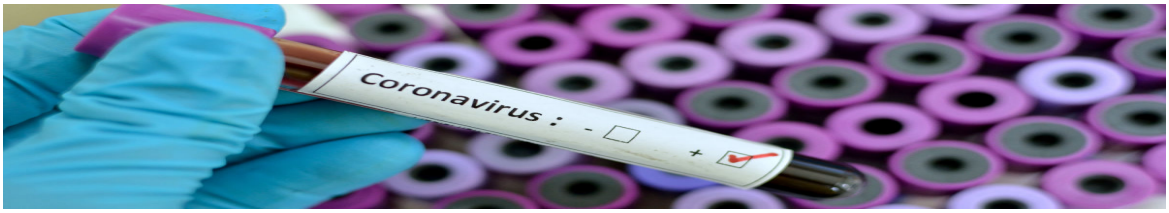
Source: Capital Economics [46]

The lower Chinese economic activity may mean lower energy and commodity prices for the global economy. This may increase economic activity in other countries. But US elections and US oil&gas producers are important. The further slipping of oil prices may have negative effects.



Conclusion

In summary, the evidence so far shows us that this epidemic is much bigger than the previous ones. The impacts are not limited to fossil fuel industry like 2003 but also impacting the on going energy transition. Interestingly enough, while oil and gas prices drop, coal and solar panel prices may go up. Still we need to see the peaking of virus to make better assessments.



References

[1] "To Tame Coronavirus, Mao-Style Social Control Blankets China - The New York Times." Accessed February 16, 2020. https://www.nytimes.com/2020/02/15/business/china-coronavirus-lockdown.html.

[2] Smith, David. "When China Sneezes, the World Catches a Cold," sec. business. Accessed February 16, 2020. https://www.thetimes.co.uk/article/when-china-sneezes-the-world-catches-a-cold-dv8mzp3x0.

[3] "Coronavirus Disease 2019." Accessed February 18, 2020. https://www.who.int/emergencies/diseases/novel-coronavirus-2019.

[4] "Timeline Charts Rising Toll of Coronavirus - Asia Times." Accessed February 18, 2020. https://asiatimes.com/2020/02/timeline-charts-rising-toll-of-coronavirus/.

[5] "Coronavirus Could Infect Two-Thirds of Globe, Research Shows - Bloomberg." Accessed February 18, 2020. https://www.bloomberg.com/news/articles/2020-02-13/coronavirus-could-infect-two-thirds-of-globe-researcher-says.

[6] "A Timeline of the Coronavirus - The New York Times." Accessed February 18, 2020. https://www.nytimes.com/2020/02/13/world/coronavirus-timeline.html.

[7] "Coronavirus COVID-19 (2019-NCoV)." Accessed February 18, 2020. https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6.

[8] Lee, Yen Nee. "4 Charts Show How SARS Hit China's Economy Nearly 20 Years Ago." CNBC, February 11, 2020. https://www.cnbc.com/2020/02/11/coronavirus-4-charts-show-how-sars-hit-chinas-economy-in-2003.html.

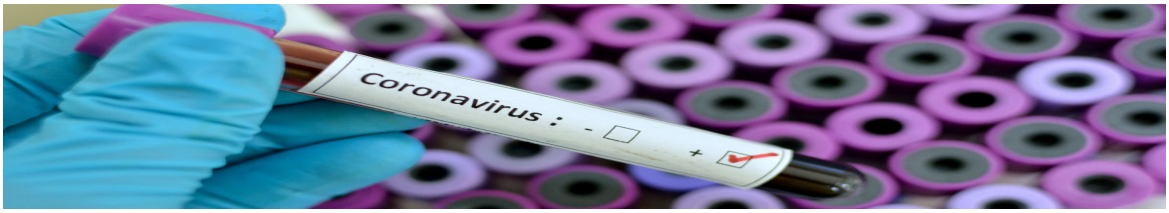
[9] TheGlobalEconomy.com. "China Percent of World GDP - Data, Chart." Accessed February 18, 2020. https://www.theglobaleconomy.com/China/gdp_share/.

[10] World Trade Organization. "Recent Patterns of Global Production and GVC Participation." In Global Value Chain Development Report 2019, by World Trade Organization, 9–43. WTO, 2019. https://doi.org/10.30875/6aa1a271-en.

[11] IEA. "Oil Market Report - February 2020 – Analysis." Accessed February 18, 2020. https://www.iea.org/reports/oil-market-report-february-2020.

[12] "LinkedIn." Accessed February 18, 2020. https://www.linkedin.com/posts/ckazokoglu_coronavirus-activity-6633178008465264640-iD3m/.

[13] World Tourism Organization (UNWTO), ed. International Tourism Highlights, 2019 Edition. World



Tourism Organization (UNWTO), 2019. https://doi.org/10.18111/9789284421152.

[14] Josephs, Leslie. "Boeing Warns the Coronavirus Could Hurt First-Quarter Aircraft Deliveries." CNBC, February 12, 2020. https://www.cnbc.com/2020/02/12/boeing-warns-coronavirus-could-hurt-first-quarter-aircraft-deliveries.html.

[15] "Aviation Fuel Market Size, Share, Growth | Industry Report 2026." Accessed February 18, 2020. https://www.fortunebusinessinsights.com/industry-reports/aviation-fuel-market-100427.

[16] "Global Oil Demand Shrinks, Hit by Coronavirus, IEA Says - WSJ." Accessed February 18, 2020. https://www.wsj.com/articles/global-oil-demand-shrinks-hit-by-coronavirus-iea-says-11581589005.

[17] February 2020, Alfred Chua14. "ICAO Flags $4-5 Billion Loss from Covid-19 Outbreak." Flight Global. Accessed February 18, 2020. https://www.flightglobal.com/air-transport/icao-flags-4-5-billion-loss-from-covid-19-outbreak/136754.article.

[18] "Coronavirus Kills International Capacity." Accessed February 18, 2020. https://www.oag.com/blog/coronavirus-kills-international-capacity?utm_content=115754886&utm_medium=social&utm_source=twitter&hss_channel=tw-41229126.

[19] Coronavirus Kills International Capacity." Accessed February 18, 2020. https://www.oag.com/blog/coronavirus-kills-international-capacity?utm_content=115754886&utm_medium=social&utm_source=twitter&hss_channel=tw-41229126.

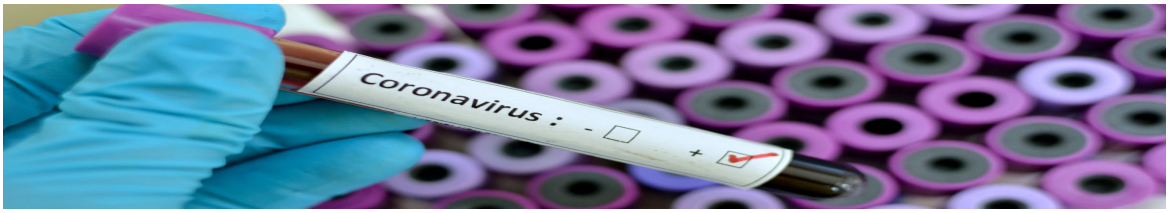
[20] "Asia Jet Fuel Demand Slumps as Airlines Cancel Flights after Virus Outbreak - Reuters." Accessed February 18, 2020. https://www.reuters.com/article/us-china-health-oil-demand/asia-jet-fuel-demand-slumps-as-airlines-cancel-flights-after-virus-outbreak-idUSKBN1ZR0SA.

[21] "China's Hubei Bans Vehicle Traffic to Curb Spread of Coronavirus - Reuters." Accessed February 18, 2020. https://www.reuters.com/article/us-china-health-hubei/chinas-hubei-bans-vehicle-traffic-to-curb-spread-of-coronavirus-idUSKBN20A06B.

[22] "Beijing Traffic Report | TomTom Traffic Index." Accessed February 18, 2020. https://www.tomtom.com/en_gb/traffic-index/beijing-traffic.

[23] "Shanghai Traffic Report | TomTom Traffic Index." Accessed February 18, 2020. https://www.tomtom.com/en_gb/traffic-index/shanghai-traffic.

[24] Analysis: South Korea's 2020 Oil Product Exports Under Pressure Amid Bleak China Sales Outlook | S&P Global Platts. (2020, February 12). Essential Intelligence to Make Decisions with Conviction | S&P Global. https://www.spglobal.com/platts/en/market-insights/latest-news/oil/021220-analysis-south-koreas-2020-oil-product-exports-under-pressure-amid-bleak-china-sales-outlook



[25] OPEC Monthly Oil Market Report, February 2020, https://www.opec.org/opec_web/en/publications/338.htm

[26] Commodity Tracker: Coronavirus and Commodity Markets. (2020, February 3). Platts Insight. https://blogs.platts.com/2020/02/03/commodity-tracker-coronavirus-030220/

[27] Short Sellers give oil a break following coronavirus concerns. (n.d.). Bloomberg . https://www.bloomberg.com/news/articles/2020-02-14/short-sellers-give-oil-a-break-following-coronavirus-concerns

[28] "Javier Blas." Twitter. Accessed February 18, 2020. https://twitter.com/JavierBlas/status/1226957806168952832.

[29] "Commodity Tracker: Coronavirus and Commodity Markets." Platts Insight. Last modified February 3, 2020. https://blogs.platts.com/2020/02/03/commodity-tracker-coronavirus-030220/.

[30] "The COVID-19 Coronavirus and Its Economic Impact (updated 18th Feb.)." Capital Economics. Last modified February 3, 2020. https://www.capitaleconomics.com/the-economic-effects-of-the-coronavirus/.

[31] "Energy Markets: Coronavirus Threatens the Energy Sector. Here's Why." E&E News -- The Essential News for Energy & Environment Professionals. Last modified February 18, 2020. https://www.eenews.net/stories/1062310667/.

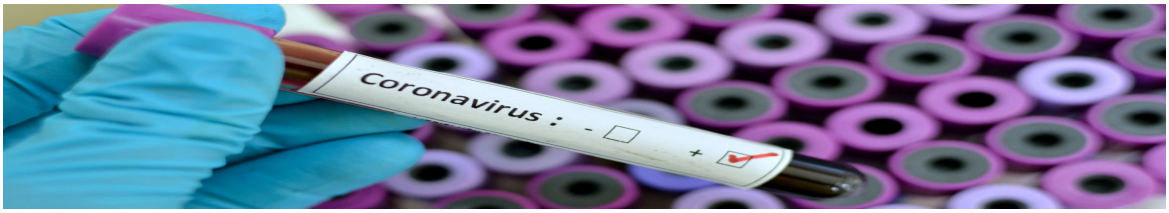
[32] "China's CNOOC Declares Force Majeure on LNG Contracts Amid Coronavirus Outbreak | S&P Global Platts." Essential Intelligence to Make Decisions with Conviction | S&P Global. Last modified February 6, 2020. https://www.spglobal.com/platts/en/market-insights/latest-news/oil/020620-chinas-cnooc-declares-force-majeure-on-lng-contracts-amid-coronavirus-outbreak.

[33] "Electric Shock: China Power Demand Drops As Coronavirus Shutters Plants." U.S. Last modified February 14, 2020. https://www.reuters.com/article/us-china-health-power/electric-shock-china-power-demand-drops-as-coronavirus-shutters-plants-idUSKBN2080HD.

[34] "China's CNOOC Declares Force Majeure on LNG Contracts Amid Coronavirus Outbreak | S&P Global Platts." Essential Intelligence to Make Decisions with Conviction | S&P Global. Last modified February 6, 2020. https://www.spglobal.com/platts/en/market-insights/latest-news/oil/020620-chinas-cnooc-declares-force-majeure-on-lng-contracts-amid-coronavirus-outbreak.

[35] "China's Renewable Investments Fall As US's Rise: BloombergNEF Report." Power Technology | Energy News and Market Analysis. Last modified January 17, 2020. https://www.power-technology.com/news/china-renewable-investment/.

[36] Vincent Shaw and Emiliano Bellini. "Coronavirus Could Cause Solar Panel Price Spike." Pv Magazine International. Last modified February 4, 2020. https://www.pv-magazine.com/2020/02/04/coronavirus-could-cause-solar-panel-price-spike/.



[37] Vincent Shaw and Emiliano Bellini. "Coronavirus Could Cause Solar Panel Price Spike." Pv Magazine International. Last modified February 4, 2020. https://www.pv-magazine.com/2020/02/04/coronavirus-could-cause-solar-panel-price-spike/.

[38] "Coronavirus Could Cause PV Module, Battery Cell Shortages in Australia." Pv Magazine International. Last modified February 14, 2020. https://www.pv-magazine.com/2020/02/14/coronavirus-could-cause-pv-module-battery-cell-shortages-in-australia/.

[39] "Energy Markets: Coronavirus Threatens the Energy Sector. Here's Why." E&E News -- The Essential News for Energy & Environment Professionals. Last modified February 18, 2020. https://www.eenews.net/stories/1062310667/.

[40] Frangoul, Anmar. "China's Wind Energy Sector Faces Significant Impact Due to the Coronavirus, Wood Mackenzie Warns." CNBC. Last modified February 17, 2020. https://www.cnbc.com/2020/02/17/chinese-wind-energy-faces-impact-due-to-coronavirus-wood-mackenzie.html.

[41] "Tesla China Resumes Model 3 Deliveries After Shutdown Due to Coronavirus Outbreak." Tech Anchor Blog - Technology Lives Here. Last modified February 16, 2020. https://techanchor.tech.blog/2020/02/16/tesla-china-resumes-model-3-deliveries-after-shutdown-due-to-coronavirus-outbreak/.

[42] "Coronavirus Outbreak is Threatening to Bankrupt China's Tesla Rival." CCN.com. Last modified February 14, 2020. https://www.ccn.com/coronavirus-outbreak-is-threatening-to-bankrupt-chinas-tesla-rival/.

[43] "Exclusive: Coronavirus Outbreak May Be over in China by April - Expert." U.S. Last modified February 11, 2020. https://www.reuters.com/article/us-china-health-doctor-exclusive/exclusive-coronavirus-outbreak-may-be-over-in-china-by-april-expert-idUSKBN2050VF.

[44] "Oxford Economics." Twitter. Accessed February 18, 2020. https://twitter.com/OxfordEconomics/status/1227206755022712833.

[45] Wallace, Joe. "Coronavirus Spurs Demand for Niche Raw Materials." WSJ. Last modified February 12, 2020. https://www.wsj.com/articles/coronavirus-spurs-demand-for-niche-raw-materials-11581511671.

[46] "The COVID-19 Coronavirus and Its Economic Impact (updated 18th Feb.)." Capital Economics. Last modified February 3, 2020. https://www.capitaleconomics.com/the-economic-effects-of-the-coronavirus/.

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