

Project: Hirtenberger Auto Safety

A special report on Austria & China relationship in the automotive industry

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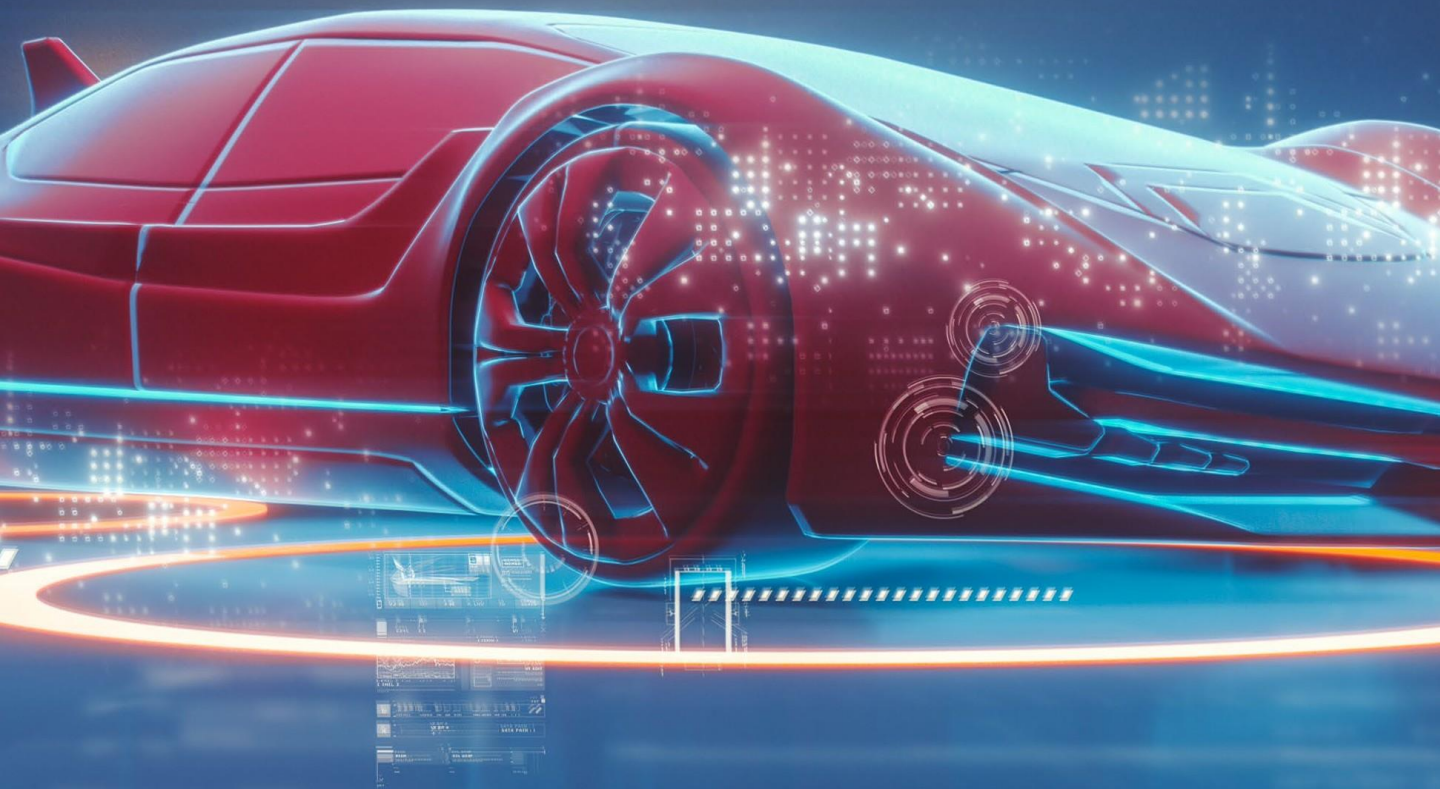
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Published date: July 2021

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Chapter 1

Economic relations between Austria and China

1. History of Austria-China Relation

The relations between Austria and China were formally established in 1971. Ten years later, the two countries built the first city partnership between Linz and Chengdu. So far, there are 27 sister-city partnerships (Austrian Embassy in China, n.d.). Since the establishment of the diplomatic relation, the two countries have continually developed in various fields and achieved fruitful cooperation. The collaborations are not constrained to the economic level. Cultural and technological exchange and interaction between the two countries are also quite common. For instance, in 2004, the Austrian Cultural Center was launched as the representative institution of Austrian culture in the People's Republic of China and Mongolia (Austrian Embassy in China, n.d. a). It was incorporated into Austria as part of the Austrian Embassy abroad (Austrian Embassy in Beijing, n.d. a). The trade deficit between Austria and China occurred around the 1990s. In 1999, Austria showed a negative trade balance of about 50 million Euros, and the number kept growing and exceeded 1000 million Euros in 2004 (Waltraut Urban, 2010). Over the past 24 years, Austria's exports to China have increased at an average annual rate of 9.58%, from \$585 million in 1995 to \$5.26 billion in 2019 (OECD, n.d.).

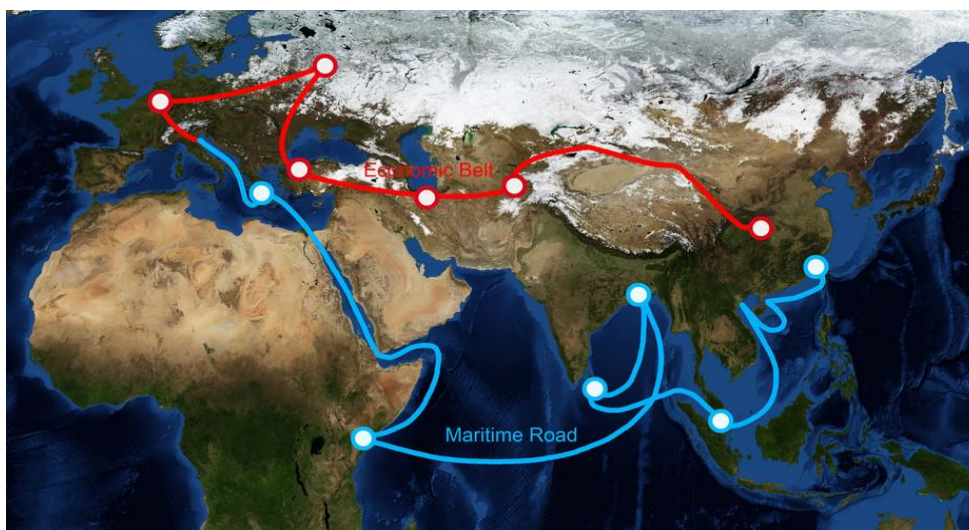
2. Current Austria-China Relation

2.1. Trade Agreements

Developing economic and trade relations between the two countries based on equality and mutual benefit is the main incentive for signing a trade agreement. In the past five years, there have been three major trade agreements signed between China and Austria.

2.2. The Belt and Road agreement

The "Belt and Road" is an open and inclusive operating mechanism and platform that can strengthen communication and cooperation between China and Europe regarding development strategy, infrastructure construction, trade, and investment facilitation. (China Daily, 2018) The "Joint Statement on the Establishment of Friendly Strategic Partnership" signed by both leaders in April 2018 has raised the level of bilateral relations. A number of agreements for e-commerce, innovative research & development have also injected new impetus into the expansion of bilateral economic and trade cooperation. (China Daily, 2018) Austria is located in the center of Europe and is an important transportation hub connecting east and west Europe. Due to the geographical advantages, historical traditions and economic connections, Austria will be playing an important role in the cooperation between China and Europe. Meanwhile, China's "Belt and Road" initiatives and development concepts provide more opportunities and space for Austria.



*“The
China Belt
and Road
Map”*

2.3. Memorandum of Understanding on Third-Party Market Cooperation

In April 2019, China and Austria jointly signed the "Memorandum of Understanding on Third-Party Market Cooperation between the National Development and Reform Commission of China and the Ministry of Digitalization and Economic Affairs of the Republic of Austria" (NDRC, 2019). According to the memorandum, the two parties will cooperate in the third-party market following the principles of business entities and the market, per international practices and guidelines, and the laws and regulations of the countries that benefit from the cooperation(NDRC,2019). Austrian companies have unique advantages in machinery and equipment manufacturing, environmental protection, engineering design, medical care, and other industries. On the other hand, Chinese companies have accumulated rich experience in infrastructure construction, energy development, mechanical equipment, financing, and other fields (Qiu,2019). Both countries have strong complementarities, and the cooperation in third-party markets has broad prospects.

2.4. Comprehensive investment agreement

On December 30, 2020, China and the EU jointly announced "comprehensive investment agreement" negotiations (Xinhua, 2020). According to Karlheinz Kopf, Secretary-General from the Austrian Federal Chamber of Commerce, the agreement will benefit the European Union in terms of geopolitical and economic benefits while encouraging Austria's economic development" (Xinhua, 2020). The agreement improves market access conditions in many fields such as new energy vehicles, cloud computing services, financial services, and healthcare. It removes investment barriers and brings new business opportunities for Austrian companies and EU investors to enter the Chinese market (Xinhua, 2020). However, due to the uncertain political environment, the agreement has now been postponed, and the specific follow-up development will take time to confirm.

2.5. Trade statistics between Austria and China

In April 2019, China and Austria jointly signed the "Memorandum of Understanding on Third-Party Market Cooperation between the National Development and Reform Commission of China and the Ministry of Digitalization and Economic Affairs of the Republic of Austria" (NDRC, 2019). According to the memorandum, the two parties will cooperate in the third-party market following the principles of business entities and the market, per international practices and guidelines, and the laws and regulations of the countries that benefit from the cooperation (NDRC, 2019). Austrian companies have unique advantages in machinery and equipment manufacturing, environmental protection, engineering design, medical care, and other industries. On the other hand, Chinese companies have accumulated rich experience in infrastructure construction, energy development, mechanical equipment, financing, and other fields (Qiu, 2019). Both countries have strong complementarities, and the cooperation in third-party markets has broad prospects.

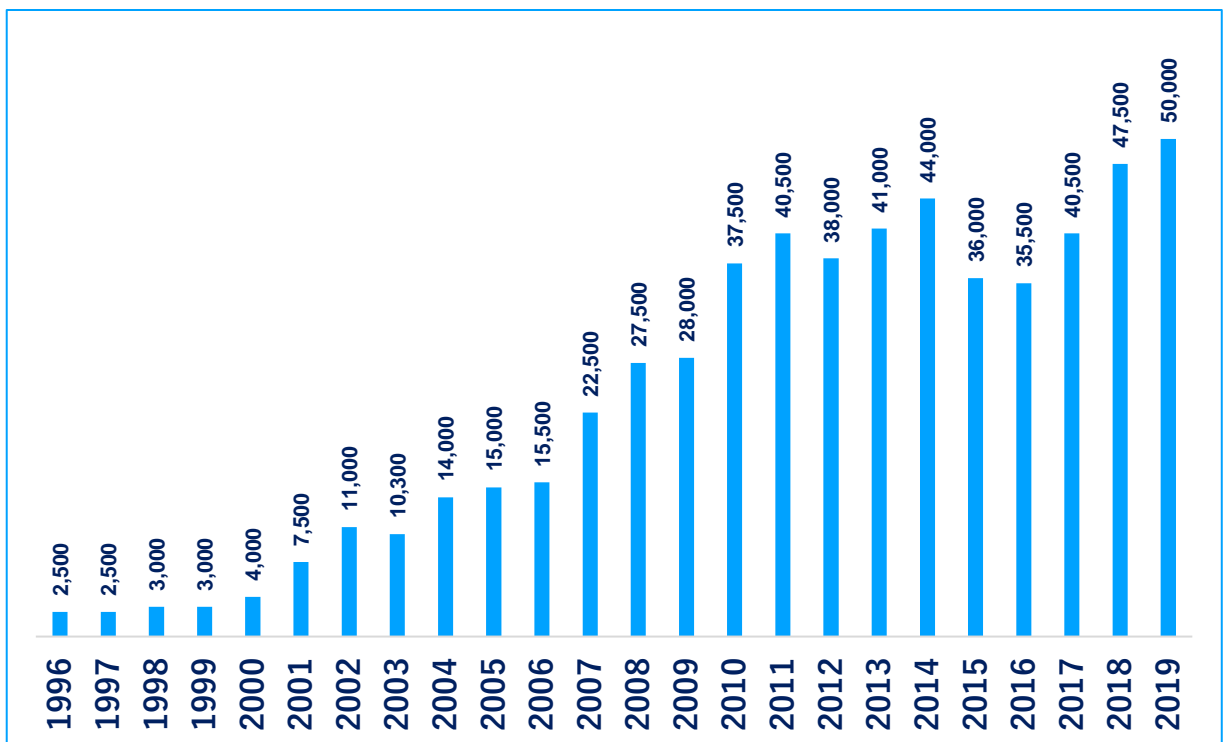


Figure 1. Austria Exports to China
(Source: Trading Economics)

2.5. Trade statistics between Austria and China

If we look into the Exports from Austria to China, in 2019, the number reached \$5.26 billion among Cars (\$361M), Blood, antisera, vaccines, toxins, and cultures (\$339M), and Unprocessed Artificial Staple Fibers (\$333M), which account for 6.86%, 6.45%, and 6.33% of the total value, respectively. (Figure 2). On the other hand, although the growth rate of Austria's imports from China is not as evident as that of its exports, it is also on the rise overall (Figure 3). In 2019, Austria's imports from China were \$11 billion, and the most significant sector is electrical and electronic equipment (Trading Economics, 2021).

Export Item	% of total export
Cars	6.86%
Blood, antisera, vaccines, toxins and cultures	6.45%
Unprocessed Artificial Staple Fibers	6.33%
Other measuring instruments	4.38%
Photo lab equipment	3.82%

Figure 2. Export from Austria to China

(Source: OEC)

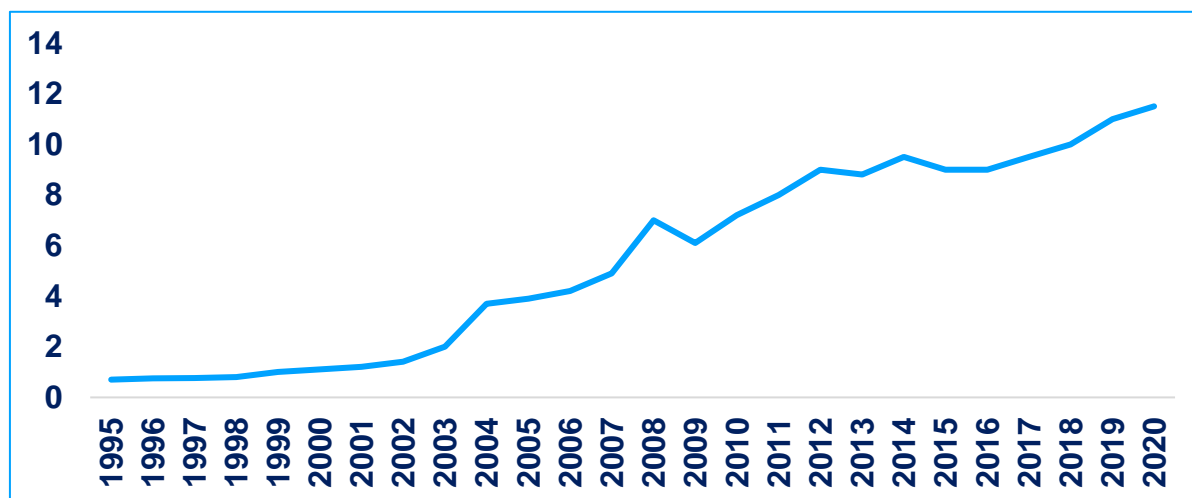


Figure 3. Imports from Austria in China

(Source: Imports from Austria in China)

2.5. Trade statistics between Austria and China

The above data and figures show a clear picture of the positive rising trend between the two countries. Moreover, due to the control of the pandemic and the growing number of China-Europe freight trains, the trade value soared 35.8 percent on a yearly basis to \$4.28 billion in the first four months of 2021 (Nan, 2021). It is predictable that the trend will continue and not be seriously influenced even under the post-pandemic time.

2.6. Foreign direct investment

As Margarete Schramböck, Austria's federal minister for Digital and Economic Affairs, said, "for Austria, we want to at least double or triple the number of Chinese investments in Austria (Cong, 2018)." During the Austrian delegation's official visit to Beijing in 2018, a total of 30 business cooperation projects were signed between Chinese and Austrian companies, including technological innovation, e-commerce and railway (Cong, 2018). Austria's advanced automotive sector has also attracted Chinese investors. The Chinese automotive brand Great Wall chose to invest about 20 million euros in Austria for a research and development center in Europe instead of Germany and England (Gibbs, 2018). In addition, Chinese firm XAC injected 40 million euros to acquire the aerospace company FACC, and CRRC ZELC decided to locate its European headquarters in Vienna (Yu, 2019). Austria has also shown great interest in investing in China. Austrian TTTech Computertechnik AG has signed a joint venture contract with SAIC Motor Corporation from China (TTTech, 2018). This is a critical step for China and Austria in the field of automobile manufacturing.

2.7. Country Risk Analysis

Political Risk

The relations between the two countries are steadily growing through the years. However, Austria also has a strong or even closer tie with the Russian Federation due to its geographic proximity and historical ties (Szyszkowitz, 2020). Russia could always have influences through President Putin's engagement with Austrian politicians (Szyszkowitz, 2020). Due to the rise of two political authorities, Austria-China relationships have come under strain in recent years, and the country usually tries to act in accordance with EU Policy (Szyszkowitz, 2020).

Credit Rating

Credit rating is an assessment from a credit agency regarding the creditworthiness of an entity. It is crucial that the Austrian companies closely monitor China's credit rating. In Figure 4, China's Long-Term Foreign and Local Currency has been at the highest at A since 2007. At the same time, China's Short-Term Foreign and Local Currency is rated at R1 (DBRS, 2020). Even though the current rating is not at its peak, the trend on all ratings has been improved to stable from negative.

Rating Agency	Rating
Standard's Poor's	A+
Moody's Investor Service	A1
Fitch Ratings	A+
DBRS	A (high)

Figure 4. China's Credit Rating
(Source: World Governments Bonds)

Currency movement between RMB/EUR

As a cross-border transaction, the power of money cannot be underestimated. As one of the major currencies in the world, the euro enjoys its price stability (Lee, 2019). Although the yuan is not one of the four major currencies, its exchange rate has been remarkably stable over the past few years (Figure 5).

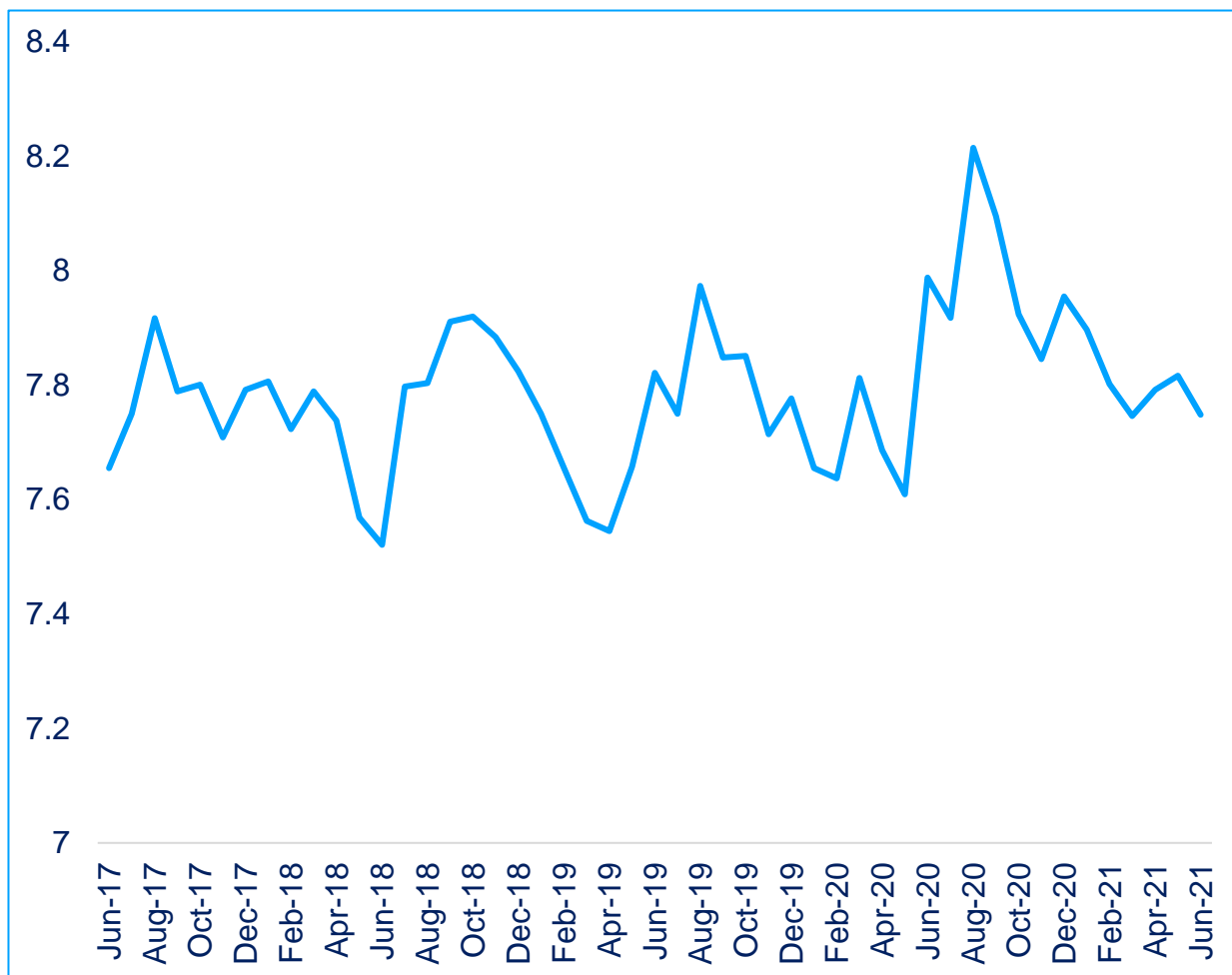


Figure 5. Euro / Chinese Yuan Exchange Rate

(Source: TradingView)

Currency movement between RMB/EUR

"Since the beginning of 2017, the yuan has been range-bound, moving no more than 4% in either direction when measured against the trade-weighted basket targeted by the People's Bank of China, known as the CFETS index. (Klein, 2020, Paragraph 2)" The performance of RMB has been particularly notable since the pandemic; despite the upheaval since the start of 2020, the CFETS index is barely moving, with the difference between its maximum and minimum values less than 5 % (Klein, 2020). The RMB's stability has benefited from government policy support. As Lian Ping, chief economist with the Bank of Communications, said, "[China] has plenty of market and policy tools to stabilize its currency and efficiently prevent speculators from taking advantage of short-term exchange rate fluctuations (Liang, 2019)." Besides, as Zhou Jingtong mentioned, China is promoting the marketization of the exchange rate formation mechanism to let the market play a crucial role (Liang, 2019)

Furthermore, compared to major and minor forex pairs, EUR/RMB trading volume is low, and the trading pace is slow; therefore, it is easier for investors to predict the long-term price movement of the pair (Awais, 2020). Consequently, it is expected that the positive relationship between the two currencies in this project will assist the smooth progress of the project.





Chapter 2

China, leader of the 21st-century automotive industry

1. Global Automotive Industry in Covid-19 era

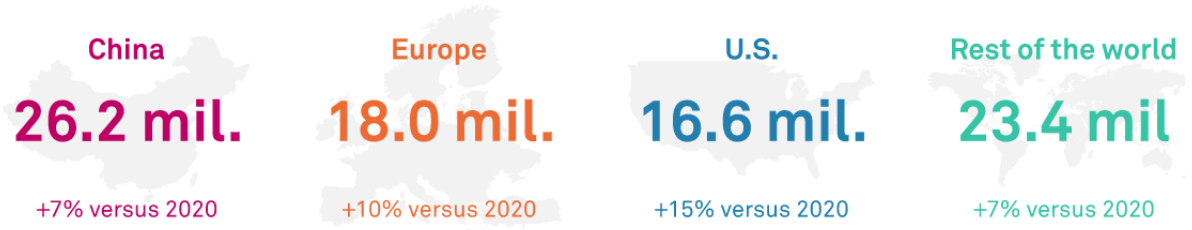
- ❑ A prolonged truncation of consumer demand as countries work through various lockdown scenarios may spark a global recession, leading to widespread loss of consumer confidence, significantly impacting automaker revenues and profitability
- ❑ Auto companies may be forced to divert capital to shore up continuing operations, starving R&D funding for advanced technology initiatives and other discretionary projects
- ❑ Strategic decisions to exit unprofitable global markets and vehicle segments may be accelerated, significantly lowering output as manufacturing capacity is rationalized/consolidated
- ❑ Suppliers facing liquidity issues may succumb to rapidly deteriorating market conditions, causing widespread disruption and potentially catastrophic consequences across the entire global automotive manufacturing ecosystem
- ❑ A significant amount of restructuring may be expected in the auto retail sector as dealers are unable to pivot quickly enough to changing demand conditions

Global Automotive Industry in Covid-19 era

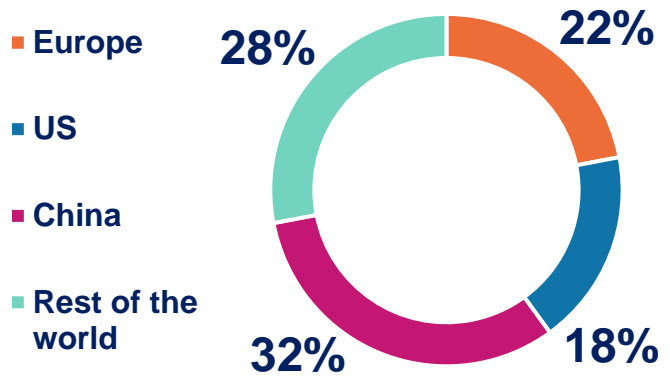
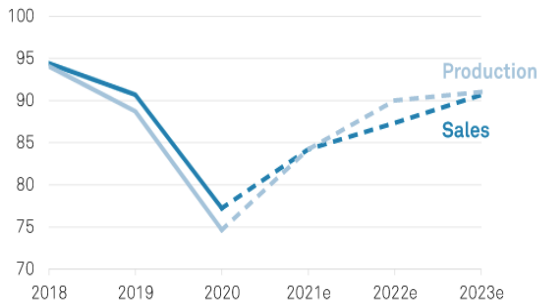
For two consecutive years in 2018 and 2019, the automotive industry reeled from shrinking economic activity, rising competition, a slowdown in BRIC economies, and tightening lending norms that dampened global demand. Then came the knockout punch inflicted by the lockdowns amid COVID-19 in the first half of 2020, plunging automotive sales to historic lows. Nevertheless, aided mainly by the consumer shift towards personal mobility over public and shared transport, the auto industry is reviving faster than expected. Analysts expect global light vehicle sales to increase by between 8% and 10% this year to 83-85 million units, from 77 million in 2020. The world is experiencing a quicker global rebound after 2020 exceeded industry expectations due to pent-up demand and successful measures to stimulate demand in the second half of the year. Given the record low inventories across the industry at the end of 2020, the industry initially anticipated a fast rebound of light vehicle production this year.

However, visibility over when supplies will normalize remains very poor. Based on manufacturers' first-quarter results, the expected supply disruption to further deteriorate in the second quarter and hopes for a recovery in units in the second half of the year are starting to fade. While almost all global auto manufacturers will have to idle production at some stage this year, the impact of the chip shortage varies substantially between companies. Nonetheless, demand remains sustained, particularly in China and the US. The situation has resulted in record pricing effects across the industry and solid residual values combined with low inventories. These factors are mitigating the supply disruption crisis on manufacturers' earnings. The way more significant markets are convalescing from the after-effects of the pandemic, China's automotive market has been the fastest off the blocks, followed by the US, which perked up from around Q3 2020. Lingering effects of the pandemic notwithstanding, Europe and India have also shown signs of a steady comeback, albeit at a slow rate.

Global Automotive Industry in Covid-19 era



Global sales versus production
2018 - 2023e, millions of units



Regional sales

2018 - 2023e, millions of units

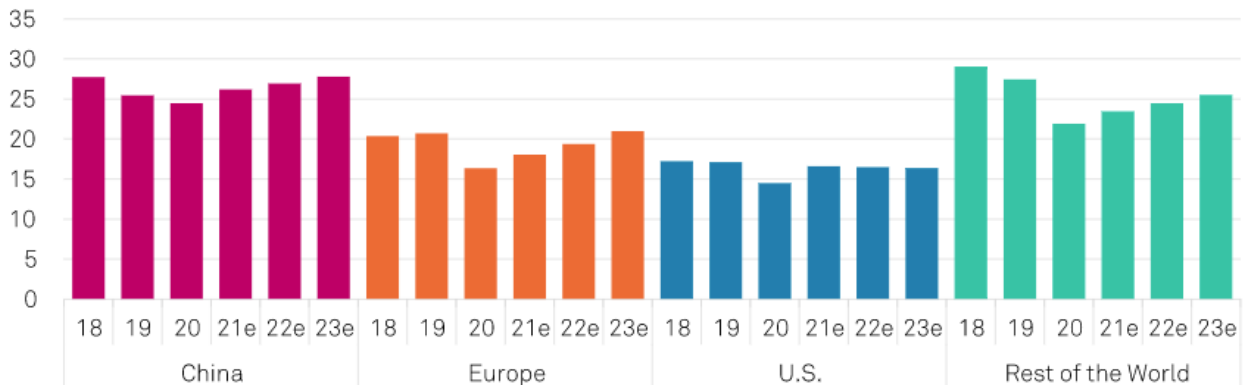
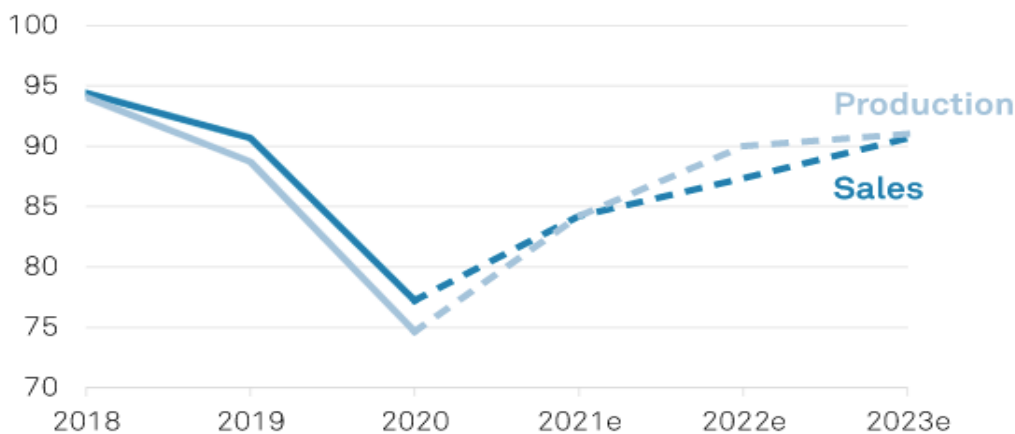


Figure 6. An infographic on global automotive industry recovery
(Source: S&P Global Ratings)

Global Automotive Industry in Covid-19 era

Global sales versus production 2018 - 2023e, millions of units



Global Light Vehicle Sales Forecast

	Actual		New Projections (as of May 11, 2021)			Old Projections (as of September 2020)	
	2020		2021e	2022e	2023e	2021e	2022e
	Mil units	% change YoY	% change YoY	% change YoY	% change YoY	% change YoY	% change YoY
U.S.	14.5	-15	14-16	-1-0	-1-0	13-15	3-5
China	24.5	-4	5-9	2-4	2-4	2-4	2-4
Europe	16.4	-21	9-11	7-9	7-9	8-10	8-10
Rest of the world	21.9	-20	6-8	4-6	3-5	6-8	10-12
Global LV sales	77.2	-15	8-10	3-5	3-5	7-9	7-9
Global LV production	74.6	-16	12-14	6-8	1-2	N.R.	N.R.

Figure 7. Global Light Vehicle Sales Forecast

(Source: S&P Global Ratings, 2021)

2. A deeper dive into the global automotive market

The global electric vehicle (EV) market is heating up, and China wants to dominate. Increasingly more and more analysts expect China to be a leader in EV production, partly because it has the largest automobile market globally. Then it has all these government policies to support consumers to buy EVs. The Chinese government has invested at least 60 billion dollars in supporting the EV industry, and it's pushing an ambitious plan to transition to all-electric or hybrid cars by 2035. China has an all of society approach to winning and dominating the electric vehicle market globally.

Despite the pandemic, deliveries of EV's grew year over year in 2020 by 43 percent globally. The US only saw a four percent increase. However, there are signs that the US is getting more serious about going electric. President Joe Biden has renewed the US commitment to fighting climate change to reach net-zero emissions by 2050. He has also announced investments in green infrastructure, including adding 500,000 charging stations, which came as a surprise to many. In addition, General Motors, one of the largest automakers in the US, announced plans to offer electric vehicles by 2035 exclusively. Last year, the company sold about 6.6 million vehicles worldwide. Just 49,149 are electric. The number is way behind China and Europe.



2. A deeper dive into the global automotive market

Political strategies for a green-led economic recovery from the COVID-19 pandemic will wing electrification of the global light vehicle fleet.

- The Green Deal in Europe
- The ambitions of the Biden Administration to drastically curb emissions in this decade
- and the Chinese government's targets to increase the proportion of new-energy vehicles to 20% of sales by 2025 (from 5.5% in 2020)

All of the points clearly down the electrification path. However, the mass adoption of electric cars still requires more granular charging infrastructure and local supply chains for battery cell production. Europe is currently leading the transition: battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) represent 15%-20% of the European market in 2021 in our base-case scenario and 30% by 2025. This compares with an expected 6%-9% market penetration in China, although analysts believe the Chinese market will regain its position as the largest EV market over time. In the US, the Biden Administration has announced a commitment of \$174 billion to accelerate the deployment of electric vehicles, including point-of-sale rebates and tax incentives, and a national network of 500,000 chargers by 2030. On a global scale, EV penetration will be in the 6%-8% range in 2021 (Figure 7). The potential further tightening of CO2-reduction goals in Europe, on the political agenda this summer, has already resulted in more aggressive fuel-mix strategies by producers with sizable operations in the region.

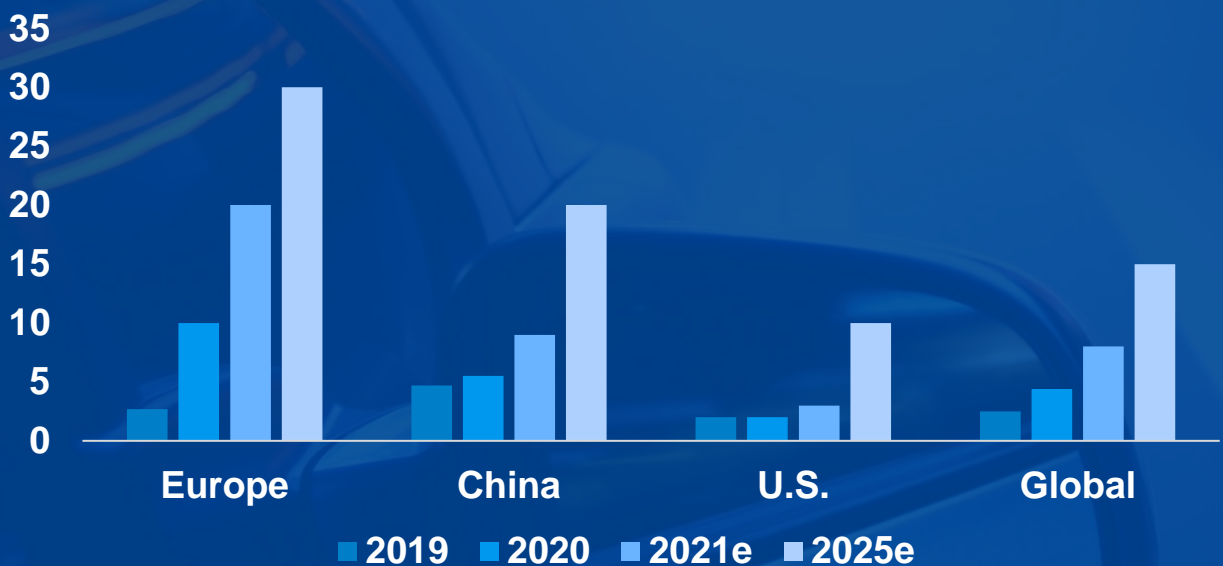


Figure 8. Electrification Scenario--Share Of BEV and PHEV as % of Total Sales
(Source: S&P Global Ratings, 2021)

4. How China conquered the automotive market

China decided over a decade ago that it wanted to be the world leader in electric cars. As a result, the industry in China has been exciting because it is an example of how government policy can potentially drive innovation in an industry.

China is betting big on electric vehicles for several reasons.

4.1. Early adoption of Technology

China has always been a follower of traditional vehicles. They wanted to find a way to catch up technologically and not be dependent on Europe or the US on engine technology. To support the adoption of EV, the Chinese government has played a massive role. It has spent tens of billions of dollars to support the sales of electric vehicles. Whether it is in California, China, or Europe, the government is pushing the electric vehicle future. China has been the most aggressive in this regard.

4.2. Subsidy and Incentives

China has subsidies and incentives that benefit automakers, suppliers and consumers. In certain cities, for example, in Beijing, car owners can only have access to the city center in a car if they are driving an electric vehicle. Elsewhere in Shanghai, drivers pay \$12,000 for the license plate alone for the gasoline-powered automobile. Alternatively, the government waives that licensing fee if the buyer purchases an EV vehicle. China also has a quota system for manufacturers. They must produce a certain percentage of electric vehicles every year or be fined. However, some question if this is sustainable. Other than Tesla, the only way to sell EVs has been through subsidies, whether state or federal. The amount of funding that has been poured into the industry is mind-boggling. It is a government-created market.

4.3. Controlling the production of EV batteries

The primary barrier for consumers to buy electric vehicles is the cost, and batteries represent the bulk of the cost of electric cars besides subsidies. China's government also provides support and battery manufacturing and the supply chain. It is the leading producer of electric batteries and motors. Battery production around the world is concentrated in Northeast Asia (Japan, Korea and China). Together, they account for about 95 percent of total battery production for vehicles (CNBC, n.d). Now within those ninety-five percent, China has more than 60 percent at this point. So, it is the leader in terms of battery production capabilities. Moreover, analysts are basically across the board, saying that China controls the chemicals. These production facilities are needed for electric vehicle battery production for the next probably five to 10 years.

4.4. Greater climate change commitments

China has a significant air pollution problem, and they are also the world's largest importer of oil. China is the world's biggest emitter of greenhouse gases and has pledged to be carbon neutral. China's leader, Xi Jinping, to speed up reductions in emissions in the world's top-polluting nation and reach carbon neutrality by 2060. It will push for the transition from ICE to EV at a rapid pace.



4.4. Greater climate change commitments

Rank	2017		2019		11M20	
	Brand	Market share	Brand	Market share	Brand	Market share
1	BJEV	18.5%	BYD	19.8%	SAIC-GM-Wuling	13.3%
2	BYD	15.8%	BJEV	9.2%	BYD	12.7%
3	SAIC	7.3%	Geely	7.0%	Tesla (China production)	12.6%
4	Zhidou	6.6%	SAIC	6.4%	GAC	5.8%
5	Zotye	6.5%	Tesla (import)	5.2%	SAIC	4.6%
6	Jiangling	6.0%	SAIC-GM-Wuling	5.2%	Great Wall	4.6%
7	Chery	5.2%	Great Wall	3.8%	BJEV	4.3%
8	JAC	5.0%	GAC	3.4%	NIO	4.0%
9	Chang'an	4.5%	Chang'an	3.4%	Chery	3.4%
10	Geely	3.9%	BMW Brilliance	3.3%	Li Auto	2.9%

Figure 9. China EV retail sales by brands

(Source: China Passenger Car Association, WAYS & KPMG analysis, 2021)

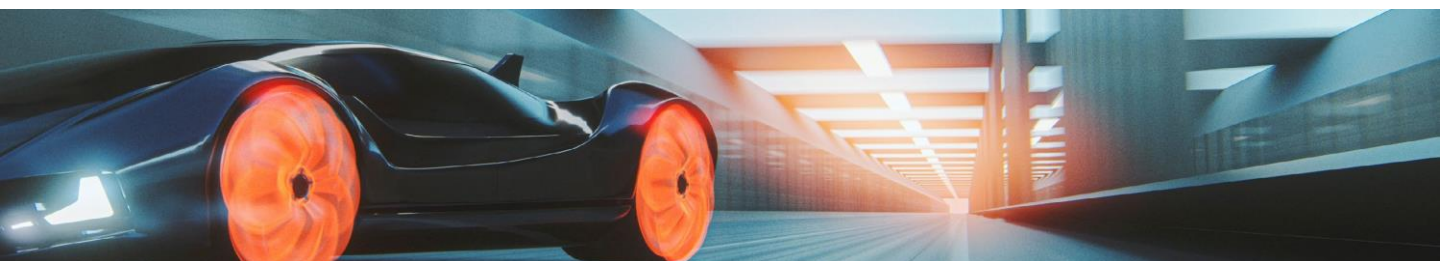
For foreign OEMs, there have been few runaway successes outside of Tesla. In recent years, Tesla has managed to position itself within the top 10 BEV OEMs by new vehicle sales with their imports of Model X, Model Y and Model 3. The brand benefits from an actual premium image and as a pioneer that sets the standards for BEVs. With such a high price tag on the import models due to import duties, Tesla never reached the pinnacle of EV sales. With a new factory opening in Shanghai in 2019, the fully localized Model 3 has emerged as amongst the top-selling BEV models in 2020.

Traditional foreign OEMs have historically taken a more conservative pace towards electrification. One need look no further than the next most popular foreign brand EV by sales: the BMW 530Le plug-in hybrid (PHEV), which is based on an ICE vehicle platform. In our view, the lack of foreign OEMs' interest to electrify in the past was due to their established position in the ICE market, the accompanying high margins, and the uncertainty around profitability and the residual value of EVs. As such, accelerating the cannibalization of their ICE business with low or negative margin EVs, mainly when demand remained soft, did not make economic sense. However, particularly in 2020, we have seen firm commitments towards an electric future by global OEMs.

5. Future Trend

Despite initial reluctance, foreign OEMs have become more eager to expand their NEV product offering for the following reasons:

- ❑ **Government support:** To achieve the goal of NEV popularization, the Chinese government has extended cash subsidies, albeit reduced in value and tagged to more stringent technical requirements, to at least 2022. There are also non-cash incentives such as a purchase tax waiver, approximately 10 percent of sticker price, and license quotas in cities with ICE ownership restrictions. OEMs also need to abide by the dual-credit, NEV credit and fuel efficiency credit system, which means acquiring positive credits by producing NEVs to meet requirements. We expect these non-subsidy incentives to continue as China remains committed to becoming a major global player in electric vehicles. Companies that follow the powertrain mix objectives' guidelines will benefit the most as the credit system matures.
- ❑ **Infrastructure improvements:** Range anxiety and insufficient charging facilities are among car owners' key concerns around EV ownership. The coordinated push by governments, OEMs, and third parties (e.g., energy companies and the state grid network of companies) rapidly populates the charging network.
- ❑ **Reduction and eventual reversal of the production cost gap:** It remains more costly to produce a NEV than an ICE of similar specifications due to battery costs. However, with ongoing improvements in higher battery power density, battery production costs are trending downward. What is more, amid a continuous tightening of emission standards, the price to develop and produce more efficient internal combustion engines will rise, given physical barriers. As such, OEMs will find their profitability - and their presence in the world's largest vehicle market - tied to their NEV portfolio.



6. The alternative fuel vehicle in China

The 19th Shanghai International Automobile Industry Exhibition was the first world-class auto show aimed at helping foreign-funded enterprises around the globe. The theme of "Embracing Change" demonstrated the new trend of intelligent driving solutions and electric cars. The Alternative-Fuel Car and Automobile Manufacturing industry focuses on three main categories: battery-powered electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs) and fuel cell vehicles (FCVs) for passenger and commercial use in China. It has developed rapidly in the past five years due to government subsidies and favourable policies that have resulted in increasing numbers of electric car charging facilities and changing attitudes toward environmental protection concerns.

6.1. Current Performance

China's alternative-fuel car and automotive manufacturing industry have the potential to boost the country's whole automobile sector's competitiveness. Because the central government has implemented a series of policies that have benefited industrial participants since 2014, from 2015 to 2020, the number of enterprises in the industry increased from 171 to 247 (Chen, 2020). Chinese government prioritized the further development of battery-powered electric vehicles (BEVs), leading many manufacturers to invest heavily in BEVs instead of plug-in hybrid electric vehicles (PHEVs). Thus, the composition of this industry is made up of battery-powered electric vehicles (BEVs), a major product of this industry output, 70 percent. In comparison, PHEVs only accounted for an estimated 23 percent in 2020.

Meanwhile, many foreign-Sino joint venture (JV) brands are also establishing partnerships with domestic companies, launching new brands and vehicle models in China. For example, Daimler AG and local BYD launched a new BEV brand, Denza. In 2018, there were more than 20 new models launched from JV brands. Furthermore, due to the significant incentives provided to consumers, the average selling price of alternative-energy vehicles is also expected to continue to increase as incomes rise and consumer preferences shift from middle to high-end branded vehicles.

6.2. International trade

- ❑ Exports in this industry are low
- ❑ Imports in this industry are moderate and increasing

Overall, industry revenue was expected to increase at an annualized 35.7 percent from 2015 through 2020 to USD 68.8 billion. Industry profit margins are relatively high, averaging 11.4 percent of revenue in 2020 (Chen, 2020). The high levels of automation and government subsidies have reduced costs for crucial accessories and parts, which have boosted the profitability of the industry.

Industry exports are limited, and revenue decreased strongly from 2.4 percent in 2015 to 0.6 percent in 2020. This was due to the late start of this industry, along with trade barriers in foreign markets. In contrast to declining exports, import levels have risen strongly over the period. Growing consumption power has predominantly driven demand for imported vehicles, which are usually high-end cars from well-known brands. In 2014, US manufacturer of BEVs, Tesla Inc, started to sell its vehicles in China. Battery-powered electric vehicles are the majority of imported products, accounting for 77 percent of industry imports in 2020. The leading import players are the United States (85.5 percent), Germany (13.7 percent), and other imports, including Slovakia, Sweden, and Japan. As a result, imports of domestic demand have increased from 1.7 percent in 2015 to 9.7 percent in 2020. This has been rising significantly at an annualized rate of 96.2 percent since 2015 (Chen, 2020).

According to the ACMR-IBISWorld forecast, the Alternative-Fuel Car and Manufacturing industry will continue its strong growth in the next five years. Its revenue is expected to increase at an annualized rate of 13.5 percent, accounting for USD 129.7 billion by 2025 (Chen, 2020).



6.2. International trade

This is a list of Alternative-Fuel Car and Automobile Manufacturers in Shanghai. The red circles indicate the NEV (New Energy Vehicle: EV, PHV, FCV) manufacturing sites in Shanghai.



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Manufacturers List

Shanghai

- SAIC Motor Corporation Limited
- SAIC Volkswagen Automotive Company Limited
- Shanghai Volkswagen Powertrain Co., Ltd.
- Shanghai Sunwin Bus Corporation
- Volvo Car, APAC Headquarters
- Shanghai Wanxiang Automobile Co., Ltd.
- Mazda Motor (China) Co., Ltd.
- General Motors (China) Investment Co., Ltd.
- Chrysler (China) Sales Co., Ltd.
- Shanghai Youxia Motors Co., Ltd.
- SAIC Volkswagen Automotive Company Limited, Anting NEV Plant
- Evergrande Hengchi New Energy Vehicle (Shanghai) Co., Ltd.
- SAIC Motor Passenger Vehicle Co., Lingang plant
- Volkswagen Transmission (Shanghai) Co., Ltd.
- SAIC General Motors Co., Ltd.
- SAIC MAXUS Automotive Co., Ltd.
- Shanghai Hino Engine Co., Ltd.
- Shanghai Shenlong Bus Co., Ltd.
- Mitsubishi Motors (China) Co.,Ltd.
- Ford Motor (China) Ltd.
- SAIC General Motors Corporation Limited, Cadillac Plant
- Tesla (Shanghai) Co., Ltd.

Figure 10 & 11. List of Electric car manufacturers in Shanghai
(Source: Automobile industry Portal, Marklines)



Chapter 3

An overview on export options between Europe and China

Air Freight



Airfreight shipment options are chartered or commercial. Airfreight is undoubtedly the fastest among the three options. In economy mode, 3 to 5 days are needed from Europe to China, but sometimes it can be up to 10 business days (Topshipping, n.d.).

Benefits and Challenges: Airfreight is known for the advantage of speed and flexibility. For urgent demand, there is no alternative. The international air transport network provides a wide range of services that meet the needs of different customers. This ensures the load arrives safely. The fragile and sensitive goods are safer in the hands of air freight services. However, the regulation of air freight is more strict. A wide range of items cannot be transported by air, including dangerous goods. Also, due to the size of airplanes, it is much smaller than a ship to contain bulky goods.

How to calculate the gross weight of airfreight shipments

Gross weight
Convert lbs to kgs
110lbs = 49.89kgs

=

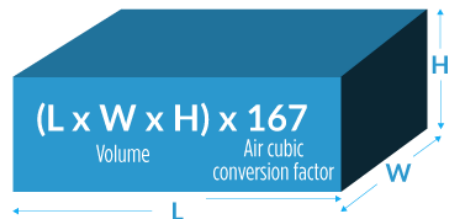
Product weight
100lbs

+

Pallet weight
10lbs

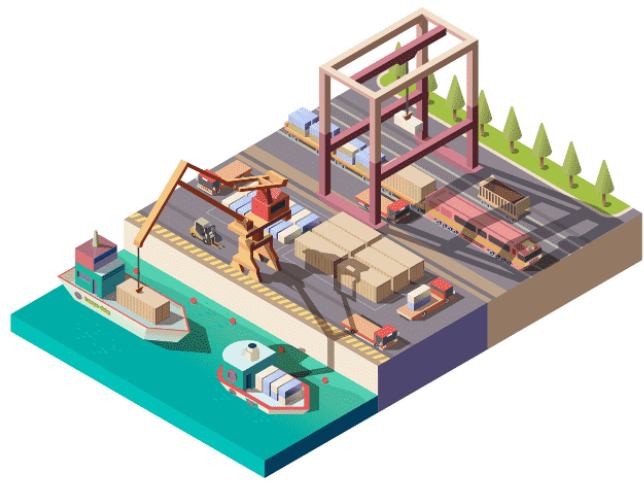


Airfreight volumetric weight formula



*Volume has to be in cbm
61,024 cubic inches = 1 cbm*

Sea Freight

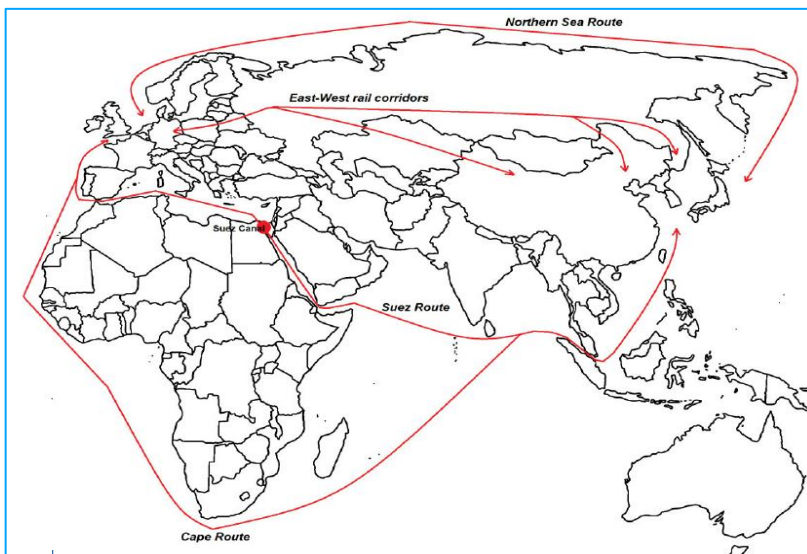


China-Europe maritime trade is three times larger than trade by air freight and railways (Duchâtel, 2018). Therefore, we found several ideal ports with facilities and services: Trieste, Koper, Bremerhaven, Hamburg, Antwerp.

Routes and Time

There are three shipping routes from Europe to China. In Figure 11, Among these three routes, the Suez Route is the commonest one that runs through the South China Sea, the Malacca Strait, the waters of the Indian Ocean and the Suez Canal. Suppose the product is from central European countries, including Hungary and Austria. Most shipping companies will recommend this particular route. Ships running between China and Europe via the Suez Route usually take 30-48 days (Shiphub, n.d.).

Based on the current data from shipping companies, the estimated time of the currently available routes from European seaports to Shanghai is estimated as the table below. However, the time did not include the railway transportation to the port. Usually, it takes 2-3 days from the company in both Hirtenberg and Papa to the seaports.



*Figure 11.
Existing
trade routes
between
Europe and
China
(Source:
Bulis &
Skapars)*

Sea Freight

Based on the current data from shipping companies, the estimated time of the currently available routes from European seaports to Shanghai is estimated as the table below. However, the time did not include the railway transportation to the port. Usually, it takes 2-3 days from the company in both Hirtenberd and Papa to the seaports.

□ From Austria to Shanghai:

From	To	Time
Bremerhaven	Shanghai	31-60 days
Hamburg	Shanghai	35-57 days

□ From Hungary to Shanghai

From	To	Time
Koper	Shanghai	46-50 days
Koper- Piraeus	Shanghai	53-60 days

Benefits and Challenges

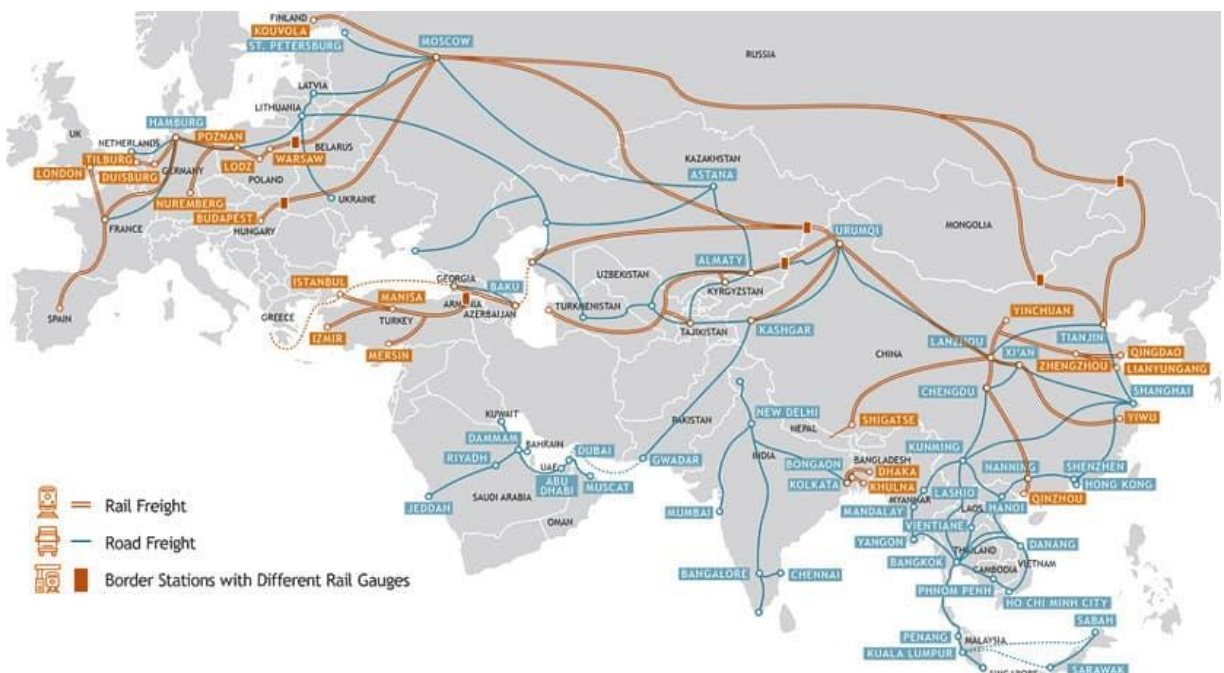
Cargo ships are the most economical option from Europe to China. Other factors also support this mode of transport. There are no dimensional limitations onboard ships. Any number of products can be accommodated (Shiphub, n.d.). Ships are designed to carry dangerous goods. The industry is mature in handling such goods and has regulations to ensure the vessel's safety, crew, cargo, and environment (Crowley, 2018).

Apart from the benefits, some drawbacks of sea cargo also needed to be considered. First, although sea freight has a low cost, it is slower than other transport modes, and stormy weather can add further delays. Poor weather conditions can also lead to cargo loss or damage. Second, some people will hesitate to choose sea freight because there is still no adequate tracking method once they are set off (SIT, 2020). Last, the qualified seaports are limited because certain parts of the world might not have the facilities of ports and terminals and can therefore not receive large ships carrying containers.

Rail Freight



The China-Europe freight train refers to the container international rail intermodal freight train that runs between China and Europe and countries along the "Belt and Road" following fixed train schedules and routes. In Figure 12, the currently paved channels of the China-Europe freight train included three main routes with several sub-routes. In China, 65 China-Europe express trains have been operated stably, reaching 44 cities in 15 European countries. Regarding the route of Hungary, there are currently six lines of the China-Europe Railway that depart from Xi'an, Shenzhen, Changsha, Wuhan, Chengdu, and Jinhua to Budapest. For Vienna, on the other hand, there are relatively few routes with only three cities that can be reached, namely Xi'an, Shanghai and Chengdu (Feng,2020). Depending on the route, it takes 15 to 18 days from the rail travelling from China to Europe from terminal to terminal. That is half the time it takes to move containers by ship. (DSV,2021) With the shortened transit time, there will be less stock in the supply chain and more rotation, leading to lower capital costs.



Rail Freight

Benefits and Challenges

For high-value electronic goods, the utilization of rail freight transport will save up more interest payments on the stock. In addition, rail freight is more cost-effective than air freight. "Depending on the departure point, volume and destination, transporting a container from door to door by rail freight is roughly twice the cost of sea freight and a quarter the cost of sending goods by air." (DSV, 2021) Also, the CO2 emission for rail freight is much lower than air freight, which is considered a more environmentally-friendly transport mode.

However, there is a downside to considering the shipment by rail. For instance, some countries along the route will be boycotted or sanctioned by European countries, vice versa, which means that certain countries may ban some products. Also, the countries without mutual trade agreements need to cross several borders, requiring the company to have detailed paperwork in order (DSV, 2021). Regarding the supporting facilities in cities along the line, Russia's infrastructure is old, and the railway tracks are different from both China and Europe. However, all railways travelling between China and Europe need to pass through Russia, which means that the container from Europe needs to be changed when the train arrives in Russia. The container needs to be changed one more time when the Russian train arrives in China. The cost of railway transportation has increased virtually.

Summary of the Options

	Air	Sea	Rail
Time	Shortest, 3-5 days	Longest, 30-60 days	Medium, 15-18 days
Cost	Highest, 8X	Lowest, 1X	Medium, 2X
Volume	Lowest	Highest, No limitation	Medium



Chapter 4

Optimized logistic option

Research Findings

We have reached out to several logistic companies (n=52) across China, Austria, Taiwan and Vietnam. The logistic expert of Business Upper Austria is further exploring options as of 15th July 2021. In selecting the mode of transportation and coming up with an optimized plan, the team have set up the following parameters:

- ❑ it costs and cycle
- ❑ Safety
- ❑ Sustainability
- ❑ And in-transit inventory costs

Based on our primary research, our conclusions are following:

The Small and medium-sized logistic companies are not capable of carrying out sizable shipments. Their ability to confirming scheduling takes a longer time. Due to limited resources, the company also work with a handful of the shipping company. It's noteworthy, Hirtenberger should be mindful of hidden charges when dealing with small companies.

The large logistics companies expressed interest in carrying out the project. They were able to confirm the quotation in a shorter duration with clear instructions. The large companies provided dedicated account managers. After receiving the quotation, the companies follow up with the team on the latest updates.

Multiple sources confirmed the rail is not a viable option. The Bussiness Upper Austria expert confirmed the same. The underlying reason is that items consider Dangerous Goods (DG).

Research Findings

In terms of airfreight solutions, it's only possible for cargo aircraft (FCL) instead of passenger aircraft. The cargo ship will reach its destination faster. However, the price is significantly higher. Meanwhile, the space is limited with additional charges due to the increased frequency of the flight it will require. A pricing guide illustrates in the picture below.

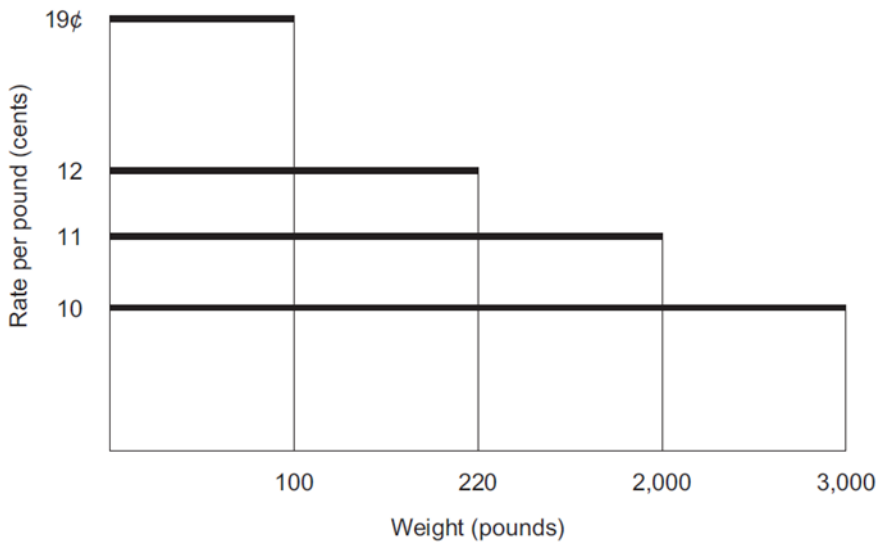


Figure 12. General commodity rates vary by weight of the shipment. The greater the weight the lower the rate

Our recommendation and the cheapest option is water carriers(FCL). The disadvantage of the option is a longer delivery time to the warehouse. It can be offset by considering the ability to ship goods in higher quantity and cost-effectiveness as LCL is not an option. The option is concentrate lower risk compare to the alternative option.

Project Hirtenberger export framework

Our findings strongly indicate that water carriers are the ideal choice.

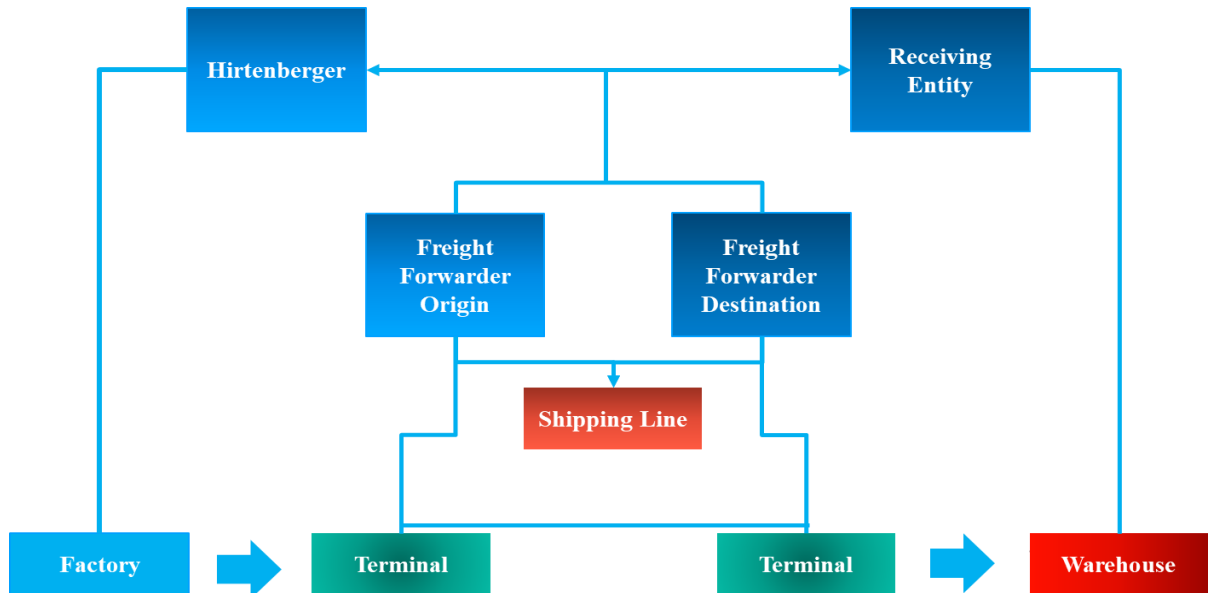


Figure 13 : Anticipated representation of the optimized transportation

Potential Destination Route

Shortest: Hirtenberg warehouse → Hamburg → Shanghai (port)

Transportation from Shanghai port to Shanghai warehouse needs to be arranged further.

Alternative route

Hirtenberg warehouse → Wiencont Container Terminal GmbH, Austria → NTB North Sea → Terminal Bremerhaven, Bremen, Germany → Yangshan Shanghai Guangdong Terminal, Shanghai, China.

The overall duration for this route is estimated at 42 days.

Duration

The average number (n=3) of days for the consignment to reach from Hirtenberger to Shanghai is estimated at 36 days.

Carrier containerization

1. 20' foot standard (STD)
2. 40' foot standard (STD)
3. 40' foot high cube (HQ)

The recommended size is 40' foot high cubes. Due to the economics of scale, the price per ton is more attractive in 40' HQ. We recommend that the batch size from the production facility should match with this size to keep the overall transportation cost optimum.

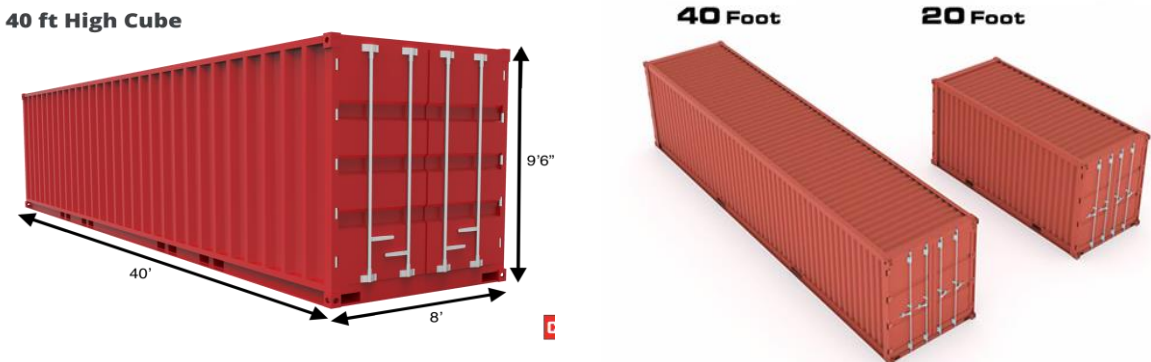


Figure 14 : Different size of containers

20' Ft container

The dimensions of a 20-foot container are:

- ❑ Exterior Dimensions (in meters): 6.10m long x 2.44m wide x 2.59m high
- ❑ Internal Dimensions (in meters): 5.898m long x 2.352m wide x 2.393m high
- ❑ Usable Capacity: 32.6m³

Carrier containerization

A 20-foot container's unloaded weight is 2,300 kg and can, in theory, be loaded to a maximum weight of 28 tons (25,400kg). However, this would depend largely on possible restrictions and limitations of the shipping line, the nature of the cargo and specific details of the shipment.

40' Ft container

The dimensions of a 40-foot container are:

- ❑ Exterior Dimensions (in meters): 12.19m long x 2.44m wide x 2.59m high
- ❑ Internal Dimensions (in meters): 12.025m long x 2.352m wide x 2.393m high
- ❑ Usable Capacity: 67.7m³

A 40-foot container's empty weight is 3,750kg and can be loaded to a maximum overall weight of 29 tons (26,300kg).

40' Ft HQ container

The dimensions of a 40-foot HQ container are:

- ❑ Exterior Dimensions (in meters): 12.19m long x 2.44m wide x 2.99m high
- ❑ Internal Dimensions (in meters): 12.025m long x 2.352m wide x 2.585m high
- ❑ Usable Capacity: 76m³

A 40-foot HQ container's empty weight is 4,150kg and can be loaded to a maximum overall weight of 29 tons (26,300kg).

Carrier containerization

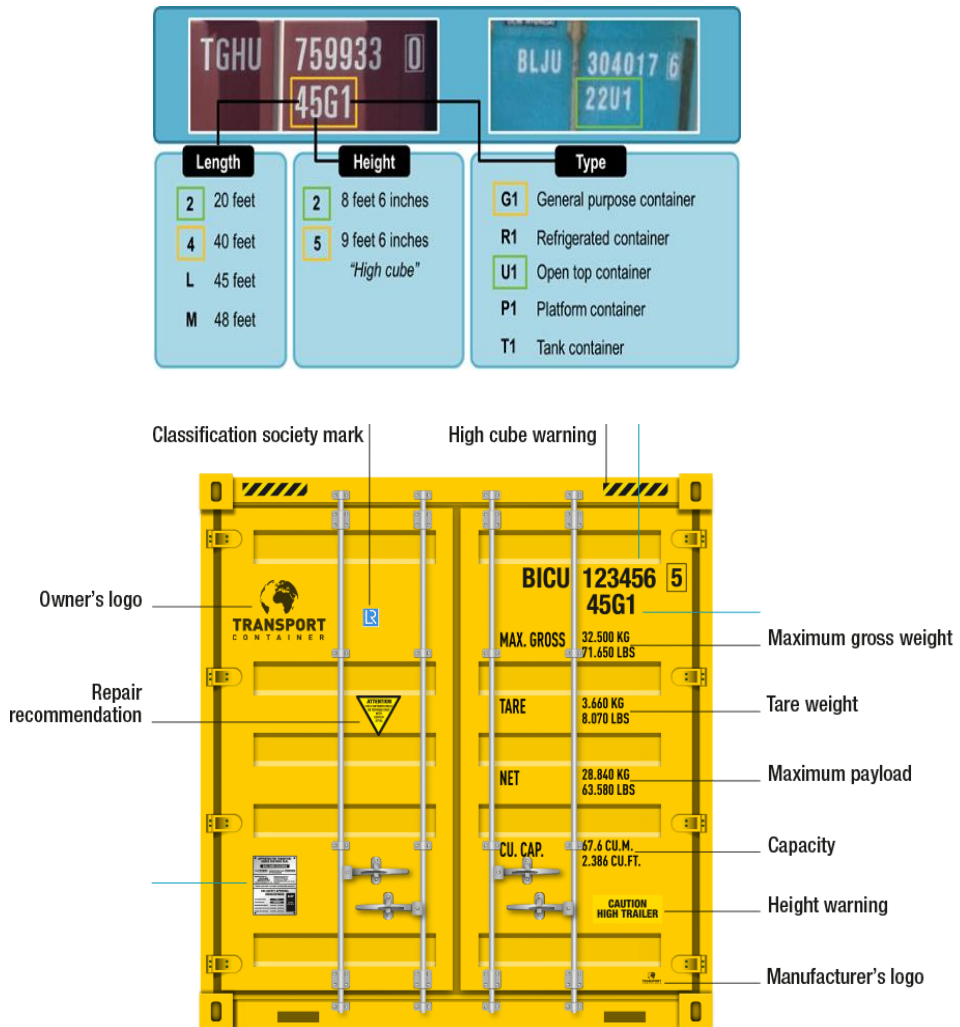


Figure 15 : Identification of container

According to container shipping companies, Hirtenberger can seek two types of logistic companies for quotation: container shipping companies (e.g. Maersk and Hapag Lloyd) and freight forwarders (e.g. DHL). The difference between the two is that freight forwarders can offer a comprehensive one-package solution and Less-than-Container-Load (LCL) service. In contrast, container shipping companies only offer Full-Container-Load service, and the client usually has to deal with the shipment to the logistic company's terminal. However, the price provided by container shipping companies will be lower.

Consignment weight and volume

Electrical Isolator

Dim.: 1220x820x990mm

Gross Weight (max): 500 kg

Volume cubic meter: 0.97

	20 Feet	40 Feet	40 Feet HQ*
Number of European Pallets in one container	25	51	52
Number of containers required to ship 2025 consignment*	50	25	19

In 2025, the number of PCs needed to be shipped in Shanghai is 850,000, approximately 1257 boxes.

Pedestrian Paddle

Dim.: 1200x1000x1000mm

Gross weight(max): 500 kg

Volume cubic meter: 1.2

	20 Feet	40 Feet	40 Feet HQ*
Number of European Pallets in one container	19	46	48
Number of containers required to ship 2025 consignment*	30	12	12

In 2025, the number of PCs needed to be shipped in Shanghai is 350,000, approximately 568 boxes.

Cost

The basis of the freight charge calculation is the following.

The total freight = the sum of the three parts = Basic freight + Port surcharge + Fuel surcharges.

1. Basic freight = unit basic freight × number of containers
2. Port surcharge = unit port surcharge × number of containers
3. Fuel surcharges = unit self-fuel surcharges × number of tickets

Freight Charges (Optimum)

Each 40ft HQ indicative freight charge is USD 1450.

Additional Charges relevant to transportation (Approximately)

Charges	Pricing
Environmental Fuel Fee	USD 91
Inland peak season surcharge Export	EUR 10
Origin Dangerous Cargo Service	EUR 30
Inland Haulage Export	EUR 800
Documentation Fee Origin	EUR 15
Documentation fee - Destination	CNY 450
Terminal Handling Service - Destination	CNY 856

All the rates are indicative. The shipping rate fluctuates weekly. For the longest tenure on locked-in price, the shipping company may charge additional on top of the standard rate. The logistic company suggests that quotation requests are better to be sent after the client has a specific expected delivery time.

Conclusion

Through the ocean is the slowest mode and weather-related services disruption. It allows Hirtenberger to ship the total production quantity in one consignment (12 containers) for the Pedestrian Paddle and two consignments (19 containers) for Electrical Isolator based on the availability in the vessel. A significant player like Maersk or DHL could be prudent logistic companies combined with a local warehouse in China. We recommend that Hirtenberger plan the buyer's warehouse pickup schedule. It will allow the overall storage cost to be relatively low.

Reference

ACEA (European Automobile Manufacturer Association). (2020). ACEA Position Paper Charging and re - fuelling infrastructure required for heavy - duty vehicles. European Automobile Manufacturer Association (ACEA). Retrieved from https://www.acea.be/uploads/publications/ACEA_Position_Paper-Charging_and_refuelling_infrastructure_heavy-duty_vehicles.pdf

AFDC (Alternative Fuels Data Center). (2020). US Department of Energy, Electric Vehicle and Infrastructure Codes and Standards. Retrieved from https://afdc.energy.gov/codes_standards_basics.html

Arruda, Williams. (2020). How Coronavirus Is Creating A Watershed Moment For Remote Work. Forbes (website Retrieved from <https://www.forbes.com/sites/williamarruda/2020/03/01/how-coronavirus-iscreating-a-watershed-moment-for-remote-work/#62cdf8462f9a>

Austrian Embassy in Beijing. (n.d.). Political Relation. Retrieved from: <https://www.bmeia.gv.at/zh/oeb-peking/bilaterale-beziehungen/oesterreich-china/politik/>

Austrian Embassy in Beijing. (n.d. a). Cultural Exchange. Retrieved from: <https://www.bmeia.gv.at/zh/oeb-peking/bilaterale-beziehungen/oesterreich-china/kultur/>

Awais, M. (2020). EUR/RMB – HOW TO TRADE THE EURO VS CHINESE YUAN. Retrieved from Forex Boat Trading Academy: <https://forexboat.com/eurrmb-guide/>

Berman, B. (2020). Washington State passes bill to become a ZEV state, pushes for ban of gas cars. Retrieved from <https://electrek.co/2020/03/11/washington-state-passes-bill-to-become-a-zev-state-pushes-for-ban-of-gas-cars/#adnrb=900000>

BCI Global. (2020). Fast growth of New Silk Rail Routes proves that rail connections between China and Europe are a solid third transport alternative. Retrieved from: <https://bciglobal.com/en/fast-growth-of-new-silk-rail-routes-proves-that-rail-connections-between-china-and-europe-are-a-solid-third-transport-alternative->

Reference

Bloomberg. (2020). The Car Is Staging a Comeback, Spurring Oil's Recovery. Retrieved from <https://www.bloomberg.com/news/articles/2020-05-10/the-car-is-staging-a-comeback-spurring-oil-s-recovery>

Bulis, A., & Skapars, R. (2014). Development of "New Silk Road" Northern Branch through Seaport of Riga in Latvia. *Procedia-Social and Behavioral Sciences*, 150, 1222-1229.

Cambridge Econometrics. (2018). Low-carbon cars in Europe: A socio-economic assessment, European Climate Foundation. Retrieved from: [//www.elementenergy.co.uk/wordpress/wpcontent/uploads/2018/02/Fuelling%20Europe's%20Future%202018_Technical%20report.pdf](http://www.elementenergy.co.uk/wordpress/wpcontent/uploads/2018/02/Fuelling%20Europe's%20Future%202018_Technical%20report.pdf)

CEM-EVI (Clean Energy Ministerial – Electric Vehicle Initiative). (2019). EV30@30 Campaign. Retrieved from <https://iea.blob.core.windows.net/assets/a7571ce8-70dd-43a8-9ed7915cb05fc638/3030CampaignDocumentFinal.pdf>

CHAdEMO. (2019). CHAdEMO Protocols - History and Timeline. Retrieved from <https://www.chademo.com/about-us/history-and-timeline/>

CharIN. (2019). Position Paper of Charging Interface Initiative e.V. CharIN's Position Towards New Standards V5. Berlin: CharIN e.V. Retrieved from https://www.charinev.org/fileadmin/Downloads/Papers_and_Regulations/190618_Position_CharIN_towards_new_standards_V5.pdf

Chen, S. (2020). Alternative-Fuel Car & Automobile Manufacturing in China: Industry Report 3721B. Retrieved from June 16, 2021, from <https://www.ibisworld.com>

China Daily, (2018) Xi Jinping holds talks with Austrian President Van der Belen. Retrieved from <https://baijiahao.baidu.com/s?id=1687557551550569880&wfr=spider&for=pc>

Cong, W. (2018). Austria looks to triple Chinese investment, expand exports to China: minister. *Global Times*. Retrieved from: <https://www.globaltimes.cn/content/1097404.shtml>

Reference

Crowley. (2018). Top Five Advantages of Ocean Freight Shipping. Retrieved from:<https://blog.crowley.com/advantages-of-ocean-shipping>

Daimler. (2018). Daimler Freightliner e-Cascadia. Retrieved from <https://www.daimler.com/sustainability/climate/ecascadia.html>

DBRS. (2020). DBRS Morningstar Confirms China at A (high), Trend Revised to Stable. Retrieved from: <https://www.dbrsmorningstar.com/research/370017/dbrs-morningstar-confirms-china-at-a-high-trend-revised-to-stable>

Dua, R. W. (2019). Understanding potential for battery electric vehicle adoption using largescale consumer profile data, Energy Reports, 5, 515-524.

Duchâtel, M. (2018). Blue China: Navigating the Maritime Silk Road to Europe. European Council on Foreign Relations. Retrieved from: https://ecfr.eu/publication/blue_china_navigating_the_maritime_silk_road_to_europe/

DSV. (2021). Rail freight transport between China and Europe, Retrieved from <https://www.dsv.com/en/insights/expert-opinions/rail-freight-between-europe-and-china>

EAF0 (European Alternative Fuels Observatory). (2020). Electric Vehicle Charging Infrastructure. Retrieved from <https://www.eafo.eu/electric-vehicle-charging-infrastructure>

Earl, T. M. (2018). Analysis of long-haul battery electric trucks in EU, in 8th Commercial Vehicle Workshop, Graz, 17-18 May 2018. Retrieved from https://www.transportenvironment.org/sites/te/files/publications/20180725_T%26E_Battery_Electric_Trucks_EU_FINAL.pdf

Electrive. (2019). CharIN is working on truck charging with up to 3 MW. Retrieved from <https://www.electrive.com/2019/07/11/charin-is-working-on-truck-charging-with-upto-3-mw/>

EUROP-E (European Ultra-Charge Roll Out Project – Electric). (2017). Retrieved from <https://ec.europa.eu/inea/en/connecting-europe-facility/cef-transport/2017-de-tm-0064-w>

Reference

- EVCIPA. (Electric Vehicle Charging Infrastructure Promotion Alliance) (2019). China, 2019-2020 China Charging Infrastructure Development Annual Report. Retrieved from https://news.cnev.cn/Info_127747.html
- Feng, R. (2020). What is the China-Europe Railway Line? Detailed explanation of the route map of China-Europe Express. Retrieved from <https://www.imsilkroad.com/news/p/397710.html>
- Federal Ministry Republic of Austria. (n.d.). Austria's economic relations with the Asia-Pacific region. Retrieved from: <https://www.bmdw.gv.at/en/Topics/International/Austria-s-Economic-relations-by-region/Asia-and-Pacific.html>
- GB/T. (2019). China National Standards. Retrieved from <https://www.gbstandards.org/>
- Global Workplace Analytics. (2015). Advantages of Agile Work Strategies for Companies. Retrieved from <https://globalworkplaceanalytics.com/resources/costs-benefits>
- Gibbs, N. (2018). China investment helps Austria to benefit from electric car boom. Retrieved from Automotive News Europe: <https://europe.autonews.com/article/20180720/COPY/307139997/china-investment-helps-austria-to-benefit-from-electric-car-boom>
- Hall, D. C. (2019). Electric vehicle capitals: Showing the path to a mainstream market. Retrieved from <https://theicct.org/publications/ev-capitals-of-the-world-2019>
- Hall, D. & N. Lutsey. (2017). Emerging best practices for electric vehicle charging infrastructure, Washington, DC: The International Council on Clean Transportation (ICCT), <https://theicct.org/publications/emerging-best-practices-electric-vehiclecharging-infrastructure>
- Horrox, J. and M. Casale. (2019). Electric Buses in America: Lessons from Cities Pioneering Transportation. US PIRG Education Fund and Environment America Research & Policy Center. Retrieved from https://uspig.org/sites/pirg/files/reports/ElectricBusesInAmerica/US_Electric_bus_scrn.pdf

Reference

- Houbbadi, A. et al. (2019). Overview of Electric Buses deployment and its challenges related to the charging: the case study of TRANSDEV, <https://hal.archives-ouvertes.fr/hal-02148377/document>
- Hove, A. and D. Sandalow. (2019). Electric Vehicle Charging in China and the United States. Columbia School of International and Public Affairs, Center on Global Energy Policy. Retrieved from https://energypolicy.columbia.edu/sites/default/files/file-uploads/EV_ChargingChina-CGEP_Report_Final.pdf
- IEA (International Energy Agency) (forthcoming). Electricity Statistics.
- IEA. (forthcoming). Energy Technology Perspectives 2020.
- IEA. (2020). Mobility Model. Retrieved from <https://www.iea.org/areas-of-work/programmes-andpartnerships/mobility-model>
- IEA. (2019a). World Energy Outlook 2019. Retrieved from <https://www.iea.org/reports/world-energyoutlook-2019>
- IEA. (2019b). Global EV Outlook 2019: Scaling-up the transition to electric mobility. Retrieved from <https://www.iea.org/reports/global-ev-outlook-2019>
- IEA. (2019c). Fuel Economy in Major Car Markets: Technology and Policy Drivers 2005-2017. Retrieved from www.iea.org/reports/fuel-economy-in-major-car-markets
- IEA. (2018a). Global EV Outlook 2018: 3 million and counting. Retrieved from <https://www.iea.org/reports/global-ev-outlook-2018>
- IEA. (2018b). The Future of Cooling. Retrieved from <https://www.iea.org/reports/the-future-of-cooling>
- IEC (International Electrotechnical Commission). (2017). 61851-1:2017 Electric vehicle conductive charging system - Part 1: General requirements. Retrieved from <https://webstore.iec.ch/publication/33644>

Reference

Ionity. (2019). Ionity and EUROP-E Pan-European EV infrastructure charges ahead after IONITY secures EUROP-E funding. Retrieved from https://ionity.eu/_Resources/Persistent/ff3594777138e66e75dcef2cd016cc4f712dece4/20190425_EUROP-E_press_release.pdf

Ipsos. (2020). Impact of coronavirus to new car purchase in China. Retrieved from <https://www.ipsos.com/sites/default/files/ct/news/documents/2020-03/impactof-coronavirus-to-new-car-purchase-in-china-ipsos.pdf>

Klein, M. C. (2020). Behind the Stability in China's Currency: Beijing's Hidden Hand. Retrieved from Barron's: <https://www.barrons.com/articles/behind-the-stability-in-chinas-currency-beijings-hidden-hand-51602846003>

Lee, R. (2019). The Top 8 Most Tradable Currencies. Retrieved from Investopedia: <https://www.investopedia.com/trading/most-tradable-currencies/>

Liang, Y. (2019). Economic Watch: Chinese yuan to remain stable despite temporary fluctuations. Retrieved from Xinhua Net: http://www.xinhuanet.com/english/2019-06/17/c_138149199.htm

McKinsey & Company. (2018). The European electric bus market is charging ahead, but how will it develop? Retrieved from <https://www.mckinsey.com/industries/oil-and-gas/ourinsights/the-european-electric-bus-market-is-charging-ahead-but-how-will-itdevelop>

Melaina, M. B. (2016). National Economic Value Assessment of Plug-In Electric Vehicles - Volume 1. National Renewable Energy Laboratory.

METI (Ministry of Economy, Trade and Industry of Japan). (2018), Long term goal and strategy of Japan's automotive industry for tackling global climate change. Retrieved from <https://www.meti.go.jp/press/2018/08/20180831007/20180831007-2.pdf>

Nan, Z. (2021). Business ties between China and Austria to only get stronger. ChinaDaily. Retrieved from: <http://epaper.chinadaily.com.cn/a/202105/28/WS60b02caea31099a2343566c7.html>

Reference

New York Times. (2020). Trump Rollback of Mileage Standards Guts Climate Change Push. Retrieved from <https://www.nytimes.com/aponline/2020/03/31/business/bc-us-trump-mileagerollback.html?searchResultPosition=1>, 31 March 2020.

NDRC. (2019). The National Development and Reform Commission and the Ministry of Digitalization and Economic Affairs of the Republic of Austria signed the "Memorandum of Understanding on Cooperation in Third-Party Markets". Retrieved from https://www.ndrc.gov.cn/fzggw/wld/hlf/lddt/201904/t20190430_1166963.html

OECD. (n.d.). China/Austria. Retrieved from OECD: <https://oec.world/en/profile/bilateral-country/chn/partner/aut>

OEM Plants Shanghai. (n.d.). MarkLines Automotive Industry Portal. Retrieved from https://www.marklines.com/en/global/chn_shanghai#list.

Ocean Insights. (n.d.). Eight Facts about the Shipping Industry. Retrieved from: <https://www.ocean-insights.com/8-facts-about-the-shipping-industry/>

Picchi, A. (2020). If you're working from home, chances are you'll save money, Retrieved from <https://eu.usatoday.com/story/money/2020/03/22/working-home-likely-save-you-money/5024967002/#:~:text=Some%20employers%20say%20they%20plan,that%20specializes%20in%20flexible%20jobs>

Plötz, P. G. (2019). Impact of electric trucks powered by overhead lines on the European electricity system and CO2 emissions, Energy Policy, 130, pp.32-40.

Qiu, Z. (2019). Analysis of the Business Environment in Central and Eastern Europe: Taking Austria as an Example, Retrieved from: https://www.sohu.com/a/289682112_610982

Ronanki, D. K. (2019). Extreme Fast Charging Technology — Prospects to Enhance Sustainable Electric Transportation, Energies, 12(19), 3721.

Routley, Nick. (2020). 6 charts that show what employers and employees really think about remote working (website). Retrieved from <https://www.weforum.org/agenda/2020/06/coronavirus-covid19-remote-working-office-employees-employers>

Reference

SAE (Society of Automotive Engineers). (2010). SAE J1772 Electric Vehicle and Plug-in Hybrid Electric Vehicle Conductive Charge Coupler, J1772_201001.

Shiphub. (n.d.). How long does the ship from China sail? Retrieved from:<https://www.shiphub.co/how-long-does-the-ship-from-china-sail/>

SIT. (2020). Pros and cons of sea freight forwarding – SIT Spain International Mobility. Retrieved from: <https://www.sitpain.com/en/pros-and-cons-of-sea-freight-forwarding/>

Smart, J. (2014). Workplace charging case study: Charging station utilization at a work site with AC level 1, AC level 2, and DC fast charging units, Idaho National Laboratory.

Spöttle, M. J. (2018). Research for TRAN Committee-Charging infrastructure for electric road vehicles, European Parliament.

Szyszkowitz, T. (2020). Between Affluence and Influence: Examining the Role of Russia and China in Austria. Royal United Services Institute.

Tesla. (2019). Introducing V3 Supercharging. Retrieved from <https://www.tesla.com/blog/introducing-v3-Supercharging>

T&E (Transport & Environment). (2020). Recharge EU trucks: time to act! A road map for electric truck charging infrastructure deployment. Transport & Environment and European Federation for Transport and Environment AISBL. Retrieved from https://www.transportenvironment.org/sites/te/files/publications/2020_02_RechargeEU_trucks_paper.pdf

The Brussels Times. (2020). 84% wants to keep teleworking after coronavirus crisis. Retrieved from <https://www.brusselstimes.com/all-news/belgium-all-news/111569/84-wants-to-keep-teleworking-after-coronavirus-crisis/>

Trading Economics. (2020). Austria exports to China. Retrieved from: <https://tradingeconomics.com/austria/exports/china>

Trading Economics. (2021). Austria exports to China. Retrieved from Trading Economics: <https://tradingeconomics.com/austria/exports/china>

Reference

TTTech. (2018). SAIC and TTTech Establish Joint Venture in Shanghai to Deploy the “Smart Brain” for Autonomous Driving Cars in China. Retrieved from TTTech: <https://www.tttech.com/press/saic-and-tttech-establish-joint-venture-in-shanghai-to-deploy-the-smart-brain-for-autonomous-driving-cars-in-china/>

Waltraut Urban. (2010). Economic Relations between Austria and China. Wiener Institut für Internationale Wirtschaftsvergleiche. Retrieved from: <https://wiiw.ac.at/economic-relations-between-austria-and-china-p-2100.html>

World Governments Bonds, (n.d.). China Credit Rating. Retrieved from: <http://www.worldgovernmentbonds.com/credit-rating/china/>

Xinhua, (2020). Foreign media attention: China and Europe announce the completion of investment agreement negotiations. Retrieved from <https://baijiahao.baidu.com/s?id=1687557551550569880&wfr=spider&for=pc>

Yu, L. (2019). Interview: Austria-China trade has great potential: expert. Retrieved from XinHua Net: http://www.xinhuanet.com/english/2019-05/21/c_138077863.htm

ZeEUS. (2017). ZeEUS eBus Report #2, ZeEUS. Retrieved from zeus.eu/uploads/publications/documents/zeeus-ebus-report-internet.pdf