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Research on the process and implications of the world energy transition under the COVID-19 pandemic

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Abstract

The global outbreak of COVID-19 has posed severe challenges to the world economy. It has changed the development trend of the world economy and society, increased uncertainties in the future, and quietly changed the international order, promoting the formation of a new pattern of "one world, two systems". In the short term, the pandemic will have a huge impact on the global oil and gas market and industry development. In the long run, the epidemic has presented a distinct feature for the global energy transition. The enlightenment of these changes to all countries is that the fundamentals of the world economy are still the biggest basis for determining the trend of the energy market, and the contradiction between supply and demand is the main line to explain this energy transition crisis. It is also important to consider that the energy market should establish a mature buffer mechanism in self-adjustment and capital allocation due to the combination of multiple internal and external factors during the epidemic and energy transition period.

Key words: COVID - 19 outbreak; World energy; Energy transition; International economic order

1. Trends in the world economy and changes in the international order under the COVID-19 pandemic

The current crisis facing the world economy comes from external economic and financial shocks. It is a health crisis not seen in a century and a social crisis more serious than the 1918 Spanish flu, because this is a "great blockade" under economic globalization and its impact is highly uncertain.The world faces an economic downturn as deep and as bad as the Great Depression of the 1930s, or worse.The World Trade Organization (WTO) announced a 9.2% decline in global trade volume in 2020, and the International Monetary Fund (IMF) announced a 4.4% decline in 2020.International trade, investment, production, living, supply, demand and so on have been severely impacted in all regions of the world.Today in 2008 than the macro and micro situation faced by the Wall Street financial storm is more difficult to solve, and health, economic crisis, social crisis, political crisis, such as overlay, international relations, geopolitical, global governance is facing severe challenges, income distribution, global development, contradiction between the poor and the rich and the poor and rich countries deteriorated.(LIANG Ling, SUN Jing, Yue Mao-jian, 2020).The impact of the pandemic has exceeded expectations. The global industrial chain, economic globalization and economic structure all need to be adjusted or reshaped.The international economic order is fragmented and may be restructured.The new scientific and technological revolution and industrial revolution have entered the expansion stage ahead of schedule, which will boost global economic development in the era of COVID-19. (Qian Bozhang, Li Min, 2018)

1.1 The international oil market is changing dramatically

First, global oil consumption has fallen by the most in history.From 2015 to 2019, global oil consumption showed an overall growth trend.In 2020, due to the impact of COVID-19, most countries adopted home quarantine, curfews and other measures to prevent and control, which led to a significant drop in global oil consumption.In 2020, global oil consumption was 88.477 million

barrels, down 9.35 percentage points from 2019.(Ma Yongsheng ,2021) Second, the largest decline in global crude oil supply in history (global oil supply fell by about 6 million b/d year-on-year in 2020);(China Energy News ,2020) Third, global oil demand has fallen by the most in history.According to the statistics of the World Energy Agency (IEA), the overall demand for petrochemical products fluctuates significantly from 2019 to 2021. In 2020, the global spread of the epidemic has caused a huge impact on the global petrochemical industry, and the demand for all kinds of petrochemical products has decreased to varying degrees.Total demand fell 8.73% from 99.7 MB/d in 2019 to 91.0 MB/d in 2020.In 2021, as the global epidemic gradually stabilizes, the total global petrochemical demand will rise to 96.5 million b/d in 2021, according to the world Energy Agency.(Che Changbo, DING Feng ,2021) Fourth, the gross profit of global refining reached the lowest level in history.Petrochemical products are obtained by further chemical processing of raw materials provided by the refining process on the basis of refining.According to data from the World Energy Agency (IEA), global crude oil processing capacity and total crude oil processing volume showed an upward trend from 2015 to 2019.Due to the impact of the global epidemic in 2020, the global crude oil processing volume in 2020 was 78.90 million b/d, down 8.36% year on year.In 2021, as the epidemic gradually improves and data are not available, global refinery crude oil processing is expected to rebound. The IEA expects global crude oil processing to reach 83.40 MMBPD in 2021. Fifth, the international oil price hit an unprecedented negative level.Sixth, benchmark oil price difference and discount hit the largest volatility in history;Seventh, international oil companies suffered the worst losses since World War II.

Structural changes in demand.Take the Chinese market as an example, the demand for refined oil products in China dropped 3.47% year on year, with gasoline down 0.49%, diesel up 1.97% and kerosene down 38.4%.China's overall oil demand growth has slowed over the past decade, from 11.0% in 2010 to 3.4% in 2019.Diesel, in particular, has slowed markedly, leading to a continuous decline in the ratio of consumer fuel to gasoline, which has slowed down in recent years and is now down to around 1.2 due to COVID-19.With the implementation of China's regional development strategy and the increasing cluster effect of city clusters, the growth center of refined oil consumption is increasingly concentrated in the eastern coastal and southwestern regions, while the demand in northeast and North China has passed its peak.

Structural changes in supply.Take the Chinese market for example. By the end of 2020, China's annual refining capacity reached 870 million tons, basically forming a "three world" pattern between Sinopec, petrochina and other refiners. Local refiners have become an important part of China's refining capacity.In terms of regional distribution, east China and northeast China have the largest concentration of oil refining capacity in China, forming a cascade distribution with the east as the main region and the central and western regions as the supplementary region.Based on the monitoring of refinery production and operation, the oil product yield was adjusted to a reasonable level, and the blend oil was included in the statistical scope. It is estimated that the proportion of off-balance sheet hidden resources in the total supply reached 18.4%.Affected by the epidemic, China's refined oil exports declined significantly in 2020, but slowly recovered in 2021 as the global epidemic situation gradually improved and overseas oil demand recovered.At the same time, with zhejiang petrochemical export quota, domestic oil surplus pressure has also been alleviated.

1.2 Drastic changes in the international natural gas market

In 2020, both sides of the global supply and demand of natural gas will be greatly impacted by the

epidemic, the collapse of international oil prices and other factors. The growth rate of global natural gas consumption will turn from positive to negative, and the annual global consumption will drop by more than 3%.As a result, the supply of natural gas resources is loose, and the export of natural gas resources is obviously blocked. The upstream production of the United States is blocked, and many export cargoes are cancelled.The bidding for the new LNG production line of Qatar north Gas Field was delayed and the negotiation progress was slow.Russia's upstream gas fields have been forced to shut down due to falling demand in Europe.International natural gas prices have rebounded after hitting record lows.In 2020, the Price of Henry Hub gas in the US fell to its lowest level in nearly two decades, while the price of National Balancing Point (NBP) in the UK briefly fell below $2 per million British thermal units.Natural gas prices in major markets are expected to bottom out and rebound in the future.As the epidemic eases and oil prices recover in 2021, countries will take measures to stimulate economic recovery, and global natural gas demand will recover significantly, supply and demand will return to pre-epidemic levels and the gap between supply and demand will narrow.LNG supply capacity is lower than expected, with global LNG supply capacity reduced by 10 million tons in 2021 compared to forecast, resulting in a surplus of about 80 million tons.

The share of spot LNG trade in the world continues to increase, and trade contracts are more flexible.The global LNG trade volume in 2021 is about 273 million tons, up 3.03% year on year, among which spot trade volume accounts for 29.4%, up 1 percentage point year on year.The share of global spot LNG trade continues to increase, with only 19% of spot LNG trade in 2013.At the same time, the pricing model of LNG trade contract tends to be diversified, and the slope of link with oil price declines.Global LNG contract terms are relaxed, with nearly 90% of new contracts signed without destination restrictions; (ZHANG Yiming,2018) For the first time, LNG supply agreements were priced on coal indices;Contract flexibility increased, short term, small quantity of purchase and sales contracts increased.

In the context of the COVID-19 pandemic, a total of 13 LNG projects have been delayed due to weak demand, low gas prices and plummeting international oil prices. Global new LNG capacity will be reduced from the planned 270 million tons per year to 130 million tons per year, and the LNG supply glut will gradually ease and there may be a shortfall in the future.Due to the collapse of international oil prices and the impact of COVID-19, oil business income of major international companies has shrunk. 28% of the investment in LNG projects comes from oil income. As a result, the final investment decision of about 10 projects has been postponed.The new investment cycle will be extended to around 2023 and the corresponding production cycle will not occur until after 2025.The global natural gas market eased and then tightened, with prices bottoming out and rising.Demand growth will slow from 2.3% in the past five years to 1.5%, and the gap between supply and demand will decrease from 200 billion cubic meters in 2020 to 20 billion cubic meters in 2025.

2. Characteristics of the global energy transition in the context of COVID-19

Despite limited progress, the world energy transition has never stopped. It has gone through a bumpy road in the past 50 years of modern history. The world energy transition under the COVID-19 pandemic presents the following distinctive characteristics of The Times.

2.1 Uneven progress of energy transformation among regions.

Different regions, different countries and even different parts of the same country face different transformation tasks.Their energy consumption levels and access to energy services vary greatly due

to the differences in levels of development.While some countries are committed to achieving low-carbon energy consumption and reducing the share of fossil energy consumption, some of the poorest and most backward countries or regions have not been connected to modern energy and cannot allow their people to enjoy modern energy services.Globally, some underdeveloped regions have yet to realize the first and second energy transition, and are in a state of energy poverty without access to electricity or modern power systems.That is why one of the UN's 2030 Sustainable Development Goals is to achieve affordable clean energy for all.Due to the accelerated the development in recent years, electric power was available parts of the world population is above 1 billion, they are mainly distributed in less developed areas of Africa and Asia, not only to be connected to the electricity, electrified, and need to leapfrog development, the increase of energy consumption at the same time as far as possible to reduce carbon emissions, which means that the task of energy transformation task.In the wake of THE COVID-19 pandemic, these regions and countries need to bridge the development gap caused by the lag of the first and second transitions, while also taking into account the needs of low-carbon transitions in the context of the pandemic.The developed economies represented by the European Union are the important advocates and practitioners of contemporary energy transformation.Increasing the share of renewable energy is part of the energy and climate policies adopted by the European Commission for 2030 and 2050 respectively.Under the impact of COVID-19, the various stages of the energy transition are not completely connected, but also overlapped and overlapped, that is, the next transition has started before the last one is completed.This is particularly evident in the energy transition of less developed countries.

2.2 The path of energy transformation is differentiated

Countries that have made some progress in energy transformation mainly include the United States, Brazil and Germany.According to the BP World Energy Outlook 2020, the United States has diversified its energy mix.The United States and Brazil are projected to be the two leading biofuel producers by 2040, growing from 2 million b/d to 4 million b/d.However, the transformation patterns of the three countries are not the same and cannot be replicated.Starting from its own geographical advantage, Brazil uses sugarcane ethanol to promote energy transformation.The United States uses its technological advantages to develop corn ethanol and biodiesel.While Germany "abandon nuclear", while using renewable energy such as wind and solar energy, reduce the proportion of fossil energy in energy consumption.The pace of the energy transition under COVID-19 also varies between countries.Generally speaking, due to path dependence and development inertia, the energy transition of small resource-rich countries is faster than that of large countries.Countries such as the Netherlands and Kuwait have rapidly transformed themselves with the help of large quantities of peat at home, while the latter's rich oil resources have helped them quickly enter the petroleum age.Iceland, for example, has shaken off its dependence on coal and oil with the help of hydro and geothermal, renewable sources of energy.In contrast, some large countries, especially those with high per capita energy consumption, "cannot achieve rapid energy substitution because they have already built extensive infrastructure to match their fuel needs."It has also discovered a lot of gas, and despite a big push to develop gas in rich areas and offshore, it has taken Britain 30 years to achieve what the Netherlands achieved in 10 years.

2.3 Diversification of alternative energy sources

Different from the historical transformation form in which one main energy source replaces another,

the current energy transformation presents a trend of diversification, that is, there are many alternative energy options, but none of them has the competitiveness of surpassing other energy sources.Energy resources or mature technologies that can promote energy transformation have not yet emerged in the contemporary energy transformation process. Some alternative energy sources or technologies that were once promising have gradually lost their appeal.In the field of energy technology, there are many failures caused by premature scale.At present, all kinds of alternative fossil energy such as nuclear energy, hydropower, wind power, biomass energy will continue to play a role in the process of energy transformation, but it is difficult for any single energy to obtain monopolistic advantages.The diversification of current energy structure is embodied in the power system.The three major sectors of energy consumption include transportation, heating and electricity, which accounts for 42% of primary energy demand.The progress of energy transformation is mainly reflected in the diversification of power generation energy options.The power generation market now has a very wide range of options, with coal, natural gas, hydro, nuclear, oil, onshore and offshore wind, biomass, solar pv and other renewable sources available for power generation. The competitive situation among different power sources is more complex. According to bp's statistical data analysis from 2015 to 2020, in terms of new installed capacity, renewable energy is roughly equivalent to the combined new capacity of coal and natural gas. This shows that the power sector is undergoing a major transformation. If the existing technology and resource conditions remain unchanged, the diversification of energy pattern will continue in the foreseeable future.

3. Implications for countries from the global energy transition in the context of COVID-19

3.1 Economic fundamentals remain the biggest basis for determining the trend of the energy market

In 2020, the world economy suffered a major impact from COVID-19, with a negative growth of 4.4%, the biggest drop in the world economy in nearly 50 years. In the same year, the world energy market was also hit hard, with global primary energy consumption falling by 4.5%, the biggest drop since 1945. Energy prices also hit rock bottom and even turned negative. As a result, energy producers have slashed production. According to another set of statistics, China's economy grew by 2.3% in 2020 under the premise that the epidemic was effectively brought under control. Total energy consumption for the year increased by 2.2%. China's import of natural gas increased by 5.3% in 2020, but its import value decreased by 19.8%. In 2021, the world economy a significant rebound, major institutions were the world economy in 2021 is expected to its fastest pace in nearly 50 years, probably more than 5%, energy demand has rebounded sharply, the international energy agency (IEA) estimated annual energy demand will grow 4.6%, energy production can't keep up with, cause energy prices rose, International oil prices have returned to levels of seven years ago. Comparing these data, it can be found that the overall energy demand is completely consistent with the economic fundamentals, which fully proves that the economic fundamentals are still the biggest basis for determining the trend of the energy market and energy policy making. Therefore, the energy market and energy policy making should not be viewed in isolation from the market fundamentals.

To revelation, pay attention to the change of energy prices in the market fundamentals, the change of energy prices are provided to the market supply and demand and valuable signal regulator, a perfect market operation, should be able to accurately and promptly supply and demand situation will be reflected in the price, help the two sides of supply and demand timely adjust strategy,

especially in a timely manner to help regulators found significant risks in the field of energy. The energy system is so complex that it is hard to have a single indicator other than price that gives a faithful, immediate and intuitive picture of the market. Negative oil prices in 2020 and high electricity prices in 2021 do not reflect market failures caused by the pandemic, but that markets are still functioning.

3.2 A variety of external factors superimposed to form the energy storm

The energy market crisis is a standard "energy storm", a term used to describe an unusual confluence of circumstances that results from extraordinary intensity. In less than two years, international energy markets have been buffeted, or simultaneously, by the pandemic of the century, a rare catastrophe, a shrinking economy, a rebound in demand and increased constraints on global emissions cuts. The COVID-19 pandemic has completely disrupted the world economic order. Supply chains have plunged into chaos that could only be seen during world wars. Inflation in some countries has continued to soar, contributing to tight energy supplies and rising prices. From The Americas to Asia and Europe, extreme weather such as cold wave, heat wave, hurricane, rainstorm and flood disrupted energy production and consumption, and the market showed a jump fluctuation. The global emission reduction constraint is unprecedented strengthened, the diversified strategy of energy security is seriously weakened in some regions, and how to deal with the energy crisis has triggered unprecedented controversy; With the increasing uncertainty of future expectations, energy exporting countries and large oil and gas enterprises are extremely cautious in the face of market changes and adjust more conservatively. Over the past 50 years, the world has suffered many energy crises of varying degrees, but never such a complex situation with multiple lines and fields as today's.

The inspiration for all countries is that energy transformation should pay attention to multiple factors. Similarly, the comprehensive improvement of the energy system, governance system and market mechanism can promote the transformation of the world energy system to a more low-carbon and rational modern direction of resource utilization. The global energy system faces challenges such as fairness, security of supply and green development, and severe uncertainties. The structural transformation of the global energy system calls for strong global governance. Regional conflicts and different development goals make it difficult to establish a unified leadership system for world energy. The commodity property of energy requires the establishment of a perfect market mechanism to promote the energy trade between countries.

3.3 The energy market in transition has not yet established a self-adjustment mechanism to withstand shocks

The causes of this energy transition crisis are complex and cannot be arbitrarily attributed to COVID-19. However, objectively speaking, the global energy system in transition is in a fragile run-in stage, and the mechanisms in all aspects are not perfect. It cannot automatically resist the strong external impact, and even needs the protection of policies to develop. Gas by many countries as the important transition energy during energy transformation, in recent years the international natural gas demand continues to increase, but there is a big different natural gas and petroleum, natural gas supply season strong volatility, price volatility, decentralized pricing mechanism, transmission and storage demand is high, if the natural gas as the main energy, Energy security policies and infrastructure must be well developed. However, the importance of gas reserves is not uniform, and the European Union suffered a severe gas supply crisis, and it did not build enough reserves in the

summer is directly related. In 2020, the proportion of renewable energy in the UK's total electricity generation will reach 43%, 6 percentage points higher than fossil energy, creating a record of 67 days of coal-free power generation cycle, making the UK a leader in energy transition. However, in 2021, there will be a long period of no wind or low wind in the North Sea of the UK, and the output of wind power generation will fall off a cliff, resulting in the UK becoming the most serious energy problem in Europe

Facing the challenges of energy equity, energy security, energy greening and economic development needs of all countries, it is necessary to further strengthen the optimization of energy systems in all countries while understanding the development status of energy systems, and establish a self-regulation mechanism that can withstand shocks. These include enhancing the design of passive systems, enhancing infrastructure connectivity, promoting energy-saving technologies, enhancing energy system flexibility and renewable energy absorption capacity, etc. In order to achieve self-regulation of energy system, it is necessary to carry out strategic adjustment in energy governance, and the implementation of energy governance measures, it is necessary to use effective policy tools to guide the operation of energy market. In the future, the relevant systems and rules of energy management should be further improved, while continuing to promote the marketization of energy and improve the energy market..

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