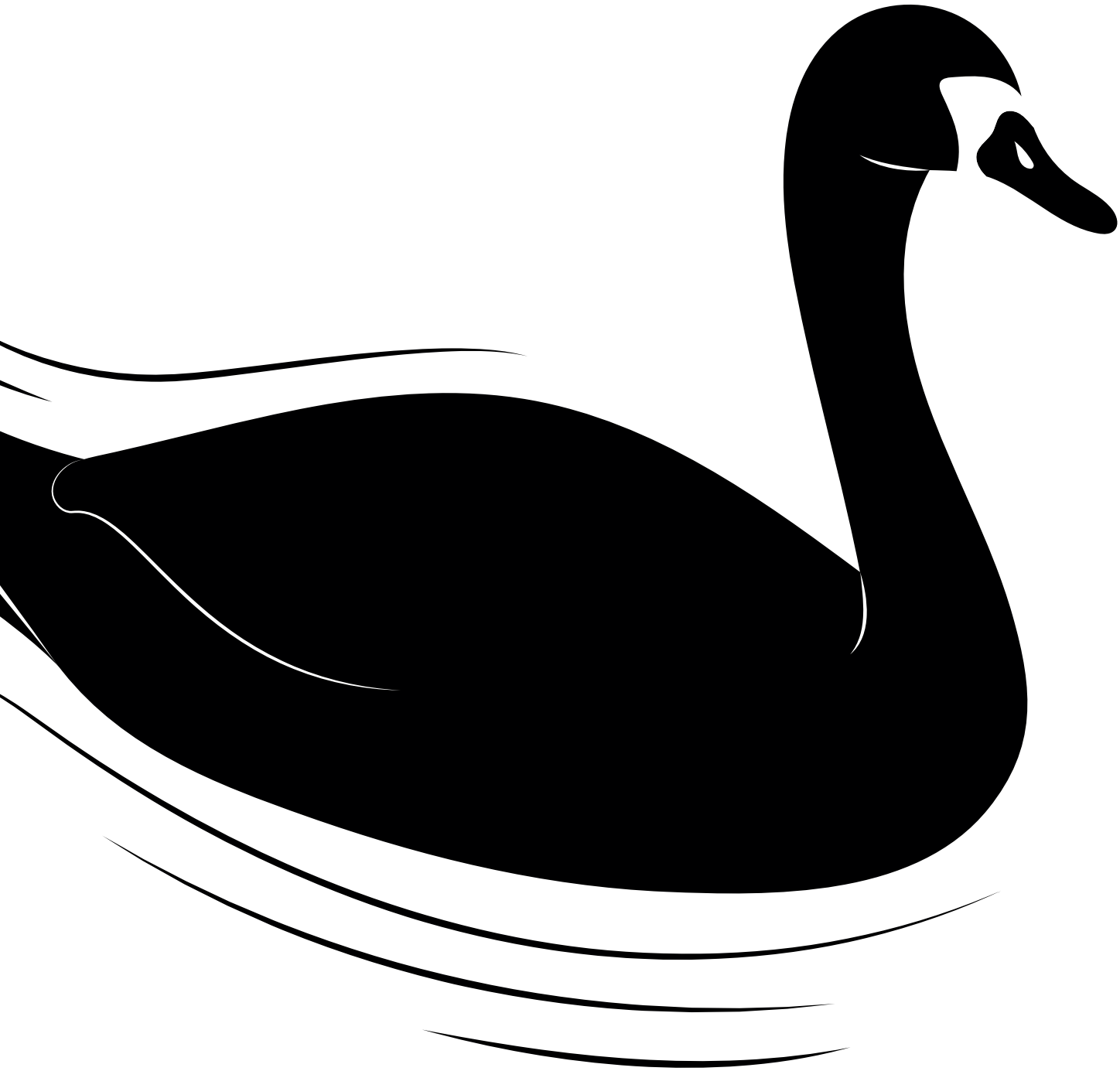
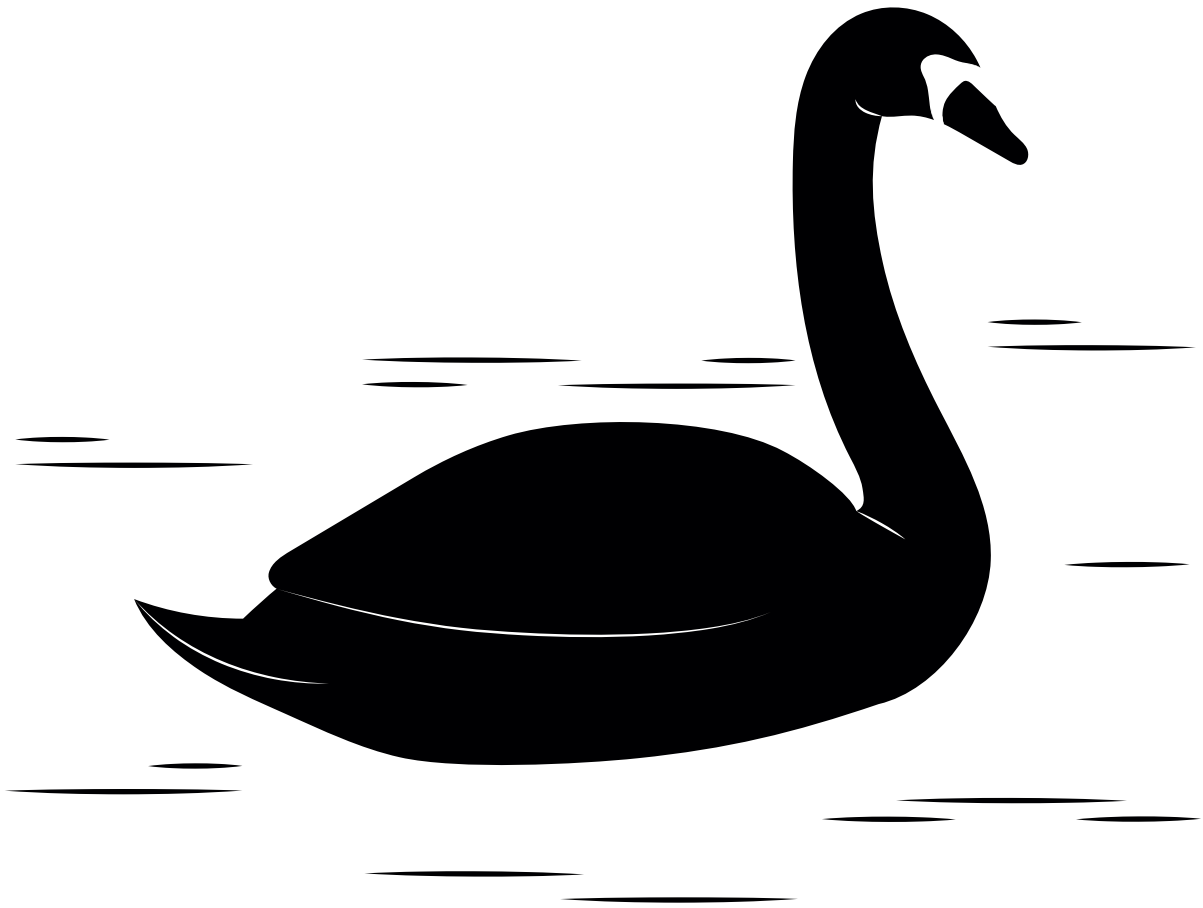
BRICS YEA

SPECIAL REPORT

BLACK SWANS IN BRICS ENERGY SECTORS



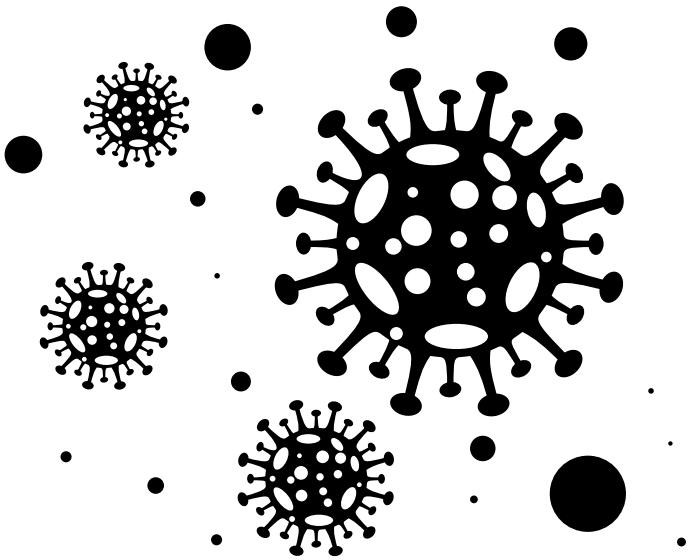
BRICS YOUTH ENERGY 2020 OUTLOOK



'Remember that you are a Black Swan.'

Nassim Nicholas Taleb,

The Black Swan: The Impact of the Highly Improbable



BRICS YOUTH ENERGY 2020 OUTLOOK

SPECIAL REPORT

BLACK SWANS IN BRICS ENERGY SECTORS

A whitepaper that shows how young people visualise unforeseen challenges for energy sectors through analysis of the past

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BRAZIL

YOUTH PERSPECTIVE

Key findings

- The discovery of a new oil reserve on the Brazilian coast could impact the economy and delay the growth of renewable technologies in the country such as biofuels
- The reduced demand from the domestic conventional energy market caused by effects of COVID-19 drove an increase in net exports of oil and its derivatives in the second quarter of 2020 compared to the first quarter
- During the pandemic solar generation was the only source of the National Interconnected System that showed growth. It increased 34.8% in June due to the entry of new plants in the system over the last year.
- In Brazil considering the growth in the use of natural gas, there is a convenient opportunity for energy integration between renewable and fossil sources, with positive impacts on the social, environmental and economic areas of the country.
- The COVID-19 pandemic may be described as a Grey Swan as it brought new challenges, such as the exposure of a series of vulnerabilities regarding social inequality and opportunities, such as the growth of e-commerce and technological innovations.

1. "BLACK SWANS" THAT HAD THE BIGGEST IMPACT

1.1. Political corruption scandals starting in 2014 involving Brazil's biggest state-owned oil producing company, Petrobras.

Petrobras is the largest public company in Brazil, with operations in more than 20 countries around the world and employing by 2014 more than 60 thousand people. After the scandals, in 2014 alone Petrobras dismissed some 8 thousand employees (around 12% of the total workforce by then) and witnessed its market value drop significantly, from a peak of 316 billion US$ in 2008 (a reflex of Brazil's economic growth) to 44 billion US$ by the end of the same year . The impact of that "Black Swan" was hard felt and the company still did not manage to recover completely, which is demonstrated by the stabilization of its market value in relatively low levels.

1.2 Climatic cataclysms such as unexpected periods of droughts

Given a large number of drainage basins in the country, hydroelectric was a logical choice to generate energy and electricity. By 1990, hydroelectric accounted for 80% of the electricity matrix; therefore, Brazil's electricity supply depended highly on this energy source. Towards the end of the 20th century, the vast urbanisation of cities - especially the Southeast region - fostered the migration of citizens from the Northeast to the largest cities in south-Brazil. This urbanisation process generated a high increase in energy demand in a short period which led to draughts.

Additionally, the country went through unexpected periods of droughts, which directly affected the production of hydroelectricity. Therefore, from the 1990s until 2002, the country suffered several blackouts and even a period of energy rationing. After this, Brazil tried to diminish its dependence on hydroelectric, and diversify its energy and electricity mix. Despite the decrease in 20% of hydro sources (ANEEL, 2009), the country still faces instability in supply and prices in periods of unexpected droughts, such as in 2012.

2. "BLACK SWANS" IN THE NEAR FUTURE

On the political level, Brazil currently faces a political crisis due to the government that is politically unstable. The ongoing criticism made by the Executive branch to the Legislative and Judiciary branches (Gragnani, 2020), the inevitable impacts of the COVID-19 global crisis, and the race for municipal elections at the end of 2020 (Alessi, 2020) may generate a political crisis more serious than expected, with the possible rise of tensions and radicalism. This could impact on important areas of investments in the energy sector, leaving Brasil vulnerable to further Black Swan events. Besides, the unstable scenario in the country has devalued Brazilian currency (BRL), making importation more expensive. If there is a bigger and unexpected increase in the dollar exchange, it will affect the energy transition in the country, as the construction of solar power plants depends largely on imported equipment.

A second wave of the pandemic could also be a possible Black Swan for the country. In just four months, the COVID-19 pandemic that was decreed by the World Health Organization on March 11 this year, had a massive impact in Brazil. The country registered more than 3.2 million people infected, and more than 105 thousand deaths (Coronavirus Brasil, August 15, 2020). Experts say that the more liberal the restriction measures are, the higher is the risk of this new wave. In summary, the pandemic already shows economic impacts in the country, such as the drop in GDP, the devaluation of the dollar, the increase in unemployment insurance claims and the reduction of industrial production (Exame, 2020). These impacts may still be prolonged if the government is not active, or if the second wave of the pandemic happens.

Another possible Black Swan would be natural disasters. By presenting a scenario of continental dimensions, Brazil is very susceptible to the occurrence of accidents of different origins, intensities and evolutions, such as tornadoes and torrential rains (IBGE, 2016). Depending on the scale, the Brazilian energy mix and the economy can suffer a negative impact. Furthermore, it can generate public health problems such as contamination of water, soil, and air, displacement of the population, and impairment of essential public services such as water supply and transportation (Ministerio da Saude, 2017).

Besides, impacts on the general budget are possible, causing a drop in revenue due to reduced economic activity. The government may also face increasing budgetary pressures, which may lead them to use foreign exchange reserves, thereby increasing the level of indebtedness or expanding the money supply (Gaspodini, 2011).

The discovery of a new oil reserve on the Brazilian coast, which could impact the economy and delay the growth of renewable technologies in the country such as biofuels. Besides, Brazil has an electrical matrix primarily coming from hydroelectric plants

» *Aerial view of burned areas in the Amazon rainforest, near the city of Porto Velho, Rondônia state. Image by Victor Moriyama / Greenpeace.*

(Almeida et. al, 2019). Thus, the country would be greatly impacted if there was a Black Swan in this area, such as long droughts that would affect the Brazilian reservoirs drastically.

3. THE MEASURES THAT ARE BEING TAKEN AT REDUCING OR PREVENTING ECONOMIC IMPACT

Thus, after the 2008 financial crisis, the country adopted two main economic policies to contain its effects, which became known as the New Economic Matrix:

- the first, represented by a monetary measure marked by credit expansion by the main public banks, as well as a reduction in interest rates;

- while the second measure – a fiscal one – was marked by fiscal exemptions for the automobile, shipping, and oil industries, as well as the maintenance of high public spending (Barbosa Filho, 2017).

These public measures taken after the 2008 crisis were initially perceived as positive, as it appeared that the country had overcome the crisis within a few months. However, these initiatives only delayed the most severe impacts of this Black Swan, that occurred between 2014 and 2017 and increased public expenditures (Oreiro, 2017). In order to mitigate these effects, the Brazilian Parliament approved the very unpopular Amendment to Constitution No. 95/2016, which limited the growth of certain government expenses for twenty years, despite allowing periodic reviews (Senado Notícias, 2016).

The first measure articulated by the Brazilian government addresses emergency aid, which consists of a financial benefit for informal workers, individual microentrepreneurs (MEI), self-employed and unemployed individuals. The aim was to provide emergency protection during the crisis (Caixa Federal, 2020). To strengthen this support mechanism, the Federal Government used BRICS international financial cooperation. It accessed the New Development Bank (2020) emergency financial instruments to raise 1 billion dollars, of which are destined to attend the demand for social credit from 5 million Brazilians facing vulnerability, informal work, or unemployment.

The Federal Government launched a credit program for small and medium-sized companies valued at R$ 300 billion through the Brazilian Central Bank (BCB), which not only reduced the interest rate to 2% per year but also eased the process of private banks' deposit in BCB. According to Provisional Measure 992/2020, banks and financial agencies installed in the Brazilian financial system can offer credit from their resources (Central Bank of Brazil, 2020).

In the industrial sphere, the participation of the National Bank for Economic and Social Development (BNDES) has become a critical factor in maintaining large companies, as well as in creating demand through infrastructure projects. One of its most promising roles was in support of the national electricity sector through the "COVID-account" measure – it consists in granting a loan of R$16.1 billion to companies. Another incentive mechanism is the issuance of debentures focused

on clean energy, instituted through the June 5th decree N.10,387, which also has BNDES as project coordinator.

The Federal Government does not act in line with State and Municipal ones in order to make joint efforts and formulate common strategies to overcome the COVID-19 pandemic. As a result, its main outcomes are the lack of confidence, instability in the economic and financial sectors and it undermines international coordination and cooperation in developing vaccines and international assistance.

4. ENVIRONMENTAL PROGRAMS

There are some Brazilian government programs applied to ecological issues and reduction of the environmental impact that contribute to minimising effects caused by crises in the energy sector. As an example, it is possible to mention RenovaBio, which recognises the strategic role of biofuels in the Brazilian energy mix in terms of their contribution to energy security. Besides, the program also acts on market analysis and prediction, and in mitigating greenhouse gases emissions in the fuel sector.

Moreover, the "Mais Luz for the Amazon" Program (More Light for the Amazon), launched in February 2020, foresees bringing access to electricity through renewable sources to a vast region known as 'the Legal Amazon', offering better life quality and less environmental impact (ANP, 2020).

Even with all the difficulties such as scarcity of resources, political instability, and low economic growth the national economic recovery must follow the global trend of investing in programs and policies with little socio-environmental impact.

5. THE MOST VULNERABLE AREAS OF ENERGY MARKETS

In times of unexpected crises, countries must choose priority sectors to invest and assist in recovery. If there is a shortage of financial resources, increased by the fall in tax collection, some areas end up being harmed. Health and social assistance usually require immediate interventions resulting in reduced support for other sectors such as education, research and development. Brazil has suffered cuts in funding in these sectors in recent years, which reduces the country's capacity to develop new technologies and improve the training of technical labour. Consequently, these cuts in technology affect the entire supply chain of products and services for the energy markets. Research centres with projects in operation had to reduce the number of researchers and postpone investments in the acquisition of equipment and products.

The Brazilian energy sector is divided into: generation, transmission and distribution. According to information supplied by ANEEL, the distribution sector is the main revenue collector in the Brazilian energy sector, being the gateway for resources, although it remains with only 18% of what it collects. As a result, it was considered a vulnerable sector during the pandemic and it started to receive aid through the Conta-covid program.

The main reason is that the pandemic caused a 14% reduction in energy consumption and an increase in defaults, which reached 10%. In this context, Conta-covid is a loan obtained from public and private banks, led by the BNDES, in order to preserve the liquidity of companies in the sector and alleviate the impacts of bills paid by consumers. The financial assistance granted by the Brazilian Government is R $ 14.8 billion and will serve around 50 energy distributors.

6. FINANCIAL AND SECTORAL CONSEQUENCES AS RESULT OF THE FALL IN OIL PRICES IN 2020

It is predicted that the drop in oil prices caused by the pandemic generates a loss for the Brazilian economy, since Brazil exports between 600 and 700 thousand barrels per day. This also implies a drop in royalties and collections for states and municipalities. It can also affect new oil projects and new exploration auctions.

Regarding the sectoral consequences, in the primary sector, low oil prices may hinder production activities in some assets. In the secondary sector, on the other hand, with the opening of the market and access to import infrastructure, liquefied natural gas (LNG) can establish itself as a safe and inexpensive opportunity for energy, which is necessary for economic growth's resumption. Even with the fall in oil prices and its derivatives, the recovery and stabilisation of the market should follow the trend of higher investments in renewable energies, such as wind, solar and biomass. In the Brazilian case, considering the growth in the use of natural gas, there is a convenient opportunity for energy integration between renewable and fossil sources, with positive impacts for the social, environmental and economic areas of the country.

7. COVID-19: A BLACK OR A WHITE SWAN?

According to Taleb (2007), a Black Swan is an event with the following attributes: (i) it is an outlier, unpredictable; (ii) it carries severe impact and widespread consequences; and (iii) after its occurrence, people will rationalize the event, making it explainable and predictable. Analyzing the pandemic in Brazil, it is possible to affirm that COVID-19 does carry major impacts in the country. For example, according to the International Monetary Fund [IMF] (2020), Brazil's GDP will have negative growth of 9,1% in 2020, while the previous predictions claimed that the country would have a positive growth of 2,2% (Agência Brasil, 2019).

On the other hand, a White Swan event can be considered as a predictable and preventable event, in which data and information lead governments to conclude its certain occurrence in the future (Lustenberger, 2020). According to Norman, Bar-Yam & Taleb (2020), governments should not classify COVID-19 as a Black Swan as a form to justify their inefficiency in dealing with this health crisis, since the event would be a White Swan. Indeed, researchers pointed out about its possibility. However, a White Swan event is also characterized by having its impacts easily estimated (Sikich, 2010), and, as the reality shows, COVID-19's impacts are still unclear for the world, including Brazil.

Thus, it is noticeable that Black Swan and White Swan definitions cannot fully explain COVID-19. Perhaps, it would be interesting to interpret the pandemic through a different lens, which could be offered by the term Grey Swan. According to Liberto (2019), Grey Swan is an event in which people are aware of its presence, but do not take the probability of occurrence seriously enough, even if it could end up having severe consequences. This can be seen in Brazil since health professionals warned about its effects in the past (Caputo, 2016; Alves, 2019) and the government acknowledged the possibility for it to happen, especially when the former Minister of Health, Arthur Chioro, alerted in 2015 about the high probability of a dengue and zika virus epidemics (Amaral, 2015). However, due to general disbelief, no further investments were made in the health sector for its prevention.

Moreover, Grey Swan events can be positive or negative and significantly alter the way the world operates (Liberto, 2019), and COVID-19 brought indeed new challenges, such as the exposure of a series of vulnerabilities regarding social inequality (Informe Ensp, 2020), and opportunities, such as the growth of e-commerce and technological innovations (Fonseca, 2020), for Brazil. Lastly, in Grey Swan events, after the fact, shifts focus to errors in judgment (Sikich, 2010). The emergence of new diseases, including COVID-19, has been linked with the increase of pollution and environmental disasters, which could lead to the reflection on how humankind is potentially harming natural habitats, leading to faster evolutionary processes and the diversification of diseases (United Nations Environment Programme [UNEP], 2020). Thus, it can be concluded that COVID-19 could represent a Grey Swan event.

8. THE INFLUENCE OF THE PANDEMIC ON THE ENERGY MARKET

The current COVID-19 pandemic is affecting the energy market globally, thus impacting this sector of the economy and generating consequences throughout the entire production chain (IEA, 2020).

First, the political and economic spheres are facing an emergency since March 20th. On the macro-level, the Senate approved the "state of public calamity" in its first remote session as a measure to stem the spread of coronavirus (Baptista, 2020). Regarding the energy consumption of industries and commerce, there is a reduction of nearly 20% between March and February according to the Brazilian Chamber of Electric Energy (Feil, 2020). On the micro-level, it is widely believed that residential consumption grew due to COVID-19, however, data is still limited (Feil, 2020).

Secondly, technological and environmental fields are still uncertain. On the micro-level, the pandemic can potentially decrease greenhouse gas emissions in Brazil, especially in the energy and industry sectors (Greenhouse Gas Emissions Estimation System [SEEG], 2020). On the macro-level, there is a significant tendency that the COVID-19 health crisis delays the development of clean energy technologies and equipment (Fernandes, 2020).

In summary, data regarding the effects of the pandemic on the political, economic, technological, and environmental spheres of the Brazilian energy market is still limited (Feil, 2020). On the political and economic level of analysis, there will be less revenue from taxes for the Government, which will likely affect the federal, state, and municipal resources. At the same time the tax collection decreased, the expenditures on aid-packages for the economy during the pandemics will both affect the country's reserves. In the technological and environmental fields, the energy sector will decrease its GHG emission in Brazil and the technological sector development will slow down.

9. THE INFLUENCE OF THE PANDEMIC ON CONVENTIONAL AND NON-CONVENTIONAL ENERGY MARKETS

The COVID-19 pandemic surely influenced both conventional and non-conventional energy markets in Brazil.

In the conventional energy market, the Brazilian state-owned oil company Petrobras had a 3% drop in its oil production in the second quarter of 2020, compared to the first quarter with a production of an average of 2.147 million barrels of oil per day. This decrease is due to the impacts of the pandemic on the industry, with a sharp drop in the value of Brent, a strong decrease in demand and a surplus of products in the market. Despite this, the negative result is considered minimal since the average production of oil and natural gas was 6.4% higher than that recorded in the same period in 2019. Moreover, according to the Petrobras 2020 second quarter's report, the reduced demand from the domestic market caused by effects of COVID-19 drove an increase in net exports of oil and its derivatives in the second quarter of 2020 compared to the first quarter. In addition, there was a strong focus on exporting such products, due to a decreased demand in the domestic market.

On the micro-level, the pandemic can potentially decrease greenhouse gas emissions in Brazil, especially in the energy and industry sectors *(Greenhouse Gas Emissions Estimation System [SEEG], 2020).* **On the macro-level, there is a significant tendency that the COVID-19 health crisis delays the development of clean energy technologies and equipment** *(Fernandes, 2020).*

Concerning the non-conventional energy market, solar generation increased 34.8% in June. It was the only source of the National Interconnected System (SIN) to show growth compared to the same period in 2019. The increase was driven by the entry of new plants in the system over the last year, which increased the generation from 508 average megawatts (MW) to 684 average MW. However, other sources declined. The wind farms had the biggest drop with a decrease of 7%. This is partly explained by the advance of cold fronts from the South to the Southeast regions of Brazil in the first half of June 2020. Moreover, Hydroelectric decreased its energy generation in 4.6% and thermoelectric had 2.7% of reduction in its volumes of energy generated.

Considering the impact on energy consumption and other related factors, both non-conventional and conventional markets were impacted in different ways but with moderate effects derived from COVID-19. The real impact in both markets will be fully known only in the next few months as the pandemic effects will cool down. However, it is possible to state that the effects on these markets were not catastrophic so far.

RUSSIA
YOUTH PERSPECTIVE

Key findings

- A reduction in production and a drop in oil prices in 2020 will inevitably lead to a reduction in budgets and a revision of investment programs. Small and medium-sized companies, as well as companies with a high debt burden, were in the worst position, since they have the lowest margin of safety. These two processes will also affect the demand for electricity.

- The situation caused by COVID-19 had the greatest economic impact. Due to this problem, Russia found itself in a recession, and in order to get out of it and revive economic activity, the measures are being taken, the effectiveness of which is still difficult to assess.

- Each energy sector was also influenced by a series of unpredictable and destructive events that had a negative impact on the sector. One of the most vulnerable energy sectors was the oil and gas industry.

- COVID-19 is determined not only as a black swan, but also as a white one event, that is not an anomaly for all of humanity. Thanks to modern technology, almost the whole world followed the development of the pandemic in real time. People knew little about this threat, but most governments acted too slowly to prevent the spread of the virus around the world.

1. INTRODUCTION

In 2007, the American writer and Ph.D. Nassim Nicholas Taleb in his book «Black Swan. Under the Sign of Unpredictability» he introduced the term «The Black Swan» (TBS). Events of this type are characterized by three properties: rarity, extreme impact, and retrospective (though not prospective) predictability. As the author of the theory notes, «these rare Black Swans explain almost everything that happens in the world ...».

Changes in the energy markets in different countries, including the Russian Federation, were no exceptions. From December 1991 to August 2020, there were multiple changes in the markets for oil, gas, coal, etc. The most important for us, citizens of the Russian Federation, is the oil and gas market, which provides about 1/3 of the income to the country's today. It is the oil and gas complex that is mostly affected by the pressure of the so-called "black swans". This is due to the fact that in the international energy arena there is fierce competition between the leading countries for the export of gas and oil.

After analyzing the Russian economy in various aspects, the Russian teams have identified several black swans that have most significantly influenced their country.

2. BLACK SWANS THAT HAD THE BIGGEST IMPACT

1.2 1998 financial crisis

The economic situation in Russia in the 1990s was influenced by many factors. The reasons for the onset of the 1998 crisis include: the illiterate budgetary and financial policy of the State Duma and President B.N. Yeltsin, the Asian crisis of 1997-1998. and the drop in oil prices since the end of the Gulf War. After the end of Operation Desert Storm by the United States and its allies, as a result of which Iraqi troops were forced to leave Kuwait, by February 1991 the price of Brent crude oil fell to $ 36.63 per barrel. In December 1998, the price of Brent oil fell to a record $ 17.64.

As a result, on August 17, 1998, a technical default was declared on the main types of government debt. The Russian economy received a heavy blow, as a result of which the Russian ruble devalued several times. In less than six months, the ruble exchange rate fell 3.5 times. The confidence of the population and foreign investors in Russian banks and the state, as well as in the national currency, was undermined. The depositors of bankrupt banks lost their deposits, the ruble savings of the population depreciated, the standard of living fell, the number of those receiving unemployment benefits doubled.

2.2 The beginning of the 2008 global financial crisis

The collapse of the world's largest economy - the US economy - could not but affect oil prices. In June 2008, the price of Brent crude oil was $ 164.92 per barrel, and in January 2009 it was already $ 50.89. It was only in June 2009 that oil prices began to rise again.

According to the World Bank, the 2008 crisis in Russia began with the private sector. It was provoked by his "excessive borrowing in the midst of a deep triple shock: on the part of the terms of trade, capital outflow and tightening of the terms of external borrowing". The capitalization of Russian companies decreased in September-November 2008 by three quarters; gold and foreign exchange reserves fell by 25%. The financial crisis lowered public confidence in banks and led to an outflow of deposits. As a result of the financial crisis, government projects in infrastructure and construction have been curtailed. According to the data released on January 23, 2009 by Rosstat, in December 2008 the decline in industrial production in Russia reached 10.3% compared to December 2007, which was the deepest decline in production over the past decade.

By the end of 2008, the world entered a global recession. The recovery process after the 2008 collapse is still under way. For Russia, the recession process is also aggravated by the economic sanctions of the US, EU and their partners.

2.3. Sanctions as complicating Russia's economic recovery after the 2008 crisis

In mid-March 2014, the US and EU countries introduced the first package of sanctions. One of the goals of the introduction of these restrictions was to reduce the volume of Russian oil production by stopping the supply of specialized equipment and technologies needed to develop hard-to-recover reserves.

After 6 years of the sanctions regime, it can be noted that this goal has not been achieved. From March 2014 to July 2020, oil production in Russia grew by 7.16% over the entire period, while natural gas production increased by 6.85% from March 2014 to February 2016. However, can the sanctions against Russia be considered events from the category of black swans?

The imposition of sanctions was expected, at least due to the fact that since the early 1990s sanctions

» *A shipment of Russia's Sputnik V Covid-19 vaccine arrives in Tunisia. Over the past four months, about 1.25m Russian-made doses have gone to export markets © Fethi Belaid/AFP/Getty Images*

have become one of the main weapons of economic wars in the international arena. Therefore, one team considers that the anti-Russian should be seen as complicating Russia's economic recovery after the 2008 crisis.

Other team is sure that the main instrument of influence at the political level and the first "black swan" are sanctions. Currently, the sanction pressure is primarily seen from the United States, since shale oil and gas are key competitors of domestic raw materials. The result of the sanctions is primarily a decrease in the share of Russian oil and gas exports, as well as a slowdown in the modernization of production and the industry as a whole.

2.4. The weakening of the national currency

The next important "black swan" is the weakening of the national currency. The most significant fall over the past 10 years is the case, which was nicknamed "Black Tuesday", this happened on December 16, 2014. The value of the ruble fell to 80 rubles for 1 dollar, which entailed a decrease in the value of shares of Russian companies by about 30%, which also significantly affected energy sector. Experts note that this collapse contributed to the formation of a new economic and monetary crisis in Russia.

3. "BLACK SWANS" IN THE NEAR FUTURE

3.1. The dynamics of world oil prices

In the near future, the black swan for our country will still be the dynamics of world oil prices, which may unexpectedly cause inflation for Russia and a new tendency for population incomes to fall.

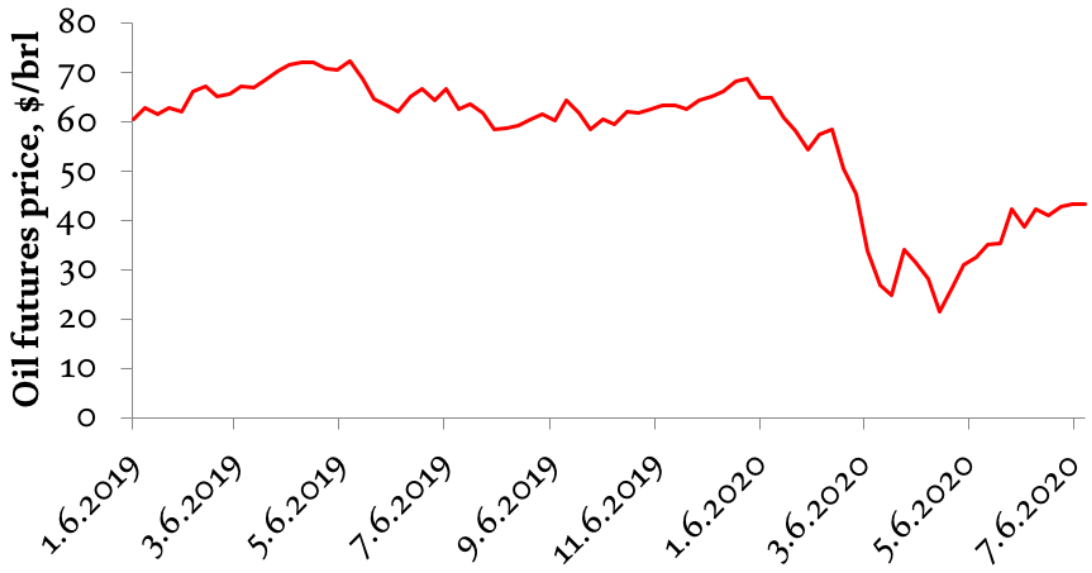
3.2. The COVID-19 pandemic

However, the ongoing coronavirus pandemic could have a negative impact on the Russian power industry over time. There is a high risk of a sharp decline in revenue due to an increase in non-payments due to a drop in income from businesses and households. At the same time, the state limits the possibility of applying sanctions against defaulters: Decree of the Government of the Russian Federation No. 424 dated 04/02/2020, part of the consumers of utilities (including electricity and heat) from fines for late payments until the end of 2020.

3.3. Fuel and energy complex

A reduction in production and a drop in oil prices in 2020 will inevitably lead to a reduction in budgets and a revision of investment programs (geological exploration, a reduction in orders for related industries, etc.). Small and medium-sized companies, as well as companies with a high debt burden, were in the worst position, since they have the lowest margin of safety. These two processes will also affect the demand for electricity. For example, a reduction in oil production will lead to a decrease in electricity demand in some Russian regions.

Increased competition in international markets could also have a negative impact on the Russian oil industry. According to Skolkovo experts, in this scenario, oil exports from Russia could decrease by 3 million barrels per day. In the most optimistic scenario, the total revenues from the reduction in



» *Figure 1. Dynamics of prices for futures per barrel of Brent crude oil 2019-2020.*

crude oil exports compared to 2019 will amount to $ 75 billion (2.5 times less).

3.4. Some others

In addition, one should not forget about such things as trade wars, mutual sanctions, and geopolitical risks, which are partly uncontrollable.

4. THE MEASURES THAT ARE BEING TAKEN AT REDUCING OR PREVENTING ECONOMIC IMPACT

4.1. Description

The situation caused by COVID-19 had the greatest economic impact. Because of this problem, Russia found itself in a recession, and in order to get out of it and revive economic activity, the following measures are being taken: introduction of a delay in paying rent payments for a period of three months for small and medium-sized enterprises; zeroing of import duties and expansion of the practice of using the "green corridor" for socially significant goods by customs; providing banks with the opportunity to credit enterprises in the field of transport without worsening assessments of their financial situation; cancellation of penalties for suppliers for the failure of state contracts due to coronavirus.

4.2. The value of efficiency

It is difficult to evaluate the effectiveness of these measures, as they are being introduced right now, and there are no results. However, the state cannot always cope with the "black swans" independently.

4.2.1. The economic impact of a fall in oil prices

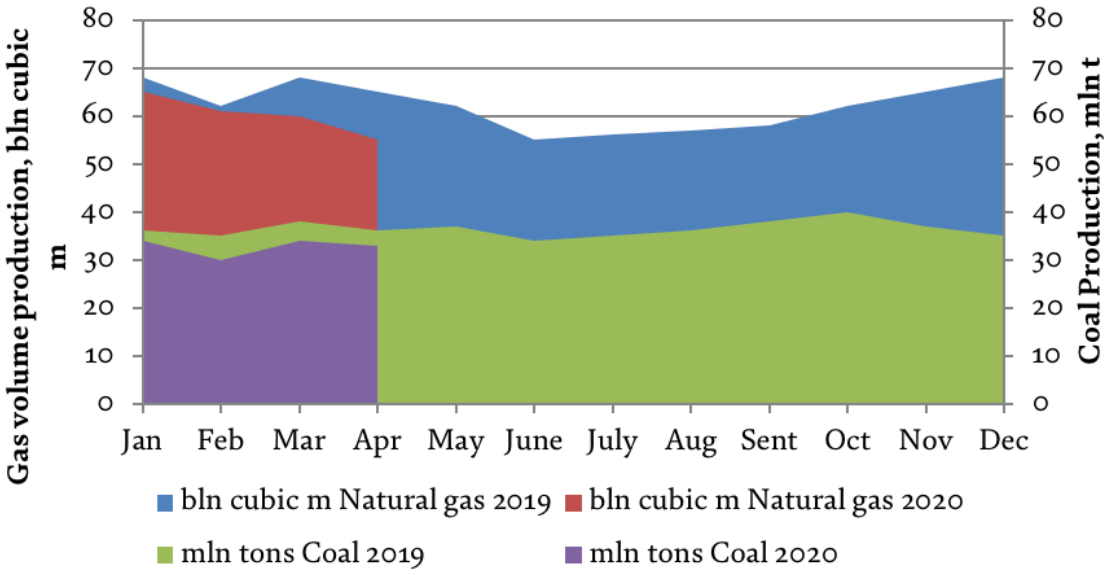
The economic impact of a fall in oil prices, mainly caused by a shock in demand because of the COVID-19 pandemic, was only minimized due to joint actions to reduce oil production by OPEC + member countries. In mid-March, the price of Brent crude oil was below 25$ for the first time since May 12, 2003, and now it is above the level of 40$, which is an indicator of the good effectiveness of the measures taken by OPEC + (Fig . 1).

5. ENVIRONMENTAL PROGRAMS

5.1. The state program "Environmental Protection"

It should be said that one of the main environmental programs that our country is developing to protect the environment not only during shocks, but also in general, is the state program "Environmental Protection", for which unprecedented budget funds are allocated in 2020 – 81,38 billion rubles, in 2021 -93,62 billion rubles, in 2022 – 103,43 billion rubles. Thus, government spending on the environment is less than 0,1% of GDP, but every year there is an increase in environmental costs, including for the elimination of unplanned accidents.

5.2. Federal laws of environmental protection



» *Figure 2. The dynamics of gas and coal production in Russia in 2019-2020.*

There are also federal laws to ensure control of oil and gas companies in the field of environmental protection: Federal Law "On Environmental Protection", Federal Law "On Environmental Expertise".

5.3. The national project "Ecology"

A key state initiative is also the national project "Ecology", which includes simultaneous interaction on many parameters, which should create a unified system of environmental supervision and create a single effective system of preventive measures to prevent environmental disasters.

5.4. The value of efficiency

But, despite all the state efforts aimed at preventing "black swans" in the environment, accidents occur quite often, as a result of partially inefficient spending, inefficient environmental monitoring, which is fixed at the state level, shows its inefficiency in terms of taking preventive measures to exclude incidents.

5.4.1. Effects of the spill of diesel fuel at the Norilsk-Taimyr Energy Company

One of the largest accidents in recent years is the spill of diesel fuel because of depressurization of the tank at the Norilsk-Taimyr Energy Company. This forced the Government, including the president, to urgently sign a new law on the elimination of oil and oil products spills. It obliges companies engaged in the extraction, storage and transportation of petroleum products to have a reserve account, a bank guarantee or oil spill insurance.

5.5. Emergency anti-crisis measures

At the moment, the Russian budget and the budgets of domestic companies are not protected from the negative impact of unforeseen events. In the event of such a situation, the Government urgently develops and applies emergency anti-crisis measures. Large companies do the same. The support of financial well-being in this case is the wealth of resources, the availability of financial and resource reserves for use in emergency situations. According to one of the teams, it is not correct to call responding to problems as they arise as a thoughtful strategy to minimize economic damage from black swans.

5.6. Some disadvantages

Solving these problems by private individuals is simply impossible. However, in the Russian Federation, there are no programs for the transition to green energy, there are no progressive programs to reduce emissions and pollution of nature or air. There is also no system of waste processing plants. It is safe to say that Russia is currently unable to cope with environmental risks due to fluctuations in global markets.

6. THE MOST VULNERABLE AREAS OF ENERGY MARKETS

6.1. Oil and gas industry

Currently, the energy market is most represented by six sectors, such as oil, gas, natural gas, hydropower, coal, renewable

» *The energy industry and foreign investors demanded huge tax breaks to launch production facilities in Russia's arctic.* © *gazprom-neft.ru*

energy sources. Each energy sector was influenced by a series of unpredictable and destructive events that had a negative impact on the sector.

Russia is one of the countries that are more prone to such events and their consequences, and as a result is in the zone of economic risk.

One of the most vulnerable energy sectors is the oil and gas industry, since a significant part of the country's consolidated budget is generated by hydrocarbon sales revenues. The increase in demand and energy prices and, as a result, the forced reduction in production, and the suspension of plants can be called a series of events that are uncontrollable and unpredictable. This is clearly visible on the graph of coal and natural gas production, the level of which in 2020 is below the same period in 2019 by 5-6% (Figure 2).

Based on the above data, it can be stated that the energy markets in Russia are in a very difficult regressive position.

The fall in oil prices is the most significant shock in its effect for domestic energy and the country's economy due to its dependence on hydrocarbon exports. The main blow was dealt by an unprecedented drop in demand - by 30% in April and almost 10% on average for the year (decline by 9,3 million barrels per day, according to estimates of the International Energy Agency). At the same time, the main drivers of global consumption - China and India - are unlikely to be able to provide additional demand for Russian oil this year.

7. THE FALL IN OIL PRICES IN 2020 THE FALL IN OIL PRICES AS THE MOST SIGNIFICANT SHOCK

7.1. A temporary reduction in world tourism

In 2020, the Russian economy will not so much suffer from a drop in oil prices, as it will feel a slowdown in the economies of its trading partner countries and a temporary reduction in world tourism. Nowadays, tourist trips, related services and consumer goods account for 6-8% of global GDP. Their reduction even by 25-30% is a shock of the order of 1,5-2 percentage points globally on the production of goods and services.

7.2. Decrease in export volumes

A global shock of this magnitude could potentially reduce the physical volume of exports from Russia by 3-7%, "which in turn will lead to (and already leads to) a shock in the exchange rate and the work of the traditional mechanism in the form of a reduction in imports of consumer and investment goods, " said the deputy ACRA sovereign rating and macroeconomic analysis group director Dmitry Kulikov.

7.3. Drop in the price of Urals

Russian manufacturers are quite competitive in the world market, but an aggressive price war so far leads to a drop in the price of Urals to a level at which budget revenues are practically zeroed out,

new projects become unprofitable, and existing ones will work on the verge of profitability. The fall in prices also affected the quotes of Russian oil companies, which also declined.

7.4. Drastic reduction in export earnings, company revenue and budget revenues

For Russia, a decline in energy markets means a drastic reduction in export earnings, company revenue, and budget revenues. The calculations show that even in the most optimistic scenario, oil export revenues will decrease by 2.5 times compared with the pre-crisis level. It is also possible a more gloomy development of events with a fall in budget revenues by 4-10 times in 2020.

7.5. Pessimistic scenario

In a pessimistic scenario (a decline in global demand of 11 million barrels per day and non-compliance with production quotas), the Russian oil industry may be on the verge of breaking even for existing projects and practically deprive the budget of revenues from export duties and mineral extraction taxes.

8. COVID-19: A BLACK OR A WHITE SWAN?

8.1. As a Black Swan

In 2018, WHO researchers suggested that the probability of a pandemic of a certain level is one in 100, or one percent in any given year. Whereas, in the case of flooding when calculating for a 30-year period, the probability of a pandemic exceeds one in four. The absence of a pandemic for more than 50 years means that the probability of a global outbreak is almost 40 percent. Thus, the virus can be defined as a black swan.

At the same time, losses from the coronavirus can be called catastrophic. In fact, we are talking about a double drop in prices and a 20-25% reduction in the volume of Russian exports of oil, gas and coal at the same time, which is equivalent to the loss of 60% of export revenue. For the budget, this means a sharp reduction in income (by about 30%) just at the moment when the population and business most need state support.

8.2. As a White Swan

At the same time, another team notes that there is no doubt that COVID-19 has had a serious impact on the entire world, including the energy sector. However, the pandemic wasn't an unexpected event. The author of the TBS theory - Nassim Taleb in an interview with Bloomberg said: «Of course, it was preventable. And we have known from June 26, when we issued our warning, that effectively you should kill it in the egg. If you can and act very quickly ... So, it was not a black swan. It was a white swan».

Events like «white or gray swan» are inevitable, but they are not an anomaly for all of humanity. Thanks to modern technology, almost the whole world followed the development of the pandemic in real time. People knew little about this threat, but most governments acted too slowly to prevent the spread of the virus around the world.

Moreover, in the past, the world has already encountered similar phenomena. Numerous cholera epidemics, the Spanish flu pandemic (1918-1921), the Asian flu (1957) and the Hong Kong flu (1968), the swine flu pandemic (2009-2010), etc. Based on the experience gained, scientists have developed several models, predicting the development of epidemics. In the late 1920s, SIR (susceptible, infected and recovered) was developed. Today, there is a more advanced model - SIER, which also takes into account those infected with the virus in the stage of the incubation period (exposed). In accordance with this model, the rate of spread of a pandemic depends on the value of the reproduction index (R), which shows how many people one sick person will infect. Based on R (for COVID-19, it is about 3) and a number of other factors, a schedule is drawn up that allows predicting the development of pandemics. This proves the fact that the development of the pandemic was not unexpected for experts and confirms the point of view that the coronavirus pandemic is not a black swan.

9. THE INFLUENCE OF THE PANDEMIC ON THE ENERGY MARKET

9.1. Decline in GDP

Losses in oil and gas export revenues in 2020 will be almost equal in volume to the National Welfare Fund. So finding sources of funding for incentive programs will not be easy.

For FEC enterprises, everything that happens will mean austerity and a reduction in investment programs, which, in turn, will inevitably affect related industries. According to calculations, this can lead to an additional decrease in the country's GDP (in addition to the direct influence of coronavirus and restrictive measures to combat it) by 5-13% in 2020, depending on the scenario.

The Russian Federation, as a result of the impact of the current pandemic, is witnessing a decline in GDP of 5.5%. In the domestic energy market, the oil industry suffered the most losses due to the strong drop in demand for oil, in particular mo-

tor fuels. In the domestic market of the Russian Federation, a decrease in demand for motor fuels is estimated at 40%.

9.2. Gas industry

The gas industry, compared to the oil industry, has not been as badly affected by the Covid-19 pandemic. Gas demand remains robust as it is primarily used for electricity generation and domestic purposes. However, the gas market did not avoid a decline in prices and consumption volumes. In addition to the coronavirus infection, this was facilitated by an abnormally warm winter and an increase in supply from producers of liquefied associated gas.

This led to a reduction in gas exports from Russia. A number of Gazprom's major partners have sharply reduced purchases, for example, supplies to Turkey fell sevenfold. A sharp drop in prices on the global gas market, including in Europe, forced Gazprom to revise its preliminary forecasts for 2020 and reduce the cost of its goods from $ 200 to $ 130-140 per 000 cubic meters. m. At the same time, the Russian company is protected by long-term contracts, which, according to optimistic forecasts, may allow it to maintain its positions in the European gas market (30-35%).

It also affected the production of natural gas in Russia. In the first half of 2020, gas production in Russia decreased by 9.7 percent compared to the same period last year. At the same time, it should be noted that the negative dynamics is largely due to a decrease in production by Gazprom, which has a monopoly on gas exports to Europe. According to calculations, in March 2020, Gazprom reduced gas production by 18% year-on-year.

9.3. Oil industry

From the point of view of market competitiveness, domestic producers look confident, since capital and operating costs in the industry are not large and are mainly denominated in rubles, which allows them to decline in the context of devaluation. In addition, the Russian oil industry has a certain margin of safety due to the peculiarities of tax regulation, in which the risks of low oil prices are transferred to the budget. For the state as a whole, oil prices budgeted for are significantly lower than other resource economies, although they significantly exceed the real price level at present.

Despite the fact that Russian producers are competitive, an aggressive price war on the global oil market leads to a drop in the price of Urals oil (April price: $ 8.48 / bar.) to a level at which budget revenues are almost zeroed, new projects become unprofitable, and existing will work on the verge of profitability.

9.4. Coal market

The coronavirus pandemic has affected the coal market as well. Changes in the coal industry of the Russian Federation should be sought in foreign markets. So, according to Deputy Energy Minister Anatoly Yanovsky, In the first quarter of 2020, compared to the same period in 2019, the export of Russian coal decreased by 14.3% - from 54.2 to 46.5 million tons. This is mainly due to the decline in coal purchases by Germany, Italy and Poland. At the same time, supplies to the countries of Africa and the Middle East increased. Thus, the export coal market will be able to compensate for losses due to a warm winter and coronavirus and by 2022 recover to 220 million tons (according to the optimistic scenario).

9.5. Renewable energy sector

The pandemic affected unconventional energy sources in two ways. On the one hand, Covid-19 has a particularly negative impact on the renewable energy sector. One of the main problems is related to the delivery of equipment to power plants. China, one of the countries most affected by coronavirus, is the world's leading producer of many clean energy technologies, such as solar panels and wind turbines. Since coronavirus delays deliveries from China, Russian companies engaged in renewable energy cannot comply with the equipment installation deadlines.

The development of the renewable energy sector may also slow down for reasons such as:

- reduction in global energy demand;
- the recent sharp decline in oil prices, followed by lower prices for other fossil fuels;
- nowadays, there is a slowdown in the process of international climate negotiations.

On the other hand, the crisis caused by the pandemic can lead to a rethinking of development in many countries and accelerate the transition to sustainable development, the integral elements of which are increasing energy efficiency and switching to renewable energy sources. Also it can accelerate the transition to renewable energy sources (RES). This is due to the desire of some countries to move from the "old" economy based on fossil fuels to a new one. Also, as noted by the Minister of Energy of the Russian Federation Alexander Novak, technologies in the field of IT, the Internet,

digital and cloud solutions will rapidly develop in the near future, and this will contribute to the rapid development of green energy and renewable energy sources.

9.6. The environment

Certainly, a pandemic will have positive environmental consequences (for example, a reduction in hydrocarbon emissions). However, there are also hidden negative consequences, the solution of which should take place at the state and interstate levels. These threats include:

- Possible cuts in green energy investment reported by the International Energy Agency;
- Departure of policies to reduce emissions into the background;
- Falling demand for public transport, colwing, car sharing and other attempts to replace one-time use with reusable ones, and personal with public ones;
- Cancellation of summits and conferences on environmental issues;
- Accumulation of huge amounts of medical waste, etc.

9.7. Global energy market after the pandemic

«The global energy market will not be the same, it has already changed», said Minister of Energy of the Russian Federation H.E. Alexander Novak at the session of the World Energy Congress (WEC), dedicated to the impact of COVID-19 on the global energy market. The structure of energy consumption and energy production will change.

In the post-crisis period, all three main technological directions of the energy transition (decarbonization, decentralization and digitalization) will receive a new impetus and begin to develop at an accelerated rate, which coincides with the foreign policy priorities of the leading OECD countries.

An important direction in the development of the energy sector of the future should be the creation of a «safety cushion» against new black swans.

INDIA
YOUTH PERSPECTIVE

Key findings

- The COVID-19 pandemic had a deep influence on India's energy industry. The demand for electricity has reduced to half of its installed capacity, mainly from high-consuming industries and commercial entrepreneurs. India has continuously witnessed a series of localized blackouts.

- Oil price fluctuations are inevitable. Some of the crucial factors contributing to significant oil price variation include demand-supply dynamics, geo-political events, and OPEC policy interventions.

- India is diversifying its sources of crude oil imports to strengthen its energy security. The country is looking to spread out its oil and gas terminals to its relatively calmer eastern coastline instead of the more volatile and vulnerable western coast.

- There is major progress in India regarding sustainable development which works in attaining the United Nations Sustainable Development Goals (SDGs), particularly SDG7 on energy. The Government of India launches environmental programs and introduces policies that gives priority to provide secure, affordable and sustainable energy to all the citizens.

1. INTRODUCTION

India is one of the fastest and largest emerging market economies in the world. Since its independence, it has reduced poverty, improved education levels, expanded basic infrastructure capacities to a great extent, along with conserving its rich biodiversity and building partnerships for sustainable development despite facing great challenges and difficulties. A number of national and international "black swan" events had a range of direct or indirect, positive, or negative impacts on India's overall economy and the energy sector was no exception. Despite the fact that India stands as the largest consumers of fossil fuels in the world, India's per capita primary energy consumption is far below the major emitters such as the United States and China. The population of India is expected to surpass China by 2022, indicating that the energy demand with the rates in climate vulnerability will increase by and large. Energy is considered one of the critical sectors of a country's economy and any disruption to this sector can wreak havoc on the country's stability.

2. BLACK SWANS THAT HAD THE BIGGEST IMPACT

India's energy industry has witnessed a couple of 'Black Swans' including Gulf War, fall of Soviet Union, Bombay High oil field's discovery, major power blackouts in 2001 and 2012, oil price fluctuations and most recently, COVID-19. The most significant Black Swans have been listed below:

1.2 COVID-19

The pandemic had a deep influence on India's energy industry. The demand for electricity has reduced to half of its installed capacity, mainly from high-consuming industries and commercial entrepreneurs. India has continuously witnessed a series of localized blackouts. India's power market activities are largely unbundled, based on the separation of generation, transmission and distribution under the Electricity Act of 2003, with retail activities being carried out mostly by the Distribution sector consists of Power Distribution Companies (DISCOMs). DISCOMs throughout the country have started working with 80% capacity hardly sustaining to pay the salaries of employees while there is hardly any investment left for power plants to procure coal and freight. DISCOMs are also compelled to extend the settlement period of their dues to power generators by 3 months and that will itself weigh heavily on the bottom lines of all power generators including RESCOs. Many of these would see their debt mountain rising and thereby affecting credit scores. With these declining credit scores, RESCOs may find it increasingly difficult to sustain themselves. The central government has announced a Rs 90,000-crore liquidity package to help sustain DISCOMs which shall take some time for approvals to execution. The independent power regulators who own magnitude projects may surrender bank letters to DISCOMs or may ask for ownership or control to regulate the power supply.

2.2 Major Blackouts (2001 & 2012)

i. July 30 and July 31, 2012 (620 Million People Affected): One of the worst-hit blackouts occurring in two phases began with the outage of the northern grid on 30th July 2012 which disconnected it from the four grids (Eastern, North Eastern, Southern and Western grids). The next day on 31st July, after 32 hours of outage another problem occurred and resulted in the collapse of the other four grids which directly affected all the 28 states and around 670 million people of the country. As stated in Central Electricity Regulatory Commission reports, the newly interconnected southern region was highly stressed during July 2012 due to monsoon rains which increased the demand for agriculture use in the Northern region. Thus, a high flow was observed from the western region to the northern grid which became the reason for the sudden failure of the northern grid and resulting blackout.

ii. January 2, 2001 (700 million people affected): A substation failed in Uttar Pradesh in January 2001, which resulted in the failure of the biggest Indian Grid i.e., Northern Grid. Many essential services such as hospitals, trains, major cities, etc stopped functioning. Loss estimation was stated by the Confederation of Indian Industry to be up to 2.5 to 5 billion rupees. The southern grid, which is the second-largest grid was also warned post the outage. One of the reasons after the investigation was found to be inadequate transmission equipment.

By the end of 2008, the world entered a global recession. The recovery process after the 2008 collapse is still under way. For Russia, the recession process

is also aggravated by the economic sanctions of the US, EU and their partners.

2.3. Unpredictability of the Global Oil Market

Oil price fluctuations are inevitable. Some of the crucial factors contributing to significant oil price variation include demand-supply dynamics, geo-political events, and OPEC policy interventions.

i. Fall in Crude Oil Prices in 2014: In 2014, oil prices started falling after reaching a peak of 115 dollars per barrel in June 2014 to as low as 59 dollars per barrel in December 2014. India, the world's seventh-largest economy, was a principal beneficiary of falling crude oil prices between 2013 and 2015. The slump in crude oil prices was beneficial for oil-importing countries like India. India's GDP touched $2 trillion in 2015, its highest achievement so far. Due to falling oil prices, India's macroeconomic indicators such as inflation, current account deficit (CAD), and trade balance improved. The CAD came down to 1.1 percent of GDP from 1.3 percent of GDP in 2014-15. The decline in the crude oil price helped the government manage its finances better as it translates into lower subsidies on petroleum products (LPG and kerosene), thereby, resulting in the lower fiscal deficit.

» *Soviet stamp 1974 for friendship between USSR and India*

ii. Rise in Crude Oil Prices in 2018: Things, however, started reversing in 2018. As against an average price of $46.2/barrel for the Indian basket of crude oil in FY16, it rose to $56.4/barrel in FY18 and averaged $65/barrel in the fourth quarter of FY18. The reason was the U.S.'s decision to walk away from the Iran nuclear deal and re-impose sanctions on Iran. The surge in crude oil prices was a significant factor in reducing India's fiscal deficit between 2014 and 2016. The rupee closed at 68.34 against the U.S. dollar on May 24, 2018. This was an 18-month low for the rupee and only 0.6% away from its all-time low of 68.825. CAD is a measurement of a country's trade when the value of the goods and services imported exceeds the value of the products it exports. CAD increased from 1.9% for 2017-18 to 2.5% of GDP for FY2019. The Indian stock markets were adversely affected due to increase in prices of crude oil. The Sensex fell by 2.3% between 1 and 24 May 2018 alone.

2.4. Gulf War

The Gulf War led to shortage of supply of oil, and the prices of oil rose almost 30% overnight after the United States declared its deployment of troops in Kuwait. The prices of oil remained high for a small period during the Gulf war crisis but had affected oil-importing developing countries to a great extent. Considering the case for India, it is estimated that India lost almost 170,000 b/d supply, which accounted for 43% of its total crude import, which was afterward fulfilled by Abu Dhabi, USSR, Iran, and Saudi Arabia. Further talking about the country's oil import bill, it rose from $3,716 million in 1989 to $5,739 million in 1990, this resulted in a reduction of its' international gold reserve from $4,108 million in 1989 to $1,521 million in 1990 and increment of the inflation rate from 7 to 10 in F.Y. 1990-1991.

2.5. Fall of the Soviet Union:

India was highly dependent on the USSR in the decade 1970-80 as the latter was a major supplier of petroleum products and almost 70% of India's imports were petroleum products from the USSR. India had a lesser need for hard currency because of rupee payment terms with eastern European countries and USSR, so less attention was paid towards reserves of other hard currencies. However, after the fall of the Soviet Union in 1991, many rupee trading agreements were terminated. Imports from the USSR decreased significantly, and India had to rely on other countries to supply necessities where payment had to be made in hard currency. As a result, India faced a balance of payment crisis in 1991, where Indian foreign reserves dropped to $ 0.98 Billion. In an attempt to seek an economic bailout from the International Monetary Fund, the Indian Government airlifted its national gold

» *Bombay High © Nandu Chitnis*

reserves, which resulted in a national outrage. The crisis also paved the way for the liberalization of the Indian economy due to a condition put forward by the World Bank.

2.6. Discovery of Bombay High oil field:
The Russian and Indian teams from the exploration vessel Academic Arkhangelsky discovered Bombay's high oil field in February 1974 while mapping the Gulf of Cambay. Around 5 billion tonnes of hydrocarbons were discovered. At that time, the world economy was struggling to come to terms with the oil crisis arisen out of the oil embargo by middle east oil-producing nations, so it was a significant move. Production from Bombay's high oil field contributed to the rapid growth of the country's total crude oil production throughout the 1980s. In 1989, oil production peaked at 34 million tons, of which 22 million tons was from Bombay high. Many new fields have been discovered in the western offshore after that, but no other field has been discovered in India close to the size of Bombay high oil field. State-run Oil and Natural Gas Corporation is now planning to boost hydrocarbon production from the old oil wells by investing $500 million in its flagship asset, Bombay high.

2.7. US Shale Revolution:
The Shale Revolution refers to the combination of hydraulic fracturing and horizontal drilling that enabled the United States to significantly increase its production of oil and natural gas, from tight oil formations, which accounted for 36% of total US crude oil production. The Organization of Petroleum Exporting Countries (OPEC) tried to drive North American frackers out of business starting in 2014 by flooding the market with crude, resulting in the most significant price crash. However, through innovation, they reduced production costs and came back with a louder roar. India is a net oil importer, with 70-80% of oil needs met by imports. Due to the oil price crash, India's net import value of crude oil and petroleum products fell from $98 billion in 2012-12 to $47 billion in 2015-16, a 52% drop in net import value. Further, India's trade deficit reduced from $190.3 billion in 2012-12 to $118.7 billion in 2015-16.

3. "BLACK SWANS" IN THE NEAR FUTURE

3.1. Cyber threats:
India has certainly resolved the 2012 crisis, but there is still a long way to go. The country must pay more attention to cyber-crimes aimed at power grids and other such sensitive areas as telecommunications. The government's vision of establishing 100 smart cities in India where every element would be centralized using emerging technologies such as IoT, SCADA (Supervisory Control and Data Acquisition), Automation, and Machine Learning, would also generate infinite user data that would be stored in the cloud, that could potentials reveal a range of vulnerabilities in Indian digital infrastructure.

3.2.Overdependence on other nations:
India's energy sector highly depends on imports from other countries, especially China. India is mostly dependent on fossil fuel imports to meet its energy demands. By 2030, India's dependence on

energy imports is expected to exceed 53% of the country's total energy consumption. Talking about the Solar Energy Sector, Chinese firms supply about 80 percent of solar cells and modules to India. Any conflict with China might disrupt the imports and increase the prices of solar power equipment. India's Nuclear Energy sector is based on an ambitious three-stage nuclear program that requires indigenous Uranium in its early stages. Uranium deposits are minimal, and most of the Uranium is imported from Kazakhstan, Canada, and Russia. Hence, India's energy sector might be impacted to a great extent if any conflict with these countries arises in the future. A Eurozone collapse could have a significant impact on the Indian economy. The collapse of the Saudi monarchy would bring instability to India, as it is India's second-largest oil supplier and critical to its economy. It will also lead to a major shift in power in the Middle East and Europe. It would mean the creation of the Shia Belt from Syria to Iran and the likelihood of an Iranian-backed government in Oman, which will also have a significant effect on India as India's 83% of crude oil is imported from Saudi Arabia and Iraq. So, it is the need of the hour to boost the power sector, reduce import dependency and make power and renewable sectors self-reliant. Even black swan, like a breakthrough in grid-scale battery storage development in India could change the dependency from fossil fuels to intermittent forms of energy.

3. Electricity Sector's vulnerability:
Indian electricity sector is highly susceptible to the black swan events, which may be partly owed to the distributed nature of the electricity sector and high financial dependence due to the weak economic sector. While around 45% of generation is privately owned, the lion's share is owned by the governments (30% by the states and 25% by the central government) and unbundling of retail and distribution grid activities remains incomplete. There is a large efficiency gap between private and state-owned power plants. The DISCOM governance model needs to be reframed. Appropriate monitoring, control and financial oversight should be incorporated. At the retail tariff level, greater rationalization is critical with a tariff system that allows all market participants, industrial, commercial or residential participants to purchase electricity. DISCOMs have to be operated in recognition of public policy objectives and incorporating the upgraded energy technologies, while putting a great effort in data collection and analysis, so as to ensure a consolidation of this sector and at least, preventing it from the turbulence of the black swans that pose great threat to its security.

4. THE MEASURES AIMED AT REDUCING OR PREVENTING ECONOMIC IMPACT

India is ranked among the top ten countries in the Climate Change Performance Index 2020 on account of low levels of per capita emissions and energy use, and 'well-below-2° C' renewable energy targets.

Unforeseen events, even in remote locations, can cause havoc for businesses and financial institutions if not appropriately managed in an age of economic and political interconnectedness. Some possibilities are just too remote to justify the expense in time, money, and human resources, and at some point, assessing the cost benefits of attempting to predict the unpredictable is necessary. As we cannot predict a black swan, we need to restructure institutions and rethink strategies to be more robust in the face of uncertainty. Here is the list of policies GOI (Govt. of India) is undertaking to reduce the impact of possible black swans:

1. India is ranked among the top ten countries in the Climate Change Performance Index 2020 on account of low levels of per capita emissions and energy use, and 'well-below-2° C' renewable energy targets. Taking forward its Nationally Determined Contributions (NDCs) under the UNFCCC, India's climate action strategies emphasize clean and efficient energy systems, resilient urban infrastructure, and planned eco-restoration.

To reduce the economic impact of fluctuating oil prices, India has set an aim to generate 175 GW renewable energy capacity by 2022 and 450 GW of renewable energy by 2030. It means by 2030, 60% of our electricity needs will be fulfilled by renewable energy, which will lead to a reduction in fuel import bills and dependency on oil-producing countries. As per sources, India has decided to reduce oil imports by 10% and fulfil the deficiency by increasing production of coal to 1.5 billion tonnes by 2022. Recently the government has surfaced an integrated Hydrocarbon Exploration Licensing Policy (HELP) which helps in diminishing the regulatory load of the previous policy. India may find it challenging to meet its 175 GW targets by 2022 even as its total capacity reached almost 86 G.W. by December 2019. The reasons are a slowdown in capacity addition and auctions due to emerging risks and unaddressed structural issues.

2. Atmanirbhar Bharat Abhiyan (Self-reliant India campaign): This campaign aims to build a self-reliant India and to reduce its dependency on other countries. Making India self-reliant in electricity is a crucial component of this campaign. On July 10, PM launched a 750 MW solar project in Rewa in Madhya Pradesh. This will be a game-changer for the country and will help in making India self-reliant.

3. Make in India campaign: 'Make in India' was launched by the Government of India in September 2014 to encourage companies to manufacture their products in India and incentivize dedicated investments into manufacturing. It was devised to transform India into a global design and manufacturing hub and targeted 25 economic sectors. The energy sector was also a part of this campaign. Until now, Chinese firms used to supply 80 percent of solar cells and modules to India. Renew Power recently announced to invest 2000 crores in setting up a 2GW solar module plant in India, which will reduce our dependence on China. The 700 MW Nuclear Power Plant in Kakrapar achieved criticality on Jul. 22 2020. This indigenous reactor is a shining example of the Make in India campaign.

4. India is diversifying its sources of crude oil imports to strengthen its energy security. Russia and India will likely sign a pact for the same in late 2020 to help the two countries achieve their target of taking the volume of annual bilateral trade to USD 25 billion from current USD 11 billion. The country is also looking to spread out its oil and gas terminals to its relatively calmer eastern coastline instead of the more volatile and vulnerable western coast.

5. The Government of India is developing means to establish better communication between the Government and industry and central and state governments to avoid communication gap in the time of crisis. The efficiency of the system can be seen by estimating the united response of the country's states towards the pandemic.

6. To boost India's energy sector and bring newer technologies that can change a negative black swan to a positive one, India is highly focussing on R&D and taking big economic reforms. Recently, India reduced the taxes to nearly half for new companies in the energy generation sector. These steps will certainly prepare India for next-generation energy.

7. India's primary policy to tackle an adverse black swan event from several years has been to increase its forex reserves. India's forex reserves crossed $500 billion for the first time in mid-2020. Unlike in 1991, when India had to pledge its gold reserves to stave off a major financial crisis, it can now depend on its soaring foreign exchange reserves to tackle any crisis on the economic front. India is further looking to cut down oil imports also to expand its reserves further.

5. ENVIRONMENTAL PROGRAMS

The energy markets play a crucial role to meet the objectives of sustainable development and for the reduction of the environmental hazards in India. There are vulnerable consequences of the climate changes in the country which includes the impacts of growing water stress level, floods, storms and other natural calamities. The primary sources of energy by share of fuels in India is shown in Fig. 1. India gives utmost importance to the Kigali Amendment to the Montreal Protocol on ozone-depleting substances. There is major progress in India regarding sustainable development which works in attaining the United Nations Sustainable Development Goals (SDGs), particularly SDG7 on energy. There is also an important policy in India which gives priority to provide secure, affordable and sustainable energy to all the citizens.

India started to address the issues of energy and its impact on environmental pollution since the 1980s. Some of these acts adopted by the Government of India for the energy sector include:

1. The Air (Prevention and Control of Pollution) Act. (which is now a part of SDG3).

2. The act on climate change under SDG13 is one of the driver policies on which the country shows the international leadership for the global energy – related carbon dioxide (CO_2) emissions.

3. A proposal has been submitted on a Nationally Determined Contribution (NDC) under the Paris Agreement which takes into account the low per capita emissions and the priorities for the development in the country.

The country is also working towards the improvement of the efficiency in the energy sector and depends on the following policies:

- National Mission on Sustainable Habitat: The India's National Action Plan on Climate Change (NAPCC) released by the Prime Minister's Council on Climate Change on June 30, 2008 which promotes energy efficiency in the residential as well as in the commercial sector.

- Energy Conservation Building Code: This is an Act under the Energy Conservation Act (2001) that led to the establishment of the Bureau of Energy Efficiency (BEE). This further started the formation of the Energy Conservation Building Code (ECBC) in 2007 which aims to reduce the baseline energy consumption for new commercial buildings.

- Standards and Labelling Scheme: The standards of this scheme are set by the Bureau of Energy Efficiency, a subsidiary body of the Ministry of Power, that defines the standards for high – energy end – use apparatus and appliances. This scheme also provides the information about the higher efficiency and maximizing the power savings.

- Green Rating for Integrated Habitat Assessment (GRIHA): This scheme is based on a five-star rating system for green buildings and recommended by the Ministry of New and Renewable Energy (MNRE) to promote energy efficiency by encouraging the optimization of energy performance in building design.

- Scheme for Star Rating of Office Buildings: The Bureau of Energy Efficiency (BEE) developed this scheme to increase the energy efficiency activities in existing commercial buildings in terms of specific energy usage (in kWh/m^2/year).

- Environmental Clearance of Building Projects: The clearance for this scheme depends on the Environmental Impact Assessment (EIA) as well as on the Energy Conservation Building Code (ECBC) – compliance and is mandatory for all projects with a built – up area over 20,000 square metres for the construction of any proposed project.

- Climate Policy Initiative (CPI): In India, CPI focuses on developing innovative finance and policy solutions in support of the renewable energy and green growth plans of the Government working hand to hand with a host of partners like MNRE and IREDA.

- National Action Plan on Climate change (NAPCC): The aim of the NAPCC is to make India an efficient, prosperous and self-sustainable and economy for all generations and confront climate change. The NAPCC is run by a list of principles, i.e., deploying a sustainable development strategy which reduces poverty and anthropogenic impacts on climate change; attaining growth objectives of the country through advancements in energy practices to encourage sustainability and reduce GHG emissions; developing and utilizing technologies at a rapid pace that helps in the mitigation of GHGs; and introducing new markets, regulatory norms as well as voluntary mechanisms that boost up the sustainable development. The NAPCC targets other ongoing tasks and objectives such as investing more on renewable plants ad discontinuing inefficient coal and gas-based plants, producing green electricity to attain a certain percentage of the grid's net energy consumption under the 'Electricity Act-2003' and 'National Tariff Policy-2006', and implement 'Energy Conservation Act-2001' to promote energy efficiency targeting industries through energy audits as well as energy labelling programs.

6. THE MOST VULNERABLE AREAS OF ENERGY MARKETS

The infrastructure of the country is owned by most of the private organizations such as communications, transportation, financial, healthcare, power, oil and natural gas etc. and these are completely dependent upon an efficient energy grid. The public sector organizations play a vital role for the protection of these infrastructure of the country. There are concerns related with the blackouts and cyber-attacks in the power and energy sector. The air pollutant and the greenhouse gas produced from the energy sector can affect the environment

which is a concern of energy security. The recent developments in the renewable power sources for the power generation needs to have an efficient and cheap energy storage device. The increase in the demand of power by means of increasing the transmission capacity may introduce the use of additional transmission lines which also increases the complexity of the system. Thus, these consequences may lead to failure of the grid and critical infrastructure in the areas of energy related markets and may be vulnerable to black swan events.

India is one of the fastest-growing developing countries globally. Its growing import dependence for satisfying its crude oil & LNG demand is shown in the graph below.

The global oil supply fell by 2.4 mb/d in June 2019 to a nine-year low of 86.9 mb/d. The global oil demand fell by 16.4mb/d year-on-year in 2020 as lockdown was imposed to combat the pandemic. Demand rebounded strongly in India in May increasing up to 1.1mb/d month-on-month. Taking into consideration the nature of data, and the practical observations, the following are the financial and sectorial consequences in India due to drop in oil prices in 2020.

The analysis of the financial consequences of the 2020 oil price crash is as follows:

The fall in crude oil prices has been primarily a boon to a majority of Indians. India's crude oil import bill fell 9% from 112 billion dollars in 2018-19 to 102 billion dollars in 2019-20. Benefits from low oil prices were a little offset by the devaluation of Indian Rupees (INR) compared to the USD. The Government of India (GOI) declared complete lockdown from the last week of March till May, and this abruptly cut off the demand of refined petroleum, CNG and diesel. As a result, the refineries and storage facilities in India, including the Indian Strategic Petroleum Reserves, were filled in April. This restricted India's ability to benefit immensely from cheap crude markets. The early lockdown strangled the Indian economy, causing soaring unemployment and mass migration of daily wage workers. As a result, GOI announced many social benefit schemes, which involved a massive INR 20,000 crores government spending. The fall in crude oil prices provided the GOI with an opportunity to increase taxes on the price of refined petroleum & diesel while keeping their increased taxes on the price of refined petroleum & diesel while keeping their market prices constant. This helped offset some of the vast government spending. Low crude prices also helped in controlling the rising inflation in the country. According to RBI, median inflation expectations have reduced by 10 & 20 basis points as compared to the earlier surveys.

The analysis of the sectoral consequences of the 2020 oil price crash is as follows:

1. Upstream: The price crash severely hurt the Indian upstream oil & gas companies forcing them to cut operational (OPEX), and capital (CAPEX) costs. India's most significant producer Oil and Natural Gas Corporation (ONGC) has a break-even price of $37 per barrel, and with oil prices around $20 per barrel, it is expected to report losses of INR 6500 crores.

2. Downstream: The downstream sector comprises oil marketing companies (OMC) and petrochemical companies primarily. They stand to gain from the crude oil price crash as these companies fulfil the majority of demand by importing crude and refining it. However, as described earlier, the massive reduction in demand for refined products due to the lockdown will offset their profits.

3. Transportation: Although crude oil prices fell, the market price of refined products like petroleum and diesel remained constant. The GOI increased the Value-Added Tax (VAT) & Excise Duty on these items, thus not allowing the transportation sector to benefit from the price crash. It also encouraged people to save their fuel cost by cutting unnecessary travel, which in turn enforced the lockdown.

4. Renewable Energy: The lockdown suspended most of the factories due to which electricity demand fell sharply, causing a considerable cash crunch for the power distribution companies (DISCOMS). If the DISCOMS fails to pay its dues to the renewable energy (RE) generation companies, this will negatively impact the already strained finances of the REs. The Ministry of New and Renewable Energy (MNRE) has extended deadlines for project completion. The extension and a shortage of labour will lead to a rise in the projects' cost. Combined with cheaper crude oil, these factors will discourage investors from investing in this sector for the time being.

5. Agriculture: The rising profit margins for the OMCs would imply that the cost of fertilizers and other petrochemical products will be lower than forecasted. This will be beneficial for the agricultural sector. However, the decrease in inflation rates will offset some of the gains. The

Indian sugar industry is set to sustain losses due to a reduction in imports. When oil prices are high, the Brazilian sugarcane mills use the syrup to manufacture ethanol to mix with oil, but when prices crash, they divert their production to produce sugar using the syrup and export it hurting the Indian exporters.

8. COVID-19: A BLACK OR A WHITE SWAN?

"As we travel more on this planet, epidemics will be more acute. We will have a germ population dominated by a few numbers, and the successful killer will spread vastly more effectively. I see the risk of a very acute virus spreading throughout the planet", wrote Nassim Nicholas Taleb, in his book The Black Swan (2007).

As defined by Taleb himself, only that event that appeared as an absolute surprise and was completely unpredictable can be termed as a Black Swan event. In the case of COVID-19, we cannot say that it was unpredictable. On the contrary, personalities like Bill Gates, Laurie Garrett, Taleb himself had predicted that the globalization of trade, ease of transportation, and increasing population density would greatly facilitate the non-linear growth of any new communicable disease. For years, the governments of various countries have been conducting several table-top simulations in order to decide their course of action in case of a global pandemic. Indian Government launched the "Digital India" scheme back in 2015 aimed at creating robust IT infrastructure to virtually connect the citizens enabling them to fulfil most of their needs from the comfort of their homes. The GOI introduced such schemes keeping in mind the need to facilitate remote communication between various sectors when physical communication is disrupted. These initiatives have proven to be extremely useful in enabling effective "Work-from-Home" during the pandemic.

Several economists and researchers had already predicted on the basis of their advanced research that any communicable disease has the potential to be converted into a pandemic if not controlled in time. The pandemic started spreading in China in the last quarter of 2019, but the first case of COVID-19 in India was reported months later in India's Kerala. India had enough time to prepare itself for the situation. Hence, it can be easily concluded that the COVID-19 was a White Swan for India. Despite the various schemes adopted by GOI, it is evident that the pandemic had taken everyone by surprise. It badly disrupted supply chains, forced us into a months-long lockdown, and caused soaring unemployment and humanitarian problems like labour migration. However, it will still not be correct to term the pandemic as a Black Swan. But fortunately, the proactive Indian Government and the health authorities were also well prepared to respond to such a crisis, but in many other sectors, an earlier response could have reduced the citizens' difficulties.

» *A coronavirus testing site in Jammu, India. Health experts said India's virus reproduction rate was ticking up as more state governments loosen lockdown restrictions. Credit: Jaipal Singh/EPA, via Shutterstock*

9. THE INFLUENCE OF THE PANDEMIC ON THE ENERGY MARKET

The Republic of India launched an exceptional 21-day lockdown on 23rd March 2020 with stringent 'social distancing' measures, and 'work from home' became a practice to be followed by most professionals, working in corporate and government agencies. The effect of the Pandemic has been categorized into four aspects:

9.1. Political effect

The pandemic has made an impact on India's plans for the energy transition. With an aggressive renewable energy ambition to achieve renewable energy targets of 175 GW by 2022, India seeks to replace its major source of energy i.e., coal with renewable energy resources. Energy import contributes a major proportion of the net import cost. The post-pandemic period will give the Indian

government a chance to rethink and rework its energy policies and focus more on green and clean energy. If India wants an economic incentive to support energy producers, then it should also carefully assess the different interventions for producers to support the transition to clean energy. In terms of Renewable energy, imports from China are a concern, with ties between India and China going down, especially after the standoff at Galwan valley. While for India, which dreams of 175 MW of renewable energy by 2022, the import of renewable energy technology will decide the fate of the dream. With 88% of solar modules coming from China, it seems difficult for the Indian Government to push forward with its dream as imports and exports with other countries across the globe have been severely affected due to COVID 19 pandemic. Alongside, there has been renewed thrust for the Make in India initiative and call for "go vocal for local" by the Prime Minister of India to boost domestic production and job creation.

9.2. Technological Effect

The most significant impact of the current pandemic has been on the National grid system. Due to the COVID-19 pandemic and the resulting lockdown, all commercial and business activities were shut down leaving only the essential goods and services to strive on. Nearly 1.3 billion population in India was either forced to live in the confinement of their homes or migrate back to their villages, while many professionals were allowed to work from home using computers and mobile and internet equipment. As a result, both industrial and commercial electricity demand decreased significantly while the demand by domestic consumers has somewhat risen as expected. The Power System Operation Corporation (POSOCO) of India which operates the National Load Despatch Centre, was able to respond to the challenge of falling demand while balancing the demand with a varied mix of generation sources during the entire lockdown period. Its ability was further put to test when India's Prime Minister called on the citizens to switch off their lights at 9 pm on April 5th 2020, as a sign of solidarity with the country's healthcare and emergency services workers. The successful management of such a rapid fluctuation in peak loads revealed the technical readiness of the grid operator. It also showed how India's investment in flexible peaking capacities such as pumped hydro and gas-based power generation has enabled the grid to respond to variability in demand, without affecting the operating frequency.

The most significant impact of the current pandemic has been on the National grid system. Due to the COVID-19 pandemic and the resulting lockdown, all commercial and business activities were shut down leaving only the essential goods and services to strive on.

9.3. Economic Effect

The commercial and industrial power demand in India is around 52% of total consumption, followed by the domestic household which is around 24%, and roughly 18 percent by the agriculture sector. Due to COVID 19 pandemic, India's daily electricity demand declined to about 25-28% as compared to the onset of the nationwide lockdown, mainly due to the sudden closure of commercial and industrial centres. According to POSOCO, the energy demand on 16th March 2020 was 3494 MU which was 3113 MU on 23rd March 2020. This further reduced to 2600-2800 MU between 25th -31st March 2020. During the month of April 2020, the peak demand and the generated electricity dropped by 21% and 22% respectively, when compared to the same period in the past year. Another economic effect, due to the COVID-19 pandemic on the power sector has been the alteration of market dynamics.

9.4. Environment Effect

The lockdown has proven that coal power is less flexible to major disruptions in consumption patterns than other sources and can also be

less competitive in the spot market. Coal-fired power generation fell up to 15% in March 2020 and 31% in the first three weeks of April 2020, as per information based on daily data from the national grid. In contrast to coal-based energy, renewable energy generation had increased by 6.4% in March 2020 and again there was a slight decrease of 1.4% in the first three weeks of April marking the increased production of green energy. Considering the environmental aspect, the total CO_2 emissions of the country fell by approximately 15% during the month of March 2020 and about 30% in April 2020. There has been a significant nationwide drop in NO_2 emissions during the lockdown period. The effect of NO_2 emission can be due to short term and long-term exposure.

10. THE INFLUENCE OF COVID-19 ON THE CONVENTIONAL AND NON- CONVENTIONAL ENERGY MARKETS

At present, 56% of India's electricity comes from coal, 36% from oil and gas, and 3% from renewable energy. In reviving the post-COVID-19 economy, India can turn the crisis into an opportunity by resetting its energy costs in favour of clean energy, allowing citizens to enjoy the unprecedented fresh air and blue skies. Due to the pandemic, the country's energy demand fell by 30% in the first week of April. The ongoing pandemic has certainly influenced both conventional and non-conventional markets by reducing demand for petroleum and limiting supply transport and domestic and international transport. As economic activity has improved, demand for coal and oil have increased, but the growth rate has slowed down.

10.1. Conventional Energy Market

Talking about conventional sources of energy, India has 75% of electricity generated from fossil fuels, however, fuel supply demands have taken a sharp decline. Coal, which accounts for half of India's energy, is being replaced by renewable energy. Now this entire model is at risk, with overall demand down by 25%. The intermediate challenge is financial liquidity. New investments will face more hurdles. Indian oil companies ONGC and Oil India, especially E&P Space (upstream), have to face tough times owing to the pressure to sell their products at lower prices. Refineries and distributors (downstream) like HPCL, Reliance, and IOCL (downstream) are likely to see better margins in the upcoming quarter, with demand increasing.

If Indian companies can build sufficient capacity to manage the storage, it will be highly beneficial to buy and reserve oil for future use. Coal supply to Coal India Limited (CIL) notified prices limits any price effect of COVID-19. However, declining demand by end-consumer sectors and significant innovations will affect CIL's e-auction receipts (~ 13% volumes). If the price of coal falls due to demand-correction, it is likely to affect energy conversion worldwide. Besides, rising fuel prices and job losses due to the COVID-led recession pose a significant threat to political leaders worldwide, including India.

10.2. Non-conventional Energy Market

A shift towards cleaner renewable energy has been a priority in the past few years for India and increasing environmental awareness and lower green energy prices have helped drive this trend. India has the most aggressive renewable energy aspirations globally, social welfare centers for many welfare policies. India has made good progress in developing its power generation: renewables, one-fifth of India's total installed electricity capacity, which increased from 13% in 2014. India has set a short-term target of 175 GW of renewable energy by 2022. The government seeks to install solar plants in more than 39,000 different health subcentres to let 230 million people in rural India access electricity. In the first quarter of 2020, the consumption of renewable energy in all sectors increased by approx 1.5% globally in comparison to the first quarter of 2019. With the completion of ongoing solar photovoltaic (PV) and wind installation projects, the generation capacity also increased by 3%. The contribution of renewable sources to global electricity generation increased from 26 percent (in the first quarter of 2019) to 28 percent (in the first quarter of 2020).

Due to the pandemic, resulting global financial recession, and a fall in oil price, the demand for electricity has decreased because financial contractions reduce the demand for power, since all forms of economic activity require electricity, directly or indirectly. India's power consumption was 3 percent lower in March 2020 as compared to March 2019. The gap reflects a lack in revenue production over about three years. Electricity consumption will follow the same course as overall economic production as the recession progresses, but in percentage terms it will decrease much less. Industry profits will also suffer, as most utilities willingly avoid shutdowns due to non-payment of bills and delay planned or expected cost changes. Reductions in demand driven by the economy, which are likely global, will harm new renewable facilities. Utilities must increase their resources and delay the development of new buildings. Policy regulations and public interest have compelled utilities to divest from coal-fired power stations. 102,000 megawatts of coal-generating capacity

have been cut down since 2010. The coal fleet is scheduled to withdraw by 2025 as well as about 17,000 megawatts. Wind, Solar, and Hydropower will eventually offset much of this.

The non-conventional forms of energy are getting more support and push by the government due to lower or no emissions and SDG commitments, but there are some short-term challenges in the renewable energy markets. However, if the energy industry takes appropriate measures with government support and incentives, distributed generations, financial discipline of DISCOM, expansion, and development of technology, it can take over the market as the major industry and can be characterized as the "new normal".

11. CONCLUSION

India's Energy Industry has faced several 'Black Swans' in the last seven decades post-independence, but the Indian government has proactively taken a number of measures in the right direction and implemented numerous policies to reduce their economic impacts. It has reduced poverty, improved education levels, expanded basic infrastructure capacities to a great extent, along with conserving rich biodiversity and building partnerships for sustainable development despite facing great challenges and difficulties. The COVID-19 pandemic and the resulting chaos have disrupted the stability of the Indian energy sector and influenced both conventional as well as non-conventional energy markets, but this situation can also be taken into control if appropriate measures are taken by the government and the energy industry.

CHINA

YOUTH PERSPECTIVE

Key findings

- China's over-dependence on external energy supply is likely to trigger black swan incident in the future. Specifically, there will be two manifestations in the field of oil and natural gas.
- In order to reduce China's energy dependence on Malacca Strait and its shipping routes the government has promoted several policies that imply importing of oil and gas from Russia and establishment of onshore oil pipeline.
- The oversupply in the coal market has been exacerbated by the fact that COVID-19 has significantly reduced the demand for energy consumption. Moreover, the negative impact of the COVID-19 on the oil industry chain is reflected in its consumption, investment, import and export.
- The growth rate of domestic investment in new energy industry has dropped sharply under the influence of the epidemic, and there may be a shortage of funds for new technology research and development.

1. Introduction

China is the world's second largest oil refining country and oil consumer. It surpassed Japan as the world's biggest natural gas importing country for the first time in 2018. Thus, its over-dependence on external energy supply is likely to trigger black swan incident in the future. Specifically, there will be two manifestations in the field of oil and natural gas.

1.1 Oil

More than 70% of China's oil imports come from the Middle East and Africa. Although China is no longer solely dependent on the Persian Gulf region, more diversified importing sources has not changed the fact that most oil still needs to be transported to China through the Strait of Malacca. Affected by the slowdown of global economy and the transformation of energy structure, the global oil price may hover at a low level, which will affect the enthusiasm of Chinese oil enterprises and bring a certain impact on oil exploration and its further development. At the same time, relatively low oil prices in the Middle East and the United States may weaken the cost advantage of China's petrochemical industry and thus affect the overall petrochemical industry in China.

1.2 Natural gas

Since 2013, under the leadership of the central government, local governments have responded to the call of "coal to gas". From the perspective of demand, "coal to gas" has heightened natural gas consumption. However, the abnormal growth of natural gas demand has broken the balance between supply and demand. The ongoing focus of "coal to gas" is bound to increase the dependence of natural gas on foreign countries and thereby greatly increase the risk of energy security.

Under the influence of COVID-19, it can be seen that the global epidemic will not only affect China's domestic energy exploitation and consumption, but also affect energy import and export, thus affecting the supply and demand of various kinds of energy and disturbing energy prices as well as the existing market order.

2. MEASURES AIMED AT REDUCING OR PREVENTING ECONOMIC IMPACT

In recent years, the Chinese government has prmoted a series of policies and plans to solve the problems of energy dependence as follows:

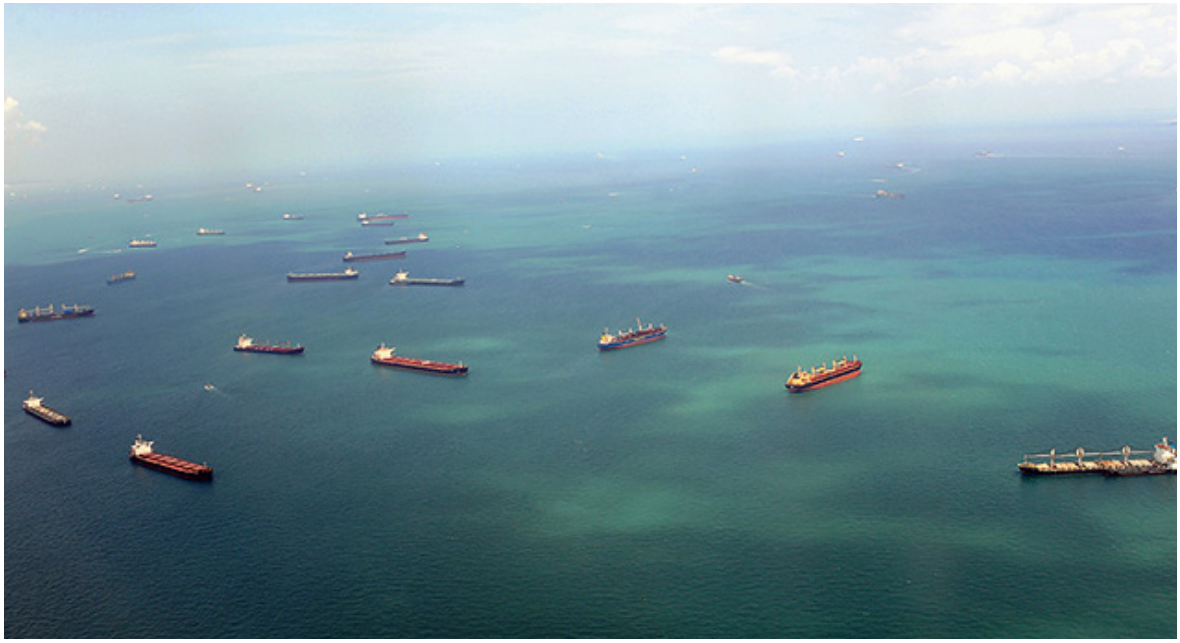
2.1. Import oil and gas from Russia to reduce dependence on Malacca shipping routes.

With the first phase of the China-Russian natural gas pipeline officially put into operation in 2019, to some extent, it will alleviate the tense over natural gas supply in China.

As a result, Russia's share of China's crude oil imports went up from 6.03% in 2010, 9.5% in 2011 to 16.2% in 2019, which improved China's dependence on the oil transportation channel of the Malacca Strait to a certain extent. After China-Russia natural gas pipeline was officially put into operation at the end of last year, export from Russia to China rose from 0.82% of its total export in 2018 to 1.87% in 2019, and 4.95% in the first two quarters of 2020.

2.2. To reduce the dependence on the transport channel of Malacca Strait through the establishment of onshore oil pipeline.

At present, the China Myanmar natural gas pipeline was put into operation on July 28, 2013. The crude oil pipeline runs through Myanmar and leads to southwest China with a total length of 770 km. The daily oil transportation capacity of this pipeline is 400000 barrels, which is equivalent to 5% of China's total daily oil imports.



» *Strait of Malacca © Olaf Schülke/Süddeutsche Zeitung Photo*

Although China-Pakistan oil and gas pipeline can avoid the over-dependence on the Malacca Strait to a certain extent, due to regional development gap, most of China's population, economic activities, and oil and gas consumption are distributed in the eastern coastal and central areas far away from Xinjiang. If the oil and gas from the Persian Gulf reaches China's ports by sea, it will directly reach China's main consumption market. If the oil and gas are transported to Khartoum via Gwadar Port, however, it will take 4000-6000 km of pipelines and railways to reach the eastern and central consumer markets.

2.3. Accelerate the development of renewable energy.

In 2017, the Chinese government launched the energy production and consumption revolution strategy (2016-2030), in which the primary result suggests that China's main renewable energy power generation capacity is 72896kw, accounting for 38.4% of the total installed capacity. Among renewable energy sources, wind power and photovoltaic account for 5.3% of China's primary energy.

3. Are there any ecological programs that your country develops in order to protect the environment during any turbulences on energy markets? (If yes, describe and analyze the efficiency)

3. ENVIRONMENTAL PROGRAMS

The chosen program: Air pollution control action plan

3.1 Description

In 2010, the Chinese State Council approved the guiding opinions on joint prevention and control of air pollution and regional air quality. At the same time, the state issued a new "air quality standard", formulated the air pollution prevention and control plan of key areas in the twelfth Five Year Plan, and standardized a series of emission standards to comprehensively solve the air pollution problem.

3.2 Analysis of efficiency

Based on the detailed supporting policies of "ten atmospheric regulations" and the implementation rules of each province (district, city), and other data, the emission reduction situation of main pollutants in various departments and industries was calculated, and the contribution of various policies and measures to reduction of emissions and PM2.5 concentration was analyzed. The main results are as follows:

All provinces have basically been through major tasks, and their overall performance is good;

The heavy pollution emergency measures in Beijing and its surrounding provinces can effectively reduce the PM2.5 concentration, and the red warning was launched twice, which reduced the daily average PM2.5 concentration by 17% - 25% during the heavy pollution period.

In 2014 and 2015, the meteorological conditions of pollution in key areas were slightly unfavorable or changed little compared with 2013, and

the meteorological conditions did not "boost" the improvement of air quality in recent two years.

4. THE MOST VULNERABLE AREAS OF ENERGY MARKETS

The southeast coastal area is the area with the best economic level, the densest population, the highest energy consumption and the most vulnerable to the impact of the energy market.

China's coal producing areas are basically distributed in the less developed areas, while the developed areas in the southeast coastal areas do not produce coal, so a large number of coal needs to be transported from the central and western regions. Therefore, compared with other regions, it is more urgent to strengthen new energy development, energy reserve and energy risk response capacity.

At the same time, most of China's crude oil and LNG imported from overseas arrive at ports along the southeast coast and directly meet the local energy demand. So, the fluctuation of the international market will have a great impact on the region.

5. THE FALL IN OIL PRICES IN 2020. FINANCIAL AND SECTORAL CONSEQUENCES

5.1 Reduce the cost of oil import and save foreign exchange expenditure.

China being a net oil importing country, the fall of international oil price is bound to lower its crude oil import and conversion costs, which will reach all aspects of consumption in various industries, and greatly reduce the overall economic operation cost.

5.2 Oil prices hit the financial market and have a contagious impact on China's market.

Petrodollars: the fiscal revenue of oil exporting countries may be under great pressure due to the fall of oil prices, which may prompt them to sell assets around the world and return to petrodollars, thus exerting pressure on global liquidity and capital markets.

The sharp drop of oil price will lead to liquidity and credit risk problems in some financial institutions (especially unilateral long crude oil).

A sharp drop in oil prices will also affect investor sentiment, which will lead to a decline in risk appetite, thus selling various risk assets.

5.3 Reduce the burden on the transportation industry and reduce the travel costs of residents.

As oil plays important role in transportation industry, the reduction of refined oil price is conducive to reduce the operation costs of transportation enterprises and provide buffer space for them to cope with the impact of epidemic situation. The high domestic oil price has enough room to fall, which will greatly reduce the profit level of domestic oil production enterprises.

6. COVID-19: A BLACK OR A WHITE SWAN?

We consider pandemic to be a Black Swan in China. On the one hand, COVID-19 is difficult to predict. The outbreak of COVID-19 was sudden, and it was the first large-scale outbreak in China in early 2020. Moreover, as COVID-19 pandemic is highly uncertain, there is great uncertainty about its scope, duration, and evolution path.

To sum up, COVID-19 can be defined as a Black Swan in terms of its unpredictability and far-reaching impact in China.

7. THE INFLUENCE OF THE PANDEMIC ON THE ENERGY MARKET

7.1 Economy

Under the influence of COVID-19, it can be seen that the global epidemic will not only affect China's domestic energy exploitation and consumption, but also affect energy import and export, thus affecting the supply and demand of various kinds of energy and disturbing energy prices as well as the existing market order.

Specifically, COVID-19 has had a significant negative impact on the demand, output, investment, employment, and prices of China's secondary and tertiary industries. As an important basic industry in the secondary industry, the energy industry has been greatly affected.

7.2 Politics

7.2.1 International

The energy market shocks due to the epidemic, causing geopolitical effects. The outbreak has triggered economic nationalism and the trend of anti-globalization, especially with the United States. Under the situation of economic depression, the United States may adopt the policy of anti- globalization to hinder the cooperation between China and the resource-based countries through sanctions.

7.2.2 Domestic

Policy support: Chinese authorities has adopted a "double loose" combination of fiscal policy and

monetary policy to support the economy and combat with the international anti-globalization trend

Infrastructure investment: Chinese authorities will boost its investment in infrastructure construction to stimulate the economy and create new demand. In the short term, it can stimulate economic growth, and in the long term, it will help to improve the operation quality and energy supply security in China.

7.3 Environment

Carbon emissions have dropped sharply and the energy industry is expected to develop in a low-carbon way. In short run, lockdown regulation is conducive to the low-carbon development of energy system. In long run, China is expected to invest more into clean energy such as wind energy and solar energy, promote knowledge spillover and international collaboration, and upgrade its traditional fossil-based industrial structure.

The collapse of international oil price may slow down the pace of China's energy reform. COVID-19 has serious impact on oil demand, which dampened enthusiasm of investment. On the one hand, if international oil prices continue to fall, oil companies will not be profitable. With the decrease of oil companies' expenditures, their investment in new energy will gradually slow down or even stagnate. On the other hand, if the oil price continues to be at an ultra-low level, which will squeeze out the market share of high cost renewable energy and drag down the pace of energy reform in China.

7.4 Technology

Current situation urges China to optimize its structure of financial subsidies and improve the efficiency of policies. In the 14th Five Year plan, China's energy policy will gradually turn to a "technology-based" one, from "development oriented", so as to boost further economic growth and social development.

8. THE INFLUENCE OF COVID-19 ON THE CONVENTIONAL AND NON- CONVENTIONAL ENERGY MARKETS

COVID-19 is a global public health crisis that has a significant impact on both traditional and non-traditional energy markets, with the overall global energy demand declined by 3.8% in the first quarter of 2020.

8.1 The influence on conventional energy markets

8.1.1 Impact on the coal market

The oversupply in coal market has been exacerbated by the fact that COVID-19 has significantly reduced the demand for energy consumption. In the first quarter of 2020, the operating income of coal enterprises above designated size in China fell by 12.7% YoY. In the first quarter of 2020, the thermal power generating capacity decreased by 7.5% compared with the same period, the second industry and the tertiary industry of electric power consumption fell 3.1% and 19.8%, respectively, largely due to the fact that cities in China carried out security emergency prevention and control measures.

8.1.2 Impact on the oil market

In terms of oil demand, the negative impact of the COVID-19 on the oil industry chain is reflected in its consumption, investment, import and export. On the one hand, it will reduce China's energy trade deficit and will benefit its energy security. On the other hand, the decline of oil demand and the subsequent sharp fall of oil prices have a great impact on China's oil industry, which means that China needs to cut oil production and ensure energy security for Chinese oil enterprises.

8.2 The influence on non-conventional energy markets

Compared with the traditional energy industry, the new energy industry is subject to Chinese government subsidies and favorable policies. However, China is facing the dilemma of reducing new energy investment. On the one hand, because of the COVID-19, some countries have proposed the "distributed supply chain" instead of "single supply chain" in order to reduce dependence on manufacturing in China, and many new energy key projects in countries along the Belt and Road stopped working. Consequently, the growth rate of domestic investment in new energy industry has dropped sharply under the influence of the epidemic, and there may be a shortage of funds for new technology research and development.

SOUTH AFRICA

YOUTH PERSPECTIVE

Key findings

- The country has encountered black swans such as high youth unemployment, oil Armageddon, insufficient power supply that led to load shedding and black outs impacting every sector of the economy. Load shedding in the energy sector has the greatest impact on economic stability.

- South Africa has never experienced a total blackout on its national power grid. A total blackout would be a catastrophic event, which is likely to occur one in 50 or 100 years. With an increase in population, increasing energy demand and constrained energy infrastructure, South Africa could also face the black swan of sustained blackouts.

- The COVID-19 pandemic and the measures that had to be put in place to combat it undoubtedly are causing the biggest human tragedy since World War II. The unprecedented economic consequences are expected to last much longer than the pandemic itself. The corona virus pandemic also impacted the South African economy, causing significant shifts in energy demand.

- The South African government is dependent on oil revenues. The recent fall in oil prices is likely to result in a higher government deficit and may result in lower government spending. The collapse in oil prices has affected the South African currency, forcing the central bank to raise interest rates and sell its foreign currency reserves to support the local currency.

1. INTRODUCTION

Energy can be characterised as a currency or globally applicable channel of exchange that influences the standard of living for the global citizenry. Throughout history, energy has played a significant role in global development and has been a driver for life expectancy.

The global energy sector has however witnessed several disruptions and shifts over the years stemming from certain unexpected but poignant events. As the biggest industry worldwide, disruptions in this sector have a tremendous impact on global economies as well as political stability. These potentially destabilising and unpredictable events could be among others, threatened security of supply, prevalent market failures such as monopoly power, declining access to reserves, geo-political risks and erratic oil prices. Black swans as documented by Krua & Jones (2013) is the term given to these "...pervasive and recurring phenomenon in the energy sector...". A black swan is an unpredictable event that is beyond what is normally expected of a situation and has acute outcomes.

South Africa is not immune to the black swans in the energy industry and has in fact witnessed a few in preceding as well as well recent times that have had a huge impact on the country.

After analyzing various aspects, the Youth Energy Outlook's South African Research Groups have investigated the black swans in the energy industry, the impact on world energy markets and effect on economic development.

2. "BLACK SWANS" THAT HAD THE BIGGEST IMPACT

The country has encountered black swans such as high youth unemployment, oil Armageddon, insufficient power supply that led to load shedding and black outs impacting every sector of the economy. Of all these events, load shedding in the energy sector has affected economic stability the most with ripple effects of unemployment.

2.1. Load shedding

The Coronavirus pandemic that shook countries globally, also impacted the South African economy, causing significant shifts in energy demand and resulting in many companies failing to recover

Contrary to Eskom's vision of providing reliable electricity supply, the country has since 2008 experienced perennial interruptions of electricity supply aimed at alleviating pressure on generating plants caused by increasing electricity demand. This phenomenon is described as load shedding; planned rolling blackouts on a rotating schedule throughout the country to avoid total power system failure. In 2019, the extent of load-shedding was so severe that that the country shed 6000MW of electricity to circumvent instability of the grid. Further to this, between R60 billion and R120 billion losses were recorded as a result of 530 hours and 1352 GWH of interrupted power supply. Since then, certain areas such as parts of Soweto have experienced sustained regional black outs lasting several months; a black swan experienced by the country's energy sector.

One of the key drivers of economic activity is electricity and the lack thereof has negatively impacted industries such as mining and manufacturing and the ability to export minerals, thus leading to some of them closing operations. Load shedding and black outs impacted the country's productivity and livelihoods of ordinary citizens. The impact also led to a decrease in investors' confidence in South Africa, further affecting economic growth and other countries that rely on South Africa's energy production.

3. "BLACK SWANS" IN THE NEAR FUTURE

3.1. Total blackout

South Africa has never experienced a total blackout on its national power grid. A total blackout would be a catastrophic event, which is likely to occur one in 50 or a 100 years.

Should a total blackout occur, it will be required to cold-start of the entire national power grid and it could take at least 2 weeks before there is a supply of electricity in some regions.

For the national power grid to fail and cause a total blackout, various turbines within the grid must trip. For turbines to trip, the frequency of the system must drop to about 47 Hz from 50 Hz.

3.2. Load shedding

With an increase in population, increasing energy demand and constrained energy infrastructure, South Africa is most likely to face the black swan of sustained blackouts affecting part of the grid if the supply of electricity is unable to meet demand.

4. THE MEASURES THAT ARE BEING TAKEN AT REDUCING OR PREVENTING ECONOMIC IMPACT

4.1. Eskom

4.1.1. Rotational Load Shedding

Eskom has implemented rotational load shedding to protect the national power grid from total blackout. Keeping the power system balanced at 50Hz, as per international standards, is critical to prevent a nation-wide blackout and when the national electricity grid is under pressure with normal measures implemented, Eskom must reduce demand, as agreed with the National Energy Regulator (NERSA).

4.1.2. Splitting up Eskom

The President has pledged to divide the power utility into 3 entities for generation, transmission and distribution so as to increase the operational efficiency. The president said that restructuring will ensure that the costs are isolated and that responsibility will be given to each appropriate entity. This will also enable Eskom to raise funding for its various much easily from funders and the market, according to the president.

4.1.3. Tariff increase

Eskom plans to raise about R40 billion ($2, 4 billion) though tariff hike to solve its financial crisis.

4.2. Uninterruptible Power Supply (UPS)

A UPS serves as a back-up battery for devices and regulates the amount of power received. In the event of power outages, the UPS switches on and provides power. UPS systems ensure that equipment performs a proper shutdown until connected to another energy source, preventing damage to electric gadgets or data corruption.

4.3. Surge protection

There are quite a number of devices available to protect electrical equipment from surges when there are fluctuations in supply voltage. The most cost-effective ones are the multi-plugs allow one to plug multiple components into one power outlet. This solution is particularly recommended for people living in rural areas where the quality of supply is unpredictable. The large fluctuations in supply voltage can damage electronic equipment.

4.4. Solar-powered solutions

There are many solar-powered options to meet basic energy needs. Another option that is available is to go off the grid completely by swapping electrical power for solar power. However, the costly nature of this option might not make it attractive to all businesses.

4.5. Strategic reserves

The government, in a bid to cushion against uncertainties in oil supply, implemented strategic reserves program to store up fuel (up to 188 million barrels) in disused infrastructure and also encouraged private companies to store up fuel needs in their factories. The reserves could last up to 500 days depending on the rate of consumption.

5. ENVIRONMENTAL PROGRAMS

5.1. Legislative aspect

Section 24 of the constitution provides that everyone has a right to an environment that is not harmful to health or well-being. Furthermore, creates an obligation for the State to take reasonable legislative and other measures to have the environment protected for the benefit of present and future generations. In order to achieve the goal, the measures taken have to prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

The National Environmental Management Act gives effect the constitution and is aimed at protecting the environment by providing principles that all organs of State may apply when performing actions that may significantly affect the environment.

5.2. Renewable Energy

The Department of Minerals and Energy of South Africa developed the Renewable Energy White Paper (REWP) in 2003 to supplements the White Paper on Energy Policy (WPEP). The WPEP is recognises the significance of the medium and long-term potential of renewable energy in South Africa.

The renewable energy resources of South Africa have large and vital potential that will contribute immensely to its energy sector, society and the economy at large.

5.3. Energy efficiency in South Africa

Improving energy efficient technologies and renewable energy sources are very important for the sustainable development of any country. Since 1998, the Government of South Africa set up a demand side management, energy efficiency measures and strategies in policy documents. The current drafted policy was National climate change response white paper of 2011, energy efficiency was highlighted as one of its main goal. Energy efficiency measures and strategies are also included in the national energy Act 34 of 2008 and the electricity regulation Act 4 of 2006. Its National Standards SANS 50001:2011 were published in July 2011 with the aim of improving energy management (EnMS) standards through energy performance, energy efficiency, and consumption uses and pattern of a building. The standard lead to two important factors, first, reduction in greenhouse gas emission and other environmental impacts and secondly, reduction of energy cost through the energy programs mentioned. South Africa has the capacity of energy efficiency of 20–30% across various sectors as stated by the Department of Energy in 2010.

In South Africa, there is a program named EEDSM. Its main function is to develop and implement energy efficiency measures, by public awareness, understanding the energy efficiency and implementation of incentives for the participants of energy efficiency.

In 2008 energy Act established the South Africa national energy development institute aimed to conduct public interest energy research.

The South African government introduced an allowances for energy efficiency via section 12I and section 12L.

1. The 12I incentive is designed to support cleaner production investment manufacturing expansion.
2. The 12L gives an allowances for energy saving achieved through energy efficiency. In has not been effective.

The key measures implemented by the South African government to support energy efficiency include the public sector, manufacturing sector, building codes, energy efficiency management and carbon tax.

6. THE MOST VULNERABLE AREAS OF ENERGY MARKETS

6.1. Petroleum sector

The unprecedented disruption caused by the COVID-19 in global travel has affected the energy industry with the greatest demand shock that can only be likened to the 2008 global financial crisis if not worse.

In response to falling crude oil prices and the failure of OPEC to set new supply constraints, Saudi Arabia responded by declaring an 'oil war' with Russia by increasing production. This collapsed the prices of oil, which affected all oil producing economies, including South Africa. The South African Petroleum Industry Association (SAPIA) highlights that, the petroleum sector contributed nearly 9.0% of the national GDP-with an increased government revenue of R90 billion in the 2016-2017 financial year. Saudi Arabia's decision to flood the market is reminiscent of the 2016 downturn where oil fell below $27 a barrel causing bankruptcies. That is why one of the teams is sure that the petroleum sector in South Africa is most vulnerable to Black Swans.

6.2. Electricity market

Electric energy in South Africa energy is the most venerable market to total blackout. South Africa is currently going through its worst energy crisis. Last year December, Eskom introduced for the first time in history a stage 6 load shedding which requires 6000 MW to be removed from the national power grid. Eskom representatives issued a statement that the utility could not produce a capacity of about 13 000 MW of its 44 000 MW total titular capacity.

The electricity market is most venerable to the Black Swan due to:

- The urgent need for capacity expansion;
- Unplanned maintenance and repairs;
- Bankruptcy;
- Corruption and mismanagement within Eskom;

- Constraints in transmission and deteriorated transmission performance;
- Poor municipal distribution performance;
- Theft of transmission lines.

7. THE FALL IN OIL PRICES IN 2020

In 2020, the petroleum sector witnessed a phenomenon of US oil plunging to below $0 per barrel. South Africa was also faced with the black swan of crashing oil prices with Brent crude also noise diving by more than 70%.

The price of oil influences the costs of other production and manufacturing across South Africa. There is a direct correlation between the cost of fuel and the price of transporting goods and services. A reduction in fuel prices meant lower transport costs and cheaper air travel. In South Africa, the drop in oil prices resulted in a fuel price reduction of R2 per litre in April 2020 for the consumer. As many industrial chemicals are refined from oil, cheaper oil prices benefit the manufacturing sector as well. This reduction of costs could be passed on to the consumer allowing for greater discretionary income for consumer spending to further stimulate the economy.

The decrease in oil prices was also positive for the country's import prices but had a catastrophic impact on local oil majors and other related industries that had to decrease production and shed jobs as a result. Oil majors like Sasol saw their share price dip to below R20 per share from around R200 per share, putting a dent in the country's economy.

8. COVID-19: A BLACK OR A WHITE SWAN?

There are various debates on whether the Corona Virus is a Black Swan or a White Swan. The corona pandemic and the measures that had to be put in place to combat it undoubtedly are causing the biggest human tragedy since World War II, as one of the teams claims. The unprecedented economic consequences are expected to last much longer than the pandemic itself. The much-needed measures to curb the spread of the virus have further deepened and exacerbated the crisis.

There are various debates on whether the Corona Virus is a Black Swan or a White Swan. Nassim Taleb explained black swans as extremely unpredictable and abnormal events that may have severe consequences while white swans have a high probability of occurrence. Black swans are characterised by being outliers, huge impact and being able to explain the events retrospectively.

The question is whether this unprecedented human tragedy could have been prevented or at least drastically limited. Governments and the global system of authority contend that the pandemic has been totally unforeseen – the embodiment of what the statistician Nassim Taleb describes as a "black swan".

The corona virus pandemic that shook countries globally, also impacted the South African economy, causing significant shifts in energy demand and resulting in many companies failing to recover and applying for bankruptcy and staff retrenchments. Based on Taleb's characterisation of black swans, all teams concluded thatthe pandemic could be argued to be a white swan and not a black swan in South Africa.

The country's integration into the global economy post-apartheid exposed the country to global scale risks such as pandemics. Global scale pandemics such as Ebola and SARS have illustrated the risks of the spread of a pandemic across international borders due to the structure of the modern world. Countries like South Africa, upon integration into global economies should have anticipated the probability of the occurrence of a global pandemic.

9. THE INFLUENCE OF THE PANDEMIC ON THE ENERGY MARKET

9.1. Electricity

The COVID-19 crisis has severely impacted progress on energy access and lockdown measures have put off-grid developments at risk and weakened the financial health of decentralized service providers. Confinement policies and the consequent drop in energy demand in South Africa is increasing pressure on power systems, calling into further question the financial health of Eskom that was already under financial stress.

9.2. Environmental impact

The environmental impact of the corona virus pandemic was a paradox. The decline in energy demand and closing of industrial firms and mines had positive externalities on the environment with record low emissions recorded for the past two decades in Johannesburg, Cape Town and Durban. Satellite image comparisons from the Highveld-the electricity generation- zone reported decreases levels of sulphur dioxide (47%) and while nitrogen dioxide (23%) in and around the commercial hub.

These positive externalities were however met with negative impacts on the circular eco-system with parks and wildlife being unmonitored due to lockdown.

9.3. Regulatory and policy-making impact

From a regulatory perspective, the South African government offered payment breaks on utility bills and prohibited electricity disconnections to consumers to alleviate financial pressure. These decisions affected cash flow for the country's power utility as well as those of trading partners, further delaying the completion of capital projects such as Medupi and Kusile construction. Companies were also offered tax breaks and pay as you earn (PAYE) deferred payment options to reduce the company's financial burden.

9.4. Oil demand

Global demand of oil plummeted as countries restricted all travel, commercial, manufacturing and service sectors. Oil prices temporarily plunged to a historic low -Western Texas Intermediate went into $37. Brent crude oil prices, more relevant to South Africa, reached $20 a barrel, which was susceptible to the Russia – Saudi Arabia price war and not demand. South Africa is a net importer of oil and gas and unlike oil producing countries its budget target is not affected by the drop in prices.

Storage capability, price, levies, taxes and the exchange rate to play an important role in determining the fuel price in South Africa and these windfalls had minimal bearing on the end consumer as movements was restricted.

9.5. Economic and social impact

The South African government is dependent on oil revenues, with nearly 9.0% of the country's GDP coming from oil. The recent fall in oil prices is likely to result in a higher government deficit and may result in lower government spending. This is in turn to have a significant impact on job creation within the country, as private sector jobs in the energy industry that are available are based on government contracts.

The collapse in oil prices has also affected the South African currency, forcing the central bank to raise interest rates and sell its foreign currency reserves to support the local currency. This has also led to a downgrade of South Africa's sovereign bonds by credit rating agencies, resulting in capital flight away from the country, all of which resulted in a contraction in the South African GDP.

Although low oil prices are always welcomed by consumers, the global impact of the fall in oil prices is much more difficult to interpret, since many countries depend on oil as a major revenue source and lower prices hurt the economy. Lower oil prices could also signify a weak global economy, which could more than outweigh the benefits of lower oil prices.

The impact of the pandemic extended beyond the country's economy and negatively affected the livelihoods of multitudes of people. It is documented that in South Africa more than 1 million jobs will be lost, with certain businesses unable to sustain themselves and many more shedding staff in order to deal with the financial impacts of the pandemic. Socially, the impact has been devastating and most nations had to redirect country resources to healthcare systems, unemployment subsidies and increased social grants.

9.6. Renewable energy sources (RES)

Although several projections suggest that renewable added capacity in 2020 will be 13% less than the previous year, renewable power sources have so far showed impressive resilience despite changes and disruptions caused by the Coronavirus pandemic and their growth is expected to resume rapidly within a short period of time.

9.7. Solar

With the economic downturn induced by the outbreak of Covid-19, demand from the residential Photovoltaic (PV) segment will be severely affected due to the financial uncertainty faced by the customers. Commercial and industrial installations are expected to be negatively affected as discretionary spending will be delayed, and preserving short-term cash flow will become a priority. Further, in the utility segment, supply chain disruptions and weaker investment will lead to delays in project commissioning of a new solar PV capacity.

Despite the slowdown expected in 2020 due to the coronavirus pandemic's challenges, the outlook for solar remains strong in the medium term, and the market is expected to expand during the forecast period as the cost of generation from solar PV is increasingly becoming cheaper than its alternatives.

10. THE INFLUENCE OF COVID-19 ON THE CONVENTIONAL AND NON- CONVENTIONAL ENERGY MARKETS

The two primary sources of energy are the conventional and non-conventional sources. Both conventional and non-convention energy markets are capital intensive. However, the conventional energy sources infrastructure is aging and in dire

need of replacement and this could be just a great opportunity to implement them.

10.1. Historical reference

The South African energy market is mainly coming from the conventional market. South Africa is blessed with an abundant reserve of coal, and thus this made it easier for the conventional energy market to have the edge over the nonconventional. Furthermore, the demand of energy was considerably lower compared to now.

With a history of racial prejudice created a great deal of unequal opportunity for the nation. As a result, many black communities, which are predominantly African, were not electrified and thus minimised the demand for energy. In the post democratic South Africa, many communities were then brought to the grid and thus increased the demand.

10.2. Conventional energy sources

COVID-19 has largely affected all markets, with energy markets adversely impacted. Conventional energy markets are particularly negatively impacted and this is evident in falling oil prices due to low demand in oil, inconsistent electricity demand as well as fuel prices. The outbreak occurred at a time when energy markets were already strained and prices under pressure. Travel restrictions and lockdown have further affected the demand for jet fuel and petroleum products, by-products of oil as well as electricity respectively.

10.3. Non-conventional energy sources

For non-conventional energy markets, the story may be different. The Energy Information Administration (EIA) forecasted additions to the total solar capacity in January 2020. Residential and commercial renewable projects were set to see new highs with more affordable, more efficient solar PV and rooftop systems hitting the market. The competitive prices of renewable energy have made the option attractive for a green economy and can be used to accelerate green energy through the various stimulus packages that have been made available. The pandemic has elevated the discussions for a green economy and possibilities of storage and grid compatibility especially in light of declining coal demand. Although the demand for renewable energy sources was also negatively impacted by the pandemic, the declining coal demand presented an opportunity and gap for the country to get a glimpse of a low-carbon future, shining the spotlight on renewables.

It is no surprise that investors in the renewable market are holding cash on hand to weather the current crisis. Given all the global uncertainty, this is causing a downstream cash flow issue for subcontractors who rely on these investments to support business.

11. CONCLUSION

South African leaders and policy makers face an historical opportunity to co-ordinate their recovery initiatives in response to the pandemic, in order to increase their efforts in achieving uplifting of masses from poverty, which aims at ensuring access to affordable, reliable, sustainable and modern energy for all by 2030. This implies building more robust and efficient energy infrastructure systems as well as implementing decentralized energy solutions using sustainable energy sources.

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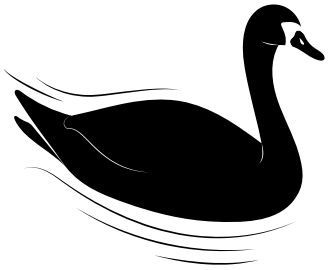

SPECIAL REPORT

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