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Consequences of Oil Supply and Demand on the Electricity Market: Coronavirus Effect

Xenia Tabachkova*

Financial University under the Government of the Russian Federation, Moscow, Russia. *Email: xenia.tabachkova@yandex.ru

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ABSTRACT

The coronavirus epidemic has dealt a serious blow to many sectors of the economy around the globe. The energy sector has dropped significantly and has been affected during the pandemic. The issue of prices for energy products and its production has become aggravated, which has become a test for energy ministries. In this article, it examined the situations in the energy sectors of Europe and Russia as an energy giant. It is difficult at the moment to determine all the impacts that the coronavirus epidemic will have on the electricity sector. The paper found some effects on financial markets in the short term, and others in the longer term. Intuitively, we can already draw the outlines. Electricity is a basic good and as with any public service, it is subject to three principles: continuity, equality of treatment and adaptability. It is the first of them that is vital here. There is no fear on that side, as the operators (EDF, RTE and Enedis) have plans which ensure that nuclear and thermal power plants will maintain their operation - even with 40% absenteeism in the event of a peak of epidemic - and that the networks will be up and running. Priority is given to operational agents, who operate the power plants and repair the power lines.

Keywords: COVID, Energy, Electricity, Oil, Demand
JEL Classifications: E37, F20, G15

1. INTRODUCTION

Support agents can continue their activity by teleworking (Prasad et al., 2012). They must also come as little as possible on site to avoid contamination of the agents who operate the power plants, particularly nuclear, as happened at the Flamanville power plant where the “pandemic plan” was activated in March 16, 2020 (Barbour et al., 2018; Barsky et al., 2004).

The cause is the slowdown or even the shutdown of industry, shops and transport (TGV, metro, tram). A situation which must therefore be accentuated. The increasing use of digital technology due to teleworking and confinement (digital technology usually accounts for around 10% of electricity consumption in France, and consumption in this sector would have increased by 40 to 50% in the context of the epidemic) should not compensate for the drop in demand for electricity in other sectors, far from it.

It should also be noted that the Energy Regulatory Commission is asking EDF and RTE to no longer apply the peak hour system, which allows certain customers to benefit from tariffs that vary depending on the time of year, which proves that the demand for electricity is decreasing. With this system, the price paid by the end consumer is relatively low for a large part of the year, when consumption is low, but increases very sharply during periods of high consumption, especially in winter, prompting him to reduce his demand. We can also expect daily peaks to cap, that is, a flattening of the electricity demand curve. Traditionally, electricity consumption peaks around 8 a.m., when companies start their activity (Robert et al., 2015). The reduction in economic activity and the containment measures put in place thus tend to attenuate this peak in daily consumption and smooth the demand curve. The use of tariff reduction to limit consumption peaks now appears to be of little use and could, moreover, lead to an increase in the bills of the consumers concerned.

2. LITERATURE REVIEW

If we consider this issue on the example of Russia, it can be insidious in sharp contrast to the expectations that existed before the change in the world landscape. Generation companies entered 2020 at their peak - shareholder value, dividend yield, modernization investment plans. Analysts have named this sector as one of the best to invest in (An et al., 2019; An et al., 2020a; An et al., 2020; An et al.,2021; An et al., 2020b). In an interview with Interfax on New Year's Eve, Pavel Zinoviev, head of VTB Capital's trading operations on the stock market, noted the good prospects of Gazprom Energoholding (GEH) and Unipro; investors were hoping for a new strategy for Inter RAO (Figure 1).

However, what prospects and what strategies the Russian energy companies may have in the new conditions is still not clear to anyonec (Baumeister et al., 2008; Buetzer et al., 2012). Non-working days made their own adjustments: already in the first 7 days of April, energy consumption in Russia decreased by 6%, later it began to recover, but the situation still remains unstable. In Russia as a whole, the decrease in energy consumption in the period from March 30 to April 20 was approximately 4%. But this is the average temperature for the hospital - in some regions, like the Volga region, the decrease reached 10%, in Moscow and the Moscow region - 7%. Of the industries, the largest decline was shown by machine builders - by 14.5%, railways - by 6.5%, metallurgy - 3.4%. If it is optimistic (the impact of the coronavirus on energy consumption will extend only to the entire second quarter), the decline in consumption by the end of the year may be 3.6%. The pessimistic and shock scenarios imply a decline in consumption by 8.2% and 10.1%, respectively.

The Ministry of Energy is counting on an optimistic scenario, but the scale of the problem is not yet clear to anyone - there is no forecast for a decrease in demand due to the pandemic for this year, and the data for the first half of April does not yet allow us to fully imagine the apocalypse in all its glory. Many countries (especially in Europe) are now in a state of overcapacity and the weather is quite mild, especially as we approach spring (Yumashev et al., 2020; Yusaf et al., 2011; Zhang et al., 2018). So you don't have to worry about the power supply. On the other hand, demand could still fall sharply. This has and will affect the price observed in the wholesale electricity market and, in turn, the revenues of electricity producers and suppliers (EDF and alternative suppliers). As power plants are called upon to the grid in order of increasing marginal cost, the means of production with the lowest variable cost (renewable and nuclear) are used as a priority to meet the demand for electricity (Olatomiwa et al., 2016; Petersen, 2018; Poruschi et al., 2018). Thermal power plants running on gas or coal, whose variable production costs are significantly higher, will therefore be the most likely to be affected by the decrease in consumption. Admittedly the price of gas is very low since it follows that of oil, itself in free fall, but the reduction in the production cost of thermal kWh will not modify the principle according to which priority is given to fatal energies (hydroelectric power) (Nyangarika et al., 2018; Nyangarika et al., 2019a).

The drop in demand could, on the contrary, accelerate the decline, already under way, of coal in electricity production in Europe. As the wholesale price per kWh falls, its price including tax should also drop slightly for the end consumer. Remember that the electricity supply represents only one third of the bill we pay, the rest corresponding to the price of transport and distribution and taxes. At the same time, the price per tonne of CO_2 collapsed on the European market, dropping in a few weeks from 24 euros on March 10 to 15 euros on March 23, due to the drop in thermal electricity production and therefore CO_2 emissions in Europe.

3. METHODS

The most important for the definition and formula in this situation: the share of the brand and the share of the market served.

$$S_{tm}=N_{tm}/N_{\Sigma} \quad (1)$$

$$S_{s}=N_{tm}/N_{s} \quad (2)$$

where
Stm- brand market share
Ntm- quantity of goods sold for a given brand sold
N∑- the total amount of goods sold in a given market
Ss- market share
Ns -total quantity of goods sold

The given chart clearly shows the change in prices in the energy market (Figure 2). Each role is played not only by the change in prices itself, but also by the rate of growth and increase in prices.

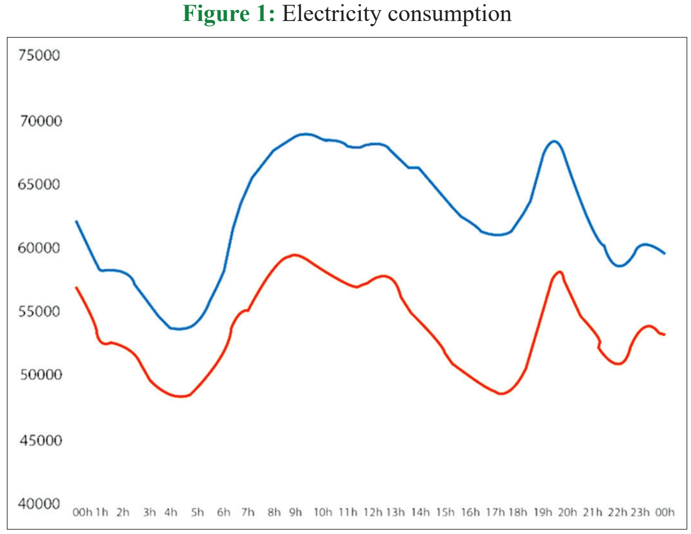
Growth rate:

$$T_{i}=y_{i}/y_{i-1}*100\% \quad (3)$$

Rate of increase:

$$T_{i}=y_{i-}\,y_{i-1}/y_{i-1}*100\% \quad (4)$$

Figure 1: Electricity consumption



Sources: IEA

Figure 2: Evolution of the forward price of 1-month electricity in euros per MWh (March 2020), USD

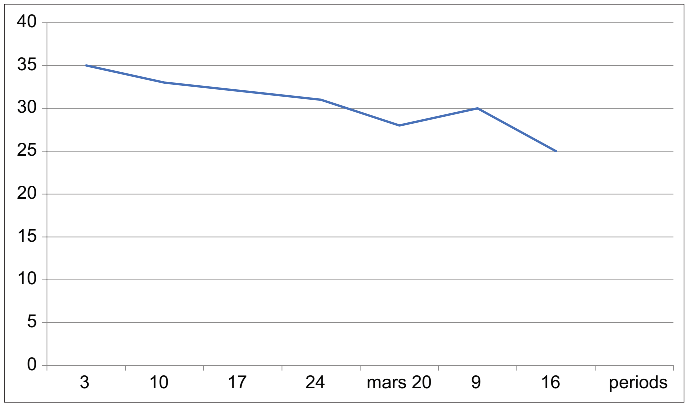
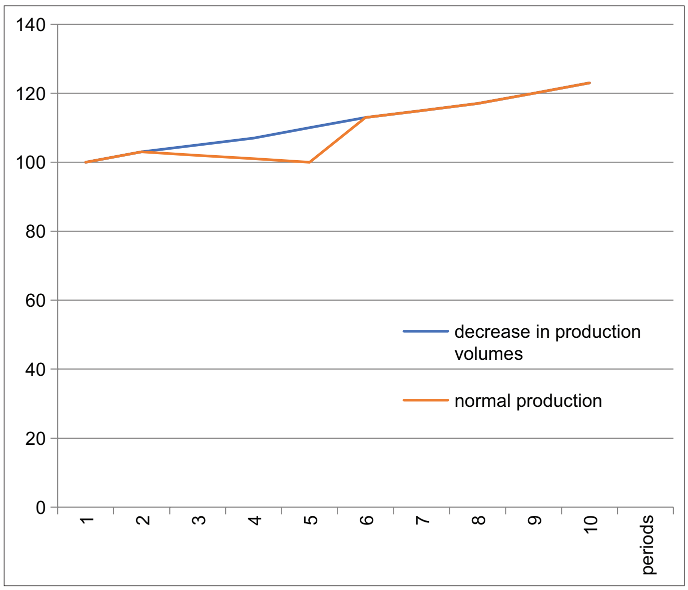


Figure 3: Volume of production scenario (Fast and swift recovery), %

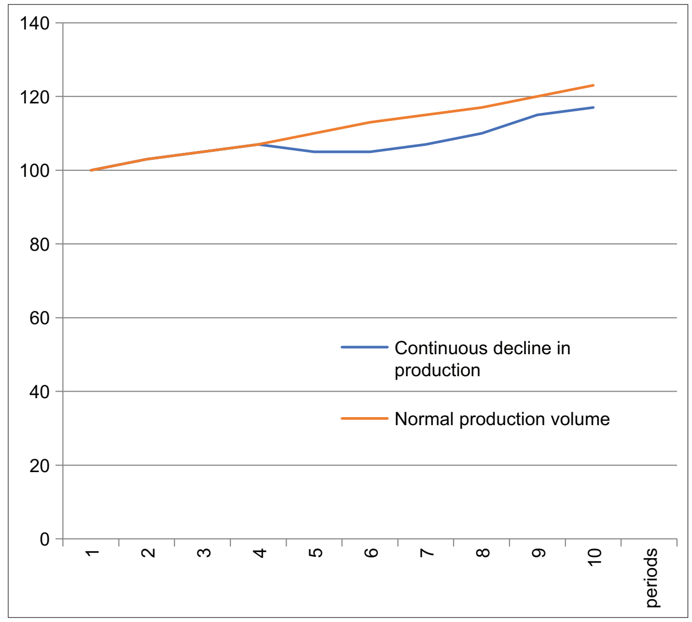


Sources: IEA

Now in Russia for the most part, energy companies do not yet provide forecasts for production indicators in 2020. The Siberian Generating Company (SGK) made a forecast of a decrease in output by 14%, but they explained this with a warm winter and an increase in the output of Siberian hydroelectric power plants. What will happen in fact is a great mystery. The direction is clear - as if all this will not grow. Therefore, we have transferred monitoring of these parameters to a daily mode. We want to quickly understand the trend, to understand which of the three scenarios the trends are approaching.

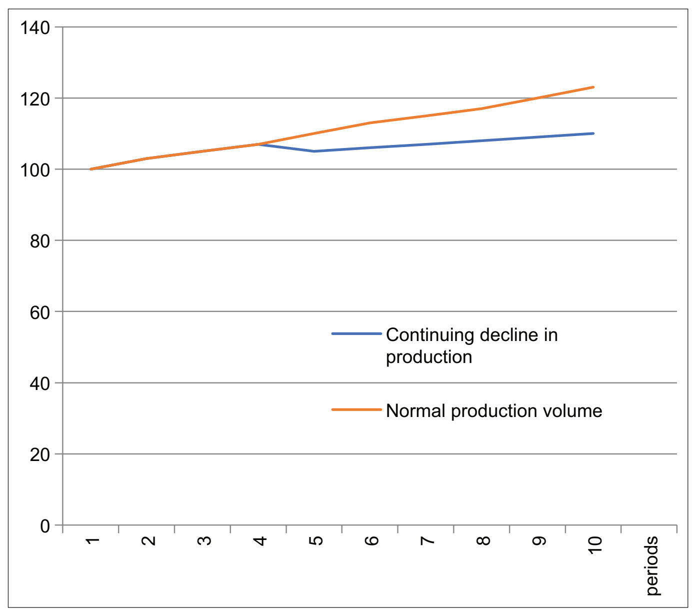
In Russia from my personal observations: so far, RusHydro looks at least not a loser. Its power plants in the first quarter increased their electricity generation by almost 20%. This was confirmed by the "thermal workers" themselves. It also notes that some generating companies see a decrease in electricity generation in the first half of April at the level of 20-25%. Coupled with a 12-17% year-on-year decline in prices in the day-ahead market (DAM), we can expect a 30-40% decline in wholesale generation revenue based on the results of the second quarter (Masini et al., 2012;

Figure 4: Volume of production - scenario (slow recovery), %



Sources: IEA

Figure 5: Volume of production scenario (Prolonged stagnation), %



Sources: IEA

McDonagh et al., 2018; Mey et al., 2016). This is a significant hit to cash flow, especially when combined with non-payments.

4. RESULTS

The main controversial issue is what form the economic recovery will take after the lifting of quarantines, mainly three scenarios are discussed: "V," "U" and "L" -shaped recovery curves. V-shaped GDP recovery involves the active release of pent-up demand, by analogy with the 1953 recession in the United States (Figures 3-5). This scenario comes from the minimal impact of current events on the future output and operation of the economy and becomes less likely as unemployment rises, demand changes and deepening other consequences of quarantine measures (Manasseh et al., 2017; Martek et al., 2019; Martek et al., 2018).

A more pessimistic U-shaped scenario suggests weaker and flatter dynamics, growing into further recovery. And finally, the L-recession is the most severe form of economic recession, which does not involve short and medium term return to line trend, and signifying a long period of low growth, forming a flat line of the letter "L." A classic example of this kind is the recession in the Japanese economy in the 1990s. Which of these scenarios is implemented in practice will influencing a number of factors, including the evolving properties of the virus, the likelihood of a second and subsequent waves of disease, the timing of vaccine development, and, to a large extent, the effectiveness of state policies aimed at containing and mitigating the consequences of the coronavirus crisis for the economy and society (first of all, effective priority measures to maintain liquidity for enterprises and the population), and direct actions of business and citizens (Amano and Van Norden, 1998). In any case, it is already safe to say that the crisis caused by the spread of the coronavirus infection COVID-19 is not an ordinary cyclical crisis, but a shock, capable of causing major organizational change world economy, social order and energy markets (Mikhaylov, 2018a; Mikhaylov, 2018b).

In general, according to the IEA9 estimates, world oil demand in April may decrease compared to April last year by a record 29 million barrels per day. - This is the largest drop in demand, recorded in the entire history of the world oil market (Figure 6) (Vieira et al., 2017; Wüstenhagen et al., 2007). At the same time, previous drops in consumption were caused by a multiple increase in oil prices, but now the situation is the opposite - even low oil prices cannot spur demand, due to the fact that already more than 4 billion people are limited in movement due to total lockdowns.

Prospects for further dynamics of demand are associated with tremendous uncertainty and will depend, first of all, on the duration of the pandemic and related quarantine restrictions. At the current moment, the assessment of the average annual demand for 2020 is in a very wide range from 5 to 11.5 million barrels per day (Figure 7). Consensus decline forecast oil demand for 2020 is now converging at an average level 9 million barrels per day (Simpson and Clifton, 2016; Slaughter, 2000; Sommerfeld et al., 2017; Stoppato, 2008).

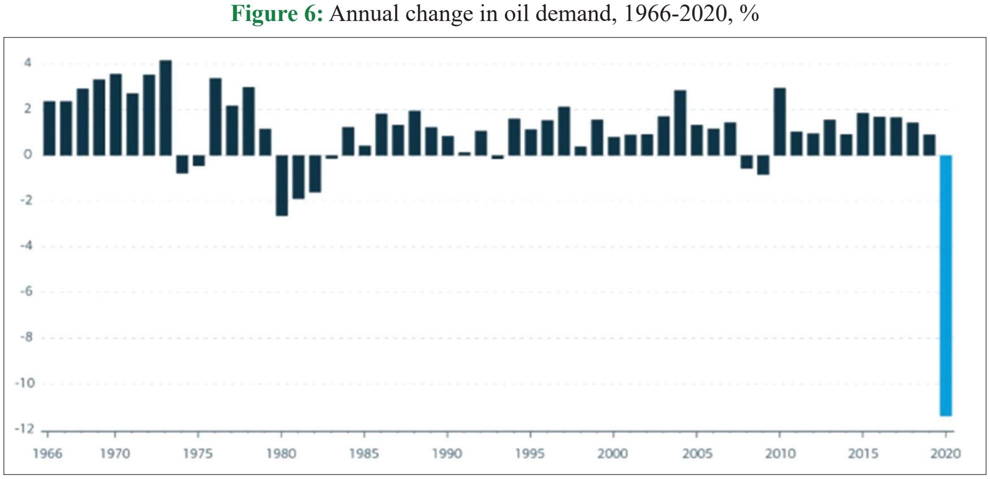
The resulting pricing environment as a result of the above scenarios will undoubtedly affect manufacturers - especially on high-cost market participants (Eid et al., 2014). Large oil and gas companies have already announced a cut their budgets for 2020 - nine largest oil and gas companies including Saudi Aramco, Exxon Mobil and Royal Dutch Shell combined to cut $ 43.4bn (minus 23%) from original spending plans of $ 177.3 billion for 2020 (Figure 8). For example, Exxon Mobil is the largest vertically integrated the company - will reduce investments by 30% to 23 billion dollars. Saudi Aramco - the largest national oil and gas company in the world - plans to cut the budget by 29% to $ 25 billion (Reim et al., 2015).

Using the above formulas, we calculate the data on oil production in Russia for August. Oil production in August in the world reached its peak (Table 1).

It is undoubtedly in terms of investments that the effects will be the heaviest in the long term. The lasting decline in demand for electricity, which should continue if France enters a lasting recession (negative economic growth rate), will be accompanied by a drop in operators' revenues and their cash flow (Denisova et al., 2019; Dooyum et al., 2020; Mikhaylov et al., 2020). We must therefore expect the postponement of certain nuclear renovation investments but also a reduction in investments in new projects (renewable energies or even new nuclear). Likewise, the plunge in oil prices considerably increases the relative cost of investments in low-carbon energies and risks affecting energy efficiency, due to lack of financial resources and because the electricity bill will have fallen slightly for the final consumer (Raison, 2006). The fight against global warming and the reduction of energy consumption are likely to take a back seat in the coming months for many economic agents - starting with public decision-makers. It is likely that for all these reasons, the process of liberalizing the energy sector risks being slowed down and the reform of the electricity market postponed indefinitely (Siegel et al., 2014).

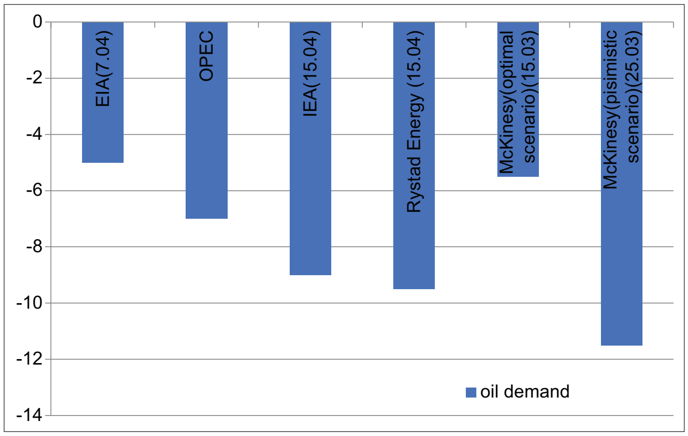
The spread of coronavirus infection threatens not only generators, but also grid companies, which also note the impact of the

Figure 6: Annual change in oil demand, 1966-2020, %



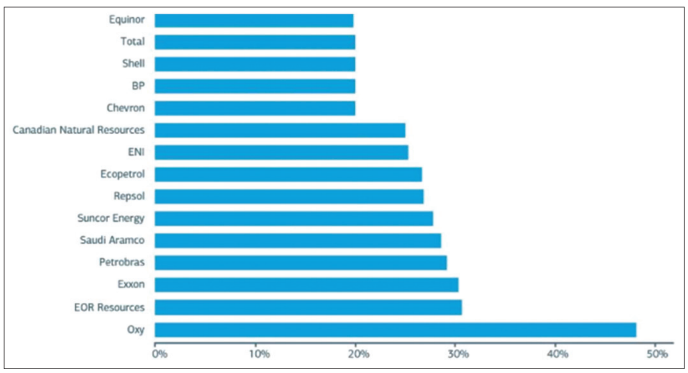
Sources: (Energy Center of the Moscow School of Management SKOLKOVO according to IEA OMR,2020)

Figure 7: Change in oil demand in 2020, %



Sources: (Energy Center of the Moscow School of Management SKOLKOVO according to IEA OMR, 2020)

Figure 8: Reduced capital expenditures by the largest companies in 2020

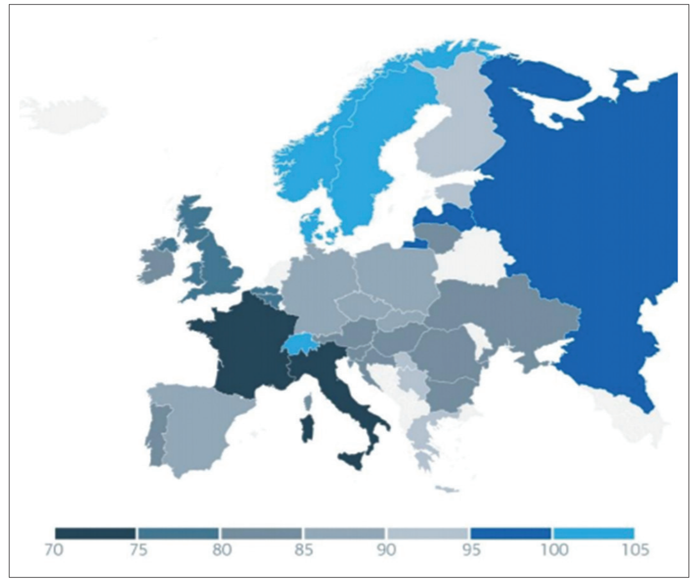


Sources: IEA

pandemic on their performance. So, according to Rosseti, the decline in consumption in the first half of April was 6.4%. Rosseti plans to finally analyze the consequences of the crisis caused by the virus by May-June, said Interfax's interlocutors familiar with the company's plans. While she is still assessing the potential impact of the spread of the coronavirus on her activities. Preliminary estimate - collection of payments in April may decrease by at least 15%, maximum - by a quarter. At the same time, Rosseti has already suspended a number of non-critical projects for the company. According to sources of "Interfax," the reduction of its investment program in 2020 may amount to at least 58-60 billion rubles. ("Rosseti" planned investments of 293 billion rubles this year - IF). However, this estimate does not take into account the possible reduction in the volume of technical connection due to the transfer of their projects by industrial consumers.

For a complete picture, it is worth taking a look at the map. For example, the maximum reduction in electricity consumption in Europe observed in Italy, France and Great Britain, while as in the Scandinavian countries that did not impose strict quarantine, even a slight increase in demand was recorded (Figure 9). At the same time, quarantine in Europe had a noticeable stimulating impact on heat demand. The heat consumption in households

Figure 9: Average deviation of electrical load in the 3rd week of April 2020 from the load of the 3rd week of April 2019 in European countries



Source: Bruegel calculations based on ENTSO-E data

Table 1: Calculations summary

Market share (for August in Russia)	0.15696
Brand market share (Share of Gazprom in August)	0.04992
Growth rate (Share of Gazprom in August regarding July)	99.69
Rate of increase (Share of Gazprom in August regarding July)	−0.302907

Sources: https://www.interfax.ru/business/724182

in Germany in March 2020 grew by 9% compared to last year, in France - by 13%, and in Italy and Spain – by 41-42%. The study was conducted on a sample of about 100 thousand households in Europe. The main reason for this trend is stay of people in houses and a wide possibility of regulating heat supply (temperature increase during presence of people in houses and vice versa).

In the United States, according to EIA73 estimates, the coronavirus crisis will lead to a decrease in overall electricity demand by 3% in 2020, while the main decline will be in the commercial sector (by 4.7%) and industry (by 4.2%), and electricity consumption in households will decrease by only 0.8% (Li et al., 2020). Interestingly, the transition of people to remote work from houses and apartments are changing the daily schedule of electric load (its shape changes to typical for the weekend days - an additional "daily" peak appears, the load becomes more uniform throughout the day) 74 and, more importantly, it increases the requirements for the reliability of distribution networks, including in the suburbs (Trainer, 2012; Tran, 2017). If before the coronavirus about 3.6% of Americans worked from home, then during quarantine their share could reach 56%, according to Global Workplace Analytics (Akpan, 2009). The quarantine-related electricity demand pressure will last for several months. Longer-term trends in electricity demand will be depend on the speed of economic recovery.

5. CONCLUSIONS

A decrease in the revenues of energy companies will lead to a decrease in tax and other obligatory payments, a delay in repayment of loan obligations, a sharp increase in the credit burden to cover cash gaps that are not accounted for in prices and tariffs, the PPA describes the picture. “We see the need for an integrated approach to the problem - in the synchronization of the timing of the government decree on a moratorium on fines and quarantine measures, in the decision to include in the tariffs 2021-2022 interest expenses on loans taken to cover cash gaps from non-payments, in the extension of non-fines. Commissioning under contracts for the supply of capacity for the duration of social distancing measures.

One might get the impression that falling prices in the oil, gas and coal markets will systemically increase the economic attractiveness of fossil fuels compared to low-carbon analogues (electricity and synthetic fuels in transport, renewable energy sources in electricity and heat supply, etc., synthetic fuels such as biomethane or hydrogen. Technologies for capturing, storing and using CO_2, etc.), will reduce the need for energy efficiency and, ultimately, slow down or stop the energy transition. But I think this inhibiting effect of the coronavirus crisis may turn out to be short-term and local. Moreover, ultimately, the energy transition has every chance of accelerating (Musa et al., 2018; Myers, 2013; Nie et al., 2020).

Lack of funds to finance the energy transition will felt by the recession, but low hydrocarbon prices will allow a carbon tax to be introduced, the revenues from which can be used to further finance the energy transition. In addition, in this case, massive state support will be aimed primarily at stimulating “green” energy, which again will give an advantage to industries that compete with oil and gas. Low oil prices will force producers with high costs to gradually leave the market (at risk: Canadian oil sands, high-viscosity oil, projects on the deep-sea shelf, Arctic projects and part of shale projects in the USA) (Molder, 2010; Montgomery et al., 2012). This will force the remaining producers concentrate on what is already there, and, therefore, increase productivity and energy efficiency at existing fields. Moreover, the climate agenda and growth demand for ‘green” oil and “green” gas will be even greater stimulate this trend. Projects for the injection and storage of CO_2 into the reservoir will be developed and investments in alternative energy sources in the fields will grow. In parallel with this, close cooperation is possible oil companies and automakers to increase energy efficiency in the transport sector (Mikhaylov, 2019; Mikhaylov, 2020; Mikhaylov et al., 2020). This will allow maintain the competitiveness of traditional cars; also maintain oil demand. For Russia, the implementation of such a scenario creates both risks and opens up new opportunities. On the one hand, the decline global demand will lead to high competition in the world market, which means inevitably a decrease in demand for Russian oil and gas, while domestic demand did not show significant growth in the best years, and after the crisis, a rapid increase is unlikely. As a result, low demand will be put pressure on the offer.

In these conditions, the Russian oil and gas sector should think about the prospects for restructuring the industry and integrating hydrocarbons into the “green” agenda. This scenario creates new challenges, but at the same time opportunities for hydrocarbon-rich countries such as Russia. And here a growing trend for decarburization of oil and gas and toughening requirements on the part of buyers for the carbon footprint of fossil fuels can play a special role (Rajesh et al., 2015). The crisis has now clearly demonstrated how events may unfold for manufacturers if not a new sustainable model for the development of the oil and gas industry on a global scale will be found - and this issue includes not only decarburization of oil and gas, but also changing systems pricing, development of fundamentally new schemes for stabilizing this cyclical market and interaction between the largest manufacturers. The oil and gas sector, which is now experiencing the most severe crisis, found itself at a fork: depending on the change consumer behavior and demand dynamics, in the long term outlook for 2025, demand will either return to normal, and in this In case, against the background of underinvestment, we will face another price cycle and a new aggravation of all problems between OPEC, Russia and the United States, or will be carried out at an accelerated pace energy transition and the peak in oil demand may be passed as early as 2019. In any case, the challenges for the industry and the stakes for producing countries are so high that they cannot be ignored.

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