



INSTITUTE OF ENERGY
FOR SOUTH-EAST EUROPE



Impact of the Coronavirus Pandemic on the Greek Energy

An IENE Study (M57)

An IENE Interim Report

Athens, September 2020

IMPACT OF THE CORONAVIRUS PANDEMIC ON THE GREEK ENERGY MARKET

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Executive Summary

Apart from the significant economic, social and political implications at global and national level, the spread of the coronavirus pandemic (COVID-19) has greatly affected the energy sector. The most obvious impact has been the sudden and sharp drop in demand, which affected all energy markets, resulting in a significant fall in prices, especially in the oil sector, but also affecting gas and, at a lesser degree, electricity.

Among other things, the COVID-19 pandemic has adversely affected hydrocarbon exploration, the construction and maintenance of energy and related industrial units (power generation, refining, transportation), electricity providers and oil trading companies, as well as oil and gas producers, and the manufacturers and installers of photovoltaic panels, wind turbines and batteries for electric vehicles and, consequently, their manufacturers. There have also been negative effects in the building of tankers and LNG and LPG carriers, as well as of special offshore equipment used by the oil and gas industry. The coronavirus pandemic has also greatly affected EU carbon allowance prices (EU-ETS), as a result of its restrictions on economic activity.

The aim of this special IENE Report is to highlight the aforementioned effects of the spread of the coronavirus pandemic throughout the energy sector globally and more specifically in Greece, and also to provide adequate and reliable data. The methodology followed was based on, (a) a thorough analysis of data produced by key players and companies in the global and domestic energy market and (b) the completion of targeted questionnaires sent to selected local energy companies, aiming at a comprehensive and specialized mapping of the COVID-19 pandemic impact on companies in the broader energy sector.

Overall, the scope of this interim report was to investigate the ways in which the Greek energy system responded to the spread of the pandemic and how it was affected by various restrictive measures, while maintaining its reliability and its smooth operation. At the same time, the report is a record of events that have taken place in the broad energy sector during the period when the coronavirus epidemic was in full swing. A clear understanding of what really happened helps formulate appropriate policies in order to be able to deal with similar crises in future.

As the coronavirus pandemic continues unabated, as a second wave now unravels (September 2020), the present report can only be considered as an interim report. IENE follows closely the situation as it unfolds, not only in Greece, but also in the rest of SE Europe, and monitors the impact upon the energy sector. Once the current wave completes its course, the Institute plans to prepare and issue a more comprehensive report.

Introduction

The coronavirus pandemic had infected more than 25 million people worldwide by the end of August this year, according to the World Health Organization (see Figure 1), making it the worst global health emergency to date. In addition to the confirmed cases, the coronavirus pandemic had claimed the lives of more than 843 thousand people worldwide by the end of last August.

Figure 1: Confirmed Cases and Deaths Due to Coronavirus Globally, January 31 - August 31, 2020

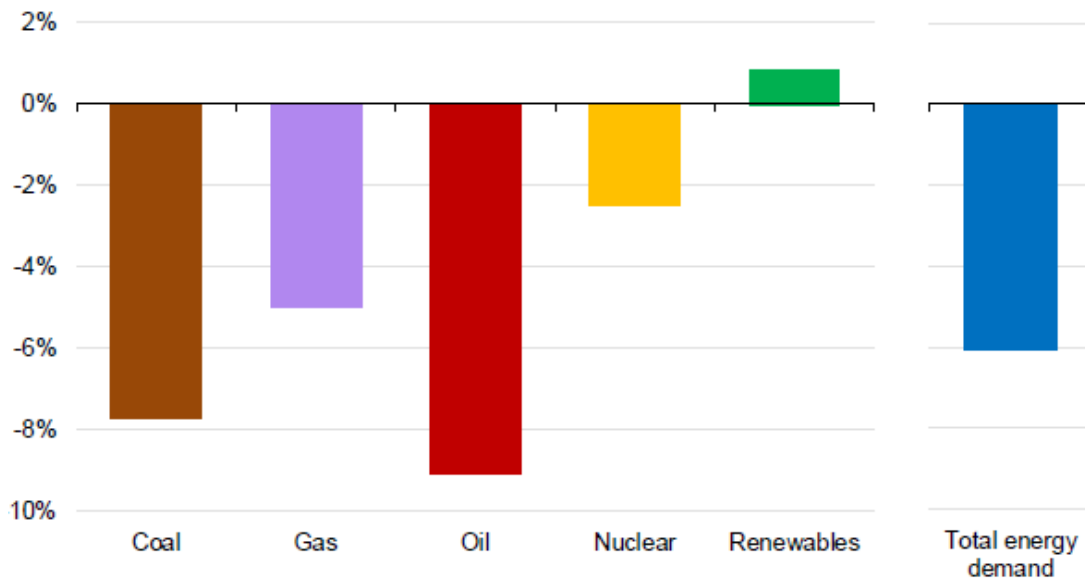


Source: World Health Organization

At global energy level, the International Energy Agency (IEA)¹ estimates that global energy demand will drop by a total of 6% in 2020 (see Figure 2). This forecast, if verified, will be the largest decline, by percentage, in the last 70 years. It is also worth noting that the fall in global demand is estimated to be seven times that of the 2008 global economic crisis. The IEA further underlines that if the situation normalizes sooner, then the drop in demand will be limited to 3.8%, but a second wave of the pandemic could increase it by more than 6%.

¹ IEA (2020), "Global Energy Review 2020", <https://www.iea.org/reports/global-energy-review-2020>

Figure 2: Estimated Change in Global Primary Energy Demand by Fuel in 2020, Compared to 2019

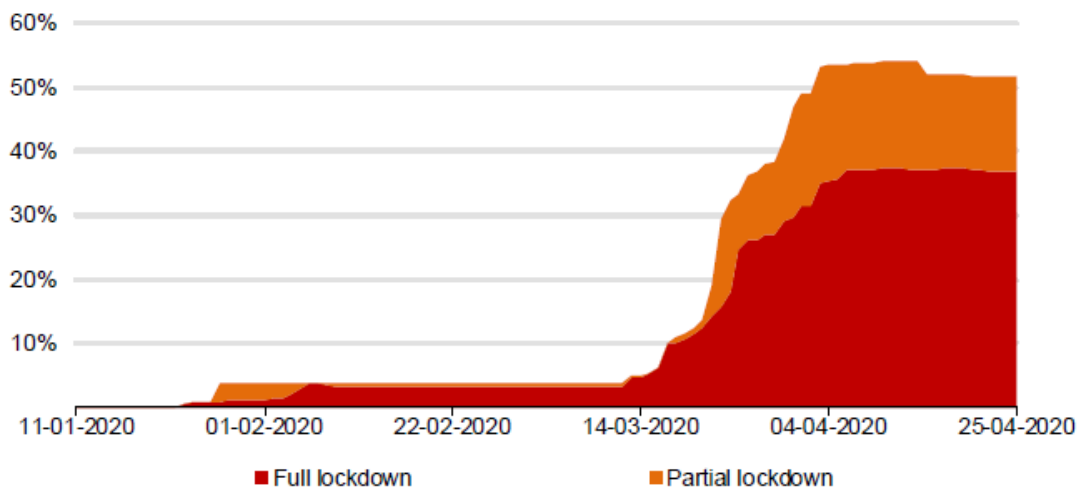


Source: IEA

According to the IEA, developed economies are expected to see the largest declines in energy demand in 2020, with demand dropping by 9% in the United States and by 11% in the European Union. The impact of the crisis on energy demand depends to a large extent on the duration and severity of measures to curb the spread of the virus. For example, the IEA found that each month of global lockdown to the levels observed in early April reduces annual global energy demand by about 1.5%.

Changes in electricity use during the lockdown led to a significant reduction in overall electricity demand, with daily consumption levels resembling those of a pre-crisis Sunday. Full lockdown has reduced electricity demand by 20% or more internationally, with the effects being smaller in cases of partial lockdown. Electricity demand is expected to drop by 5% in 2020, the biggest drop since the Great Depression of the 1930s.

Figure 3: Percentage of Global Primary Energy Demand Affected by Lockdown, January - April 2020



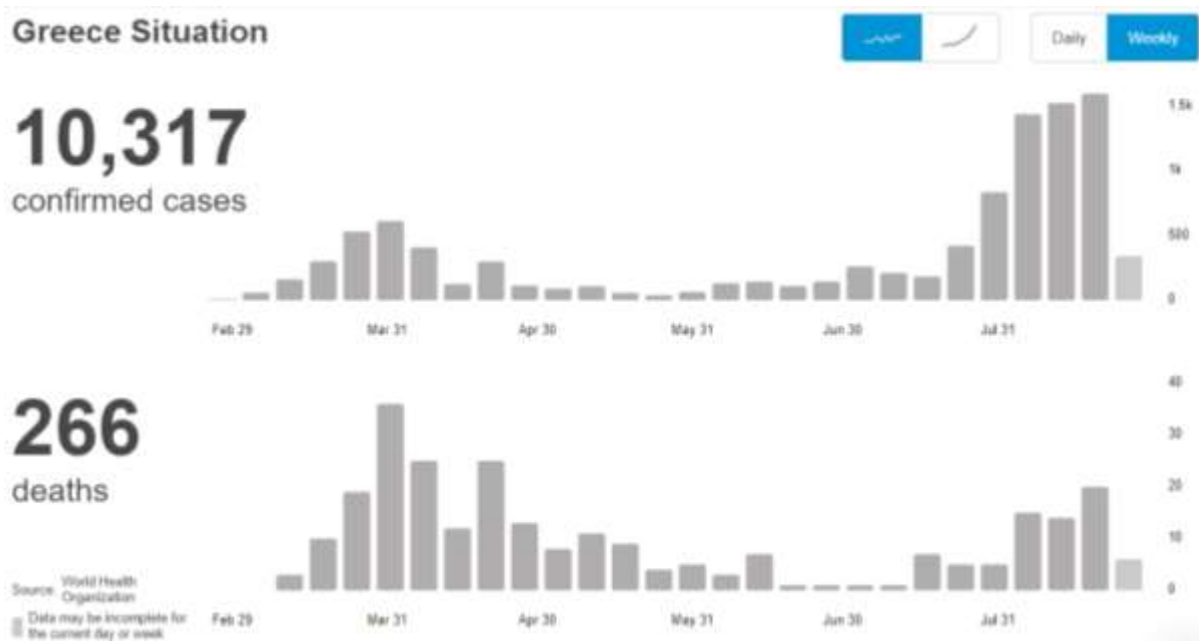
Source: IEA

At the same time, the IEA announced that it expects global oil demand to decline by 9% in 2020, compared to 2019 and consumption to return to 2012 levels, while forecasting a drop of 8% in coal demand. The only source of energy that is expected to increase this year and which the IEA characterizes as "sustainable" is RES, as in the first quarter of 2020 they recorded an increase of 3%. Also, pollutant emissions are projected to be reduced by 8% in the first 9 months of this year.

At European level, energy demand in the European Union fell by more than 5% in the first quarter of 2020 compared to the same period in 2019. The fall in economic activity and energy demand was mainly observed last March after the imposition of lockdowns. Demand fell at a greater extent in countries that imposed lockdowns earlier, implemented tighter protection measures and where tourism represents a significant part of the economy.

In Greece, the outbreak of the coronavirus pandemic and the emergency measures taken to limit its impact have negatively affected the liquidity of the energy market. That principally concerned electricity and gas supply companies active in the retail market, which have a strong clientele in the Medium Voltage, as negative impacts were recorded in sectors that were expected to be most affected by the virus, such as tourism, hotels and catering. Even in the commercial sector, with the exception of supermarket chains, where there was a sharp increase in sales, the signs were quite ominous.

Figure 4: Confirmed Cases and Deaths Due to Coronavirus in Greece, February 29 - August 31, 2020



Source: World Health Organization

It is noted that in addition to liquidity problems, demand was also hit, given that the tourism sector and the catering sector are dynamic business sectors with a significant share in consumption. It is clear that this year's tourism season (i.e. summer-fall 2020) should be considered "lost", with all that this implies for the Greek economy and consequently for the energy market and the supply sector.

The following chapters of this interim report summarize the effects of the spread of the coronavirus pandemic in all energy sectors of the country.

1. Impact on the Greek Economy

The current situation finds the Greek economy, after a decade of challenges and adjustment, once again in a very severe crisis, this time not of its making and with unprecedented characteristics. The health problem caused by the COVID-19 worldwide and the measures taken to deal with it make it impossible for many people to move and therefore to consume and work. It is therefore a direct blow to aggregate supply and demand, leading the global economy into recession.

Concerning the Greek economy, the initial recession was inevitable and is expected to be very deep; specifically, for the current year it is estimated to be similar to the levels experienced during the first years of the structural adjustment programs (2011-2013). According to the basic scenario prepared by the Bank of Greece², the economic activity is estimated to decline significantly in 2020, with the rate of change reaching -5.8%. In 2021, the economic activity should recover and increase at a rate of 5.6%, while in 2022 it is anticipated to increase by 3.7%.

At the same time, and taking into account the high uncertainty surrounding macroeconomic forecasts due to the ongoing coronavirus pandemic, two alternative scenarios have been developed, one optimistic (mild) and one more pessimistic (adverse) than the baseline scenario, depending on the total duration of measures taken to contain the pandemic.

According to the mild scenario, which assumes a shorter transition period to normalcy, Greece's GDP is estimated to decrease by -4.4% in 2020 and increase by 5.8% and 3.8% in 2021 and 2022 respectively. According to the adverse scenario, which now appears more likely, the consequences are expected to be more disruptive and long lasting and the economic recovery will be slower: the GDP is estimated to shrink by -9.4% in 2020, while it will increase by 5.7% in 2021 and 4.5% in 2022. It is noted that the above scenarios incorporate all the economic policy measures announced by the Greek government until the end of May in order to address the effects of the pandemic.

² Bank of Greece (2020), "Monetary Policy Report 2019-2020", <https://www.bankofgreece.gr/Publications/NomPol20192020.pdf>

Table 1: Macroeconomic Forecasts for Greece (Baseline Scenario, Annual Percentage Changes, Unless Otherwise Stated), 2019-2022

	2019	2020	2021	2022
GDP (fixed prices)	1.9	-5.8	5.6	3.7
Private consumption	0.8	-5.8	5.0	2.2
Public consumption	2.1	1.5	0.5	1.7
Fixed capital investments	4.7	-9.9	12.6	12.6
Exports of goods and services	4.8	-26.6	21.4	5.7
Imports of goods and services	2.5	-24.7	19.2	4.9
Harmonized Index of Consumer Prices (HICP)	0.5	-0.6	1.2	1.4
HICP without energy	0.6	0.1	0.9	1.1
Employment	2.2	-4.4	3.7	2.9
Unemployment (% of labor force)	17.3	20.7	17.6	15.2
Current account balance (% of GDP)	-1.4	-2.8	0.7	0.6

Sources: ELSTAT and Bank of Greece

Table 2: Macroeconomic Forecasts for Greece (Alternative Scenarios, Annual Percentage Changes, Unless Otherwise Stated), 2019-2022

	2019	2020	2021	2022
Basic scenario				
GDP (fixed prices)	1.9	-5.8	5.6	3.7
HICP	0.5	-0.6	1.2	1.4
Unemployment (% of labour force)	17.3	20.7	17.6	15.2
Alternative scenario 1: Mild				
GDP (fixed prices)	1.9	-4.4	5.8	3.8
HICP	0.5	-0.4	1.4	1.4
Unemployment (% of labour force)	17.3	19.9	16.8	14.2
Alternative scenario 2: Adverse				
GDP (fixed prices)	1.9	-9.4	5.7	4.5
HICP	0.5	-0.8	1.1	1.5
Unemployment (% of labour force)	17.3	24.3	20.3	17.3

Sources: ELSTAT and Bank of Greece

Especially for the Greek tourism sector, travel is difficult, even after the lifting of special restrictive measures. As the Greek economy is more dependent on inbound tourism than any other European economy, it is estimated that its recession will be deeper and will last longer. In 2019, according to IOBE data³, about 34 million tourists visited Greece, while total receipts of €18 billion were recorded. As a measure of comparison, Greeks themselves, as tourists, spent less than €2 billion domestically, and about €3 billion abroad. Also, again according to IOBE, the survival of the tourism sector in the short term and its strengthening in the medium term requires further

³ IOBE (2020), "Quarterly Report on the Greek Economy – 2020, 2nd Quarter", http://iobe.gr/greek_economy.asp?PD=2020

development of infrastructure, mainly in transportation, communications and health, interconnection with other sectors of the economy, such as food and culture, and overall quality improvement.

At the same time, it is becoming increasingly obvious that it is necessary to develop a strong second pillar in the economy focused on manufacturing, which will be based on innovation and exports. Today, the Greek economy has one of the lowest manufacturing outputs, while its research base is rated poorly within the EU. Of course, there is a risk that large economies will turn to self-sufficiency policies that will reduce the export potential for Greek companies. Also, there is a risk that big companies will be supported by strong economies with extensive state aid and that the relative competitiveness of their Greek counterparts will be reduced, resulting in the further contraction of the manufacturing sector in the country. Overall, policies will be required to increase business financing in the outlying EU country members.

In such a difficult situation, companies must protect, as much as possible, their workforce, continue their productive activities as much as conditions allow, and plan the next day, on an entirely new basis. Otherwise, the Greek economy will find itself stuck with a significantly lower productive potential. That is, it will not only start from a lower level, but it will also develop at a lower rate. Hence, it may be necessary to steer industries and companies to new activities and production methods. If this does not happen, the economy will not be able to claim the necessary production share as the markets will be rearranged in view of the overall lower global demand. Technologically backward and inefficient companies that do not offer high quality services and products will find themselves marginalised, according to IOBE estimates.

During the past decade, three adjustment programs were needed as a deep recession grasped Greece's economy. With considerable effort, central imbalances were corrected and significant progress was made in some areas, but the basic structure of the economy did not change. The domestic economy has benefited in recent years from a boost in tourism following global recovery. However, quantitative and qualitative growth in tourism has been weaker than in competing countries, while the balance of trade remains in deficit. Funding costs were significantly reduced, but with a long delay. Eventually, the growth of the global economy impacted the course of the Greek economy much later and less than other small countries. Delays in crisis management and only limited success in reform efforts have left a very narrow window of opportunity for recovery until another crisis arises.

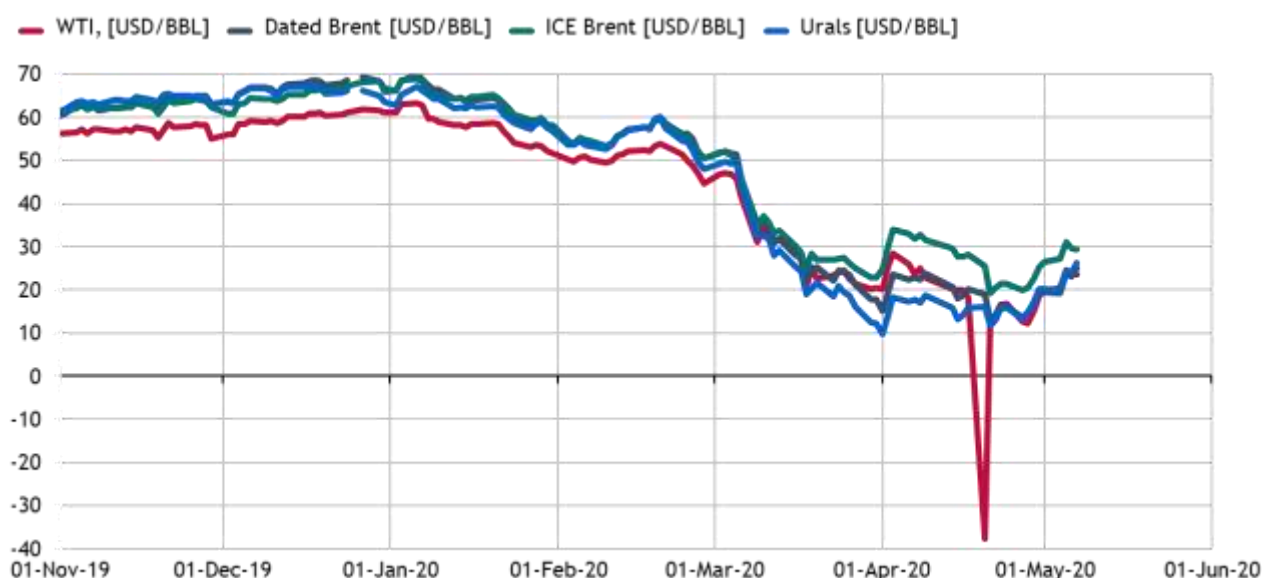
It is anticipated that the health crisis will sooner or later pass and many indicators will recover. It is, however, crucial for the Greek economy to go through the next period with the lowest possible cost, as well as to prepare to claim a share in global growth in the future. The current situation makes it obvious that the transformation of the Greek economy and the change of the production model, with emphasis on industry and production of goods with high domestic added value, is not a luxury, but an absolute and urgent priority.

2. Impact on the Oil Market

International developments due to the coronavirus pandemic and especially the "price war" between Saudi Arabia and Russia last March and early in April negatively affected the global oil market, while the lockdown measures caused a dramatic drop in demand.

Indicative data from the IEA⁴ confirm that the biggest blow to demand took place in the first half of 2020, when it fell by 10.75 million barrels per day on average in a global market of 100 million barrels per day. It should be noted that oil demand also shrank significantly in the second quarter of 2020 by 17.8 million barrels per day, according to IEA data, compared to the corresponding period of 2019, while in some weeks it reached -25 million barrels per day. In turn, the reduced demand led to a sharp drop in crude oil prices, with significant effects on Greek refineries and domestic oil trading, but most importantly creating total inability to predict even short-term market behavior.

Figure 5: Fall in Crude Prices During March-April 2020



Source: S&P Global Platts

In particular, Hellenic Petroleum (HELPE) and Motor Oil, the two leading Greek oil groups and major importers and exporters of petroleum products, but also Energean, the only oil producer in Greece, have been and are still being affected by the significant drop in demand and low oil prices. It is noteworthy that on March 30, 2020, Brent crude, the international benchmark, slipped to a 17-year low as the effects of the coronavirus pandemic had overwhelmed the world's largest economies, leaving the market to stumble as between a shrinking demand and an expanding surplus.

⁴ IEA (2020), "Oil Market Report – July 2020", <https://www.iea.org/reports/oil-market-report-july-2020>

In this environment, the selling price of the unleaded 95 fell sharply in mid-March, after many years, to less than €1,000 per cubic meter (including tax, duty and net of VAT). According to data from the Ministry of Development and Investment, this drop, compared to the prices of the so-called "Black" Monday, March 9, 2020, was over €100. Also, exports, a major activity for the Greek refineries, were significantly affected, as fuel demand fell internationally.

At the end of March 2020, the Federation of Gasoline Dealers of Greece (OBE) described the difficulties faced by service stations, reiterating the issue of including them in the category of companies affected by the coronavirus and accordingly receiving state financial support, while maintaining that their viability is considered precarious with significant consequences for their future.

According to the president of the Hellenic Petroleum Marketing Companies Association (SEEPE), the decrease in sales was combined with longer delays in the time in which marketing companies receive their now reduced income. This is happening because a significant portion of their customers belong to the affected sectors, for which payment of bills has been extended by 75 days. He points out that although the above measure is in the right direction in supporting domestic companies, in the case of the members of the Association it will result in them running out of liquidity, since for them the obligation to advance taxes and duties for the quantities of supplied fuel still applies. As he adds, "the advance payment of taxes and duties, which correspond to 70% of the price of fuel, is already a negative liability for marketing companies, even compared to similar industries, such as e.g. the beverage and tobacco trade. However, under the current situation, which has been created by the crisis due to the coronavirus, it threatens to totally wreck our industry".

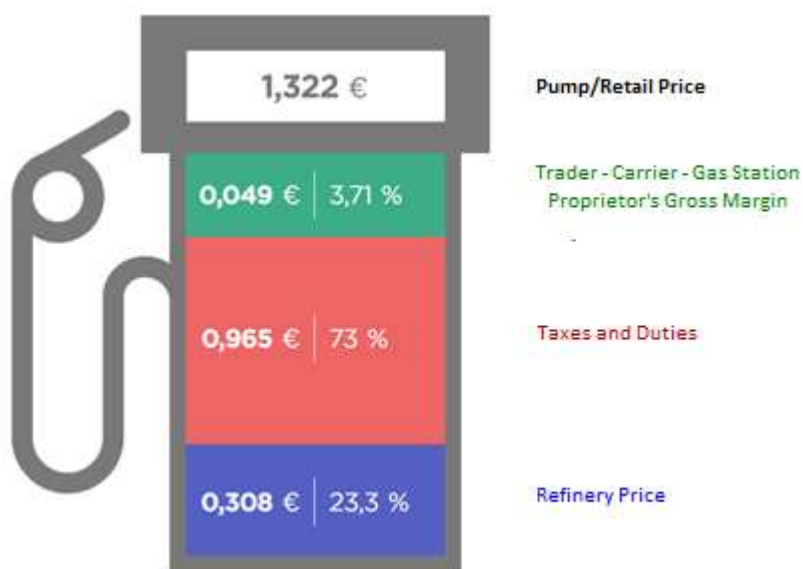
Overall, oil companies and gas stations found themselves in a state of economic turmoil due to a sharp drop in sales volumes by 30% in gasoline and 12% in diesel fuel last March and a shrinkage of more than 80% sales in gasoline and 35% in diesel fuel in April-May.

At the end of April 2020, the front-month May WTI Nymex crude futures contract recorded a negative price (see Figure 5), as a significant volume of futures remained available one day before their expiration, with no deferral agreement (especially in Cushing, Oklahoma, which is the site of physical contracts settlement and the largest oil depot in the world). As a result, contract holders were forced to dispose these contracts even at negative prices in order to get rid of the long positions they had built before the contracts expired, avoiding the natural delivery of the product in May. Significantly, about 10% of the 100 million barrels were priced negatively, while the rest were priced positively.

This development may not have affected the Greek market, as it has nothing to do with US crude WTI and is more affected by Brent prices, but it did create a negative sentiment. Of course, this situation was positive for consumers, households and businesses, since the average price of gasoline nationwide, has fallen by about 27

cents per liter since the beginning of 2020, and at the end of April stood at €1,347 per liter and it would have fallen further if there was no over-taxation (73%) on the pump price (see Figure 6). The diesel also fell by about 25 cents per liter, with the price being at €1.15 per liter.

Figure 6: Average Pump Price of Unleaded in Attica, 22 May 2020



Source: SEEPE

However, the lockdown of Greece's economy negatively affected the fuel demand in April, with sales of unleaded oil reduced by 60%-65% and diesel by 40%, compared to the same month in 2019. Also, a huge increase of 95% was manifested in the sales of heating oil, with its average price amounting to €0.797 per liter at the end of April, as many households rushed to store quantities for next winter.

The turnover of gas stations at the beginning of May appeared reduced by 80%, compared to last year, while the inclusion of the companies of the sector in the third category of the Activity Code Numbers (ACN) of the Ministry of Finance affected them negatively, as this removed privileges such as the 25% discount on tax liabilities.

However, oil companies recorded a slight improvement in fuel sales during the first 13 days since the lifting of traffic restrictions in early May. More specifically, gasoline sales were down to 30% when in April the drop had reached 60%. The decline in diesel sales was smaller. In those first days, it was 10% less, whereas in previous month a decrease of 30% was recorded. Market executives attributed the closure of the "gap" to the re-circulation of vehicles and due to the fact that citizens still did not trust public transport and used their private vehicles.

Impact on refineries

At the same time, and according to market participants, one of the negative effects faced by the two energy groups (i.e. HELPE and Motor Oil) was the cost of inventories. Which of course could be offset to some extent by the opportunities that were

presented for the purchase of cheap oil. The good news for the two groups was that before the outbreak of this crisis, they had managed to reduce the cost of servicing their loans. Especially, HELPE, which had high borrowing, while Motor Oil has traditionally maintained a lower financial exposure.

It is worth mentioning that the coronavirus pandemic led to the filling up to the brim of most storage tanks for crude and petroleum products at both HELPE and Motor Oil refineries, following a sharp drop of sales at the gas stations (50%-60%). For 2020, according to market participants estimates, overall sales of gasoline are expected to fall by -60% and diesel by -30%. With regard to sales of heating oil, there will depend on weather and prices, but in practice most of their sales for 2020 have already taken place amid the outbreak of the pandemic, mainly from domestic consumers at very low prices.

The turmoil in global oil market and the price war brought an unexpected relief to the refining industry. Several energy analysts reported that lower crude oil prices by \$6-\$8 per barrel reduce raw material costs for the industry and thus, there is a positive effect on refining margins. The refineries reaped additional benefits last April as Riyadh's decision to increase production in Saudi Arabia was implemented, further boosting market supply. The biggest benefits, however, were intended for the complex refineries that can take advantage of the spreads between light and heavier oils, something that applies to both Greek energy groups mentioned above, i.e. HELPE and Motor Oil.

At the same time, however, as the opportunities from cheaper oil supply were working in industry's favor, the benefits were being undercut because of limited demand due to the coronavirus outbreak.

Impact on domestic oil production and hydrocarbon exploration

Energean, the only Greek oil producer in the Prinos field off the island of Thasos in Northern Greece, was also negatively affected by the turmoil in the international crude oil markets. Indicatively, a cargo purchased by BP last April, under a long-term contract signed with Energean, was paid at \$9 per barrel, i.e. about 60% below the production cost.

There is also an ominous scenario on the horizon about a possible permanent halt in oil production at Prinos, which will cause a significant loss of revenue for the company and the local community, at around €1.5 billion. According to RIS data, the public would lose a wealth of €440 million from the proven and potential reserves of 95 million barrels of oil equivalent underground, as certified by the independent NSAI appraiser. In addition, in the event of a shut down, the estimated cost of removing the offshore platforms, the onshore oil refinery and storage plant and the restoration of the site is likely to reach €200 million. Since 2008, Energean has made an overall investment of €340 million in rejuvenating the old Prinos oil field, with more than €150 million going to the local community.

Now, the Prinos field is producing less quantities. From 2018, when it was a record year with 4,000 barrels per day, this production was reduced to 3,300 in 2019 and 2020 is expected to be a more difficult year, according to company sources. Energean has already curtailed its investment program in Prinos by \$80 million, with the company also stopping the development of the neighboring Epsilon field.

Also, the prevailing atmosphere in the global oil market and the geopolitical tensions present in the East Mediterranean have caused concern in international energy companies active in hydrocarbon exploration in Greece, but also in the wider region. On the one hand, there are questions about the viability of the companies that currently hold licensing blocks in the region and on the other hand about the competitiveness of natural gas in an era of very low prices (mainly LNG).

In Greece, one of the most mature projects is the Katakolo oil field, which is managed by Energean, as well as the Gulf of Patras of HELPE-Energean, following the acquisition of Edison's portfolio by the latter. For the first concession, RIS has not yet approved the Strategic Environmental Impact Study, but even if this had happened, the cost of the exploration work required is not covered by current oil prices. The Patraikos concession, just before last Christmas, received an extension of 18 months for the first drilling, which is now postponed to June 2021, as the consortium could not find suitable port infrastructure to support offshore drilling, while there is talk that any preparations are to "freeze".

In conclusion,

- The oil market suffered an unprecedented collapse internationally, as oversupply and overfilled tanks led to a dramatic drop in prices, creating much uncertainty, both in the energy sector and in the global economy.
- On Monday, April 20, 2020, the price of crude oil in the US market fell "below zero" for the first time in the history of oil markets. This unprecedented situation came about by the coincidence of two factors: (a) the reduction of oil demand due to the coronavirus crisis and (b) the fullness of the tanks and the inability to receive cargo from trading and refining companies.
- Low oil prices, due to the coronavirus pandemic, have greatly affected hydrocarbon exploration activities.
- The domestic oil market was significantly affected, especially during the outbreak of the pandemic in the second quarter of 2020. Gasoline consumption decreased by 60%, while diesel, mainly due to steady agricultural needs and limited domestic transport, showed a milder decline of 35%-40%.

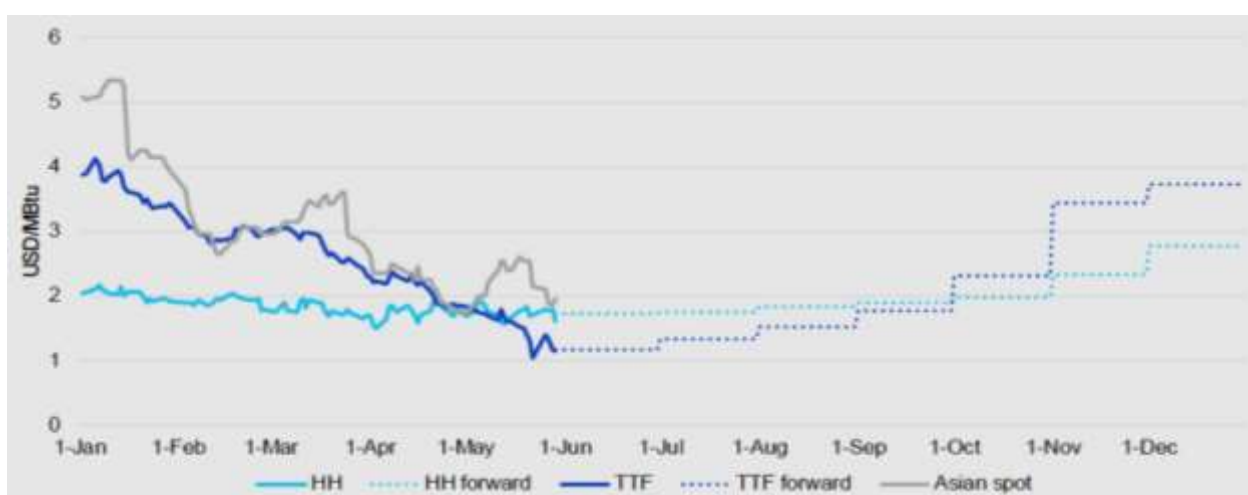
3. Impact on the Gas Market

Lockdown measures related to the COVID-19 pandemic, which were introduced in Europe in March 2020, resulted in less energy consumption, which, coupled with other supply and demand side factors, led to steep falls in energy prices in Q1 2020, also impacting the gas market.

In Q1 2020, spot gas prices underwent steep falls and were in the range of €9-11/MWh on average in most of the European gas hubs. The Dutch TTF spot gas price fell to €7.1/MWh by the end of March 2020, which was the lowest since August 2009. Gas prices in Europe were impacted by abundant LNG supply to Europe, and by the intensive storage withdrawal activity. On the demand side, mild winter weather, reducing heating needs, high share of renewables in electricity generation across the EU, which reduced the need for gas in the power sector, and with the introduction of the lockdown measures in March 2020, industrial demand for gas fell as well. Forward gas contracts also fell during Q1 2020, though not so steeply as the spot prices, implying that the market anticipated a price recovery in the future.

The ICIS East Asia Index (EAX) for May deliveries fell from \$3.375/MMBtu in mid-March to a record low of \$2.250/MMBtu in mid-April. The average across the four weeks was \$2.85/MMBtu, down 7% from the previous month and down 40% from the same period last year. The ICIS TTF price for spot gas in Europe averaged \$2.422/MMBtu and the ICIS South America Index \$2.340/MMBtu over the same period. The EAX showed a small premium over Europe in late March, but all three regions were close in line in April. The front-month US Henry Hub slipped well under \$2/MMBtu over the same period.

Figure 7: Evolution of Gas Prices, January-June 2020

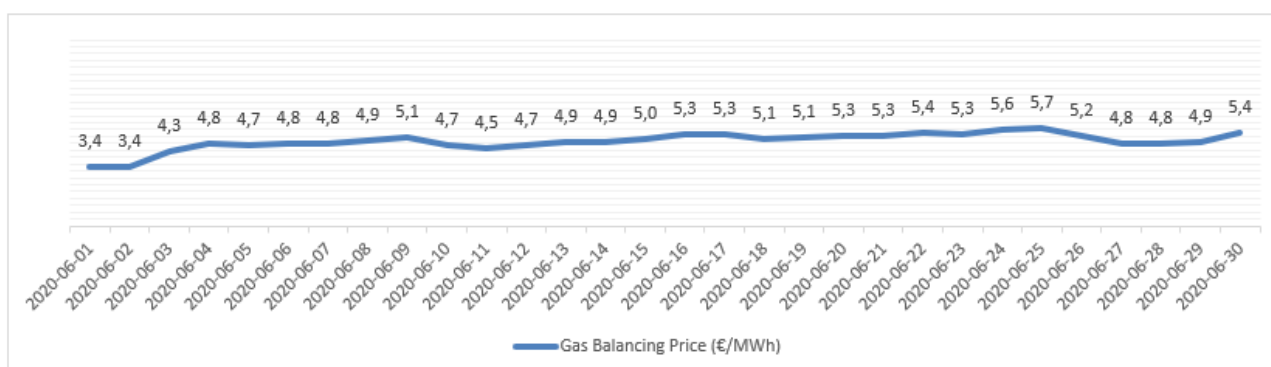
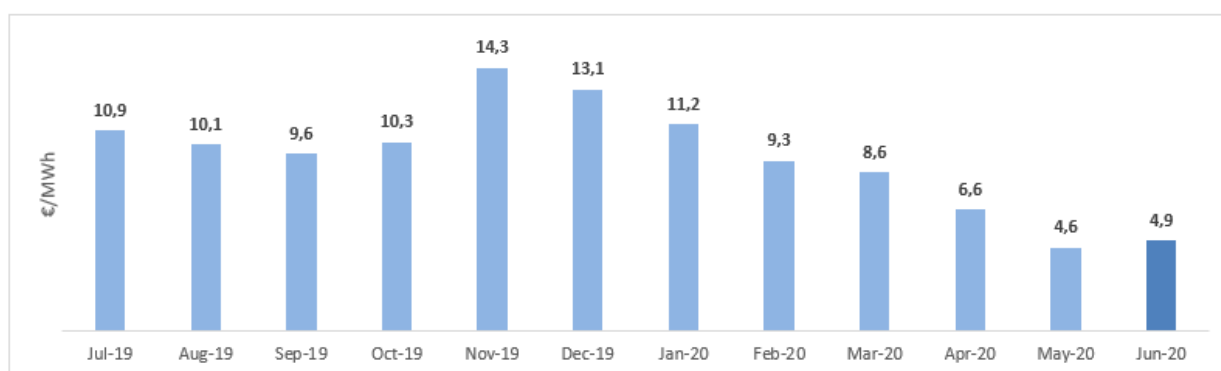


Source: IEA

In practice, if the current scenarios are confirmed that want Brent prices to remain low or to fall to even lower levels, then it is likely that there will be further drop in prices in piped gas, since its oil-indexed contracts are and could become even more competitive than LNG.

Regarding the Greek gas market, there was a temporary decrease in demand, which in no way was comparable to oil. At the same time, no problems were observed in the operation of the LNG terminal of Revithoussa, as well as in the National Natural Gas System. Also, piped gas was not fully competitive last March, as there was intense competition with LNG. In parallel, there were LNG cargoes looking for buyers at a low price, which were fully exploited by domestic players. As a matter of fact, the first six months of 2020 saw an increase in net gas consumption as Greece's electricity generation switched from expensive (due to emission charges) lignite to gas.

Figure 8: Gas Balancing Price (€/MWh) in Greece, July 2019-June 2020



Source: IENE

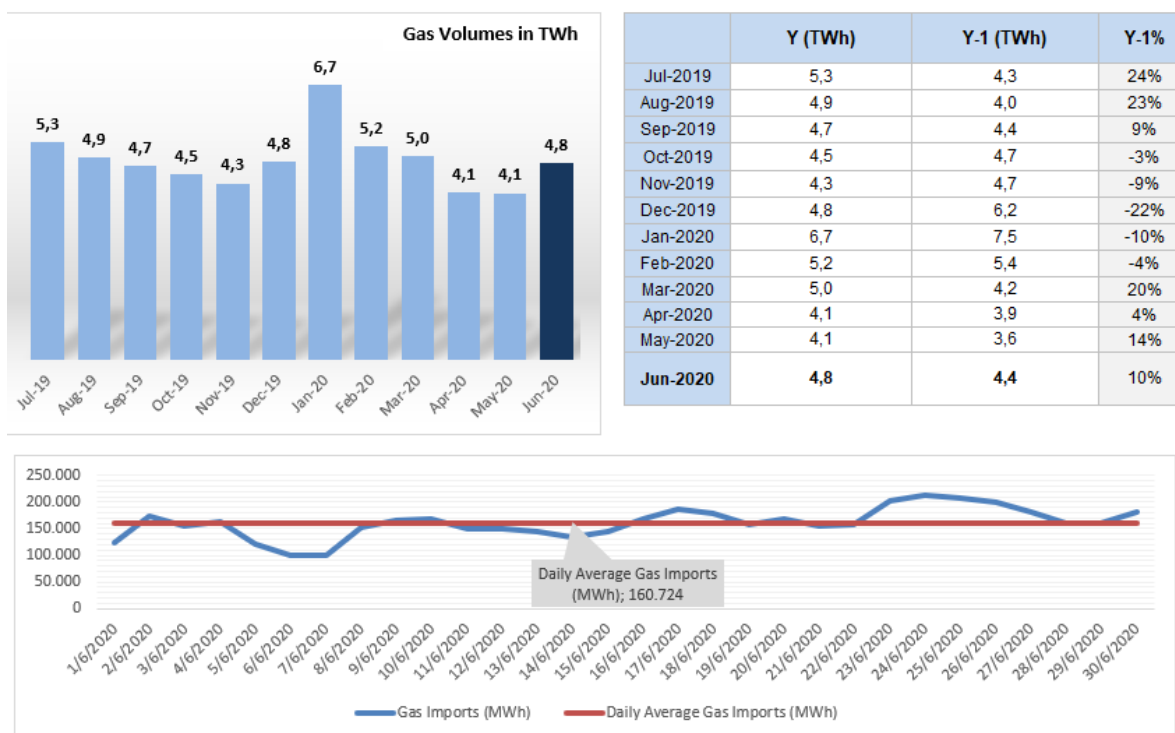
Also, payments of consumer bills were at a satisfactory pace at least at the end of March, with bad debts being in low single-digit percentages and sales still being maintained at about stable levels, without any significant shocks.

Of course, this picture had a logical explanation, as the retail gas market in Greece remains a purely seasonal market, i.e. it only concerns heating, especially in October-March, in contrast to other countries where its use spreads throughout the year. Therefore, the crisis coincided with the end of the heating season and consequently the market did not face serious losses due to household consumption.

However, the domestic gas market in the two months March-April 2020 faced a drop of 30% in revenues, according to the latest available data, with the result that settlements and postponements of payments increased significantly for a considerable portion of consumers.

In fact, for a small percentage of customers, who had debts before the crisis, the companies cut off the supply of natural gas, fearing the worst. However, the industry did not raise the issue of liquidity with the government, as occurred with electricity. It is worth noting that at the beginning of April the cases of significant increase of consumer default rates were still limited, bad debts were moving in low single-digit figures and sales were still maintained at stable levels, without major disruptions.

Figure 9: Total Gas Imports in Greece, July 2019-June 2020



Source: IENE

Undoubtedly, a significant development for the domestic gas market was in mid-April the announcement by the Public Gas Corporation (DEPA) that it will pay a rebate to its customers amounting to €120 million, obtained from retroactive charges paid by Turkish BOTAS, constituting a significant "injection" of liquidity to the market. It is recalled that on March 5, 2020, BOTAS paid to DEPA all the retroactive charges awarded by the Stockholm International Court of Arbitration (ICC). Earlier, in its decision of January 10, 2020, the ICC ruled in favour of DEPA against the Turkish energy company, considering the request of the former for a price reduction.

In conclusion,

- Although there was a temporary decline in domestic gas demand, it was rather marginal and did not reach the levels seen by oil.
- In fact, a small increase in gas demand occurred during the first six months of 2020, because of much higher gas use by electricity producers, following the government's decision about decarbonization.

- The proper functioning of the National Natural Gas System of the country was not affected due to the pandemic.
- There was a significant drop in gas prices (mainly LNG), due to developments in international markets (e.g. a large drop in the price of crude oil), while there was a large penetration of LNG in the electricity generation of Greece, resulting in 64% of gas supply in the first semester of 2020 to be provided by LNG.

4. Impact on the Electricity Market

The coronavirus crisis caused intense concern in the Greek electricity market, given the state of special conditions imposed on the public and the impact on markets and society. A number of consumers, whether business professionals who were forced to suspend activities or domestic consumers who suddenly found themselves without a job, faced problems in paying their bills. These problems were passed on to power providers; thus, re-creating a liquidity crisis in the market.

In addition to the unemployed, there is a significant percentage of customers who pay their bills over the counter. Of all PPC customers, about 50% use electronic payments and the remaining 50% pay at banks, post offices and PPC branches. And there, due to the limitations of the coronavirus, certain problems have created.

However, the data on the rate of collection of electricity bills that are monitored day by day by the companies that are active in the supply of electricity and are also sent on a weekly basis to the Ministry of Environment and Energy (YPEN) and to RAE, confirmed the fears that had been expressed from the beginning. The data on the rate of non-collection differentiate from company to company; however, the majority appeared to be facing a problem.

For example, the number of unpaid bills to PPC and to private suppliers declined by 10%-15% and by 40%-50% respectively last April, with wide range of discrepancies due to the customer base in each company. More specifically, PPC had fewest problems in April, as its revenues decreased by 10%-15%, while the previous month the losses were higher, ranging between 20% and 25%.

The main reason for this development is that the majority of PPC customers are households and high-voltage customers, while it has already lost large shares of business consumers in the low and medium voltage. Thus, domestic consumers present a comparative advantage, as during the quarantine they stayed at home, consumed more electricity and ultimately seemed to be more consistent in paying their bills.

In contrast, private electricity providers typically have a larger share of professional and business clients, i.e. small and medium-sized enterprises. Many of them closed in April and therefore had zero consumption, while some small businesses postponed the payment of their electricity bills. Thus, for private electricity providers the drop in revenues ranged from 25%-30% in April, while for some companies with a large exposure to businesses, the losses reached or even exceeded the level of 50%.

In any case, the capital base required for a company to be active in electricity supply is quite large. The suppliers pay every day for the energy they buy from the Day-Ahead Schedule, while themselves receive payment from their customers after about 45 days, when the customers' accounts expire. Also, high is the cost they have to be able to pay in the form of guarantees to the market operators, based on their turnover (the amount corresponding to the regulated charges of their customers for one month). In

addition, until now they have generally been paid significant amounts from the operators, while themselves are obliged to pay on time the amounts of the regulated charges regardless of whether they have received them or not from their customers. The only advantage the private electricity providers had during the period of the great outbreak of the pandemic was the satisfactory margins they enjoyed due to the collapse of wholesale electricity prices.

According to estimates by Greek energy analysts, the domestic electricity market is expected to need further capitalization of nearby €1 billion, in order to safely cover a large part of its operation in the months ahead.

The effect of the coronavirus was also significant on the implementation of several energy projects in Greece. At the end of March, the suspension of operations in the construction site of PPC's unit 5 in Ptolemaida for a month was announced in order to protect workers from the spread of the coronavirus, while a few months of delay were announced for the district heating project in Amynteo, which is already 80% completed and will include two biomass units with a total capacity of 30 MW.

However, estimates for electricity consumption were ominous, as after tourism and trade, the coronavirus "hit" the energy-intensive industry, which inevitably affected the financial results of retail suppliers. Several textile factories and five plants belonging to Sidenor SA suspended operations, removing significant loads from demand in the coming months. In particular, Sidenor Industrial Steel SA, of the Viohalco group, announced at the end of last March that it was suspending for one month the main production activities of itself and its subsidiaries Sovel SA, Erlikon SA, Praxis SA and Etil SA. The boards of the companies made these decisions due to the difficult conditions prevailing in the international steel market, which deteriorated rapidly as a result of the pandemic, as it drastically reduced demand for their products, as there was a sharp decline in construction activity and activities that use steel as raw material.

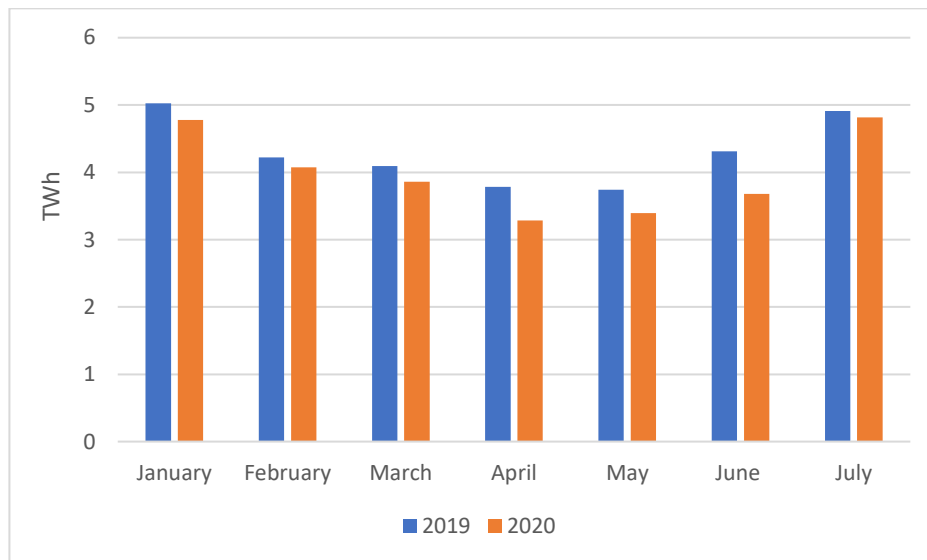
According to IPTO data, which concern the evolution of demand in the electricity system and not the loads declared by companies in the Greek Energy Exchange, a large drop in electricity demand of 14% was recorded last April, reflecting the suspension of commercial and industrial activities that require electricity consumption. It is worth noting that according to the official IPTO bulletin for March, the decrease was of the order of 1.8% compared to the corresponding month last year.

Also, the reduction in electricity demand from the perspective of energy-intensive industries connected to high voltage was almost double last April compared to the overall reduction. More specifically, the decrease in demand amounted to 23% and reflects the closure of large processing plants in the context of taking preventive measures to reduce their financial losses due to falling consumption when in March the corresponding amount of reduction was on the order of 10%.

The aforementioned drop in electricity demand of 14% is unprecedented and according to historical data on electricity demand, it occurred again in July 2013, then

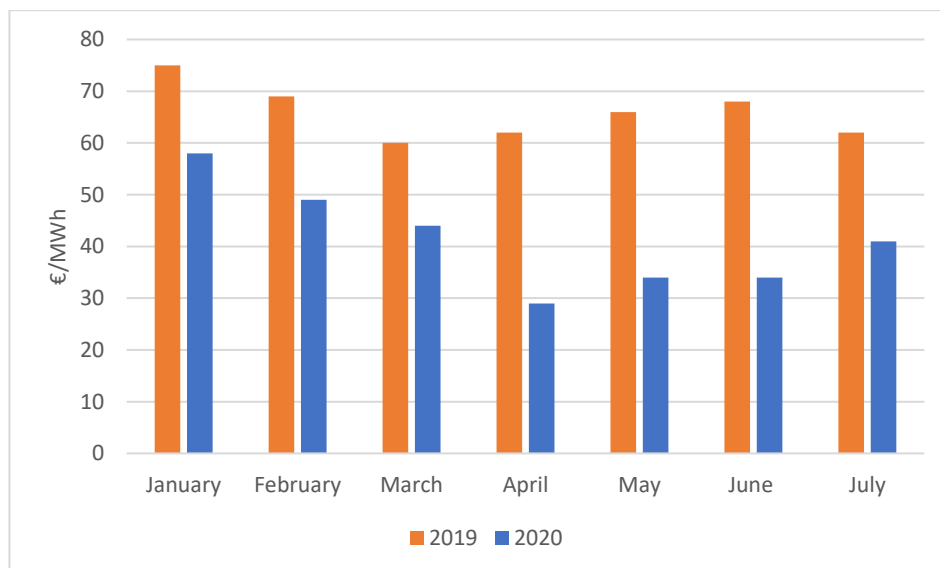
recording a drop of 18%. Therefore, the fall of 14% is essentially a record of at least seven years, which did not occur even during the period of the latest economic crisis.

Figure 10: Comparison of Total Electricity Demand (TWh) in Greece, January-July 2019 and 2020



Source: HEnEx

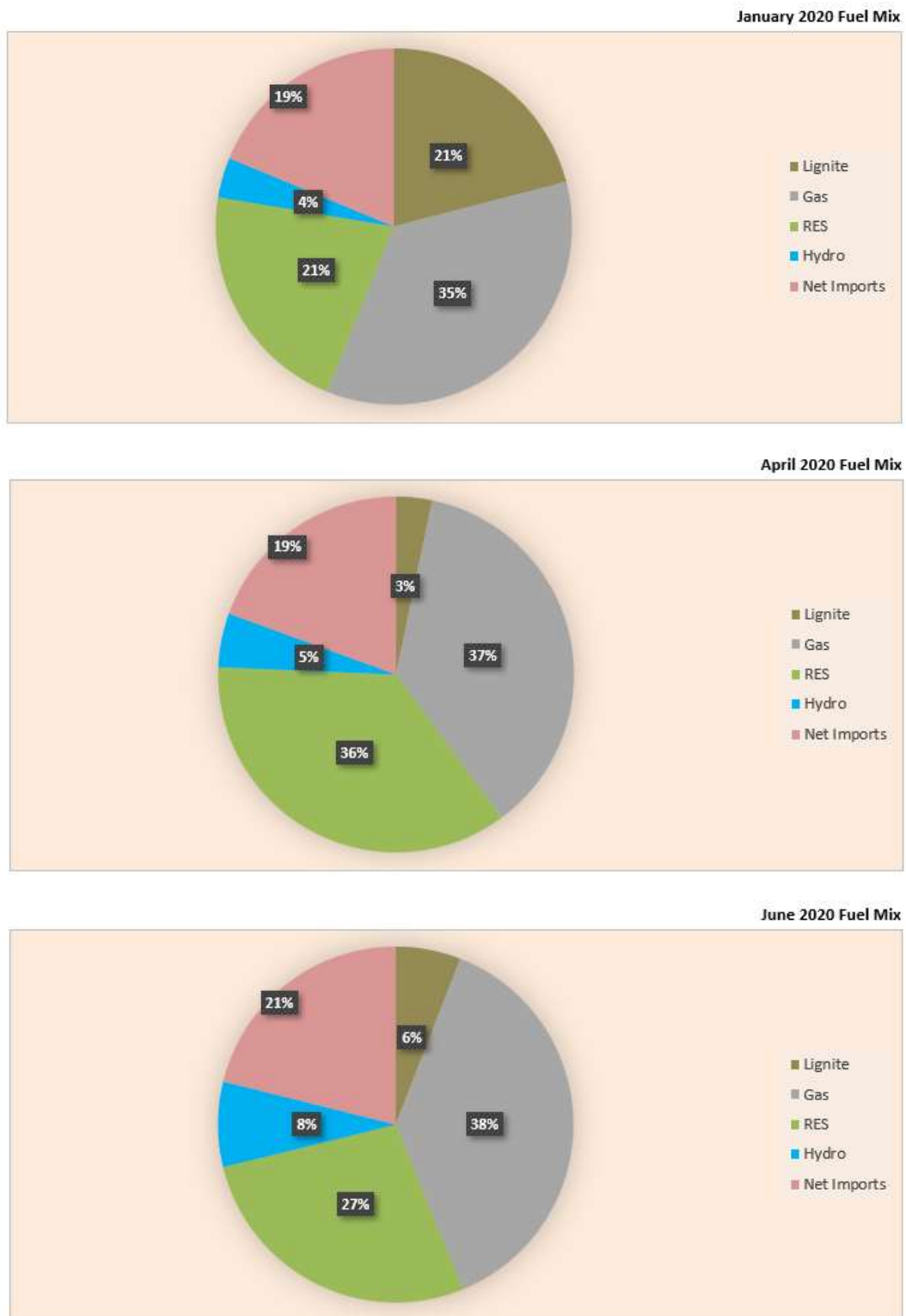
Figure 11: Price Comparison (€/MWh) in the Day-Ahead Electricity Market in Greece, January-July 2019 and 2020



Source: HEnEx

Regarding the country's fuel mix, the coronavirus has brought about significant changes, as the very large drop in the prices of natural gas (mainly LNG), but also the very low prices that characterized the wholesale electricity markets in neighboring countries, have changed the power injection priorities in the system.

Figure 12: Greece's Fuel Mix in Power Generation in the Interconnected System, January, April and June 2020



Source: IENE

More specifically, last March, Greece's electricity imports from neighboring countries (i.e. Bulgaria, Italy, Turkey, Albania and North Macedonia) covered on average about 30% of total domestic consumption in the interconnected system. There were, in fact,

certain hours with recorded bids for larger imports but the capacity of electricity interconnections had been exhausted. Also, RES covered a higher percentage of consumption that reached an average of 30% or more last March. The gas generators of independent producers did not enter for just a few peak hours, as was the case in the past, but instead operated 24 hours a day, bidding with very competitive offers. This led to them covering over 30% of consumption and dropping the pool system marginal price.

On the contrary, PPC appeared in March to cover with its own production a very small percentage of daily consumption, which ranged at levels slightly higher than 10%. In fact, this percentage mainly concerned the operation of lignite plants (some of which must operate in order to cover the district heating needs of the respective areas) and less so the operation of hydroelectric and natural gas units.

Also, particularly important in terms of energy security was the decision by IPTO last March to keep available and active for inclusion in the system all units that could operate, postponing even their annual maintenance scheduled for this period. In particular, IPTO postponed the start of the planned annual maintenance of unit 4 of steam power plant Megalopolis as well as the thermal power plants of Elpedison Thess and Agios Nikolaos (Protergia CC).

At the same time, PPC and RAE, in order to ensure adequate electricity supply in Crete during the summer, were in the process of re-evaluating the data resulting from the health crisis and the impact on electricity consumption of the island. The assessment made by RAE (based on HEDNO data) was that this summer a reinforcement of the system in Crete would be required with the installation of additional 80 MW to 85 MW. The normal practice from previous years is the installation of portable Power Generating Sets (G/S). PPC already made a tender and contracted a 58 MW power G/S.

However, as mentioned above, the electricity demand data has changed. The most important change was tourism which was hit hard this summer due to the coronavirus crisis. It is worth mentioning that PPC had the option within the context of the above tender for the 58 MW power G/S to rent more capacity with the same terms, in case of need. However, such need never materialized and no extra capacity was installed.

In conclusion,

- The pandemic crisis led to a significant reduction in the total electricity load in Greece, which was probably due to the fact that commercial consumption decreased with a parallel moderate increase in the domestic sector, while industrial activity did not cease to a large extent.
- The reduction in electricity consumption, along with a drop in CO₂ prices, led to very low energy prices.
- A number of consumers have had problems paying their bills, creating a controlled liquidity crisis in the market.

- The majority of electricity suppliers offered their customers discounts on electricity bills.
- There was a delay in the start of operation of the Target Model in Greece (originally scheduled for September 17, but now postponed for November 1), as the contractor's team in Athens (General Electric), which would deliver the software of the balancing market to IPTO, invoked force majeure and left the country.
- Significant delays were noted in projects under construction, as happened recently with the new lignite plant of PPC, Ptolemaida 5.
- Significant impacts were also recorded in the energy-intensive industry, which inevitably affected the financial results of retail suppliers.

5. Impact on the RES Market

The spread of the coronavirus caused cancellations and delays in major RES and energy storage projects. Despite the fact that the manufacturing plants of photovoltaic panels and wind turbines in China, which is the world's leading supplier of solar energy systems, have gradually returned to normal levels of operation since the beginning of last March, there have been recorded problems in the development of Greece's domestic RES sector.

However, the problems and risks faced by domestic RES projects, which are related to delays in licensing and delivery schedules, restrictions on travel and accommodation in hotels that do not facilitate the movement of installers in many parts of the country and delay the construction of new projects, but also the maintenance of old ones, as well as tighter restrictions on movement on the islands, can be characterized as manageable.

Regarding the auction by RAE for wind and photovoltaic plants, this was normally held on April 2, 2020, while it is estimated that the next tenders per technology will also be held as planned, showing that Greece has now developed electronic infrastructure that can support the economy even during such a difficult period.

In the case of RES, the main challenge that emerged was the lack of liquidity in the energy market, which is expected to affect the Special RES Account (ELAPE), which finances the income of electricity producers who operate wind and photovoltaic plants. Also, important reasons for the deterioration of the situation of the ELAPE account is the slump of the System Marginal Price (SMP), i.e. the wholesale market price of electricity, and the price of emission allowances, but also the risk of impairment of cash flows due to the possible increase of late payments by consumers.

According to market participants and officials, revenues from the above two main sources are already at low levels. One is from SMP, with the percentage of revenues corresponding to about 40%. SMP had dropped dramatically to €43 to €44 per MWh at the end of March 2020, compared to €60 per MWh the month before. Emission rights, which constitute another significant percentage of the capital that flows into ELAPE, which corresponds to approximately 20%, also recorded a large drop. The price of emission allowances fell to around €16 per tonne at the end of March when in the preceding period was around €25 per tonne. Another concern for RES power producers is whether the revenues of the Special Duty of Greenhouse Gas Emissions Reduction (ETMEAR) will be reduced, which is expected to happen if delays or non-payments of electricity bills by households and businesses are intensified.

In general, ELAPE generates revenues of about €2 billion per year, through which RES production is being paid. ELAPE, after the "bubble" of the previous decade, had turned in deficit, threatening to blow up the electricity market. After many years of good "housekeeping" and "cuts" in tariffs, economic consolidation was eventually achieved in 2018, as it turned marginally in surplus, payments were restored and now ELAPE is called upon to support the country's energy transition to clean energy.

However, according to the revised bulletin of the RES Administrator & Guarantee of Origin (DAPEEP) in March 2020, the projected deficit of ELAPE is estimated at €110 million for the current year, taking into account the need for a special contingency reserve of €70 million. Including the aforementioned "cushion", the deficit of ELAPE is expected to reach €180 million by the end of 2020. The assumptions made include the forecast of the SMP for 2020 at €47/MWh (from €48/MWh, which was in previous bulletin) and a forecast for the prices of pollutants at €20 per tonne.

Also, the ongoing RES investments have faced several difficulties due to delays in the licensing process, restrictions on the movement and accommodation of executives and technical staff, delays in equipment delivery schedules, objections by organized local groups for the installation of wind turbines and the handling of technical and/or operational problems in existing projects.

In conclusion,

- The spread of the coronavirus caused cancellations and delays in major RES and energy storage projects.
- The ongoing RES investments have encountered several difficulties due to delays in response from licensing authorities, restrictions on the movement and accommodation of executives and technical staff, delays in equipment delivery schedules, and the handling of problems in existing projects.

6. Impact on Energy Efficiency

The coronavirus pandemic has also had a negative impact on energy efficiency, as priorities have now changed for most European governments, including that of Greece, although renovating and energy upgrading of buildings is considered an appropriate way to restart the economy after the lifting of restrictions, taking into account the fact that the construction sector has always been a key driver of economic development.

In Greece, priority in the field of energy efficiency was the harmonisation with the revised Directive 2018/844 by March 10, 2020, but the coronavirus delayed these procedures, as the environmental bill containing relevant regulations was finally passed by Parliament on May 5, 2020.

The Ministry of Environment and Energy (YPEN) signed in mid-April 2020 a memorandum of cooperation with the Technical Chamber of Greece (TEE-TCG), which concerns the energy upgrade of buildings and the provisions of existing legislation. According to TEE, if the country was to proceed strictly on the basis of the existing legislation, then construction activity might be negatively affected due to cumbersome legal and administrative restrictions in place. This means that there will be a one year's delay in Energy Class A buildings as it was finally decided that the country should not proceed so strictly and ambitiously in order to create problems with building permits and construction activity in general.

In conclusion,

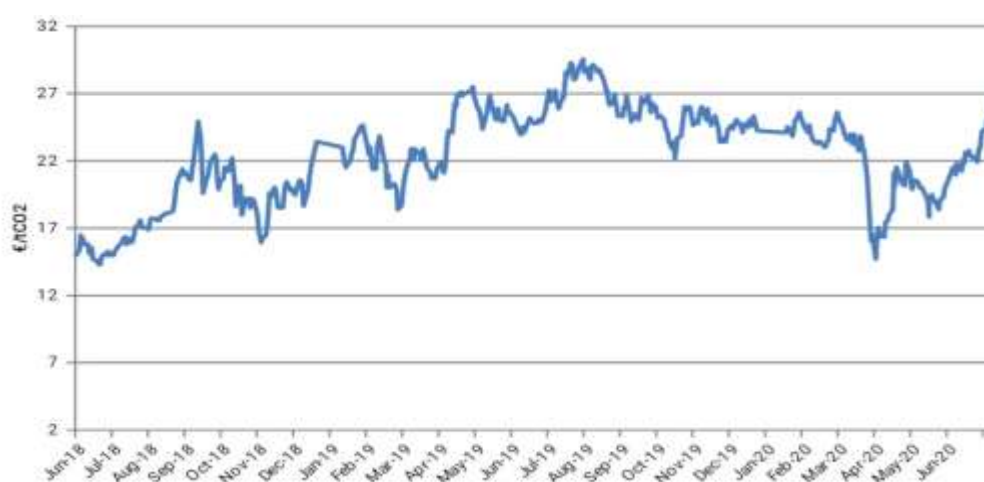
- Considerable delays were recorded in the renovation and energy upgrade of buildings

7. Impact on the Emissions Market

As already discussed, the coronavirus has also greatly affected the prices of pollutant emission allowances in the EU, through its restrictions on economic activity. It is noteworthy that on March 23, 2020, emission allowances had lost about 40% of their value since the beginning of this year and were at their lowest levels since June 2018, just under €15 per tonne of CO₂ (see Figure 13).

More specifically, emission allowances fell for the first time on an annual basis below €20 per tonne of CO₂ on Monday (16/3), while the last time this happened was for a 10-day period in February 2019. All the rest of 2019, the average emission allowance prices were over €25 per tonne of CO₂.

Figure 13: Emission Allowance Prices in the EU, June 2018-June 2020



Source: European Energy Exchange

Also, according to the Norwegian energy analysis company Montel, the price of pollutant emissions is expected to range this year at €18-22 per tonne of CO₂, i.e. €8 lower than previous estimates.

Several energy analysts estimate that CO₂ emissions are expected to decrease dramatically by 26.5% in 2020 compared to 2019. It is also positive that the reduction in emissions will not be temporary, but they will remain lower than the National Energy and Climate Plan (NECP) the following years too (i.e. 60.8 million tonnes in 2025 compared to a forecast of 63.4 million tonnes before the coronavirus). The reason is that the drop in the price of natural gas puts the lignite power plants that emit the largest amounts of CO₂ in an even more disadvantaged position.

According to measurements by the Atmospheric Physics and Chemistry Group of the Institute for Environmental and Sustainable Development Research (IEPBA) of the National Observatory of Athens, air pollution in Athens showed a significant decline, following the imposition of restrictive measures due to the pandemic.

The benchmark for comparing pollution levels was set for March 23rd, when the curfew was lifted. The measurements cover until April 12, while the period from

March 1 to March 22 was used as a reference period for the concentrations of pollutants before the implementation of the measures.

In conclusion, the period March 23-April 12, 2020, when traffic control measures were implemented to prevent the spread of the pandemic, showed a reduction in the concentrations of pollutants related to traffic of the order of 30%-40%, compared to the period 1-22 March 2020 and at least 10%-25%, compared to the corresponding period of 2019.

The other main conclusions of the measurements can be summarized as follows:

- There was a decrease in the concentrations of gaseous pollutants associated with combustion processes. In particular, nitrogen oxides (NO_x), which come mainly from car emissions, were reduced by 45%. In particular, levels of nitrogen dioxide (NO₂), which is a statutory pollutant, were reduced by 35%. Carbon monoxide (CO), produced by incomplete combustion of fossil fuels and biomass, also shows a reduction of 30%.
- Carbon dioxide (CO₂) levels have been reduced by 2%. However, with regard to the urban contribution (of Athens) in particular, taking into account the regional background, a significant reduction of 35% was observed.
- The concentrations of PM_{2.5} fine particles (up to 2.5 μm in diameter) decreased by 20%. In particular, particles emitted locally mainly from the circulation of traffic, such as carbon black (BC) and characteristic trace elements, showed a reduction of 25% -45%. In contrast, concentrations of sulfur (S) representing the energy production sector as well as cross-border pollution did not change significantly.
- During the corresponding period 1-22 March of this year there was no significant difference, both in the levels of pollutants and in the prevailing meteorological conditions (wind speed, rainfall and temperature) compared to 2019. On the contrary, during the period 23 March-12 April 2020, the concentrations of pollutants decreased by 10%-25%, compared to 2019. Considering that the wind intensity in that period of 2019 was higher by 30%, compared to 2020, thus contributing to the natural cleaning of the atmosphere, it is estimated that the real decline this year is even greater.

In conclusion,

- The coronavirus pandemic has also greatly affected the prices of emission allowances in the EU, with the result that at the end of last March they lost about 40% of their value since the beginning of 2020.
- A positive effect of the coronavirus pandemic was the significant drop in air pollution in Athens, but also in other major cities in Greece.

8. Measures to Strengthen the Greek Energy Market

The smooth operation of the Greek energy market is one of the main challenges, which emerged during the current crisis caused by the coronavirus pandemic. As a result of the strict measures taken to limit the spread of the pandemic, there has been a delay in the collection of energy bills, a development that has negatively impacted the liquidity of the market. At the end of April 2020, the weighted average decrease in revenues collection amounted to 20% (for PPC), while a similar picture applied to the revenues of private companies.

However, the intervention on the part of YPEN ensured the smooth operation of the sector, while at the same time a security "net" was created that ensured adequate market liquidity. In particular, initiatives were taken and measures were implemented to reduce the consequences of the coronavirus crisis, on the one hand, and to further shield the liquidity of the energy market, on the other.

The interventions undertaken by YPEN for the smooth operation of the domestic energy market included the following:

1. The first measure was implemented on March 30, 2020 when petrol stations were included in the Activity Code Numbers (ACN) of the companies that were entitled to the compensation of €800 each from the State. The same thing happened with the employees of energy companies' customer service stores.
2. At the same time, companies in the energy sector were given the opportunity to make use of the new Guarantee Fund of the Ministry of Development. Through the Fund, the Hellenic Development Bank provided guarantees amounting to €1 billion to commercial banks, in order to lend to companies to help them deal with the effects on working capital shortage due to the pandemic. The goal was through the leverage of this amount to mobilize at least €3.5 billion. The loan guarantee that was granted under this Fund corresponded to 80% of the actual loan and the respective bank undertook to cover the remaining 20%.
3. Also, the Act of Legislative Content (ALC) of March 30, extended the possibility for consumers to use telecommunications and internet applications or other means of remote service for a number of services, such as sending and paying bills, submission of bids by potential suppliers to new customers, concluding a supply contract, providing documents accompanying a new contract as well as preparing the documents accompanying a contract.
4. Also, with the same ALC, the deadlines for licensing, the submission of letters of guarantee, the maintenance of reference prices and the implementation of RES stations were extended in order to mitigate the adverse consequences for investors from the current situation. The relevant deadlines were extended by 6 months for those contracts that expired at the end of June and by 4 months for those that expire at the end of December.

5. At the same time, companies operating in the liquid fuel market and companies operating in the electricity market were given the opportunity to procure materials or spare parts from companies or stores whose operation had been suspended.
6. Finally, with the ALC, the number of guarantees that electricity suppliers are required to provide to HEDNO was temporarily reduced, due to the expected drop in electricity demand in the non-interconnected islands. This initiative will enable suppliers to release guarantees or use their available credit lines at banking institutions to serve other needs. The measure was expected to boost the liquidity of companies in the electricity market (PPC and private electricity providers) by approximately €10 million.
7. With a new ALC on April 13, 2020, the electricity and natural gas suppliers were given the opportunity to settle part of their debts to the Operators of the electricity and natural gas markets (IPTO, HEDNO, DESFA, DEDA, EDA Attikis, EDA Thess), and the RES Administrator & Guarantee of Origin (DAPEEP). The measure was deemed necessary, as energy bills are paid at a rate of 50% at bank counters, branches, Hellenic Post, etc., resulting in delays in the payment of bills. The measure provides for a settlement of 30% of the net worth of each invoice in four interest-free monthly installments.
8. DAPEEP was given the opportunity to be able to conclude a short-term special purpose loan to cover any deficit in the income of the special account that covers the payments of RES producers. DAPEEP will use the loan to cover the amounts that it may not collect from the electricity suppliers in the specific period and must repay it with the amounts that it will gradually recover from them.
9. The energy market received a liquidity injection from DEPA in the form of rebates to its customers amounting some €120 million, which was resulted from the return of retroactive charges by Turkey's company Botas, as a result of the decision of the Stockholm International Court of Arbitration.
10. DAPEEP continued the good practice of timely payments to RES producers, without delays; thus, strengthening the liquidity of the RES market.

Conclusions

We may not yet know exactly when the coronavirus pandemic will be fully controlled and when we will be able to return to full normalcy, but what is beginning to be realized is that the next day will not be the same. This is especially true in the energy sector, which is in a way the "backbone" of any economy.

The new situation of limited circulation, social distancing and work inactivity has changed the basic operating characteristics of the energy system internationally, but also in Greece. The disruption of the basic supply-demand relationship, which directly determines the price formation, and the global economic downturn are expected to affect the energy sector even more. The demand that has fallen to unprecedented levels as a result of the restrictive measures taken in order to contain the pandemic spread lies, undoubtedly, at the heart of the problem, while it remains unknown how long the pandemic will last.

The sharp and substantial drop in energy demand was particularly visible in liquid fuels in the first and second quarters of 2020, where in Greece we had a drop in sales totaling some 33% in March and by 75% in April. On the contrary, the decline in demand for gas and electricity was considerably lower, with a fall of 10% and 5% respectively.

In the oil market, the collapse in the price of crude oil, which occurred after the OPEC+ meeting in Vienna on March 6 and continued until the end of April, was a direct result of two key factors. On the one hand, the failure of an agreement between two major oil exporting countries, namely Russia and Saudi Arabia, to reduce oil production and on the other hand the parallel and progressive collapse of global demand. According to company estimates, aggregate demand is expected to drop by at least 10 million barrels per day in a global market of 100 million barrels per day in 2019. It should be noted that this is the first time this has happened since World War II, but then the circumstances were entirely different.

The question now is to what extent the current special conditions are expected to affect our lives in the post-Coronavirus era and what this means for the energy sector on which the functioning of our current technology-oriented society is based. The first observation is that in the period after the lifting of measures in Greece and internationally, the energy demand is not going to recover to pre-coronavirus levels, because the shock that the population will have undergone will be so great that there will be a great reluctance to work in contact with other people and more generally to get involved in social gatherings. For a large part of the workforce teleworking came to stay, while in the industry the transition to fully automated systems will be accelerated. International trade will be significantly reduced for a while, with a negative impact on the productive chain of many sectors, while air travel will be reduced to a minimum, as current experience shows that conferences and meetings can be conducted comfortably and safely at a distance. Combined with the decline of tourism, the blow to most airlines will be irreversible.

The second observation is that the new social conditions, a remnant of the current crisis and dictated by a new range of measures that will be adopted worldwide to prevent a new pandemic, will have a direct impact on the way we use and manage energy. A common denominator will be the acceleration of the transition to an all-electric system that will be facilitated by a significant reduction in the use of hydrocarbons, not so much due to the implementation of measures to address climate change, but due to a change in the operational model in industrial and agricultural production. Hence, peak oil demand is anticipated to be accelerated by at least 10 years.

Another major challenge will be the viability of the current operational model of energy markets, especially in electricity and gas, as priority will now be given to energy security with all that this may mean for maintaining the existing competitive model.

The emerging liquidity crisis, due to the spread of the coronavirus pandemic, marks the beginning of a "domino" of debt accumulation at every stage of the energy market chain, starting with supply and ending with production. In fact, since Greece depends on other countries to meet its energy needs, having almost 75% energy import dependency, if the liquidity crisis is not addressed on time, it is very likely to cause energy supply problems at national level, in addition to testing the resilience of the companies.

Also, a significant effect was the decline in demand, which combined with the unprecedented drop in wholesale market prices (including CO₂ emission allowance prices) and their unpredictable volatility, posed an additional serious threat to gas and RES investments.

Therefore, a prolonged crisis will test the viability of energy companies, as it will create deficits in the energy market, at a time when the financially vulnerable and affected will be unable to pay their electricity bills.

The reduction in overall collection of electricity bills and liquidity concerns, combined with the possibility of force majeure and "unforeseen change of circumstances" being invoked by the affected parties, gives rise to grounds for the legal adjustment of their contractual energy commitments both among the energy market players and the consumers.

It is obvious that after the end of the pandemic, a lot will have to change in the economic, social and energy life in our country, but also internationally, and one of the most important is the way we deal with our critical infrastructure and the functioning of the market. Preparing for extreme situations, by enhancing their resilience, has now become an absolute necessity.

After all, a typical example of the huge impact of the coronavirus pandemic on global economy is the \$3.98 trillion package (18.6% of GDP) by the US federal government since the onset of the crisis, with an estimated impact of \$2.48 trillion (11.6% of GDP)

in the government deficit, while additional support initiatives are expected by the end of this year.

Similarly, at European level, measures totaling €3.9 trillion have been taken (28% of EU GDP), including measures approved by the European Commission at national level, while the latest €750 billion support package (5.4% of EU GDP), agreed last July, includes €390 billion grants and €360 billion in loans to ensure EU cohesion and promote its strategic priorities. The €750 billion package will support a €1.1 trillion Community budget in seven years, with the total package reaching €1.85 trillion.

The pandemic has caused other major changes that will affect energy, society and the economy. It has accelerated and expanded electronic transactions and payments, work and training via the Internet, with a direct impact on transport/employment, the promotion of robotics and automation in production processes. At the same time, the substantial global funding for intensive research in biomedicine and biotechnology will hopefully lead to useful results and effective measures (see vaccines) in order to safeguard the health of the population.

In conclusion, the effects of the coronavirus pandemic on the Greek energy market can be summarized as follows:

General Conclusions,

- The coronavirus crisis has accelerated changes in consumer and business behaviour, with the adoption of new business models, further digitalization, travel restrictions, teleworking, e-commerce, etc. These changes mean a reduction in energy consumption, which has affected and will further affect the energy sector, but will facilitate the achievement of energy and climate policy objectives.
- The systemic risk of consumer insolvency, mainly in the electricity sector, increased significantly, especially during the initial outbreak of the pandemic. Maintaining a satisfactory rate of collection of electricity bills has proved a key factor for the smooth operation of the system, as a possible failure to control it could have caused chain effects in a number of other sectors, which will be difficult to address.
- The significant degree of digitalization and automation, which has already been introduced in the Greek energy system, was a key factor in maintaining the smooth operation of the country's energy system. This development was observed both in the distribution and transmission of electricity (see HEDNO and IPTO) and in the transport of natural gas (see DESFA).
- Reducing energy demand has weakened the forces influencing carbon prices. Combined with the recently reduced international oil and gas prices, if they are kept low, the competitive position of RES and energy efficiency investments may deteriorate.

- The uncertain prospects of the global and national economy lead energy companies to make even more cautious moves and possibly postpone investment plans.
- The planning and scheduling of large investments for the majority of energy companies in Greece was not affected, apart from few months' delays (e.g. Alexandroupolis FSRU, IGB, new lignite plant of Ptolemaida 5, regional gas networks).

In the oil sector,

- The oil market suffered an unprecedented collapse internationally, as oversupply and overfilled tanks led to a dramatic drop in prices, creating much uncertainty, both in the energy sector and in the global economy.
- On Monday, April 20, 2020, the price of crude oil in the US market fell "below zero" for the first time in the history of oil markets. This unprecedented event came about by the coincidence of two factors: (a) the reduction of oil demand due to the coronavirus crisis and (b) the fullness of the tanks and the inability to receive new cargoes from trading and refining companies.
- Low oil prices, due to the coronavirus pandemic, have greatly affected hydrocarbon exploration activities.
- The domestic oil market was significantly affected, especially during the pandemic outbreak (March-May). Gasoline consumption in transport decreased by 60%, while diesel, mainly used in agriculture and domestic transport, showed a milder decline of 35%-40%.

In the gas sector,

- Although there was a decline in domestic gas demand, it was rather marginal and did not reach the levels seen in oil.
- The proper functioning of the National Natural Gas System was not affected due to the pandemic.
- There was a significant drop in gas prices (mainly LNG), due to developments in international markets (e.g. a large drop in the price of crude oil), while there was a large penetration of LNG in the electricity generation of Greece, resulting in 64% of the supply in the first semester of 2020 to take place via LNG.
- Overall gas demand increased thanks to the ongoing decarbonization.

In the electricity sector,

- The pandemic crisis led to a significant reduction in the total electricity load of Greece, which was probably due to the fact that commercial consumption decreased with a parallel increase in domestic, while industrial activity did not stop at a large extent.

- The reduction in electricity consumption, along with a drop in CO₂ prices, has led to very low energy prices.
- A number of consumers have had problems paying their bills, creating a liquidity crisis in the market.
- The majority of electricity suppliers offered their customers discounts on electricity bills.
- A delay occurred in the start of operation of the Target Model in Greece, as the contractor's team in Athens (General Electric) experienced pandemic-related problems.
- The planning and implementation of most major investments (e.g. electricity interconnection of Crete) were not significantly affected.
- Significant effects were also felt in the energy-intensive industry, which was inevitably affected by the financial results of retail suppliers.

In the **RES sector**,

- The spread of the coronavirus caused cancellations and delays in some major RES and energy storage projects.
- Ongoing RES investments have encountered several difficulties due to delays in response from licensing authorities, restrictions on the movement and accommodation of their executives and technical staff, delays in equipment delivery schedules, and the rectification of problems in existing projects, among others.

In the **energy efficiency sector**,

- Delays were observed in renovation and energy upgrade of buildings' projects

In the **emissions sector**,

- The coronavirus crisis has also affected to a large extent the prices of emission allowances in the EU, with the result that at the end of last March they lost about 40% of their value since the beginning of 2020.
- A positive effect of the coronavirus pandemic was the significant reduction of air pollution in Athens, but also in other major cities in Greece.

The above conclusions were reached both from the thorough analysis of data provided by key players and companies in the domestic energy market and from the elaboration of targeted questionnaires submitted by IENE to a variety of local energy companies. The energy companies and institutions, which responded to IENE's invitation and submitted completed questionnaires, follow in alphabetical order and we warmly wish to thank them for their excellent cooperation:

- Hellenic Electricity Distribution Network Operator (HEDNO)
- Public Power Corporation (PPC)
- Hellenic Gas Transmission System Operator (DESFA)
- Greek Solar Industry Association (EBHE)
- Hellenic Union of Industrial Consumers of Energy (UNICEN)
- Hellenic Biomass Association (HellaBiom)
- Hellenic Wind Energy Association (HWEA)
- ELINOIL SA
- Hellenic Petroleum (HELPE)
- Hellenic Energy Exchange (HEnEx)
- Protergia SA
- Hellenic Petroleum Marketing Companies Association (SEEPE)
- Hellenic Association of Photovoltaic Companies (HELAPCO)
- Hellenic Association of Photovoltaic Energy Producers (SPEF)

Annex

In this Annex, a standard questionnaire follows, which was sent to the aforementioned domestic energy companies and entities and was adapted accordingly based on the energy sector concerned.



IENE Interim Report on

“Impact of the Coronavirus Pandemic on the Greek Energy Market”

Questionnaire

1. What operational problems does your company face due to restrictive measures against the spread of the coronavirus?
2. What was (and is) the impact of the reduction in demand on your activities? What is your estimate for demand recovery in 2020, 2021?
3. What do you think will be the overall impact of the coronavirus spread on your company in 2020?
4. Do you estimate that your medium-term investment planning will be affected and to what extent?