

## **Public transportation and energy utilisation during Covid-19 pandemic in Nigeria**

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### **ABSTRACT**

New public transport planning requirements are developed as many countries start to navigate their return to normality after the COVID-19 lockdown. This study combines key developments regarding public transportation and effect of the lockdown on energy utilization during the first and second wave of COVID-19 pandemic in Nigeria. Data were sourced from the National Bureau of Statistic and Nigerian National Petroleum Company (NNPC) on distribution of Fuel and gas energies which thematically analyzed the impact of COVID-19 on transportation systems in Lagos Nigeria. The decline in vehicular density on roads which leads to reduced fuel consumption coupled with infection risk in public transportation in the so-called post-lockdown phase. Domestic gas consumption and electricity generation

were slightly affected during this period. Changes in travel demands; Financial sustainability; Increased cost of transportation and Loss of revenue were revealed as significant impact of the pandemic. Lastly, this study identifies maintenance of key principles in mitigating the spreading of the virus, probable energy utilization, policy recommendations and future management of resources that are most inclined to the development objectives of developing nations in the time of COVID-19 and beyond.

**Keywords:** covid-19, public transportation, gas utilization, electricity generation, lagos and nigeria.

## 1 INTRODUCTION

A nationwide lockdown was imposed in Nigeria amid the COVID-19 pandemic for three weeks from 24th March to 14th April 2020 following other countries and was later extended to 3rd May 2020 in order to cushioning the effect on the rise. Loss of life and human suffering is the first and foremost aspect of the pandemic. The coronavirus pandemic as evidenced that six million global confirmed cases of infection with closing confirmed death of 400,000 as occurred as at June 1, 2020 (Johns Hopkins University, 2020). However, significant and multi-dimensional effects of this type of epidemic always develop to environmental and economic consequences including essential lockdown in logistics (Siddique et al., 2016). The variety between the effects of the pandemic and the economy shows the rate of infection of COVID-19 placing 30% of the global population in total lockdown, with an order on stay-at-home, travel restrictions, social distancing, wearing of face mask, spacing of market days, restrictions on numbers of passengers on public transport and so on (WHO, 2020; Di Domenico et al., 2020). This is continuously showing severe economic effects with ~80% of the international workforce having their workplace closed, and with the expectation of 3% recession which may be adjudged as the worst since the Great Depression (Gopinath, 2020). Anticipated changes in road travel and road safety have been reoccurring since the advent of the pandemic which has created an economic crisis (Conference Board of Canada, 2020). The overall question for road transportation professionals is what effects could COVID-19 have on road and rate of fuel consumption now as well as when the pandemic subsides and also the significant knowledge about road safety in general from the substantially traffic levels? In an effort to apprehend the havoc on the economy, the effect of COVID-19 can be summarized on individual aspects of the world economy, focusing on the tertiary sectors including all service provision industries, secondary sectors involved in the production of finished products and primary sectors which include industries involved in the extraction of raw materials (Nicola et al., 2020)

Lagos State is an interesting case study, as it is disputably the most economically important state of Nigeria, inclosing the nation's largest urban area (Nigeria Congress- Administrative Division Description Archived 2005). Lagos was the first state that suffered from COVID-19 in Nigeria and the fifth largest economy in Africa compare to a country and a major financial center (Ekundayo, 2013). With the highest population density in Nigeria despite some dispute between the official Nigerian Census of

2006, Lagos State houses headquarters of most conglomerates and commercial banks in Nigeria (National Bureau of Statistics, 2017). 22% of its 3,577 km<sup>2</sup> are lagoons and creeks (Nigeria-education.org, 2020). Lagos was the first state in Nigeria that suffers from COVID-19. Nevertheless, Lagos state still remains the financial center of the country, and also grew to become the most populous megacity in the country (National Bureau of Statistics, 2015). Apart from being the most populous megacity in Nigeria, Lagos State is one of the most emerging urban coastal cities and fastest growing economy in Sub-Saharan Africa (Sojobi et al., 2016). Lagos state has the highest energy consumption of fuel in Nigeria (NNPC). This increase in energy consumption is inevitable because of the growing numbers of vehicles owners and also domestic industrial market which is concurrently increasing export of goods, due to decades of globalization (Xu et al., 2017). As economic hub and the commercial nerve center of Nigeria and West Africa, Lagos state has five ports and generates internally generated revenue (IGR) between \$32–\$52 million monthly (Filani, 2012), while almost 60% of Nigeria non-oil revenue comes the state (Adelekan, 2010).

However, an evolving question is whether COVID-19 will push Nigeria and Lagos with other developing countries, backward in its economic maturing, and thereby prolong the transition period towards reduced energy (fuel) consumption, or if COVID-19 might reduce the increasing foreign trade and immediately force Nigeria into recession. Lagos as a coastal city is the West Africa's foremost port city and the second largest megacity in Africa after Cairo (Adelekan, 2016). The city of Lagos contributes about 30% (\$52bn) to the nation's gross domestic product (GDP) which is an evident of Nigeria's economic capital and is the leading contributor to the nation's non-oil sector of about (62%) GDP (LMEPB, 2013). Lagos accommodates over 60% of Nigeria's manufacturing industry, including about 2000 industrial complexes, 10 000 commercial ventures and 22 industrial estates (Adelekan, 2016). The economic activities in the city are due largely to the concentration of population growth.

The future energy policies will be informed undoubtedly with such trends not only in Lagos Nigeria but globally in the period post-COVID-19. It is on this light of the coronavirus pandemic that this paper aims to do quantitative analysis, through data gathered from Nigeria National Petroleum Corporation (NNPC), National Bureau of Statistics (NBS) and Petroleum Product Pricing Regulatory Agency (PPPRA) in order to determine the significance and susceptibility of different economic sectors with unambiguous focus on the petroleum (fuel) demand (Gopinath, 2020). No published articles have been found on the rate of energy consumption (fuel) effects of COVID-19 on road transportation. The present study is an effort to assess the effect of the pandemic on economic activities in road transportation sector and proffer solution for any future occurrence. However, this paper aims to examine the link between the macroeconomic parameters especially the petroleum (fuel), gas and electricity demand and supply during the pandemic situation. The paper will also contribute to the policy of predicting the

reactions of the demand and supply of energy (fuel) showing the government the impacts of economic sluggishness during and after a pandemic.

## 2 LITERATURE REVIEW

Considering the literature, the influence of pandemics (and epidemics) on the economy has been examined as a severe global influenza with the estimating cost of deaths (such as the 1918 epidemic) of about 0.6% of global GDP otherwise reaching 500 billion USD a year (Norouzi et al., 2020). The comparison between the high-middle income and low-middle income countries tends to be affected within the range of 0.3% to 1.6% respectively. The joint report of World Bank and the World Health Organization (WHO) on the other hand projected that the effect of such epidemic is even weightier, with up to 2.2–4.8 percent of global GDP of 3 trillion USD (Maden and Baykul, 2012). Furthermore, International Monetary Fund (IMF) in another article compliments that less access to health care may cause vulnerable populations especially the poor, to suffer due to fewer protection in facing the financial disaster (Alinejad and Shadmehr, 2016). World Bank report in Africa, categorized a year as the fastest-growing economic period for Guinea, Liberia and Sierra Leone due to the impacts of Ebola in which most of the economic gains of these countries were affected in the years prior to the epidemic (Bildirici and Ersin, 2015). Furthermore, WHO described the significant impacts of this type of outbreak in the private sector posing threats to cross-border trade with restrictions on movement, goods, and services and also food security due to the reduced agricultural production across the country (Norouzi et al., 2020) Social readjustment of daily routines, behaviours, and practices are caused by such events such as people have to adjust to being at home during quarantine, frequently without the choice to work or while doing it distantly. Road facilities are associated with economic indicators through exposure and risk; as travel decreases, economic activity declines, and drivers are exposed to a lower risk of collisions (Antoniou et al., 2016). Indeed, during this COVID-19 pandemic observation of fewer vehicles has been noticed on roads (Stavrinos et al., 2020).

The megacities of the Africa and Asia are predicted by the World Urbanization Prospect 2018 Revision that 90% of its population will be experiencing population growth by 2050 (World Urbanization Prospect 2018 Revision). The level of consumption and production of energy (fuel) have changes more importantly, on the usage patterns due to the current pandemic which is still on-going (Chen et al., 2020). Although the systems have been significantly affected by COVID-19 in which masses tend to look inward before embark- ing on any trip. The oil industry has been affected with reduced usage for transportation with global air traffic coming to a halt, as well as passenger and goods transportation in contention (McKibbin and Fernando, 2020).

## 2.1 TRAVEL DEMAND

A broad socioeconomic development road transportation plan with robust and sustainable business models should be introduced in order to allow transportation business to flourish. It is sensible that governments and financial institutions continuously re-evaluate and re-assess the state of play and ensure that 'whatever it takes' transportation sector will continue to flourish without any encumbrances (Bu et al., 2020). With total lockdown during the first wave of COVID-19, the reduction in road traffic had gone to an unprecedented level but recently with a partial lockdown it is almost 40–60% (Khursheed et al., 2020). The global calculated road fatalities are 155.8/100,000 motor vehicles (Rodrigue, 2020), while on an average, 3700 people lose their lives every day on the roads with more than 1.25 million people die in road accidents each year. Additionally, 20–50 million suffer from non-fatal injuries, often resulting in long-term disabilities (Zhang & Batterman, 2013). In order to evaluate the public health consequences of alternative scenarios and strategies, it is essential to understand and quantify the spread of virus in public transportation systems (Tirachini & Cats, 2020).

Using public transport has now become a major concern since the initial restrictions; passengers remain reluctant to adhere to the COVID-19 rules which are causing higher levels of concern about public transport hygiene (Beck & Hensher, 2020). Risk awareness may thus not only influence immediate travel decisions and trade-offs made between time and gathering (Gkiotsalitis & Cats, 2020), but may also have major effects for the ridership levels of public transport in the post-lockdown period and possibly even at the aftermath of the pandemic. During the different phases of this unprecedented crisis there is therefore a great level of uncertainty in relation to demand forecasting (Tirachini & Cats, 2020). Passengers are keen to use public transportation without fear of contamination even in cases where public transport services operate as usual (Qiu et al., 2020). Access to alternative means of transport as was found in the context of the transition to a nationwide lockdown in India depends not only on prevailing perceptions of personal safety but also on travellers commuting to various destinations (Pawar et al., 2020).

## 2.2 ENERGY CONSUMPTION

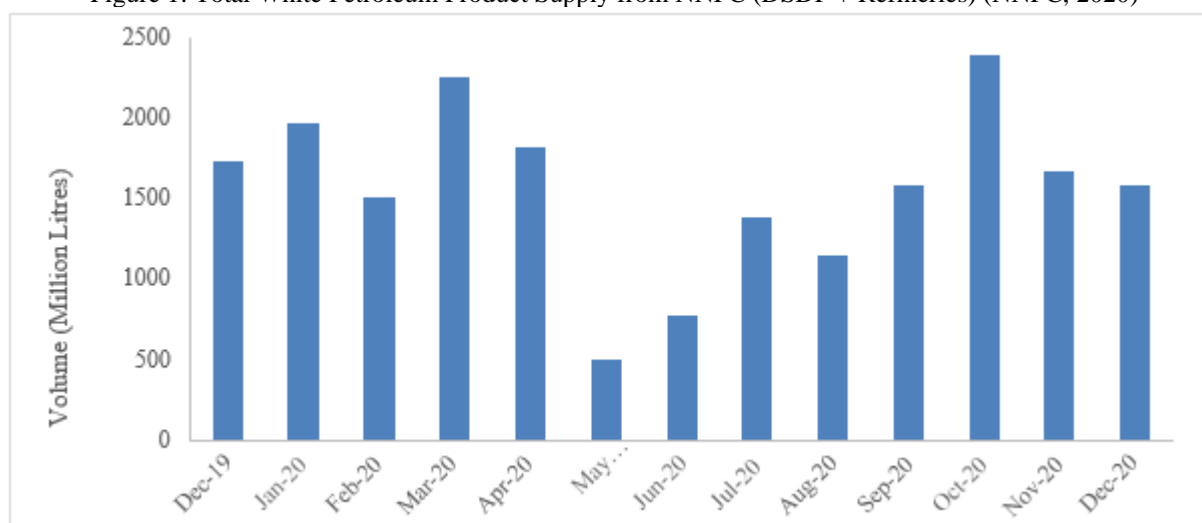
The total white petroleum product (PMS and AGO) supplied into Nigeria during the pandemic period is presented in Table 1.

Table 1: Total White Petroleum Product Supply from NNPC (DSDP + Refineries) (NNPC, 2020)

Period	PMS (Litres)	AGO (Litres)	Total
Dec-19	1,637,848,043.15	95,014,557.83	1,732,862,600.98
Jan-20	1,961,410,760.15	-	1,961,410,760.15
Feb-20	1,396,547,333.80	115,242,192.48	1,511,789,526.28
Mar-20	2,250,559,764.25	-	2,250,559,764.25
Apr-20	1,812,808,207.22	-	1,812,808,207.22
May-20	495,100,973.57	-	495,100,973.57
Jun-20	767,421,646.65	-	767,421,646.65
Jul-20	1,374,949,628.99	-	1,374,949,628.99
Aug-20	1,139,274,296.63	-	1,139,274,296.63

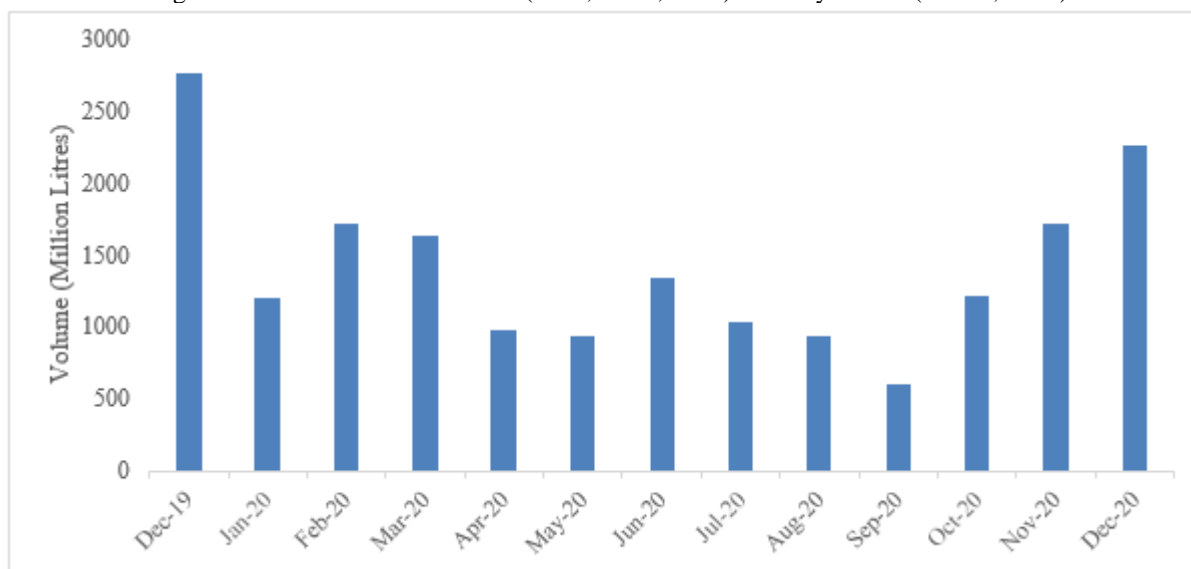
As depicted in Figure 1, there was a sharp decline in petroleum supply between March, 2020 and May, 2020 which was the period of lockdown. The supply is mainly by Direct Sales Direct Purchase as there was no operations in domestic refineries due to maintenance and rehabilitation. The supply increased gradually from May, 2020 as the lockdown restriction was relaxed.

Figure 1: Total White Petroleum Product Supply from NNPC (DSDP + Refineries) (NNPC, 2020)



The petroleum product sold during the pandemic period in 2020 is presented in Figure 2. The sales of petrol and diesel dropped by 45% between February 2020 and May, 2020 during the lockdown period. This indicates that transportation sector is a major consumer of petroleum products in Nigeria.

Figure 2: Total Petroleum Product (PMS, AGO, DPK) Sales by PPMC (NNPC, 2020)



### 2.3 GAS UTILIZATION

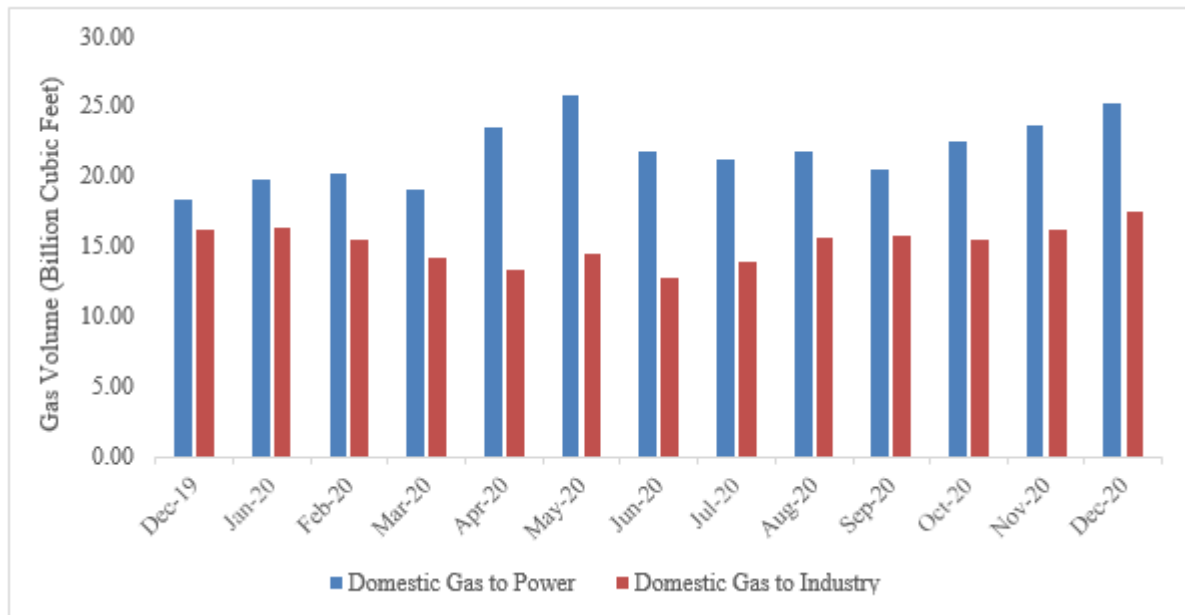
The monthly domestic gas consumption and the amount of exported gas in 2020 is presented in Table 2. There was about 10% decline in domestic gas supplied to the industries between February 2020 to April 2020 while the gas supplied for power generation increases by about 16.6% as shown in Figure 3. This slight variation (compared to petroleum products) in domestic gas consumption was because about 78% of domestic gas consumption goes to electricity generation (IEA, 2019). Since the power generation company was not affected by the lockdown, the impact of lockdown on gas utilisation was minimal.

Table 2: Total Gas utilization (NNPC, 2020)

	Commercialised Gas (BCF)				Total Non-commercialized Gas (BCF)	Grand Total (BCF)
	Domestic Gas to Power	Domestic Gas to Industry	Total Domestic Gas supply	Total Export Gas		
Dec-19	18.48	16.29	34.77	113.54	90.05	238.36
Jan-20	19.83	16.37	36.20	114.96	101.24	252.40
Feb-20	20.27	15.56	35.83	110.71	93.89	240.43
Mar-20	19.17	14.28	33.45	87.28	96.28	217.01
Apr-20	23.63	13.36	36.99	99.45	90.58	227.02
May20	25.85	14.54	40.39	103.17	88.10	231.66
Jun-20	21.83	12.82	34.65	114.01	83.38	232.04
Jul-20	21.22	14.04	35.26	115.71	84.75	235.72
Aug20	21.81	15.70	37.51	110.21	85.93	233.65
Sep-20	20.59	15.78	36.37	104.08	81.46	221.91

The gas supplied to the industry declined from February 2020 to April 2020 as non-essential sectors were under lockdown during this period.

Figure 3: Domestic gas utilisation in 2020 (NNPC, 2020)



## 2.4 ELECTRICITY CONSUMPTION

The electricity generated by all power generation company in Nigeria in 2020 is extracted from Transmission Company of Nigeria (TCN) daily operation report and presented in Figure 4 and Figure 5. The amount of electricity generated varies slightly (about 5%) between February,2020 and March 2020. This slight variation corresponds to slight drop in gas supplied to the power sector as depicted in Figure 3. The quarterly average electricity generated also show lower production in the second and third quarters.

Figure 4: Average electricity generated per month in year 2020 (TCN, 2020)

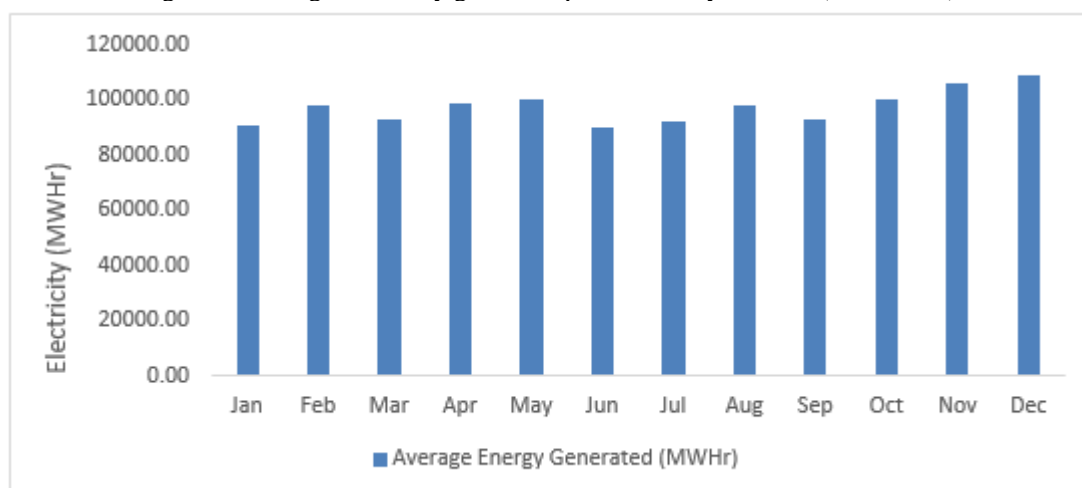
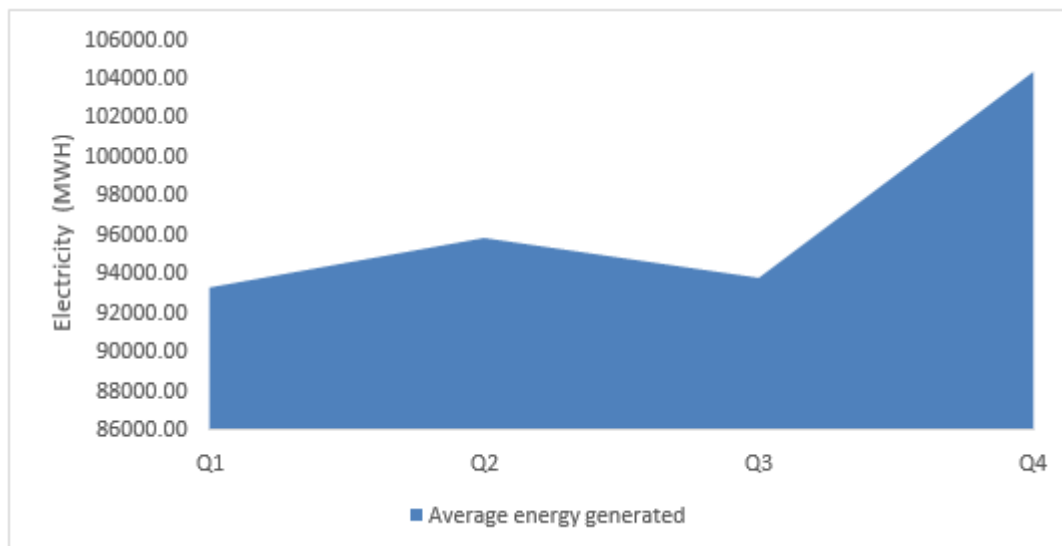




Figure 5: Quarterly average electricity generated in 2020 (TCN, 2020)



### 3 CONCLUSION

The COVID-19 pandemic and the associated shutdown impacts have already had significant effects on transportation and fuel consumption levels as manifested above as well as the operations and provision of public transport services. Public transportation systems worldwide had witnessed great challenges from the advent of COVID-19 pandemic. This study has shown the existing proofs as it relates to the effect of several factors on increasing or reducing the COVID-19 infection risk in public transportation, together with the enforcement of use of face mask, the exposure time (trip length), occupancy levels of vehicles and stations, and the application of improved hygiene standards (including sanitization and ventilation). At this stage, it remains indefinite whether the pandemic crisis will have long-lasting impacts on public transport systems since the on-going pandemic forces policy makers to make decisions in the context of uncertainty are confused. Previous knowledge advocates that large-scale crises, such as the energy crisis in the '70s, the SARS outbreak in the early 2000s, and the 9/11 terror attacks have not essentially changed travel patterns but have led to changes and modernization in cleaning and security standards in the industry. Any restrictions or regulations on public transportation use should be tailored differently depending on the phase of an outbreak because absolute risk of infection is highly dependent on the disease prevalence in the community at any definite time.

Public transportation operation fell significantly by 50% to 90 at the climax of the virus, which prompted several governments to order instructions by shutting down completely public transportation movement as one of the most affected sectors by the pandemic. It is essential to issue a detailed analysis on detecting levels of infection that make public transportation use increasingly unsafe from a public health viewpoint. Petroleum product consumption was greatly affected by the lockdown while gas utilisation and electricity generation were only slightly affected by the lockdown. For the post-lockdown phase some encouraging indication is developing as to how to make public transportation safe or at least

meaningfully decrease the infection risk. More research is needed to assess the true level of safety in public transportation as it is too early to arrive at definitive conclusions when the contagious virus will disappear at different stages of the pandemic. Maintaining many of the key principles in mitigating the spreading of the virus, including social distancing, use of face mask, hand sanitising can restore the segments of civil society and the economy with the gradual lifting of the lockdown measures at the peak of the pandemic. It is therefore critical to avoid contributing to stereotyping the use of public transportation as unhealthy because our societies need public transportation services to prosper and to address key societal challenges that may outlive the pandemic itself and hinder the long-term prospects of public transportation services.

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