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Energy and Water in the Time of COVID-19

Filemon A. Uriarte Jr.

National Academy of Science and Technology Philippines

ABSTRACT

The paper examines the impacts of the coronavirus pandemic and the resulting government actions on the energy and water sectors, in particular on energy demand and water usage. The energy sector has been severely affected by the coronavirus pandemic resulting in a decline in global energy demand by 5-10% due to significant reductions in the demand from the commercial, services, and industrial sectors. In the Philippines, energy demand in the Luzon and Visayas grids dropped by 30% and Mindanao grid by about 9.5%. Water, sanitation, and hand hygiene are the first line of defense and are central to preventing the spread of the virus. Consequently, the service providers must ensure the availability of clean water, well-trained and healthy staff, and the protection and operation of equipment, which require continued access to financial resources. Many of the challenges faced by the energy and water sectors caused by the COVID-19 crisis will gradually resolve once the crisis comes to an end and previous levels of economic activity resume. However, energy and water companies have to develop a high degree of flexibility to adjust operations, act quickly to secure supply chains and manage component inventory, implement structural measures to reduce risk, and develop a more mobile workforce that can work virtually and at distance. But while the pandemic may have significant permanent economic effects in the energy sector, it is expected that there will be less pronounced permanent effects on the water sector.

Keywords:
energy, water, Covid-19, pandemic, coronavirus

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Email: dr.jun.uriarte@gmail.com

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INTRODUCTION

The outbreak of COVID-19 and the resulting global pandemic have resulted in a major calamity adversely affecting health systems, economies, and communities around the world. The pandemic has prompted governments to execute drastic actions and implement containment measures to bring the disease under control and "flatten the curve" to give the health system more time until a vaccine or cure is developed. But while the containment measures imposed by governments are crucial to slow the spread of the virus and limit the number of deaths, they have also hindered or halted business activities and caused widespread disruptions in various economic sectors. Energy and water are among the sectors gravely affected.

To help drive the recovery of the global economy, governments have to implement various fiscal, financial, and other countermeasures. One such countermeasure is to increase spending in infrastructure. However, a Global Infrastructure Industry Survey (Holebrook 2020) conducted in March 2020 in 40 countries and sent to more than 13,000 global respondents in engineering, construction, finance, public sector, and technology fields showed that the majority of the respondents (52%) thought that infrastructure investment would decline, rather than increase, as a result of the coronavirus pandemic. The Philippines was not included in the survey. A separate U.S. survey was done with similar results. Furthermore, infrastructure spending appeared to be redirected towards new hospitals and schools, clean water and wastewater treatment facilities, transportation, and highways. While enhanced investment in water and sanitation infrastructure is among the top post-COVID-19 priorities, increased spending on energy infrastructure is regrettably not.

The principal purpose of this paper is to examine the impacts of the coronavirus pandemic and the resulting government actions on the energy and water sectors in particular on energy demand and water usage.

ENERGY

Key Findings

The energy sector has been severely affected by the coronavirus pandemic primarily as a consequence of quarantine and physical distancing measures enforced in many countries. Data through mid-April from the Global Energy Review 2020 of the International Energy Agency (IEA) (IEA 2020) showed global energy demand decreasing by 3.8% in the first quarter of 2020. The negative impacts started to be felt in early March 2020 as the pandemic brought about a significant reduction in global transport, trade, and economic activities. Among the key findings are:

- Mobility has declined significantly;
- Fuel consumption has fallen dramatically; and
- Lockdowns have reduced electricity demand.

To "flatten the curve" and contain the spread of the COVID-19 virus, lockdown measures have been imposed by governments. But these measures cannot be sustainable for long periods unless the affected communities have access to reliable and affordable electricity. People need fuel and electricity to enable them to cook and store food and to light and cool homes. Different communities need electricity to stay connected. They can continue to communicate with one another and with essential public, health, and other services only if the needed devices are linked to a power source. Lack of access to energy sources will magnify the human suffering resulting from containment and physical distancing measures. Even more importantly, the absence of a sufficient and reliable source of fuel and electricity will drastically delay, if not avert, early recovery from the disastrous effects of the pandemic.

Mobility has declined as a result of stay-at-home measures imposed by governments. Home confinement for long periods results in people watching more videos and streaming shows, children doing online schooling, employees working from home, and everyone conferencing online. These activities result in increased energy use in homes. A study by SaveOnEnergy shows that indulging in Netflix uses a significant amount of energy (and

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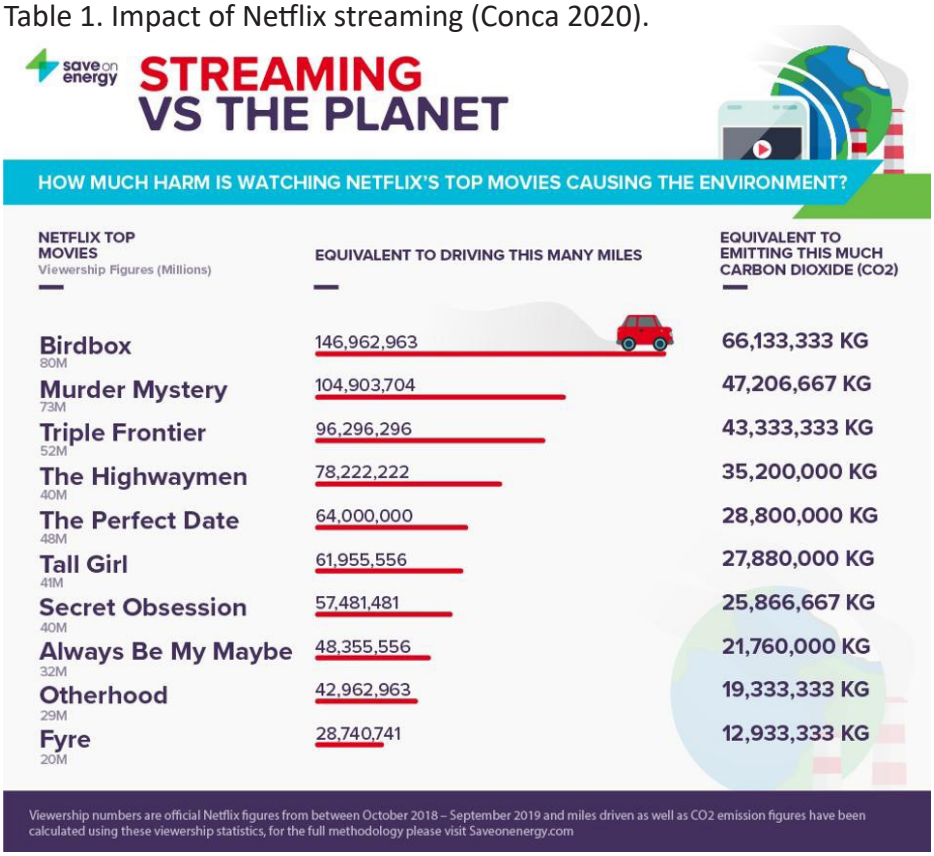
emits more CO2) (Conca 2020). For example, the study finds that the energy generated from Netflix users' total 80 million views of the thriller Birdbox is the equivalent of driving more than 230 million kilometers and emitting over 66 million kg of CO2 (Table 1). The reason for this is that data centers and server-farms that store the content of Netflix movies are among the most energy-intensive type of buildings. They are estimated to consume 10 to 50 times the energy per floor space compared to a typical commercial office building. However, this finding is contested by other experts who claim that Netflix uses a different type of data center called a Content Delivery Network. This type of data center consumes less energy since it merely physically stores the episode and simply copies information unlike other data centers with computers that crunch numbers and search through massive banks of data and information.

Table 1. Impact of Netflix streaming (Conca 2020).



Regardless of which view is closer to reality, it is a fact that home containment measures result in increased activities in the residential sector. Cisco's Visual Network Indicator (Cisco 2020) foresees that online videos will account for 82% of all Internet traffic by 2022 from the almost 5 billion Internet users that will exist by 2022. Concomitantly, there will be over 28 billion fixed and mobile personal devices and connections that will need charging from a source of electricity. Consequently, the global IP traffic is expected to reach about 5 zettabytes (1 followed by 21 zeros is a zettabyte) per year by 2022. All these require some energy source.

Apart from the residential sector, there is also increased energy use in the medical care and hospital sector. As the number of hospitalized COVID-19 patients grow, the doctors, nurses, and other health workers require adequate number of medical equipment that are fully functioning. This involves a significant increase in the number of properly maintained and operating medical and related equipment that have access to sufficient, uninterrupted, and reliable sources of electricity. This requires giving priority to energy access and solutions to power hospitals, health clinics, and first responders.

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A hypothetical situation in the United States may be cited as an example of the possible impact on energy of the expected increase in hospital services to contain the pandemic (Conca 2020). It is reported that the U.S. has 925,000 hospital beds or 2.8 beds per 1,000 people. But the ideal number to handle epidemics is 4.5 beds per 1,000. Thus, to adequately care for patients during this COVID-19 pandemic, the U.S. needs an additional 575,000 hospital beds. To add and operate this additional number of beds will require an additional 85 billion kwh of electricity per year, not including the energy requirement of the intensive care units. This translates into 10 new nuclear power plants the size of the Columbia Generating Station , or 4 new hydropower plants the size of Grand Coulee Dams , or 13 large coal power plants, or 15 large gas plants. Of course, this is a purely academic exercise and the calculated energy requirement may or may not arise depending on how governments and the medical care sector would actually address the containment of the pandemic. The point nevertheless is that the energy demand from the medical care sector will likely increase as a result of the pandemic.

Despite the expected rise in the energy requirements of the residential and medical care sectors, the overall effect of the pandemic is a decline in energy demand. In general, mobility accounts for about 57% of global oil demand. As a consequence of the lockdown and other measures to address the COVID-19 crisis, the movement of people and goods declined at an unprecedented scale in early 2020. By the end of March 2020, road transport in areas with lockdowns in place was reduced by between 50% and 75%. The global average road transport activity declined by almost 50% compared to the 2019 level. Air travel went down 60%. Consequently, energy use fell dramatically. Limited restrictions reduced weekly energy demand by about 10%, partial lockdown by 17%, and full lockdown by around 25% (Figure 1). The coverage of COVID-19 lockdown measures jumped from 5% of global energy demand in mid-March 2020 to over 50% by early April 2020 (Figure 2). By early May, however, global energy demand has started to recover due to the easing of lockdown measures in some countries.

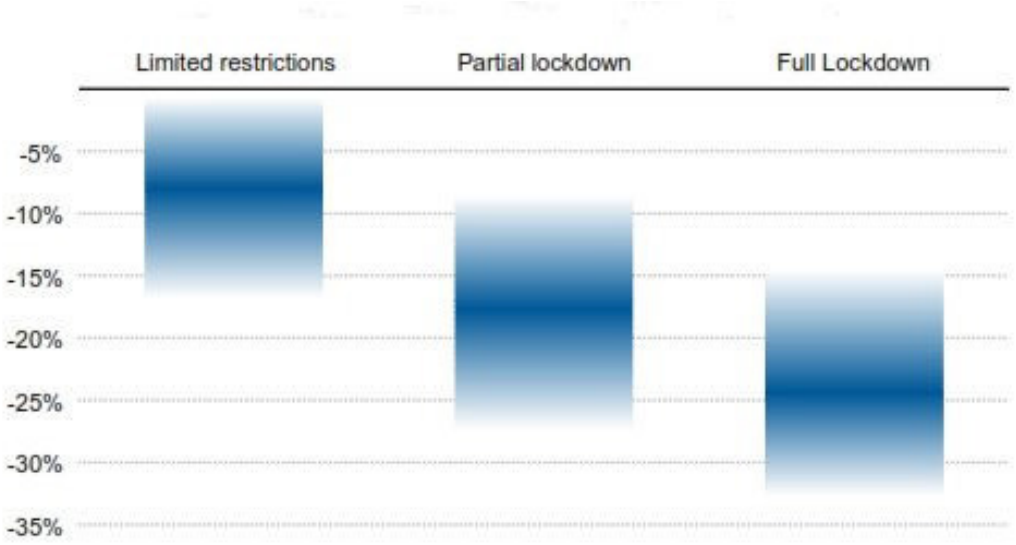

Figure 1. Reduction in weekly energy demand by containment measures. Source: IEA (2020).

[1] Columbia Generating Station is the northwest's only commercial nuclear energy facility using boiling water reactor and is the third largest electricity generator in Washington state with a gross generation capacity of 1,207 MW.

[2] Grand Coulee Dam has three generating units rated at 600 MW and three units rated at 805 MW, resulting in a total capacity of 4,215 MW, with average power generation of 21 billion kWh per year.

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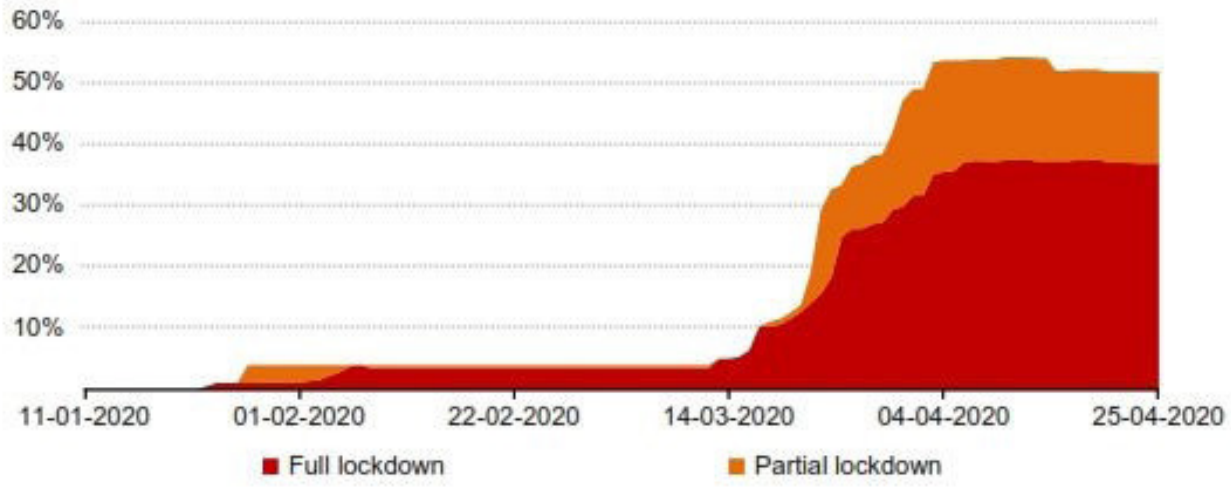

Figure 2. Share of global energy use affected by mandatory lockdown. Source: IEA (2020).

It is expected that for the entire year of 2020, the reduction in energy demand would be the largest in 70 years. Global energy demand is estimated to decrease by 6%, which is a level that is seven times greater than the decline in energy demand that occurred as a result of the 2009 financial crisis (Figure 3).

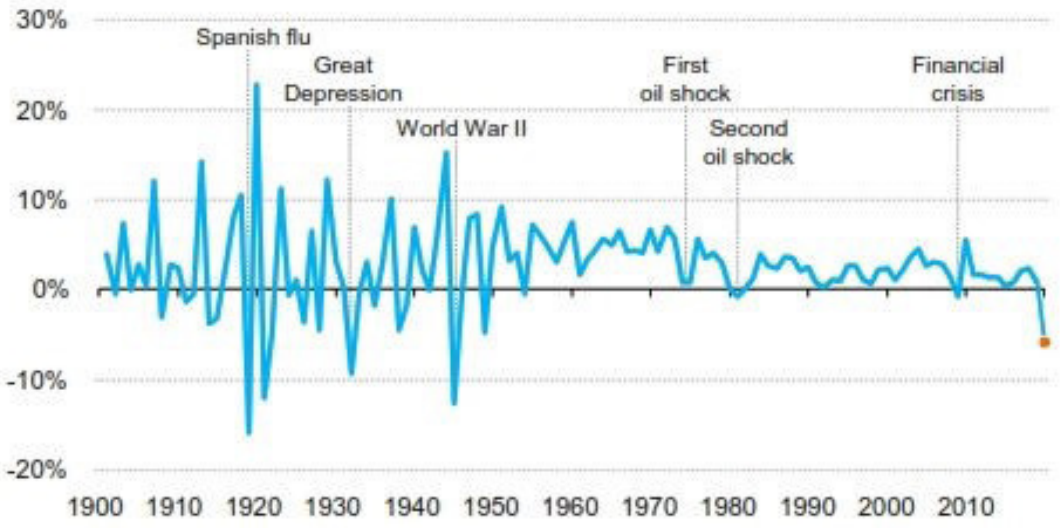

Figure 3. Change in global energy demand, 1900-2020. Source: IEA (2020)

As shown in Figure 4, there were significant reductions in global energy demand for coal, natural gas, and oil. Global coal demand suffered the largest reduction, falling by almost 8% compared with the first quarter of 2019. And since electricity demand is projected to decline by 5% for the whole year of 2020, coal demand is expected to decrease by 8% over the year. However, the expected early recovery of coal demand for industry and electricity generation in China could partially offset reductions of demand from other countries.

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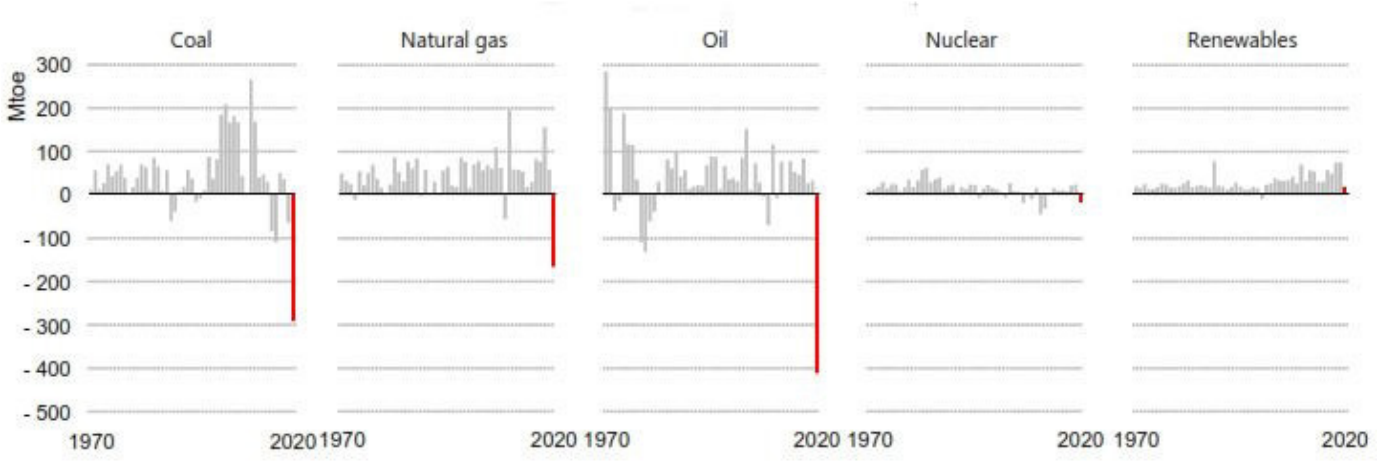

Figure 4. Change in global energy demand by fuel, 1970-2020. Source: IEA (2020).

The curtailment in mobility and aviation, which account for about 60% of global oil demand, resulted in a 5% reduction in oil demand during the first quarter of 2020. In April 2020, global oil demand declined by 29 million barrels a day to a level last seen only 25 years ago in 1995. Consequently, oil demand is expected to fall by about 9% or a record 9.3 million barrels a day for the whole of 2020. This significant reduction will wipe out the growth in oil demand that was experienced during the last ten years and will return oil consumption to 2012 levels. Similarly, gasoline consumption is expected to decline by 2.9 mb/d, or 11%; diesel consumption by 2 mb/d or 7%; and jet fuel and kerosene by 2.1 mb/d, or 26%.

The impact of the coronavirus pandemic on the demand for natural gas was more moderate. The demand for natural gas declined by only 2% since economies heavily dependent on gas for energy were not strongly affected during the first quarter of 2020. However, if power and industry applications continue to fall for the rest of 2020, global natural gas demand could decrease by as much as 5% for the full year 2020. In the power generation sector, gas consumption is estimated to drop by around 7%, accounting for almost 60% of the decrease in global demand. In the industry sector, gas consumption is projected to drop by about 5%, accounting for about 25% of the global decrease. Overall, the entire energy sector is predicted to decline by 4%, accounting for around 10% of the fall in global gas demand.

Nuclear power has so far been the least affected by lockdown measures. However, if the demand for electricity continues to decline due to continuing containment measures, global nuclear power output is expected to fall slightly by 3% for the whole of 2020 compared to 2019 levels. On the other hand, renewable energy sources are expected to continue to grow slightly by 1% in 2020 compared to 2019 levels since there are already several projects in the pipeline in 2020. Furthermore, in contrast to all other energy sources, the increasing preference for renewables because of low operating costs and climate change considerations will contribute to the continued growth of the renewable energy sector.

For the expected increase in energy demand once the economy has recovered and health facilities have been expanded, nuclear energy appears to be the most attractive non-carbon option to ensure an adequate and reliable supply of electricity (Macola 2020). Major concerns revolve around global supply chains in the case of fossil-based fuels as well as some renewable energy sources. On the other hand, nuclear power plants could have fuel available on site for many years since they use little fuel to produce so much energy. In addition, nuclear power plants are among the most security and disaster-minded operations in the energy industry. In general, nuclear energy workers are highly trained in protocols and procedures that are

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ideal for handling various types of contamination, radioactive, or biological.

The dramatic declines in the services and industry sectors have only been partially offset by higher demands from the residential and medical care sectors. Accordingly, regional electricity demands are expected to fall by 3–7% depending on the duration and extent of containment measures, about 3% in China, 5% in the U.S., and 7% in the EU (Figure 5). During the first quarter of 2020, global electricity demand declined by 2.5% although lockdown measures lasted only for about a month in many countries. Impacts were largest in Italy, India, Spain, and France, but other countries suffered as well (Figure 6). Full lockdown measures pushed down electricity demand by 20% or more, with smaller effects for partial lockdowns. Service-based economies suffered the most. The shape of electricity demand looked a lot like that of a prolonged Sunday. Countries that implemented the strictest measures generally suffered the largest negative impacts.

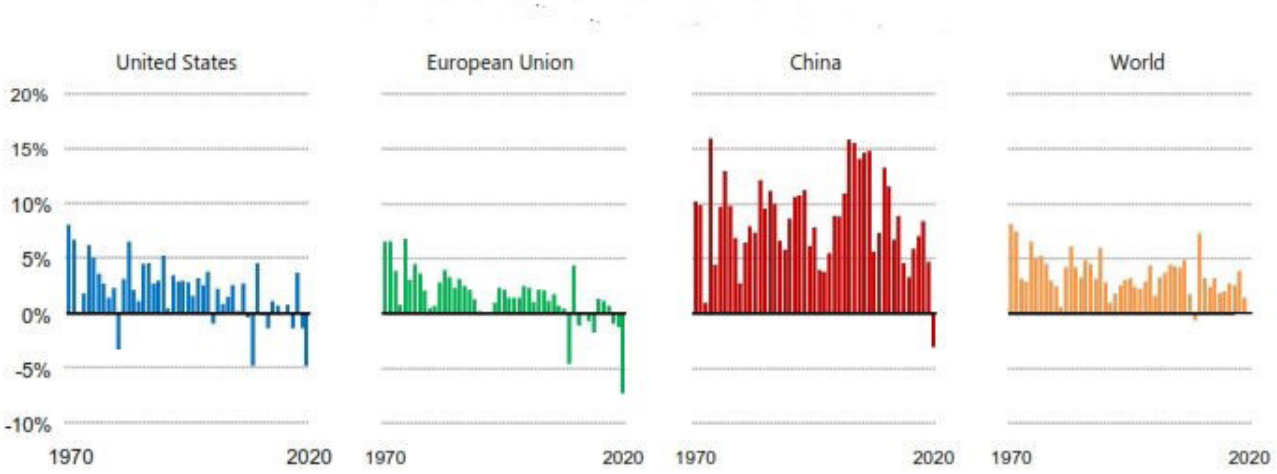

Figure 5. Percentage change in electricity demand in selected regions, 1970-2020.

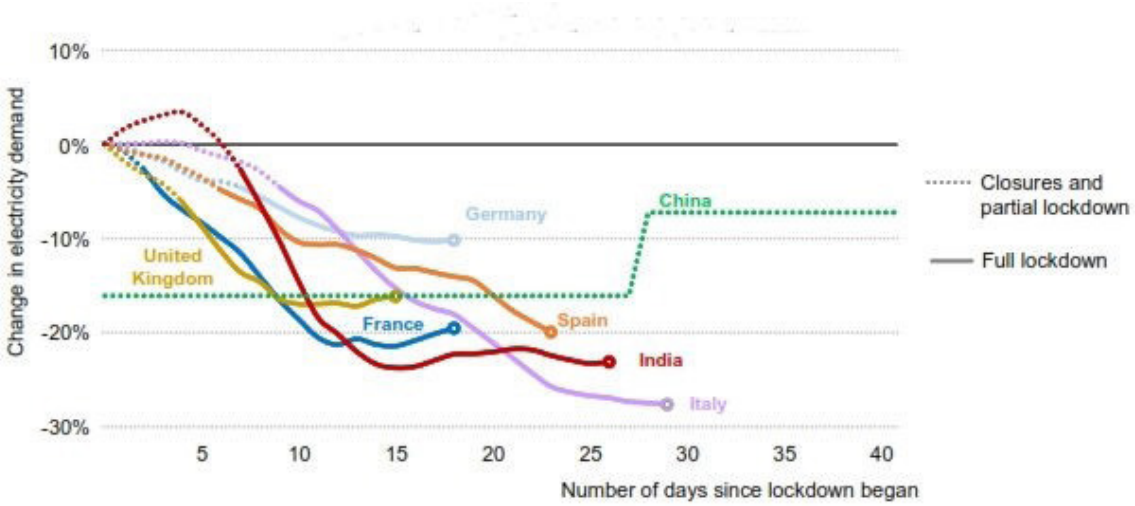

Figure 6. Evolution of electricity demand following lockdown implementation. Source: IEA (2020).

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IMPLICATIONS ON ENERGY INDUSTRY AND EMISSIONS

The overall impact of the COVID-19 pandemic for the rest of 2020 and the next few years will depend on how fast or how slow the economic and social activities will resume. If these activities resume only gradually, the global GDP in 2020 is expected to decline by at least 6%. The global economic recovery will be U-shaped and despite various macroeconomic policy efforts by governments, it is expected that there will be a significant permanent loss of some economic activities.

Although the measures taken to slow down the spread of COVID-19 already had a profound impact on energy demand, its full impact cannot yet be determined. This will depend greatly on the duration and severity of quarantine and other measures taken by the governments. The stimulus packages that governments will be putting in place will contribute significantly to the shape of the energy sector in the coming years. These developments will have significant consequences for the energy industry, energy security, and clean energy transitions. Many energy companies will lose substantial revenues due to lower demand and lower prices for their products and the financial impacts will be felt throughout value chains.

Despite the possible loss of revenues by many energy companies, it is essential that clinics and medical care providers in low-income communities have access to reliable and affordable electricity. In addition, low-income households and communities that are likely to be unable to afford their electricity bills must not be disconnected. If necessary, electricity bill payments must be suspended or postponed during the entire period of the coronavirus pandemic (Ogunbiyi 2020). Payments could also be spread out over a longer period to be affordable to low-income households.

As a consequence of the coronavirus crisis, energy companies will have weakened financial positions and strained balance sheets resulting from the low prices and reduced demand for their products. The crisis has put to test issues related to energy security and thus it will have a severe impact on investment across the entire energy industry. For example, there have been unprecedented reductions in energy demand as a result of concomitant supply and demand shocks arising from quarantine measures imposed by governments. These have sent oil markets into turmoil. As a result, macroeconomic and financial disruptions arising from disorderly production shutdowns have undermined the energy industry's ability to ramp up production as global economy and oil demand recover. Furthermore, significant energy security concern is likely to emerge as a result of added costs of restarting dispatchable power capacity that had been shut down due to decreased demand. In sum, the energy industry that will emerge from the pandemic will likely be significantly different from what it was prior to the crisis.

Reductions in the electricity demand has resulted in an increase in the relative share of renewables in the overall supply of electricity, as their output is largely unaffected by demand. Since governments are expected to play a major role in shaping the post-COVID-19 recovery of the energy sector, this will provide an excellent opportunity for countries to transition to clean energy systems through the design of environment-friendly economic stimulus packages. Applied and executed appropriately, such stimulus packages could steer the energy system towards a more sustainable path leading to the use of cleaner and more resilient energy technologies. Accordingly, it is expected that as countries recover from the coronavirus pandemic, low-carbon sources will far outstrip coal-fired generation globally, continuing the trend that started in 2019 (Figure 7). The London-based think tank Carbon Tracker predicted that an annual 2% decline in demand for fossil fuels could cause the future profits of oil, gas, and coal companies to collapse (Ambrose 2020) and concluded that the coronavirus pandemic might have pushed the fossil fuel industry into "terminal decline" as governments accelerate the transition to renewables (The Independent 2020).

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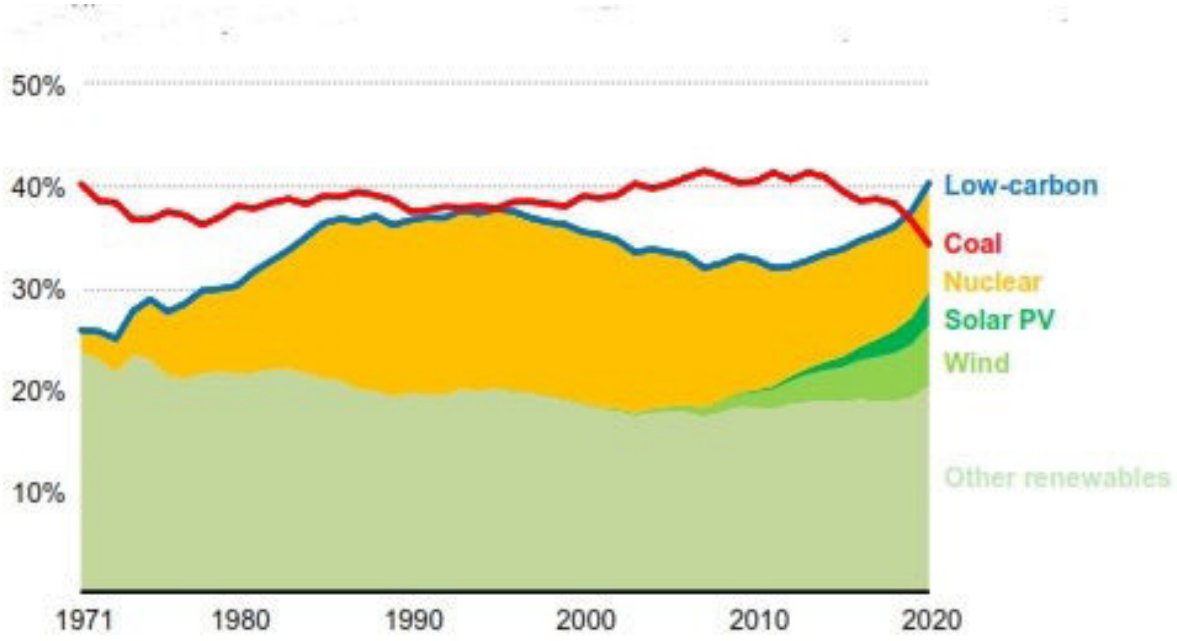

Figure 7. Global generation rates from coal and low-carbon sources, 1971-2020. Source: IEA (2020).

As a consequence of the shift to low-carbon fuels, global energy-related CO2 emissions are expected to fall to their lowest level in a decade by almost 8% in 2020 (Figure 8). These emission reductions come mainly from reduced transportation usage and diminished industrial activities. Since industrial activities are expected to recover post-COVID-19, a more sustained energy-related carbon emission reduction may come from the transport sector if telecommunity and the use of virtual conference technology become and remain widespread.

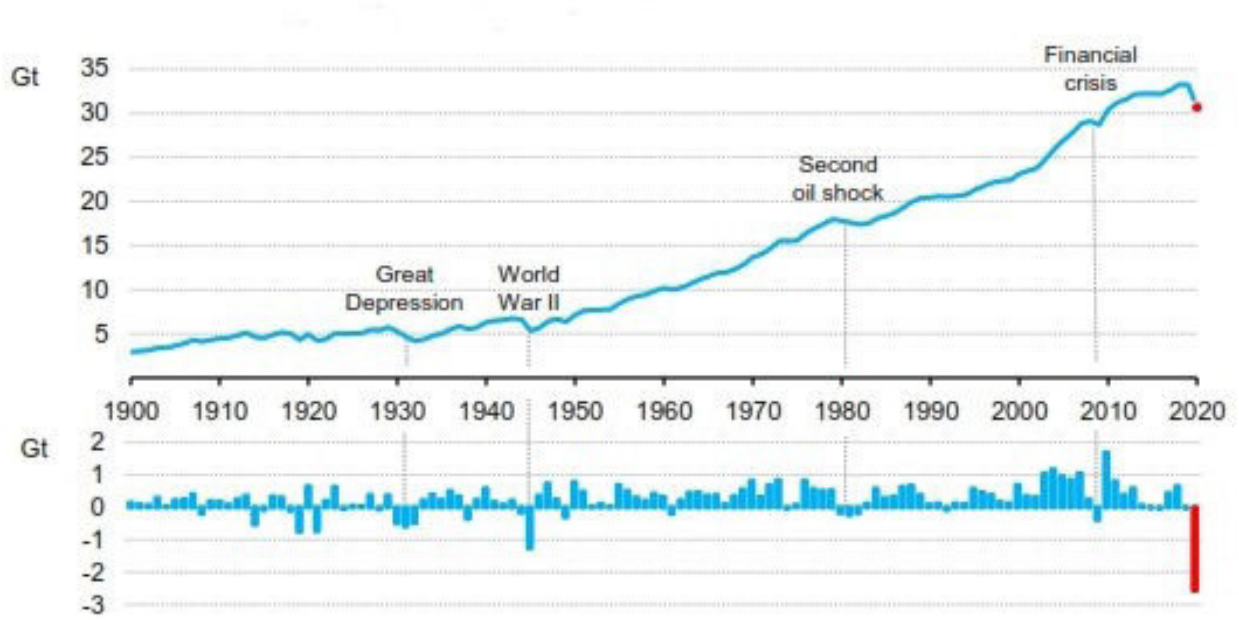

Figure 8. Global energy-related CO2 emissions and annual change, 1900-2020. Source: IEA (2020).

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PHILIPPINE SITUATION

The Philippine Medium-term Development Plan 2017–2022 has a long-term vision for attaining high-income status by 2040 with the economy growing at an average rate of 6.3% and electricity consumption increasing to nearly four times its 2018 level by 2040. Then the COVID-19 pandemic happened. As a result, energy demand across the country considerably dropped due to the closure of commercial establishments and industries following the declaration of national health emergency that enforced lockdown in Luzon and subsequent similar lockdowns in Visayas and Mindanao as the government raced to stem the spread of the COVID-19 pandemic (Velasco 2020). Energy demand in the Luzon and Visayas grids dropped by 30% and Mindanao grid by about 9.5%.

During the lockdown period, coal use dropped from 56 to 48% of generation. Generation with natural gas decreased by 6%, but as a share of total generation increased from 23 to 27%. Other sources stayed about the same, with solar and biomass generation increasing slightly, reflecting new generation capacity (Ravago and Roumasset 2020). The average wholesale electricity spot market price fell by 55% during the lockdown period. And while wholesale prices used to peak in the afternoon, they now peaked in the early evening, reflecting the shifting demand from commercial and industrial to residential consumers. As for retail prices, rates increased from PHP 8.90 (USD 0.18) per kWh in March to PHP 9.00 per kWh in April in Metro Manila. Outside of Metro Manila, most electric cooperatives and private distribution utilities struggled with collections since meter-reading was manual and prevented by the lockdown.

The National Economic and Development Authority projected the Philippines' real GDP growth for 2020 to fall to somewhere between -0.6 to -4.3%. The lower growth trajectory means that electricity demand targets may be reduced, investments in the pipeline may be delayed, and new projects may be put off. It is then possible that the concern with insufficient generation capacity may resurface in the future.

Water

Water availability

Water is essential for human survival. But only 2.5% of the water on earth is fresh and only 0.1% of it is readily accessible to humans. During the past ten decades, global water use has increased by a factor of six. Globally, about 30% of freshwater is consumed by industrial and residential sectors. The remaining 70% of freshwater is used by the agriculture sector for the irrigation of crops that eventually feed us, for raising the animals that we eat, and for growing the materials used for the clothes we wear. It requires 214 liters of water to produce one kg of tomatoes, 2,500 liters for a kg of rice, 3,180 liters for a kg of cheese, and 15,400 liters for a kg of beef. On average, each person needs between 50 and 100 liters of water per day to meet their primary needs. But the average American uses about 340 liters of water each day and this is calculated as consumption at home only without considering the water contained in the food consumed. If the total lifecycle water used to produce the food is considered, then the amounts are as follows: morning coffee (140 liters), a banana (80 liters), grilled chicken (430 liters) and tomatoes (50 liters) for lunch, cheese (200 liters), olives (200 liters), and a beer (150 liters) as an aperitif, and rice (250 liters) and broccoli (40 liters) for dinner. The average daily water consumption adds up to 1,900 liters per day (Cecchini 2020).

As a consequence of the continuing use of freshwater, desertification is on the increase everywhere in the world. In Europe, it already affects 8% of the territory; in Africa, almost 70% of the continent is arid or semi-arid land; and in North America, about 40% of the continental land is at risk of desertification. Thus experts forecast that 47% of the world population is going to experience water scarcity by 2030 (Cechhini 2020). Today about 40% of the world's population lives in regions where water is becoming increasingly scarce, and an estimated 1,000 children succumb to preventable water-and-sanitation-related diseases each day (WHO 2020). These problems of water shortage and sanitation scarcity have been around for decades primarily due

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to bad economics and poor infrastructure. These problems have negatively affected the livelihoods of billions of people, food security, and educational opportunities for impoverished families around the world (UN 2020).

While progress has been made towards universal access to water in the Asia-Pacific region, many are still living without adequate water supply in the region. In Southeast Asia, more than 100 million people live without access to safe water, with only Singapore, Malaysia, and Thailand having 100% access to clean water (Figure 9) (Nortajjudin 2020). In the Philippines, nearly five million people lack access to safe water while nine million lack access to improved sanitation (Water.org 2020). Acute watery diarrhea is one of the top 10 leading causes of death in the Philippines, which claimed 139,000 lives in 2016 (WHO 2020). In many urban slums, daily necessities such as cooking and personal hygiene are done in common spaces filled with people. Not only are water points limited,but self-isolating and social distancing are also difficult to achieve in these settlements amid the coronavirus pandemic.

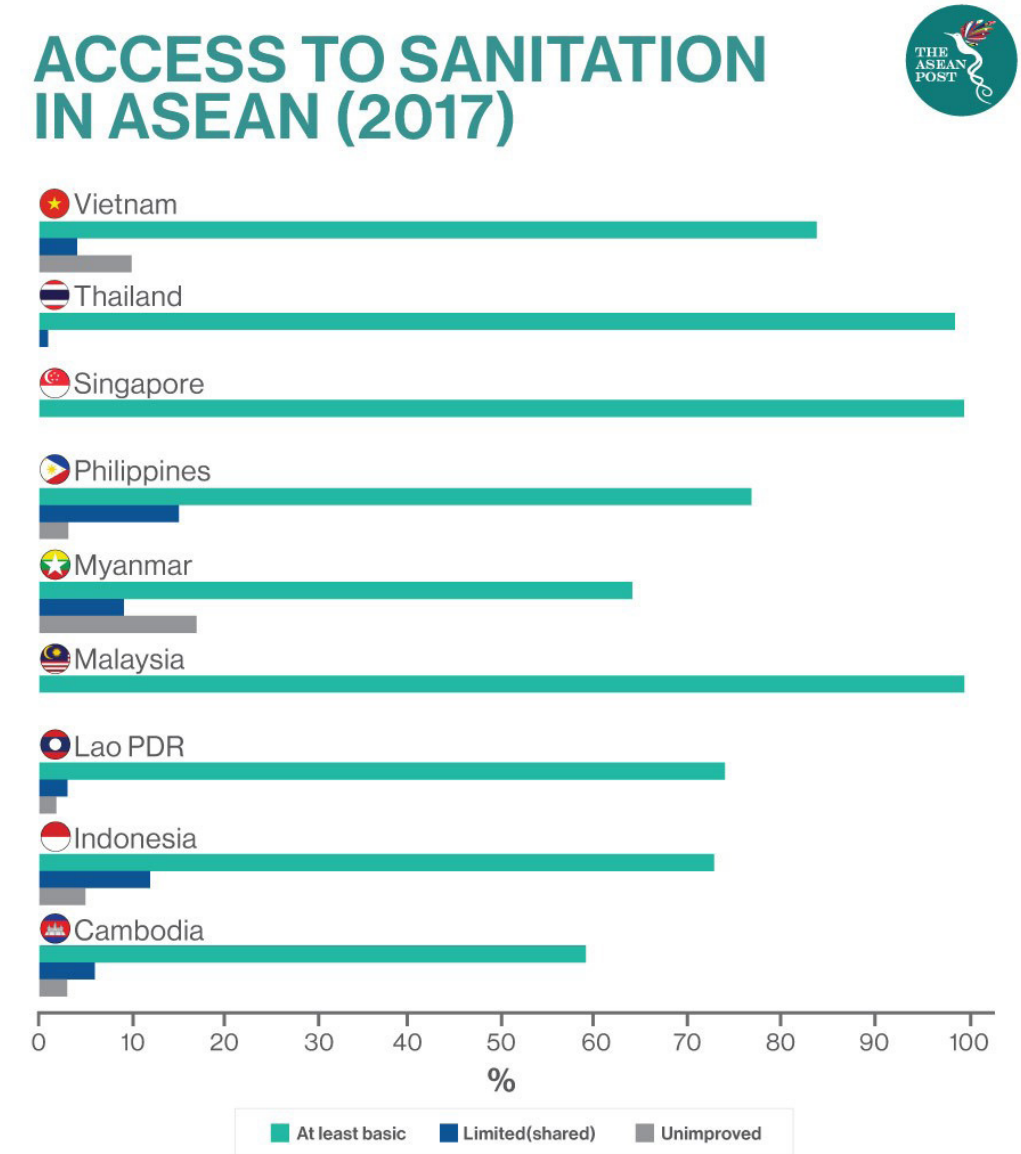

Figure 9. Access to sanitation in ASEAN. Source: WHO (2018).

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COVID-19 impact on the water sector

As the world experiences the effects of the coronavirus pandemic, there is no better cure than prevention until there is a vaccine or treatment for COVID-19. Accordingly, adequate and safe water services are essential in the fight against the pandemic to enable service users to maintain the required level of personal hygiene, especially during self-isolation. This highlights the importance of the availability of clean, safe, and freshwater. The WHO and UNICEF have given assurance that while the presence of SARS-CoV-2 virus in untreated drinking water is possible, it has not been detected in potable water supplies, and even other coronaviruses have not been detected in surface or groundwater sources. The COVID-19 virus is enveloped and thus less stable in the environment compared to non-enveloped human enteric viruses with known waterborne transmission (WHO/UNICEF 2020). Accordingly, the risk of coronaviruses to water supplies is low.

Water, sanitation, and hand hygiene, together with physical distancing, are central to preventing the spread of the virus. They are the first line of defense against this serious threat to people's lives and health systems. Handwashing with water and soap kills the virus but requires access to running water in sufficient quantities. The response plans, therefore, at national, regional, and global levels, must prioritize water, sanitation, and hygiene services. But for proper water and sanitation services to continue, the service providers must ensure the availability of well-trained and healthy staff and the protection and operation of equipment, which in turn necessitates continued access to financial resources.

All these developments represent unparalleled challenges to societies and economies around the world. While there is still a lot of uncertainty about the duration of the lockdown imposed to contain the virus and the post-COVID strategy, it is clear that the virus has the potential to have wide-ranging impacts on the water sector. Some of these potential impacts are descriptively shown in Figure 10 (Frontier Economics 2020).

Figure 10 is not exhaustive, but it demonstrates the multiple and complex ways in which the virus will affect the water sector. The net impact on total expenditure is not clear since some costs are likely to increase (e.g., to protect staff and vulnerable customers, changes to working patterns), but in some areas, they will fall in the short term (e.g., reduced costs of installing new meters). The impact on performance commitments is also not clear since in some areas, costs may be lower but the likelihood of penalties may be higher (e.g., in

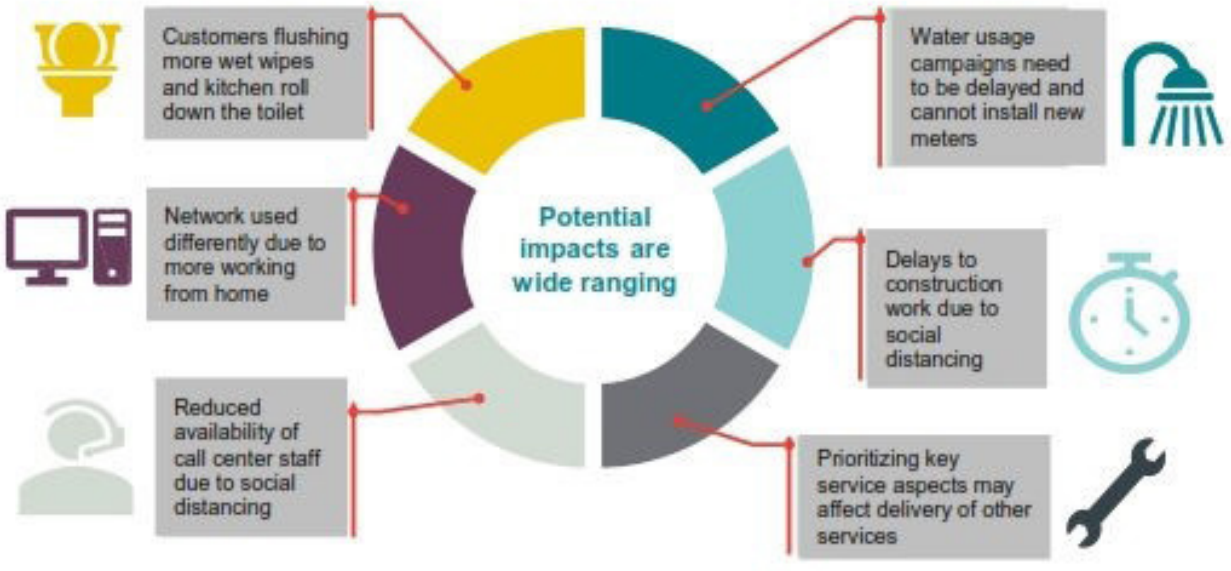

Figure 10. Potential impacts of COVID-19 on the water sector. Source: Frontier Economics (2020).

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respect of metering and per capita consumption). In some cases, the reverse might be true or companies may have to spend more to meet their targets (e.g., sewer flooding as customers flush more kitchen rolls because of a shortage of toilet paper). The timing of the impacts over the whole price control period is also not clear. It is possible for some effects to cancel each other out while other effects may be intensified throughout the price control. These impacts may include possible delays to service quality investments, which in turn may affect the ability of water companies to deliver performance commitments. The other more immediate and immediate issues include the potential decrease in cash flow as households and businesses are unable to pay their water bills.

Water districts will need to cope with the impacts of the economic fallout resulting from the pandemic. As previously mentioned, these impacts include, among others, adverse effects on property values, lower revenues, and billing and collecting issues. Given the complexity of the impacts, it is challenging for water companies and governments to determine the most appropriate response to the crisis. On the one hand, there is a need to act quickly and decisively as the pandemic is affecting the economy, customer behaviour, and business continuity in an unprecedented way. Tens of thousands of restaurants, cafes and bars, shops, cinemas, and other leisure businesses have closed. Without government assistance, many will not have the financial resources to survive. There will also be serious consequences on suppliers to these businesses.

To help alleviate the situation, government assistance will be needed to assist utilities in addressing the loss of revenue. Among the measures that could be considered are (Mamerow 2020):

- Financial support to cover costs associated with moratoriums on water service disconnectionsor reconnections of delinquent accounts;
- Provision of low-interest loans to help support utility operations at a time when incomes are dropping markedly; and
- Making available funding through established water infrastructure investment programs and other water infrastructure grant programs to catalyze local economic activity.

To ensure that the public has access to safe and reliable water during the pandemic, cities and municipalities in many countries have resumed water service to residents who have fallen behind in payments. Most governments have also passed measures to halt water supply disconnections. As a result of these actions, water utilities expect to see billions of lost revenues from unpaid bills from households that face financial hardship. Accordingly, many water utilities may not be able to recover unpaid bills. Invariably these amounts will be passed on later as higher rates to customers. Utilities also face a large loss in revenue from a decrease in industrial and business water usage. Furthermore, wastewater treatment systems may soon experience clogged-up sewer lines and flooding toilets as a result of people improperly disposing of paper towels, disinfectant wipes, and other used paper products into the toilet.

Among the many broad set of measures that may be considered in support of water companies are the following:

- Defer some performance commitments;
- Allow increases in total expenditures to maintain minimum services; and
- Permit recovery of bad debt from customers in the long run.

It is still unclear how long the crisis will last. A six-week lockdown will have a vastly different impact from one that lasts for several months. Given this uncertainty, there is a need to balance the interests of investors and the ability of water companies to finance themselves against the risk of customers potentially paying over the odds for unnecessary additional protection for companies. Any regulatory response will need to be based on good quality evidence. A robust evidence base is needed to justify short-run sector-wide changes that are implemented quickly and for longer-term applications for interim determinations. This is

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because it is important that any change is based on isolating the impact of the crisis and maintaining appropriate incentives to deliver efficient services.

Global inequality in water access will be an important factor in determining the course of and response to the pandemic. As the pandemic continues to spread, clean water must be made available to as many people as possible to enable them to take the basic precautions needed to reduce the risk of viral infection. Improving access to water, sanitation, and hygiene systems could bring down the overall global disease burden by 9% and reduce the number of deaths to disease by more than 6% (Nicol 2020). However, this cannot be achieved when over 840 million people worldwide currently lack basic supplies. Accordingly, this matter should be given high priority in post-coronavirus economic recovery efforts.

While the pandemic has caused loss of life and economic disruption, it is worth noting that there have also been positive impacts on water and environmental systems resulting from the decline in the pollution load from industries, transport systems, and other sources. There is anecdotal evidence showing a significant reduction in biochemical oxygen demand and coliform levels in river systems and coastal waters. For example, the quality of the coastal waters and beaches in the international resort island of Boracay (Philippines) has returned to its original pristine condition (CNN Philippines 2020) and in Venice, Italy, the water in the famous canals has cleared significantly due to the settling of sediments that are normally disturbed by boat traffic from tourism activities (CNN 2020). The quick recovery of many rivers and coastal waters, particularly in tourist destinations, would not have been possible without the extreme measures imposed by governments due to the pandemic. This unintended positive impact on water quality offers opportunities for finding feasible pathways through appropriate policies and practices for the continued quality improvement of riverine and coastal waters even post-COVID-19. However, one lookout should be that as countries rapidly restart their economies, the renewed industrial and touristic activities may dispose residuals and produce impacts leading to even worse pollution of water bodies.

SARS-CoV-2 Virus in Wastewater

It is also worth noting that the presence of the SARS-CoV-2 virus has been detected in untreated domestic sewage. The researchers of the National Institute for Public Health and the Environment in the Netherlands analyzed wastewater samples from the Amsterdam Schiphol Airport and detected the presence of SARS-CoV-2 within four days of cases being confirmed in the country (Long et al. 2020). Subsequently, several researchers have also detected rising SARS-CoV-2 RNA levels in sewage from several cities in the Netherlands (ACS 2020). These researchers were interested not so much in finding out the possible human transfer of the virus but in determining if levels of the virus' RNA in sewage could be correlated with the COVID-19 prevalence in each city. If this correlation could be established, then sewage surveillance could be a helpful tool to monitor the spread of SARS-CoV-2 in affected communities.

The scientists at the University of Stirling (UK) warned that the possibility of the spread of COVID-19 via the domestic wastewater system must not be underestimated since coronaviruses have been found to remain viable in sewage for up to 14 days (University of Stirling 2020). In fact, there have been recent reports concerning the presence of SARS-CoV-2 virus in untreated wastewater. The National Institute of Health in Italy found traces of SARS-CoV-2 virus in untreated sewage samples collected between October 2019 and February 2020 from wastewater treatment plants in northern Italy (Kelland 2019). A total of 40 samples were taken in Bologna, Milan, and Turin. Samples taken in December 2019 and in January and February, 2020 showed traces of the new coronavirus while samples taken in October and November 2019 tested negative.

The U.S. Centers for Disease Control and Prevention (US CDCP 2020) has advised however that standard practices associated with wastewater treatment plant operations are sufficient to

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protect workers from the coronavirus and that there is no information to date that anyone has become sick with COVID-19 because of exposure to wastewater. The WHO and UNICEF (2019) have also stated that there is no evidence to date that the COVID-19 virus has been transmitted to humans via sewerage systems with or without wastewater treatment. Accordingly, no additional COVID-19-specific protections are recommended for workers involved in wastewater handling, treatment, and management. Conventional wastewater treatment methods that utilize filtration and disinfection can inactivate the COVID-19 virus which was also shown by the fact that other human coronaviruses are destroyed by chlorination and exposure to ultraviolet (UV) light.

The possible presence of SARS-CoV-2 in the wastewater and sewage systems may spur regulators to require water and wastewater service providers to take appropriate measures to address this untreated sewage issue, including encouraging the providers to explore water recycling and reuse. This is a post-COVID-19 issue that should be kept in mind.

PHILIPPINE SITUATION

A major issue in the country is the inadequate and intermittent water supply in Metro Manila and other parts of the country. This has serious health consequences, particularly during this time of COVID-19. When water is scarce, people are compelled to rely on drinking water sources that may not be safe. They may also lack sufficient water to wash themselves and their clothes, and to prevent infection including from foodborne and waterborne diseases. Low or negative water pressure in pipes due to short supply attracts impurities that will put water quality at risk when the supply is restored.

Even before the onset of the coronavirus pandemic, Metro Manila has already been experiencing an inadequate supply of water from the two concessionaires, Manila Water Company, Inc. (MWCI) and Maynilad Water Systems, Inc. (MWSI) due primarily to the low level of water in the main water reservoir, Angat Dam. In early March 2020, the National Water Resources Board (NWRB 2020) increased the allocation for the Metropolitan Waterworks and Sewerage System (MWSS) from 42 cubic meters per second (cms) to 46 cms. In May 2020, the allocation was further increased to 48 cms. These measures were implemented to ensure that water supply is available in performing preventive measures against COVID-19 such as frequent handwashing and other cleaning and disinfection activities.

The MWSS has also assured Metro Manila customers that the water supplied by both MWCI and MWSI are safe and free from bacteria and virus, including the COVID-19 virus, having been disinfected with chlorine, as prescribed by the Philippine National Standard for Drinking Water (PNSDW) set by the Department of Health (DOH). The wastewaters from the sewage and septage treatment plants being discharged into the receiving water bodies have also been disinfected with chlorine (Miraflow 2020).

Other parts of the country also experience a lack of or inadequate clean water supply. For example, Metro Cebu has been experiencing prolonged rotating water service interruptions even at this time when it is essential that communities and health workers have access to safe and adequate water at all times to protect them from the spread of Covid-19.

Water districts in the country also have to cope with the impacts of the economic fallout resulting from the pandemic. The collection of water bills from poor communities where many have lost their sources of income is a serious concern. This is an area where government intervention will be urgently needed. One possible measure is for local governments to use calamity funds to subsidize water costs for the poorest sectors, particularly informal settler families crowding in urban centers. In this time of COVID-19, safe water, adequate sanitation, and hygienic conditions are crucial to people's survival.

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CONCLUSION

The energy sector has been severely affected by the coronavirus pandemic primarily as a consequence of quarantine and physical distancing measures, which have reduced mobility, enhanced residential activities, and increased energy use. There is also increased energy use in the medical care and hospital sector. But the overall effect of the pandemic is a decline in global energy demand by 5–10% due to significant reductions in the demand from the commercial, services, and industrial sectors. As a consequence, the relative share of renewables in the overall supply of electricity has increased. This provides an excellent opportunity for countries to transition to clean energy systems.

In the Philippines, energy demand dropped significantly following the enforcement of various lockdown measures. Energy demand in the Luzon and Visayas grids dropped by 30% and Mindanao grid by about 9.5%. Coal use dropped from 56 to 48% of generation, natural gas decreased by 6%, solar and biomass generation increased slightly, and other sources stayed about the same.

For proper water and sanitation services to continue, the service providers must ensure the availability of well-trained and healthy staff and the protection and operation of equipment, which in turn necessitates continued access to financial resources. In addition, they need to cope with the impacts of the economic fallout resulting from the pandemic, including, among others, adverse effects on property values, lower revenues, and billing and collecting issues. While the pandemic has caused loss of life and economic disruption, it is worth noting that there have also been positive impacts on water and environmental systems resulting from the decline in the pollution load from industries, transport systems, and other sources.

Many of the challenges faced by the energy and water sectors caused by the COVID-19 crisis will gradually resolve once the crisis comes to an end and previous levels of economic activity resume. Energy and water companies have to develop a high degree of flexibility to adjust operations and not assume that recovery will be a continuous and linear process. They have to act quickly to secure supply chains and manage component inventory, implement structural measures to reduce risk, and develop a more mobile workforce that can work virtually and at distance. Finally, energy and water companies will have to take into serious consideration the possible impacts of behavior change and whether people will not completely return to previous habits.

While the pandemic may have significant permanent economic effects in the energy sector, it is expected that there will be less pronounced permanent effects on the water sector. Nevertheless, the lessons learned from the sharp drop in global economic activity resulting from the pandemic may help countries, societies, and communities to better understand the concepts and demands of environmental sustainability and societal consumption patterns.

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