**A REPORT ON**

**ENGINEERING STRATEGIES FOR HANDLING COVID-19 FOR ENVIRONMENTAL HEALTH AND ECONOMIC SUSTAINABILITY**

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**ABSTRACT**

While several teams have quickly set up COVID-19-related field hospitals in convention centers and places of public assembly considered the low-hanging fruit of alternative sites for coronavirus surge beds others are working behind the scenes on longer lead time retrofits and conversions for hospitals, hotels and dormitories. Many of these are aimed at increasing the supply of coronavirus patient intensive care units and airborne infection isolation rooms, with the goal of protecting health care workers from getting sick.

For the retrofits and conversions, **health care architects and engineers** are seeking the best ways to quickly design code-compliant and safe ICU and airborne infection isolation rooms, suites or wards, in a time of changing intelligence about virus transmission. The main reason for AII, rather than ICU-only rooms, is to keep health care personnel from contracting COVID-19.

**The Nigerian government is rolling out measures to fight off the coronavirus after launching lockdown procedures on 30 March.**

The Nigerian Presidential Task Force on Coronavirus has urged state governments to ensure that they have isolation facilities in their localities. These facilities should:

* Have at least 300 beds;
* And be preferably linked to existing infectious disease centres or medical centres (such as tuberculosis and HIV centres), as this makes it easier to continue to make use of them after the pandemic.

However, any spaces will do, with health minister Osagie Ehanire, saying: “I urge all states to find more beds for isolation and treatment, and this may include hotels.”

**CHAPTER ONE**

**INTRODUCTION**

**1.0 WHAT IS CORONAVIRUS (COVID-19)?**

Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus.

Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment.  Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness.

The best way to prevent and slow down transmission is be well informed about the COVID-19 virus, the disease it causes and how it spreads. Protect yourself and others from infection by washing your hands or using an alcohol based rub frequently and not touching your face.

The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, so it’s important that you also practice respiratory etiquette (for example, by coughing into a flexed elbow).

At this time, there are no specific vaccines or treatments for COVID-19. However, there are many ongoing clinical trials evaluating potential treatments. WHO will continue to provide updated information as soon as clinical findings become available.

**1.1 SIGNS AND SYMPTOMS OF COVID 19**

The most common symptoms of COVID-19 are fever, tiredness, and dry cough. Some patients may have aches and pains, nasal congestion, runny nose, sore throat or diarrhea. These symptoms are usually mild and begin gradually. Some people become infected but don’t develop any symptoms and don't feel unwell. Most people (about 80%) recover from the disease without needing special treatment. Around 1 out of every 6 people who gets COVID-19 becomes seriously ill and develops difficulty breathing. Older people, and those with underlying medical problems like high blood pressure, heart problems or diabetes, are more likely to develop serious illness. People with fever, cough and difficulty breathing should seek medical attention.

**1.2 HOW DOES COVID-19 SPREAD?**

People can catch COVID-19 from others who have the virus. The disease can spread from person to person through small droplets from the nose or mouth which are spread when a person with COVID-19 coughs or exhales. These droplets land on objects and surfaces around the person. Other people then catch COVID-19 by touching these objects or surfaces, then touching their eyes, nose or mouth. People can also catch COVID-19 if they breathe in droplets from a person with COVID-19 who coughs out or exhales droplets. This is why it is important to stay more than 1 meter (3 feet) away from a person who is sick.

WHO is assessing ongoing research on the ways COVID-19 is spread and will continue to share updated findings.

**1.3 Basic protective measures against the new coronavirus**

Stay aware of the latest information on the COVID-19 outbreak, available on the WHO website and through your national and local public health authority. Most people who become infected experience mild illness and recover, but it can be more severe for others. Take care of your health and protect others by doing the following:

**Wash your hands frequently**

Regularly and thoroughly clean your hands with an alcohol-based hand rub or wash them with soap and water.

**Why?** Washing your hands with soap and water or using alcohol-based hand rub kills viruses that may be on your hands.

**Maintain social distancing**

Maintain at least 1 metre (3 feet) distance between yourself and anyone who is coughing or sneezing.

**Why?** When someone coughs or sneezes they spray small liquid droplets from their nose or mouth which may contain virus. If you are too close, you can breathe in the droplets, including the COVID-19 virus if the person coughing has the disease.

**Avoid touching eyes, nose and mouth**

**Why?**Hands touch many surfaces and can pick up viruses. Once contaminated, hands can transfer the virus to your eyes, nose or mouth. From there, the virus can enter your body and can make you sick.

**Practice respiratory hygiene**

Make sure you, and the people around you, follow good respiratory hygiene. This means covering your mouth and nose with your bent elbow or tissue when you cough or sneeze. Then dispose of the used tissue immediately.

**Why?** Droplets spread virus. By following good respiratory hygiene you protect the people around you from viruses such as cold, flu and COVID-19.

**If you have fever, cough and difficulty breathing, seek medical care early**

Stay home if you feel unwell. If you have a fever, cough and difficulty breathing, seek medical attention and call in advance. Follow the directions of your local health authority.

**Why?** National and local authorities will have the most up to date information on the situation in your area. Calling in advance will allow your health care provider to quickly direct you to the right health facility. This will also protect you and help prevent spread of viruses and other infections.

**Stay informed and follow advice given by your healthcare provider**

Stay informed on the latest developments about COVID-19. Follow advice given by your healthcare provider, your national and local public health authority or your employer on how to protect yourself and others from COVID-19.

**Why?** National and local authorities will have the most up to date information on whether COVID-19 is spreading in your area. They are best placed to advise on what people in your area should be doing to protect themselves

**CHAPTER TWO**

**2.0 EFFECT OF COVID-19 ON HUMAN LIFE AND ENVIRONMENT**

**2.1 The human consequences**

In recent weeks, we have seen the significant economic impact of the coronavirus on financial markets and vulnerable industries such as manufacturing, tourism, hospitality and travel. [**Travel and tourism account for 10% of the global GDP and 50 million jobs are at risk worldwide**](https://www.wttc.org/about/media-centre/press-releases/press-releases/2020/open-letter-from-wttc-to-governments/)**.** Global tourism, travel and hospitality companies closing down affects SMEs globally. This, in turn, affects many people, typically the least well-paid and those self-employed or working in informal environments in the gig economy or in part-time work with zero-hours contracts. Some governments have announced economic measures to safeguard jobs, guarantee wages and support the self-employed, but there is a lack of clarity in many countries about how these measures will be implemented and how people will manage a loss of income in the short-term.



Behind these statistics lie the human costs of the pandemic, from the deaths of friends and family to the physical effects of infection and the mental trauma and fear faced by almost everyone. Not knowing how this pandemic will play out affects our economic, physical and mental well-being against a backdrop of a world that, for many, is increasingly anxious, unhappy and lonely.

Fear of the unknown can often lead to feelings of panic, for example when people feel they are being denied life-saving protection or treatment or that they may run out of necessities, which can lead to panic buying. [Psychological stress is often related to a sense of a lack of control in the face of uncertainty](https://freedomhouse.org/report/freedom-world/freedom-world-2018).

In all cases, lack of information or the wrong information, either provided inadvertently or maliciously, can amplify the effects. There is a huge amount of misleading information circulating online about COVID-19, from fake medical information to speculation about government responses. People are susceptible to social media posts from an apparently trustworthy source, often referred to as an “Uncle with a Masters”-post, possibly amplified and spread by “copypasta” posts, which share information by copying and pasting and make each new post look like an original source, as opposed to posts that are “liked” or “shared” or “retweeted”. [The blend of half-truths and nonsense in these posts makes it hard for social media firms to filter them out](https://www.bbc.co.uk/news/blogs-trending-51931394).

**2.2 ON THE ENVIRONMENT**

Sadly, criminals and hackers are also exploiting this situation and there has been a significant rise in Coronavirus-themed malicious websites, with more than 16,000 new coronavirus-related domains registered since January 2020. Hackers are selling malware and hacking tools through COVID-19 discount codes on the darknet, [many of which are aimed at accessing corporate data from home-workers’ laptops, which may not be as secure as outside an office environment](https://www.wsj.com/articles/hackers-target-companies-with-fake-coronavirus-warnings-11583267812).



Social distancing and lockdowns have also prompted altruistic behaviours, in part because of a sense that “we’re all in this together”. Many people report being bored or concerned about putting on weight; [others have discovered a slower pace of life and by not going out and socializing have found more time for family, others and even their pets](https://www.ft.com/content/9fb43d7c-646a-11ea-abcc-910c5b38d9ed).

The downside of self-isolation or social lockdown are symptoms of traumatic stress, confusion and anger, all of which are exacerbated by fear of infection, having limited access to supplies of necessities, inadequate information or the experience of economic loss or stigma. This stress and anxiety can lead to increased alcohol consumption, as well as an increase in domestic and family violence. [In Jingzhou, a town near Wuhan in Hubei province, reports of domestic violence during the lockdown in February 2020 were more than triple the number reported in February 2019](https://www.sixthtone.com/news/1005253/domestic-violence-cases-surge-during-covid-19-epidemic).

**2.3 EFFECT OF COVID-19 ON THE ECONOMY**

**THE ECONOMIC IMPACT OF COVID-19 IN AFRICA**

The coronavirus pandemic continues to take its toll on the African continent. While the continent as a whole still accounts for relatively few deaths from the disease, the numbers are rising, with [more than 4,700 confirmed cases](https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200402-sitrep-73-covid-19.pdf?sfvrsn=5ae25bc7_4) and 127 deaths. As countries scramble to contain the virus—and are affected by the efforts of other countries to do the same—the economic impacts grow.

Here’s a selection of this week’s coverage on the observed and expected economic impacts across the continent, divided into growth and income, sectors and sub-populations, policy responses, and commentary.

**Growth and income analysis**

* [McKinsey proposes different scenarios](https://www.mckinsey.com/featured-insights/middle-east-and-africa/tackling-covid-19-in-africa) for Africa’s growth in the wake of COVID-19. Before the crisis, the 2020 growth estimate for the continent was 3.9 percent. In the “least-worst case,” characterized by the outbreak being somewhat contained both globally and in Africa, growth drops to 0.4 percent. In other scenarios (including a lack of containment globally and in Africa), the rate drops as low as -3.9 percent. The scenarios explicitly do not take into account either fiscal stimulus packages or currency devaluations.
* [Breisinger and others estimate](https://www.ifpri.org/blog/economic-impact-covid-19-tourism-and-remittances-insights-egypt) monthly GDP losses for Egypt under a range of scenarios, with estimates around 0.7 to 0.8 percent.

**Sector and sub-population analysis**

* The [World Food Programme’s analysis](https://reliefweb.int/report/world/economic-and-market-impact-analysis-covid-19-west-and-central-africa-wfp-regional) for West and Central Africa highlights that 2019/2020 had been a strong agricultural season “with overall higher than average production of cereals,” which is good for food security. But despite that, the “consumer price index for food is at its highest since 2008 in the Monetary Union of West Africa zone.” They talk about informality, remittances, and migration, and here’s their take on agriculture:

*“More than 80 percent of rural population rely on subsistence farming in West and Central Africa. The 2020 off season harvests should be reaching markets and providing substantial incomes of stallholder farmer. However, market closure, restriction on internal and cross borders movement limit markets access. Planting period starts in May/June for the main agricultural season while the Covid-19 epidemic is forcing governments to cut agricultural expenses and to prioritize health-related expenditures. If the above-mentioned restrictions continue, famers won’t have access to market to buy good quality seeds and fertilizers.”*

* [Reardon, Bellemare, and Zilberman propose](https://www.ifpri.org/blog/how-covid-19-may-disrupt-food-supply-chains-developing-countries) seven ways that COVID-19 will likely affect the food supply. They also discuss policy paths for the short, medium, and long run: “In the short run, implement new, broad safety nets for SMEs and workers in the midstream and downstream segments of FSCs; for example, governments could use cash-for-work schemes to employ workers to distribute emergency food rations, upgrade sanitation in wholesale markets and wet markets, and maintain essential operations in their own enterprises so that the latter are there when the crisis passes.”
* In Kenya, day laborers are dramatically affected, according to [Mpungu’s Al Jazeera report](https://www.aljazeera.com/ajimpact/covid-19-kenyans-brace-tough-times-economic-shock-looms-200329053436760.html): “The coronavirus containment measures are expected to bring additional economic hardship in a country where … informal labourers account for 83.6 per cent of the total workforce.”
* [Resnick highlights dangers](https://www.ifpri.org/blog/covid-19-lockdowns-threaten-africas-vital-informal-urban-food-trade) for informal traders during lockdowns: “African governments have a history of cracking down on informal traders, especially during public health outbreaks. When the Zambian government used the military to close down markets during Lusaka’s 2018 cholera outbreak, farmers who sold their fresh produce to informal traders lost a significant amount of income.”
* [Kestler-D’Amours at Al Jazeera highlights](https://www.aljazeera.com/news/2020/03/front-worry-covid-19-spreading-african-refugee-camps-200329054029304.html) the particular dangers in Africa’s refugee camps: “Scary, distressing, catastrophic: A bleak assessment by experts, humanitarians and epidemiologists on what a severe coronavirus outbreak would look like in countries across Africa sheltering millions of refugees and other vulnerable people.” She reports that the UN High Commissioner for Refugees is taking steps to change the crowd dynamics in camps.
* [Turse writes that](https://theintercept.com/2020/03/26/burkina-faso-africa-coronavirus/) Burkina Faso, the first country to suffer a COVID-19 fatality, faces “a new kind of threat to a country wracked by a war that has displaced around 700,000 Burkinabe in the last year. Many of those people now find themselves under great physical and emotional strain, lacking proper shelter, food, and the other necessities — all of which makes them more vulnerable to the pandemic.”

**Economic policy responses**

* Various countries are implementing social safety net policies, as reported by Gentilini: [Uganda](https://twitter.com/Ugentilini/status/1245333586112282625) is allowing businesses to reschedule social security contributions, [Namibia](https://twitter.com/Ugentilini/status/1245359983438553089) is offering an emergency income grant to workers who lost jobs, [Cabo Verde](https://twitter.com/Ugentilini/status/1244045318091571200) is offering cash transfers and food assistance, and the [Central Bank of West African States](https://twitter.com/Ugentilini/status/1244040947291369474) has abolished a number of transaction fees.
* [Dell’Ariccia and others at the International Monetary Fund](https://blogs.imf.org/2020/04/01/economic-policies-for-the-covid-19-war/) propose three key objectives of economic policy in the face of COVID-19—guarantee functioning of essential sectors, provide resources for people hit by the crisis, and prevent excessive economic disruption. At the end of their post, they propose a series of economic policy options to target households, businesses, and the financial sector.
* [Zimbabwe entered](https://www.nasdaq.com/articles/zimbabweans-enter-coronavirus-lockdown-amid-severe-economic-crisis-2020-03-30) a COVID-19 lockdown this week, following other countries. Dzirutwe reports that “unlike in South Africa, where many citizens defied calls to stay indoors with some clashing with security forces at the weekend, Zimbabweans mostly stayed home... Central Harare's streets were deserted. Banks, government offices and businesses were shut.”
* [Kenya has proposed](https://home.kpmg/us/en/home/insights/2020/03/tnf-kenya-tax-relief-measures-include-reduced-corporate-tax-rate-covid-19.html) tax relief and governments leaders are accepting [pay](https://www.msn.com/en-xl/africa/kenya/uhuru-ruto-propose-to-take-80percent-salary-reduction-during-covid-19-crisis/ar-BB11HjaV) [cuts](https://www.theafricareport.com/25164/kenyan-government-agree-to-pay-cuts-curfew-imposed-as-coronavirus-cases-grow/), as reported [by Golubski](https://www.brookings.edu/blog/africa-in-focus/2020/03/28/africa-in-the-news-debt-relief-in-somalia-government-efforts-to-combat-covid-19-and-new-boko-haram-attacks/).

**Bracing up for COVID-19 consequences on the Nigerian economy**

For most developing economies, the odds of sliding into a downturn are gradually expected as the global coronavirus outbreak puts severe pressure on the economy. For Nigeria, the country is still sluggishly grappling with recovery from the 2016 economic recession which was a fall out of global oil price crash and insufficient foreign exchange earnings to meet imports. In the spirit of economic recovery and growth sustainability, the Nigerian federal budget for the 2020 fiscal year was prepared with significant revenue expectations but with contestable realizations. The approved budget had projected revenue collections at N8.24 Trillion, an increase of about 20% from 2019 figure. The revenue assumptions are premised on increased global oil demand and stable market with oil price benchmark and oil output respectively at $57 per barrel and 2.18 Million Barrels Per Day.

The emergence of COVID-19 and its increasing incidence in Nigeria has called for drastic review and changes in the earlier revenue expectations and fiscal projections. Compared to events that led to recession in 2016, the current state of the global economy poses more difficulties ahead as the oil price is currently below US$30 with projections that it will dip further going by the price war among key players in the industry. Unfortunately, the nation has grossly underachieved in setting aside sufficient buffers for rainy days such as it faces in the coming days. In addressing these daunting economic challenges, the current considerations to revise the budget downward is inevitable. However, certain considerations that are expected in the review must not be left out. The assumptions and benchmarks must be based on realizable thresholds and estimates to ensure optimum budget performance, especially on the non-oil revenue components.

Furthermore, cutting expenditures must be done such that the already excluded group and vulnerable are not left to bear the brunt of the economic contraction. The economic and growth recovery program which has the aim of increasing social inclusion by creating jobs and providing support for the poorest and most vulnerable members of society through investments in social programs and providing social amenities will no doubt suffers some setbacks. Besides, the downward review of the budget and contractions in public spending could be devastating on poverty and unemployment. The last [**unemployment report**](https://www.premiumtimesng.com/news/headlines/301896-nigerias-unemployment-rate-rises-to-23-1-nbs.html) released by the National Bureau of Statistics (NBS) ranks Nigeria 21stamong 181 countries with an unemployment rate of about 23.1%. The country has also been rated as the poverty capital of the world with an estimated 87 million people living on less than $2 a day threshold.

The decision to cut the retail price of gasoline under a price modulation arrangement is a welcome development. The cut is expected to curb rising inflation, especially food price inflation which will mainly benefit the poor. However, rather than the price capping regime introduced, by which it is expected of the Petroleum Products Price Regulation Agency (PPPRA) to constantly issues monthly guide on appropriate pricing regime. It is expected that the government will use this opportunity to completely deregulate the petroleum industry in line with existing suggestions and reports. In the event that the global economy becomes healthier and crude oil prices increases, the government might return to the under-recovery of the oil price shortfall by the Nigerian National Petroleum Corporation (NNPC). A policy that annually costs the government huge revenue and recurring losses to the NNPC.

Basically, the Nigerian government essentially must lead economic diversification drive. It is one practicable way to saddle through the current economic uncertainties and instabilities. What the consequences of COVID-19 pandemic should further offer the Nigerian economic managers and policymakers, is that the one-tracked, monolithic reliance on oil is failing. Diversification priorities to alternative sectors such as agriculture, solid minerals, manufacturing and services sectors, should be further intensified.

**2.4 EFFECT OF COVID-19 ON THE ENGINEERING WORLD**

**Crisis management and response**

**Possible issues**

The industry should prepare for potential struggles in the subcontractor middle market of the industry, especially if construction site shutdowns begin to occur on a large scale and remain in place for a prolonged period. If this segment does not receive government support and sites begin to close extensively, many firms may become insolvent in the next two months, which could cascade  throughout the industry in the form of a major worker shortage and an abrupt cessation of projects. Such a scenario would likely also open the door to a potential rise in acquisitions of distressed firms.

Engineering and Construction companies, E&C may face continued downward pressure on demand, along with supply chain issues, as the COVID-19 pandemic intensifies. That may cause privately commissioned projects and even some state and local government projects to be delayed, and future spending to be curtailed. Such a scenario could trigger cash-flow liquidity challenges and difficulties in managing debt obligations.

The industry’s workforce may be vulnerable given that most of the work must take place  on-site and cannot be done remotely. Additionally, companies may need to find ways to impose social distancing through smaller crews and longer, staggered shifts.

**Workforce**

**Possible issues**

E&C companies should prepare to put in place immediate and contingent safety measures for their employees and decide which functions can be carried out remotely should an outbreak occur within their ranks.

The industry should also plan for a prolonged reduction in capacity and cost structure, which may translate into potential staff reductions and related measures.

In the event of widening outbreaks of COVID-19 that may affect workers, companies should consider the need to outsource some corporate functions (e.g., moving IT to the cloud, or shifting internal non-core operating functions to contractors). Such changes can help lower operating costs and eliminate maintenance capital expenses.

**Operations and supply chain**

**Possible issues**

E&C companies should prepare for continued weakening links in their supply chain — both nationally and internationally — as some vendors and suppliers may likely face operational or financial struggles. The industry may experience continued supply issues surrounding construction equipment and materials from Asia (e.g., structural steel and floating glass) and, to a lesser degree, from the EU.

The deeper into the supply chain the outbreak goes, the greater likelihood the impact may be. Companies with global supply chains may see tier 2 and especially tier 3 suppliers most affected by disruptions related to the pandemic.

As with previous downturns, the industry may move quickly to cut discretionary and capital spending to support operations. A key question for all companies will be: Do you have the financial reserves to weather the storm — or even to capitalize on the tumult in the industry

**Financial reporting**

**Possible issues**

Disruption in the sector may lead to numerous[**financial disclosure implications**](https://www.pwc.com/us/en/cfodirect/publications/in-depth/coronavirus-faq-accounting-implications.html). Stakeholders are making it clear they expect transparency from companies, as well as disclosures about actual and anticipated impacts and, most important, the risks and vulnerabilities to their business.

**Tax and trade**

**Possible issues**

E&C companies should plan for potential changes to supply chains and workforce global mobility due to COVID-19. This will require careful consideration of potential tax implications.

The E&C industry should prepare to be affected by the government stimulus plan. For example, some E&C companies may be contenders for government-provided financial assistance. Extending lines of credit, reducing infrastructure costs, short-term funding, lowering the tax burden and supply chain assistance are measures the government is likely to explore.

Multinational companies should expect potential cash-flow constraints from overseas operations — including cash repatriation complications and irregularities. Cash could also be bottlenecked when goods are paid for but not supplied (or delayed and stranded). Such cash bottlenecks will likely occur in geographies most affected by COVID-19.

**CHAPTER THREE**

**ENGINEERING STRATEGIES TO HELP CURB THE SPREAD OF COVID19**

**3.0 HEALTH STRATEGIES**

**Strategies to Optimize the Supply of PPE and Equipment**

Personal protective equipment (PPE) is used every day by healthcare personnel (HCP) to protect themselves, patients, and others when providing care. PPE helps protect HCP from potentially infectious patients and materials, toxic medications, and other potentially dangerous substances used in healthcare delivery.

PPE shortages are currently posing a tremendous challenge to healthcare officials all over the world because of the COVID-19 pandemic. Healthcare facilities are having difficulty accessing the needed PPE and are having to identify alternate ways to provide patient care.

Engineers together with the help of different healthcare agencies optimization strategies for PPE offer options for use when PPE supplies are stressed, running low, or absent. Contingency strategies can help stretch PPE supplies when shortages are anticipated, for example if facilities have sufficient supplies now but are likely to run out soon. Crisis strategies can be considered during severe PPE shortages and should be used with the contingency options to help stretch available supplies for the most critical needs. As PPE availability returns to normal, healthcare facilities should promptly resume standard practices.

**All healthcare facilities should begin using PPE contingency strategies now.**

* Maximize use of engineering controls, such as barriers and maintained ventilation systems, and administrative controls, such as altering work practices to minimize patient contacts.
* Cancel elective and non-urgent procedures/appointments.
* Reserve PPE for HCP and replace PPE normally used for source control with other barrier precautions such as tissues.
* Use re-usable PPE that can be reprocessed.
* Use PPE beyond the manufacturer-designated shelf life for training.
* Consider allowing HCP to extend use of respirators, facemasks, and eye protection, beyond a single patient contact.

**Strategies to Allocate Ventilators from Stockpiles to Facilities**

During a large-scale public health emergency involving a respiratory disease like COVID-19, federal, state, or local stockpiled ventilators should be deployed in a way that optimizes the effectiveness, efficiency, and equity of this scarce resource. Decisions on the allocation of stockpiled ventilators to facilities should be based on multiple factors, including:1

* Assessment of need
* Determination of facilities’ ability to absorb additional ventilators
* Ethical considerations to inform how this scarce resource is provided to facilities to save as many lives as possible
* Input from state and local leadership, legal and ethical experts, and informed stakeholders

State and local planners can use the strategies in this guide to assist them when allocating ventilators from public health stockpiles to hospitals and other facilities during a pandemic.

**Assessment of need:**

* Use available surveillance data to predict the number of ventilators needed
  + Growth in number of daily cases (increasing, stable, decreasing)
  + Number of hospitalizations
  + Percentage of hospitalizations with critical illness requiring critical care
  + Percentage of critically ill patients needing ventilatory support
* Assess the number of ventilators currently available for use by each facility
  + Ventilators currently not in use or in storage
  + Ventilators anticipated to be available from surge contracts or sharing agreements
  + Ventilators in use that may be available for future use

**3.1 ECONOMIC STRATEGIES**

**CRISIS MANAGEMENT AND RESPONSE**

* Work closely with subcontractors (and governments) and consider emergency measures to assist them in the case of widespread construction site shutdowns.
* Assess how profitability, loans, revolving credit and cash flow reserves can support ongoing operations in a low-revenue environment — in light of current (and forecasted) cash operating expenses, taxes and other cash expense items.
* Review capital and corporate cost budgets to help identify not only marginal investments, but also discretionary items that can be cut.
* Consider divesting non-core or possibly underperforming assets or assessing mergers and acquisitions (M&A) prospects as potential sources of cash.
* Consider refinancing debt — although access to capital may be constrained.
* Work closely with municipal, state and federal governments to coordinate plans for worker and consumer safety, while keeping mission-critical projects running.
* To help assess labor costs, consider workforce contingency planning scenarios, including during a period of diminished demand and activity.

**WORKFORCE**

* Confirm that your employees are safe and know how to protect themselves. Consider instituting sanitation rules in the workplace and assess mobility policies to encourage remote working, when necessary and possible. Ask employees who are sick to stay home until they are better. Stagger shifts, increase distance between workers and ban visitors to construction sites. Eliminate non-essential travel.
* Consider “forward-paying” subcontractors whose construction sites have been shut down due to COVID-19 containment efforts.
* Establish risk-mitigation programs for employees who still need to work on-site. Invest in education campaigns for front-line employees who have to be on-site so they know what to do  to minimize the spread of the disease and what to do if they experience symptoms.
* Consider potential workforce scenarios to help reduce immediate labor costs.
* Gather necessary data on employees (geography, visas, etc.) and track movements during the crisis.
* Consider which functions may be outsourced to help trim operating costs.

**OPERATION AND SUPPLY CHAIN**

* Work with local, state and federal governments — and your subcontractors — to help assess which construction projects may be shut down, and prepare accordingly.
* Transfer new knowledge down the supply chain. Update leading practices as the situation evolves, and assist subcontractors and governments in implementing them. This may require increasing transparency in the supply chain through daily self-reporting with critical suppliers.
* Gain a keener, real-time situational awareness of your supply chains, especially those affecting critical materials and components. Identify potentially weak links in the supply chain — especially in geographies currently affected by COVID-19 and those that could be impacted in the future.
* Prepare for supply chain pivots that could mean identifying alternative suppliers.
* Prioritize cybersecurity and system resiliency in response to significantly higher levels of remote access to core systems, and because employees and management could be more susceptible to social engineering efforts in the midst of a crisis.
* Evaluate the use of automation solutions to reduce the number of workers on sites. Companies that have piloted solutions should ramp them up carefully, while others should start exploring them. Focus on autonomous materials movement (e.g., autonomous forklifts and cranes and high-payload drones) and the automation of repetitive tasks.

**FINANCIAL REPORTING**

* Broaden disclosures to go beyond what’s required in financial statements. For example, you might consider disclosing management’s analysis of the current and potential future impact of liquidity and credit crunch on the business.
* Plan for impairment and disclosure considerations, particularly if your company’s fiscal year ends on or after Jan. 1, 2020, as any adverse financial implications may be considered a Type I subsequent event (vs. a Type II).
* Plan for disclosures about risks, such as how recent events may impact current and future judgments and the estimates inherent in financial reporting (e.g., inventory obsolescence, receivables collectibility or debt covenants).
* Proactively communicate with lenders and other stakeholders to avoid surprises and enable potential rescheduling of debt or alternative financing sources.

**TAX AND TRADE**

* Plan for — and assess — potentially major tax-related changes announced by the government that could impact your employees (e.g., payroll tax cut, sick leave pay).
* Companies with extensive international supply chains should consider the tax and transfer-pricing components of restructuring their supply chains. Planning should go deeper than merely identifying alternate suppliers. Implications could include customs and duties, as well as transfer-pricing considerations if the substitute components or materials are internally sourced.
* Companies need to consider trade and customs impacts. Global companies should evaluate whether it is advantageous to repatriate overseas cash from foreign subsidiaries.
* Companies with stronger balance sheets may have M&A opportunities.

**CHAPTER FOUR**

**CONCLUSION**

As the COVID-19 crisis unfolds, E&C companies will likely be hit on numerous fronts. Yet, how your company will be impacted depends on what segments you serve and where you sit in the industry’s value chain. For instance, large E&C firms with federal contracts will likely experience some protection, and that protection could extend to a lesser degree to companies holding state and local contracts. Projects commissioned by private enterprises, though, may be more precarious — especially if the contracts are with companies who may be hardest hit by the volatility of the markets and the severity of COVID-19 (such as energy companies in survival mode during a low oil-price environment).

How the subcontractor middle market fares amid this crisis in the short term could dictate how the industry in general may fare in the long term. Keeping construction workers safe and subcontractor firms’ balance sheets healthy are critical for the overall recovery of the industry. This will also help prevent a possible buying spree of distressed middle-market firms by foreign investors.

Large multinational E&C players will also need to look beyond their own economic viability. They may need to coordinate closely with the public sector to help forge plans central to public safety and the solvency of their workforce, while keeping the lights on in their operations. This should be especially relevant for firms designing and building projects connected to critical infrastructure, such as energy and power, transport, communications, food and agriculture and others.

Many E&C companies will be compelled to make cuts during this volatile period. Some will be austere. So, be surgical with cuts while balancing short- and long-term needs.

Keep in mind that austerity measures should be tempered to preserve long-term objectives. Although moving quickly can certainly create an advantage, knowing where you’re headed will help you ensure the changes you make are more impactful.

**COVID-19 Critical Items List**

**PPE:**

* Gloves, examination
* Gloves, surgical
* Goggles, protective
* Gown, protective
* Face shield
* Mask, particulate respirator
* Mask, surgical

**Diagnostic equipment:**

* Lab screening test kit
* Lab confirmation test kit
* RT-PCR kit
* Extraction kit
* Cartridges for RT-PCR automatic systems
* Swab and Viral transport medium

**Clinical care equipment:**

* Pulse oximeter
* Concentrator O2, 10L, 230V, 50 Hz + acc.
* Nasal oxygen cannula, with prongs,
* Ventilator patient, for adult, pediatric w/acc.
* CPAP, with tubing and patient interfaces for adult and pediatric, w/acc.
* Suction pump, mechanical
* High-flow nasal cannula (HFNC) w/acc