COVID-19 Solutions and Sustainability Impacts
Bala Consulting Engineers COVID-19 Task Force & Villanova University RISE Partners
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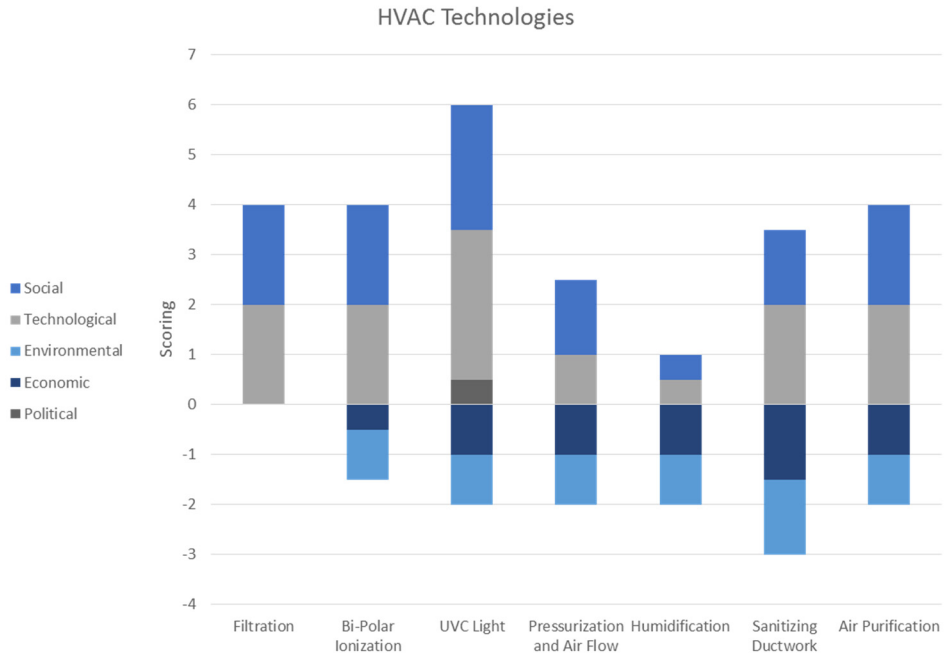
Recovering from the current worldwide pandemic will impact the lives of the work force in obvious ways, such as social distancing, working remotely and cleanliness, but also in more obscure ways, such as energy use, waste streams and office norms.

Since the energy crisis of the early 1970s, the rise of the EPA, and even more so, the advent of LEED, the United States has been striving to create more energy-efficient designs and built environments. Rebounding from the pandemic of COVID-19 and its associated economic downturn may cause an undetermined percentage of the good work and improvements made over the last 50 years to suffer as a result of re-engaging the economy and the workforce.

To progress Bala's research on COVID-19 recovery strategies, this document takes a high-level view of potential impacts that may be created by some of those strategies and recommendations. Working with our research partners in the RISE (Resilient Innovation through Sustainable Engineering) Program at Villanova University, we have put together an analysis of the positive and negative impacts some recommendations could create.

As is favored by the RISE Program Team at Villanova, we have formatted this discussion in the framework of the STEEP analysis model, which filters a topic through five core impact sectors – Social, Technical, Economic, Environmental and Political – to look at the positive and negative effects.



This graph illustrates the impact score of some HVAC recommendations, referenced in Bala's COVID-19 White Paper, across the STEEP framework.

Our research reviewed the positives of ramping up the economy to return to work and the negative impacts that this will have on our strides to be a more energy efficient and sustainable society:

	Social	Technological	Environmental	Economic	Political
Positives	• Cleaner indoor air quality • Better remote connection • Education on safety measures • Changes in social structure caused by Social Distancing	• Cleaner air in buildings with newer technology • More frequent air filter changes • Automation innovation	• Increased awareness on climate issues • Reduced emissions and pollution • WFH has proven to be successful • Higher value on nature	• Allow the economy to expand again • Technology business will grow • Continued materialism – but online • Emergency preparedness changes • Job creation	• Major disruption across the board • Healthcare and emergency preparedness may change • Address equity among citizens
Negatives	• Continued social distancing enforced • Adjust to wearing PPE • Work hours may shift • If Children are still at home, workers will need to stay home • New forms of unsafe waste • Employee stress concerns	• Maintaining pressure • Treating a greater volume of air • Cleaning more frequently • Increasing filtration may not capture all of the virus	• HVAC filters reduce energy efficiency (more CO_2) • Increased chemical use for cleaning • Increased material solid waste (filters, PPE, etc.) • Increased online shopping, increased shipping • Supply chain management	• Reduce efficiency= higher operating costs • Capital cost for new systems • Increased maintenance & cleaning costs • High unemployment and job loss • Added expenses to buy PPE	• Major disruption across the board • Impacts on civil liberties • Enforcement of new standards • Prioritizing buildings

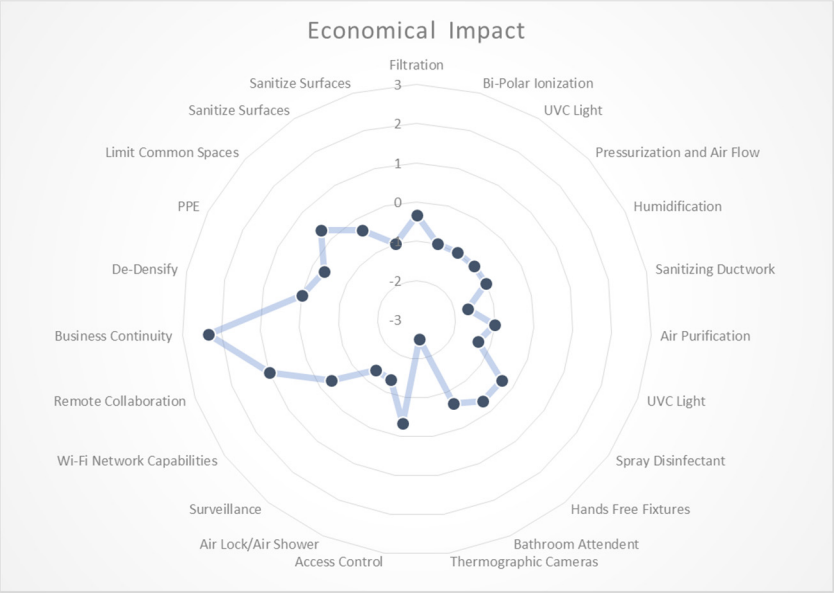
SOCIAL

Positives:

From a social standpoint, the workforce will benefit from cleaner indoor air quality, which has been shown to increase productivity as well as reduce absenteeism. The Work from Home period, caused by the pandemic, is educating our employees on how to remain connected and productive while working remotely. This knowledge will increase the employer's comfort level in continuing to provide the flexibility to work from home. The requirement of safety and Personal Protective Equipment (PPE) for normal daily life will give people better training on the use and importance of PPE, such as gloves and masks. The emphasis on proper cleaning and sanitizing for persons and surfaces will increase the overall cleanliness of workplaces. Social distancing modifications will alter previous social patterns and could provide the opportunity for a new/different positive office experience.

Negatives:

The social downsides will start with the impact of enforcing social distancing and how that will change the way we previously worked. For at least a period of time, it is expected that PPE in the workplace will be required, which will also affect the social setting. People will have to adjust to the potential modification of work hours/days if shift or alternating workdays are adopted as part of the social distancing requirements. The workplace may be affected by the scheduling difference between a return to school for children versus a return to the workplace. This will cause employees to continue working remotely to care for their children and remove them from the workplace. The use of PPE noted above, as well as increased cleaning practices, may create new waste streams out of the workplace which will require additional training and care. Due to the pandemic, workers may suffer increased mental health issues caused by returning to the workplace, as well as unsettled concerns. Staff that are high risk may also need to work remotely for an extended period of time.



This diagram illustrates the Economic Impact of various COVID-19 recommendations. The farther from the center the more positive the impact.

TECHNOLOGICAL

Positives:

The positives in this category will come from the upgrades and modifications to buildings systems and equipment so that they are capable of providing cleaner indoor air quality, increased air changes/fresh air and pressurization. Additionally, the workplace will migrate to a touchless environment through automation, such as automatic doors, touchless entry, hands-free device operations. This will help to mitigate the spread of germs by touch.

Negatives:

Unfortunately, the technology positives above come at a cost in terms of energy use. The increased air treatment will require additional energy to run equipment longer and increase fan power requirements. Also, additional cleaning and maintenance of filters and equipment will be required. The automation of the workplace, in the form of automatic or touchless operations, will also require additional energy.

ENVIRONMENTAL

Positives:

Environmentally, we are seeing benefits from the Work from Home period in the form of cleaner air and water due to the reduction of auto, production and airplane exhaust. For example, the lack of smog in the Los Angeles area is visible and so are the Himalayan peaks, which haven't been visible for many years. Obviously, the return of the economy will reduce these benefits**,** but as more of the work force remains working from home, the exhaust and traffic reduction benefit will still be maintained to some extent. Through this experience, telecommuting has proven to be a viable option in many lines of business. By working from home people are also embracing their local walking paths, streets and surrounding nature. Additionally, a shift to more online shopping has also helped to reduce automobile emissions and traffic.

Negatives:

The energy efficiency gains we have made as a society over the last half century are being impacted by the increased energy usage for equipment and technology systems. The increased energy production required will increase the CO2 emissions from the generation sources. The increased use of daily cleaning chemicals and sanitizing agents may also pollute the workplace with VOC and noxious fumes. The new waste streams for filtration substrate and cleaning materials will create additional landfill issues. While online shopping reduces some automobile traffic**,** it may increase air traffic to ship goods further distances. Lastly, the increased demand for some products will cause stress on the materials supply chain, which will reduce the sustainability of the production process.

ECONOMIC

Positives:

As noted in the beginning, returning the workforce to their places of work to energize the economic rebound is the goal of the recovery. The increased technology required for remote working, as well as potential advancements in the workplace, such as temperature sensing cameras to detect and prevent illnesses from entering the workplace, will cause the Technology field to grow. Online sales of general goods will also continue to grow. The current pandemic will force us to be better prepared for potential future pandemics. Lastly, the pandemic is also creating some job growth in the form of new services or jobs required, such as specialized cleaners, industrial hygienists, and in the healthcare fields.

Negatives:

There will be higher operating cost**s** incurred by Owner, Landlord and Tenants from the environmental and technology impacts noted above. The same group will also be impacted by an increase in capital costs for additional equipment, including installation and maintenance required. During the economic recovery period, there will still be high unemployment rates. Additionally, companies will incur new expenses from requirements to provide employees and visitors with PPE and additional cleaning materials. Toilet room designs and layouts will change and may require more space and higher construction costs.

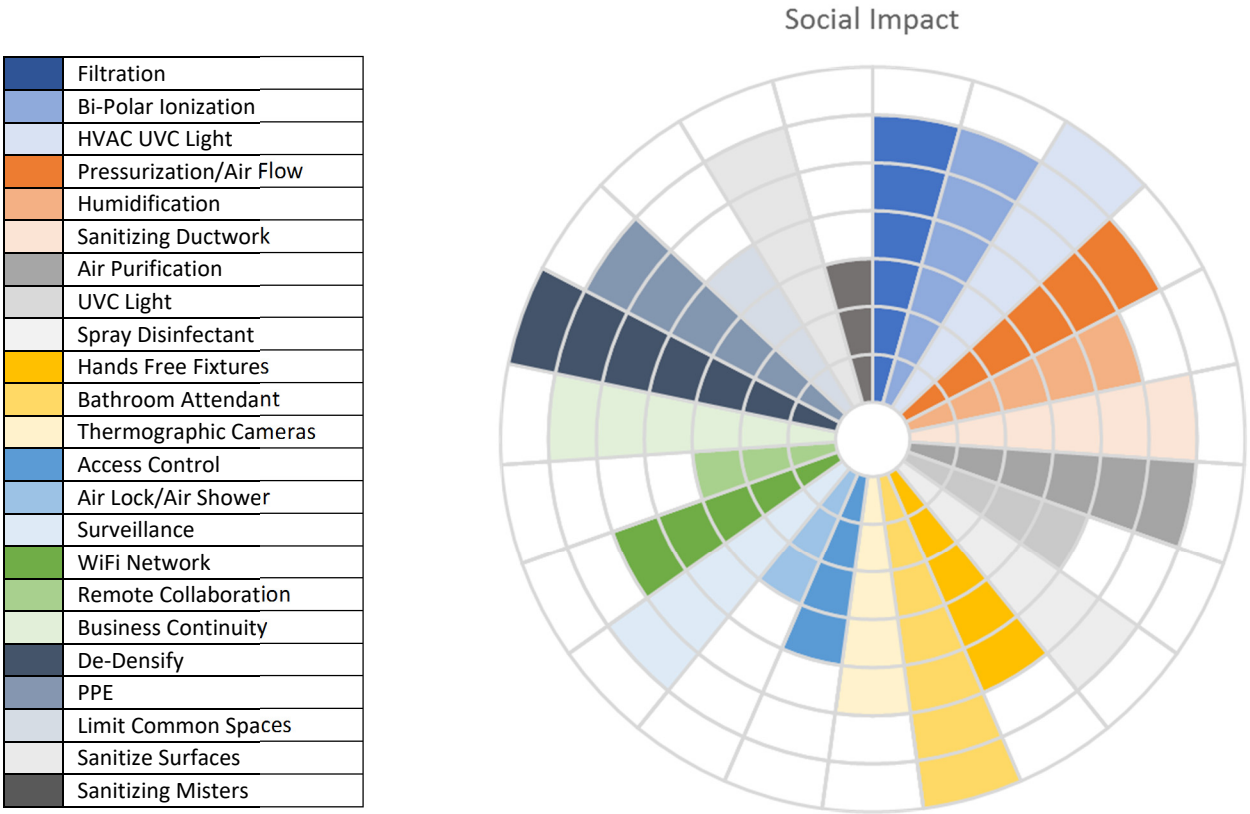
POLITICAL:

Positives:

The pandemic has been a major worldwide disruptor at the highest government levels and the political impacts, both positive and negative, will play a major role in the resolution of this current state. The political impacts fall on both sides of this analysis more than any other factor. As mentioned above, our entire state of Emergency Preparedness will be raised from this experience. Concerns around the virus' impact across socio-economic lines could help to provide equity in healthcare treatment.

Negatives:

As noted above, this disruption will create change for both the good and the bad. Prevention requirements imposed on the workforce during this recovery process, including social distancing, disinfection, PPE requirement and potentially CCTV temperature sensing, may infringe on people's civil liberties. Enforcement of new standards will need to be decided. Buildings may need to be prioritized and it must still be determined who makes that decision.



This diagram illustrates the Social Impact of various COVID-19 recommendations. The farther from the center the more positive the impact.

As much as the population looks forward to the restart of the economy and the return to normal, albeit a *New Normal*, the purpose here was to present a discussion of the potential positive and negative impacts that could be created. The positives of the economic restart will still come at some costs. However, we are proving our ability to adapt and pivot during these times and that is a benefit that will continue to drive our need to remediate any negative effects. We are becoming a more resilient society and that is the most valuable lesson of all.

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