ARCADIS Design & Consultancy for natural and built assets

RESILIENCE IS MISSION CRITICAL

Utilities

RESILIENCE TO RECOVERY

Foreword:

In cities and towns all around the world, most of us just assume that when we turn on the tap at the sink, clean water will come out. We never worry about whether there is electricity in the house when we flip a light switch or turn on the television. And when we hop on our computers or mobile devices to check our email, we just assume we are connected to the internet. But of course, these essential services are not a given. Countless kilometers of pipes, cables, and fiber optics –not to mention innumerable facilities, stations, towers, data centers and processing plants – make it possible for us to enjoy these amenities. In fact, these are more than just amenities, they are critical infrastructure and essential services that form the bedrock of society. All these assets are operated and maintained by utility workers who employ their expertise to make sure we can take all of this for granted.

As COVID-19 swept across the planet, and the global economy nearly ground to a halt, it was very clear that utilities and the critical services they provide would have to continue. This meant that despite the health risk to employees, the sharp drop in revenues, and the disruption of supply chains, utilities had to continue operating. In order to do so, many have had to rapidly adapt – adopting new digital tools, platforms, and new ways of working so all of us could continue to rely on those services. In other words, when the pandemic hit, utilities quickly had to build a different kind of resilience.

On the whole, during this crisis, utilities have risen to the challenge, but we know it's always better to get prepared for crises before they happen. This is why resilience is such an important topic for utilities and why we have written this paper. This white paper builds on our previous report, The business case for resilience, in which we laid out how utilities (and other organizations) can substantiate investments in measures that enhance business continuity and help guarantee service to customers will not be disrupted. We have revisited this topic in light of all that we are learning from the pandemic and how we'll need to lead our lives and take action to continue to improve quality of life in a post-pandemic world.

Within this document, you will find specific steps utilities can take to become better prepared for a resurgence of COVID-19, a future pandemic or, more importantly, any other type of disruptive event that may emerge in the years to come. These steps will not just help utilities survive the next crisis or adapt to chronic stressors, they will help our utilities to thrive daily – improving efficiencies in daily operations and building a resilient and contented workforce of the future.

Carly Foster

Expert Management Consultant, Resilience, North America

INTRODUCTION

The COVID-19 pandemic has brought a level of disruption to the world that brings into sharp focus the need to reconsider how to adequately prepare for an uncertain and seemingly unpredictable future. Having only recently overcome the global financial crisis of 2008 – and the many natural and man-made disasters since – the pandemic has hit harder than many expected, with utilities around the world rushing to safeguard their workforce while also ensuring the delivery of critical resources to the public like water, electricity, public transportation, and broadband connectivity.

RESILIENCE AND RISK

The deepening health and economic crises exacerbated by coronavirus underscore the importance of investing in resilience as an integral part of an organization's daily operations and business functions. In our 2019 report, The business case for resilience, we explored how utilities could raise resilience investments higher up the corporate agenda by using financial modeling tools and resilient index frameworks to articulate the business benefits and potential returns on investment in resilience. As demonstrated by the impacts of the pandemic, the business case is undeniable.

The pandemic has also helped clarify the need to move beyond framing resilience solely within the context of risk management and integrate a more mission-centric approach. We are seeing consistent waves of shocks and stresses, and the collective surprise at the pandemic is symptomatic of current blind spots about the forms these shocks and stresses might take, as well as how we should prioritize action to mitigate their associated risk. By exploring resilience solely within a risk framework, resilience-building opportunities will likely be missed, and critical risks left unexplored and unmitigated.

Instead, we should approach resilience-building from two angles: mission-centric, and risk-based. A mission-centric approach begins by characterizing the mission of the facility, organization, or other scale of interest and characterizing the essential functions, systems, assets, and internal and external interdependencies required to accomplish that mission. These systems can then be assessed against key metrics for resilience, root causes for gaps explored, and solutions developed that strengthen the organization's capacity to meet its mission, reducing susceptibility to the range of risks it faces in the process. A risk-based approach still has its place, but the mission-centric approach can help prioritize focus, illuminate blind spots, and build resilience against unexpected hazards in ways that might not be anticipated or even intended.

The World Economic Forum's (WEF) Global Risks Report 2020 demonstrates this point. The report was issued in January 2020, as the coronavirus was spreading largely undetected around the world. WEF surveyed an "extensive network of business, government, civil society and thought leaders," to produce its Global Risks Landscape. A global pandemic did not make the list of the top ten most likely risks for this year. In fact, not even a quarter of the respondents believed that the risk of a large-scale infectious disease outbreak would increase in 2020. With hindsight it becomes quite clear that our risk assessments can be woefully inaccurate.

THE QUALITIES OF RESILIENCE

It is also worth reflecting on what is meant by resilience. Resilience describes the quality of being able to survive, adapt, and grow no matter the stress or the shock. Utilities are in a critical but challenged position as the services they provide form the foundation of civil society, alongside other critical infrastructure, and underpin the increasingly interconnected nature of society – a system of systems. Utility companies have large impacts on the societies they serve. These impacts go beyond the service they provide to clients and include the way these organizations manage the natural transitions and growth potential of the people within their workforce and the impact they have on the environment. Like every member of society, utility companies have a responsibility to help foster a truly resilient world, which is about the creation of inclusive, healthy and well-informed communities as much as it is about hardening assets or building redundancies into systems against shocks.

So, how can utility companies go about increasing their resilience to pandemics or any other future shocks, while limiting stressors?

Both resilience and sustainability can only be enhanced with the implementation of projects that make a difference – "here's how we've achieved it".

It starts with identifying the organization's critical systems, infrastructure, workers, and supporting functions: those things that absolutely must function, no matter what happens. Once those critical systems have been identified, continuous effort must be made to ensure that they are robust (strong enough to withstand varied and significant stress and shocks) and adaptable (capable of being modified and updated as the world changes around them). This requires constantly collecting and analyzing data on the performance of critical systems, infrastructure, and workers against metrics for resilience, and ensuring that the framework – such as plans, tools, training – are maintained, revisited, and updated to continue to meet evolving needs. This will allow smart decisions to be made based on current conditions and as circumstances change over time, and this more-informed and more-comprehensive decision making process can help utilities avoid costly disruptions to operations or loss of service to customers.

The resilience agenda shares many of the same qualities as the sustainability agenda. Tackling climate change is as much about implementing robust and adaptable solutions, as it is about mitigating the effects of global warming. And, like resilience, sustainability will only be achieved if talk moves quickly to action. Resilience cannot be achieved if organizations labor too long in the strategy phase – "what can we do to be better prepared". Both resilience and sustainability can only be enhanced with the implementation of projects that make a difference – "here's how we've achieved it".

UTILITIES CAN LEAD THE WAY

Although they are likely to be the last recipients of stimulus funding to kick-start regional economies, utilities have a significant opportunity to help close the gap between resilience planning and resilience implementation. The primary mission of utilities, which endures under all conditions, is to ensure undisrupted service and, to that end, the continued protection of critical systems and assets. Through the pandemic crisis, utility companies have had to safeguard their greatest asset – their people – while suffering the loss of another important asset: revenue. Future resilience, therefore, rests in part upon ensuring that workers are safe, many of whom cannot do their jobs from home, and that critical systems can still function during this unprecedented economic downturn and in the event of future crises.

The pandemic has also had a significant impact on the economic resilience of power utilities, some of which are faced with a major decline in demand – impacting revenues – at a time when there are historically low prices in oil and gas. Capital expenditure plans have been put on hold, and organizations have focused mainly on those activities which are critical to the provision of services. The revenue loss experienced by utilities could serve to reduce capital investments for asset renewal in the future – further exacerbating the aging infrastructure problem. The renewable energy sector has been hit hard, too, with the global lockdown impacting supply chains for the delivery of renewable energy technology, much of which is produced in China, also impacted by the pandemic.

THE RESILIENCE OPPORTUNITY FOR UTILITIES

The rapid response of many utilities to the pandemic, implementing new approaches, procedures and technologies to cope with the crisis, has clearly shown that the industry has long had the potential to make improvements to the way it operates. Given that it is always better to make those improvements prior to a crisis, many companies are taking the opportunity to accelerate these changes, becoming more fleet-of-foot in the process. In the pandemic recovery phase – despite the fall in revenues and energy prices – there is an opportunity for utilities to refocus investments towards projects and initiatives that will lead to greater resilience in the future.

In order to become more robust and adaptable – better prepared for unknown future events – it's also crucial to take an approach that embeds resilience into every aspect of the business in the same way that regulatory codes and environmental standards are embedded. This means integrating resilience into every primary and supporting function of the business and embedding it into systems, from asset management plans to capital improvement plans to employee succession plans, and beyond. These should all be developed based on a clear articulation of the mission, goals, and resilience metrics that the organization aims to achieve.

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Internet connectivity

Telecommunications companies and data center operators are frontrunners in the economy when it comes to integrating the principles of resilience (robustness and adaptability) into their operations. Together, these companies develop and maintain the backbone of our digital societies. They are keenly aware of the potentially catastrophic consequences for their business and the economy at large if internet connectivity is inaccessible to the public. Even a short period of disrupted service, with only localized effects, can lead to hundreds of millions of euros in losses across entire economies.

At Arcadis, we believe broadband internet, and the infrastructure behind it, has essentially become a public utility in many parts of the world, and should be seen as such everywhere. During the worldwide lockdowns, much of the global economic activity that took place was the result of organizations and their employees using broadband connectivity to conduct business.

The resilience of the sector is very much integrated into its decision-making, whether it's back-up generators, multiple layers of redundancies designed into network systems, on-site renewable energy generation or the continuous use of real time data to optimize network performance.

DATA CENTERS

Resilience is a guiding principle in data center design because of the central role data servers play in the global economy. These facilities tend to be very robust and are hardened against a vast array of potential shocks such as storms and flooding, power outages, and earthquakes. COVID-19 has accelerated the need for these already-in-demand facilities with the sharp increase in e-commerce, as well as increased demand for streaming internet services and video conferencing. Big data, 5G and the Internet of Things will continue to fuel this over the years to come.

Operations in this sector are also typically highly adaptable. Data centers can be controlled remotely, so they usually do not require a large staff presence on site, meaning that the lockdowns had only marginal impacts on service provision. Adaptability can also be seen in the advanced technology these companies employ to anticipate and manage surges in demand for server capacity. Self-healing, self-replicating and highly predictive networks, powered by artificial intelligence, can anticipate heavy traffic periods and locations. The system then virtually spawns applications in servers to cope with increased demand and then dismantles the applications and repurposes the server capacity for whatever comes next.

Given the large amount of electricity needed to operate these facilities, longer-term resilience in this sector must be coupled with sustainability measures. As nations – and cities, in particular – transition away from fossil fuels, it will be important that they rapidly upscale renewable capacity, driven in part by demand from energy-guzzling data centers. One potentially promising approach could be converting decommissioned fossil fuel power plants into facilities for data centers, as most of these assets already have the necessary fiber optic and electricity infrastructure in place.

Generating electricity on-site from renewable sources is also a growing trend, giving data center companies control over this critical asset and allowing them to build in the level of resilience that meets their business continuity needs. Additionally, any surplus power generated on-site can be sold on energy markets, creating another revenue stream.

Most data center owners and operators are set to emerge from the crisis in a strong position, with definitive signals that the expansion of remote working in many sectors of the economy will guarantee even higher demand for data centers than before the pandemic.

5G

In a number of countries around the world, 5G technology has been implicated in unsubstantiated conspiracy theories about the origins of the COVID-19 virus. This has led, in some instances, to 5G towers being destroyed. But the burning or toppling of any one tower does not pose a major risk to service provision. These networks have been designed to withstand this type of stress. The destruction of these radio towers may diminish service temporarily in a particular area, but this is not likely to lead to full on service interruption because the redundancies designed into these networks make them very robust. The critical infrastructure in mobile networks is actually the fiber optics and data servers that underpin the radio masts. Those aspects of mobile networks are typically highly resilient.

Resilience thinking is driving an increasing trend among some of the large corporate clients of telecommunications companies, namely building private mobile networks. Some large industrial and energy companies are experimenting with setting up their own networks in order to save money, but also to directly control the level of resilience built into this infrastructure, which is critical for their operations.

FRAMING THE RESILIENCE DISCUSSION WITH UTILITIES

In our work with private and public sector clients around the world, we focus on the following five means of enhancing resilience:

PEOPLE

Societies, cities, communities and organizations are only as resilient as their people. After the pandemic, we must focus on improving the health and wellbeing of people wherever they live, work or play.

DESIGN

Resilience will be enhanced by embracing new ways of designing and retrofitting buildings, facilities and urban spaces in a post-pandemic world.

PLANNING

Resilience thinking must be placed at the heart of business continuity planning. Collaboration must also be embraced, between communities, organizations, industry sectors and supply chains.

DIGITAL

Digital tools and platforms are essential for gathering and analyzing data which can inform smart decisions that can ensure business continuity and lead to competitive advantage.

SUSTAINABILITY

Resilience and sustainability go hand-in-hand. By implementing projects that improve sustainability performance, reducing resource consumption and protecting the environment, organizations enhance long-term resilience.

People

Establish trust to build a fit-for-future workforce

Empower workers and cultivate trust through openness and transparency about plans and decision making. Trust between management and employees is the key to cultivating a truly adaptable workforce, which is particularly important during crises. Under duress, people will consistently follow well-trodden paths. Employers need to have built trust that workers will achieve their goals, and workers need to have built trust that the changes they might be asked to make will be sensible and in the best interests of everyone.

Embrace inclusive decision-making processes and employee feedback loops. These are important means of creating a work culture built on trust. This also creates invaluable opportunities to leverage employee insights about what is and is not working within operations, and to effectively build resilience within the organization. After all, the collective intelligence of the workforce is the utility company's most important asset.

Reintroduce mission and purpose into corporate cultures. By moving beyond a risk-based approach to a mission-based approach – "what do we want to be and what's stopping us from getting there?" – fundamental questions can be asked about how an organization works, opening the door to change.

Reinforce trust when making the transition to using more digital tools and ways of working. Workers may feel digital methods will lead to job losses, but help them understand that there is still a need for people in a more digital work environment, and that they will be supported to gain the skills and know-how to work digitally. This underpins an organization's collective intelligence. A digitally-enabled work environment is also highly correlated with increased employee satisfaction, which is critical for attracting and retaining top talent.

Design

Bring best practice into workplace design for robust and adaptable working environments

Embrace new ways of designing and retrofitting – facilities and spaces to enhance resilience. Utilities are specialist environments but have the same challenges as any other workplace: they must be made healthy and secure for their employees. Utilities should embrace new ways of designing facilities to counter the possibility of future outbreaks and enable new ways of working or build a framework to be able to adapt quickly to the emergent needs in an outbreak. Engineering controls will need to be reassessed, ensuring that air flows and mechanical, electrical, and plumbing systems improve operations, rather than detract from them. Comprehensive space-planning assessments should also be conducted as workplace requirements inevitably change in the post-pandemic period.

Learn from peers or other industries with similar challenges. Social distancing measures can be implemented within laboratory environments and R&D facilities by learning from those who are going through the same challenges, including pharmaceutical and life-sciences companies that are collaborating in previously unheard-of ways to develop COVID-19 therapies and a vaccine. Social distancing solutions include one-way traffic within the workspace, dedicated entrances and exits, remote working, split shifts, and staggering breaks. As we enter the recovery phase and address resilience concerns, utilities should evaluate what worked and what was effective, and formalize these approaches with policies and procedures.

Planning

Embrace a holistic and adaptable approach in planning throughout your organization

Make your planning processes iterative. Utility companies should take a holistic and adaptable approach to resilience planning in a world where crises are more common and can occur simultaneously or in rapid succession. Static plans will no longer work; the rapidly changing technology landscape and operational context means that planning needs to become an iterative process.

Reassess capital expenditure projects in light of historically low energy prices. Re-prioritize investments in projects that improve the robustness of operations, and which enhance decision making by using digital enterprise decision-making tools, which will lead to greater resilience.

Place your organization's mission at the heart of all business planning. Integrate more flexibility into the planning process, expecting that changes will occur, and that constant course-correction will be needed to ensure that organizational objectives – and resilience – are both achieved. Once the mission is articulated and has been accepted throughout the organization, it becomes easier to align all plans and efforts towards it, without the need for micromanagement. It serves as a beacon in the distance that the organization can keep in sight.

Assess whether your organization is able to function in a substantially altered business environment. For example, some utility companies have found in-house IT departments unable to cope with servicing essential technology needs when most of the workforce is out of the office. These human and technological impacts need to also be included in the capital planning processes. Along with the physical assets – pipes, pumps, generators – the human and technological areas also carry a significant risk to business continuity.

Increase transparency around suppliers and recognize the many interdependencies that exist within the organization and with external stakeholders. Building collaborative partnerships can lead to greater transparency across the supply chain – and customer base – which will lead to a better understanding of risks.

Enhance financial resilience by exploring and integrating alternative earning models that are not based solely on customer use. In the United States, post-Hurricane Sandy, Arcadis helped clients access over US$5 billion in additional resilience initiative funding. Utilities need to build lasting relationships with external providers of funding, which will last long after a crisis has abated.

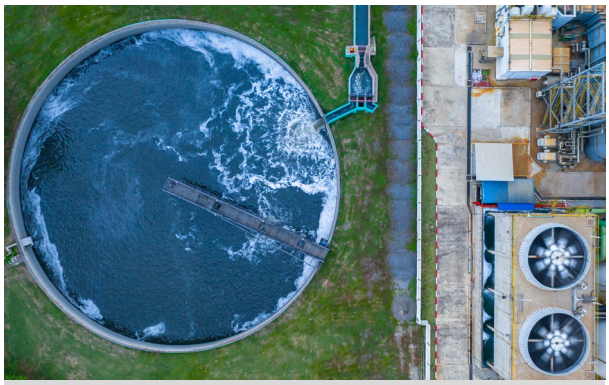
Digital

Use technology to bring organizational resilience by empowering employees and strengthening decision-making

Embrace the pursuit of collecting complete, accurate and high-quality data that will underpin wise decision-making. For most utility companies, data is a key to enhancing resilience. Digital tools unlock insights around the critical systems that are essential to the resilience of utilities, including how workers, infrastructure and business systems are performing. Organizations must accelerate the adoption of digital enterprise decision-making tools and digital asset management systems, to enhance resilience by integrating business planning across the organization. By doing so, data will become embedded into decision making, leading to more robust and adaptable operation, maintenance, and asset management programs.

Digital systems should also be used to direct and monitor the activities of workforces in the same way that critical infrastructure assets are monitored digitally. This creates clarity and transparency for workers about what they need to be doing at any time, and when workers are empowered to work digitally, they tend to be more satisfied with work conditions. Also, the next generations of utility workers will be highly versed in the use of digital technology and will expect this in their work.

Organizations must encourage their workforce to embrace technology. At a time when utilities are losing experienced staff due to an aging workforce, knowledge loss can be minimized by the use of digital tools that give better data on facility performance and support training and knowledge transfer, again building collective intelligence. A high level of human engagement will be needed to make any conversion to digital systems effective.



ICON WATER, AUSTRALIA

Australia's Icon Water provides high quality drinking water and wastewater services to the Australian Capital Territory and surrounding regions. Their water and sewerage network is over 6,440 kilometers of pipeline delivering more than 100 megaliters of water each day and treating over 29 giga-liters of wastewater each year. Icon Water had a sewer network that was lagging behind the performance of other places in the country, because of stress, like blockages and overflows and shocks like pipe collapses.

Icon Water is turning all of this around with a set strategic objectives centered on people, asset management, financial sustainability, and customer outcomes. The development of asset-planning analytics and predictive modeling tools for better decision making have played a central role in the success of these efforts. This was accomplished with the use of Enterprise Decision Analytics (EDA) from Arcadis Gen.

EDA helps asset intensive organizations better understand their complex portfolios and make smart investment decisions based on reliable data. Combining the power of predictive and prescriptive analytics, modeling and optimization, EDA is an integrated platform for asset investment planning, project and portfolio optimization and financial modeling. Arcadis also assisted Icon Water with many other services including data assessment, analysis and reporting consultancy, asset investment planning optimization and training to help them develop internal analytical capabilities.

The project gave Icon Water a clear understanding of the balance of cost, risk, and performance of the network. This resulted in reduced risk, improved network performance and customer experience, as well as a concrete investment plan, related to specific assets and interventions to be delivered over a five-year time span. Icon Water serves approximately 400,000 residential, commercial, and municipal customers.

Sustainability

Take the lead on sustainability to bolster societal resilience

Accelerate the transition to clean renewable energy. This is essential because an estimated seven million people die each year from air pollution, according to the World Health Organization, and air quality plays a fundamental role in ensuring the health and well-being of citizens, which is a major factor in societal resilience. By investing in the renewal of high- and mid-voltage electricity grids, in hydrogen instead of natural gas, in district heating initiatives, and in carbon capture and storage, overall business resilience will be improved, along with the overall resilience of all stakeholders in society, particularly those who have underlying health problems and other vulnerabilities.

Focus on your own energy independence. This includes reducing reliance on the energy grid and making use of on-site renewable energy generation to help with the resilience of critical assets, such as water pumps and air-flow units. Surplus power can also be sold back into the grid, generating revenue.

Reach out to upstream providers and end users – hospitals, data centers, industrial users, police, and emergency services – to better understand the resource interdependencies that exist. This will help build a greater understanding of what happens when services are disrupted. Recognizing the interconnections – and where vulnerabilities lie – will strengthen all stakeholder relationships and help develop a true understanding of how to improve resilience for all.

Financial resilience must remain a key focus, including reviews of existing systems to ensure their continued relevance or whether ongoing costs and the level of operational and management intervention needed are sustainable.

Resist the temptation to focus solely on the short-term challenges related to lower energy consumption, falling revenues and the immediate need to re-prioritize capital expenditure projects. By focusing on the goal of resilience and by accelerating the transition to cleaner forms of energy, utilities will enhance the robustness and adaptability of themselves, and the communities they serve.

CONCLUSION

As utilities emerge from the pandemic, it's crucial to place resilience at the heart of an organization's mission and embed this throughout all business planning. By developing a true understanding of all of the systems, functions, metrics and interdependencies required to accomplish that mission, resilience will be enhanced in ways that might not be anticipated, or even intended. By strengthening this resilience planning process, investments can be prioritized that make those critical elements more robust and adaptable.

The human elements of organizational systems must also be addressed, as resilience comes from knowing where critical knowledge resides within the workforce or the supply chain and making sure that this knowledge is captured or accessible at all times.

It's vital that we seize this opportunity for change. At Arcadis, our experience shows that there is usually a short window of just a few years following shock events – floods, hurricanes, superstorms, terrorist attacks – within which greater steps can be taken towards increasing resilience. This is typically the timeframe within which business focus is aligned with a supportive regulatory or commercial environment, typically with increased access to sources of funding.

It is crucial that utilities move quickly to eliminate the gap between resilience planning and resilience implementation, using a clear value framework that can demonstrate the true benefits of embracing resilience.

Utility companies should now have the confidence to invest in the resilience of their people, their assets, their important operational systems, and their communities. It is time to move away from the notion that returns on investments in resilience are only obtained when and if a shock occurs, to a new state where it's understood that resilience is an inherently valuable goal to pursue.

About Arcadis

Arcadis is the leading global Design & Consultancy firm for natural and built assets. Applying our deep market sector insights and collective design, consultancy, engineering, project and management services we work in partnership with our clients to deliver exceptional and sustainable outcomes throughout the lifecycle of their natural and built assets. We are 27,000 people, active in over 70 countries that generate €3.3 billion in revenues. We support UN-Habitat with knowledge and expertise to improve the quality of life in rapidly growing cities around the world.

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