ARCADIS
Design & Consultancy
for natural and
built assets

2020

International Construction Costs

Foreword

The Arcadis International Construction Costs (ICC) Comparison 2020 is being published as the COVID-19 pandemic continues to accelerate. While the rate of new cases in China has slowed, exponential growth rates are being seen in many countries around the world.

Such a fast-moving and all-consuming crisis threatens, in the first instance, to shut down large sections of the global economy, including construction. Its long-term impacts are likely to upset many widely held assumptions about our economies and societies.

Our research for ICC 2020 was completed before the potential scale of the pandemic was in sight. While China's rapid response may not be possible in other countries, the extent of the disruption caused is now clear to see. This report's market conditions snapshot provides valuable insights into the state of markets on the eve of the crisis and a useful anchor point for future impact assessments.

Within this context, we have chosen to focus our commentary on 'rethinking resilience'. Unlike recent responses to extreme weather events, we are all having to react, respond and find new forms of resilience in public health and essential services, to an extent that has perhaps never been seen. In the short term, we share our clients' and colleagues' deep concerns about forthcoming supply and demand shocks. As economic activity is reduced across markets and isolation of people restricts normal ways of living, the other major reduction is the harmful carbon and other greenhouse gas (GHG) emissions we release into the atmosphere. This highlights the fact that in the long term, the climate emergency is an even greater challenge for this sector.

Right now, we are focusing our wider response on the ability of clients and their project teams to mitigate both the immediate and medium-term effects of the pandemic. Project-based industries like construction will be severely damaged unless collective steps are taken to manage supply-chain continuity and resilience. From protecting the health of the workforce to the effective management of force majeure claims to the safe mothballing and restarting of sites, we all must work together to preserve industry capacity for the very real challenges ahead.

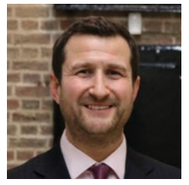
The greatest of these challenges is, of course, the climate emergency. It is well known that construction processes alone are responsible for nearly 12% of global, energy-related carbon dioxide (CO_2) emissions and that heating and cooling buildings is one of the biggest single causes of global warming. Nevertheless, as it currently stands, neither construction businesses nor our clients are collectively making anywhere near enough progress towards the Paris carbon emissions reduction goals. While the potential positive benefits for people and the planet are clear, the shift to lower carbon means of construction poses new affordability challenges, because more stringent regulations or embracing new ways of working both create financial costs in the short-term.

2020 needed to be a breakthrough year for construction and carbon reduction. Now there is a very real risk that progress will stall. As we struggle to keep the industry afloat in the face of COVID-19, we must also ensure that we are ready to play our part in confronting the climate crisis.

Decarbonization is an enormous undertaking, but as the global response to COVID-19 demonstrates, it is possible to take bold steps. A long-term, collaborative response will maximize our chances for success – not only in developing capability but also in gaining the public support necessary for action.

Everyone who builds, owns, operates or refits an asset has a stake in the problem and a responsibility to address it. Just as with COVID-19, the cost of inaction is too risky. And just like we are reconsidering our priorities in light of this pandemic, we should be rethinking and broadening resilience both in the short and long term.

At Arcadis, we work with clients and project teams to design, create, operate and futureproof their assets, while making positive contributions to resolving the climate crisis. We help our clients establish an investable business case for resilience, both short and long term and across ever-broadening risks and uncertain events. The impact of COVID-19 on public health is bringing a new understanding and awareness of the need to make our assets, cities and communities more resilient.



Andrew Beard
Global Head of Cost & Commercial Management - Arcadis

The Arcadis International Construction Costs Comparison 2020: Rethinking Resilience

In this year's report, Arcadis is dealing with twin challenges: addressing the short-term crisis of COVID-19 and the longer-term, but equally urgent, impacts of climate change.

Once again, the comparison covers 100 of the world's large cities across six continents. This year's report builds on its strong heritage as the leading reference point for comparing the relative costs of construction in major cities around the world. This is one of the most expansive comparisons of its type.

Arcadis' annual International Construction Costs Comparison is based on industry-leading market knowledge. In addition to providing a comparative index of global construction costs, this report also focuses on emerging trends associated with climate change, highlighting work being done in many markets to reduce the environmental impacts of construction.

This year, coverage has been extended to cities in Eastern Europe including Poland, Serbia and Montenegro. The main change to the index is that the cost of construction in cities is now relative to Amsterdam, instead of London. This change has no direct effect on the relative ranking of cities.

"Resilience is our ability to live and thrive no matter what happens. In the context of the COVID-19 pandemic, it means that the construction industry and society as a whole must withstand the negative impacts and learn from the current crisis, to be better prepared for the future. We must make smart decisions that can position us to bounce back even stronger the next time an unforeseeable calamity occurs. Down the line, as construction markets reopen, there will be a push to make these businesses more resilient. Those efforts should be coupled with sustainability so that we are better able to confront the future together and leave behind a better world for future generations."

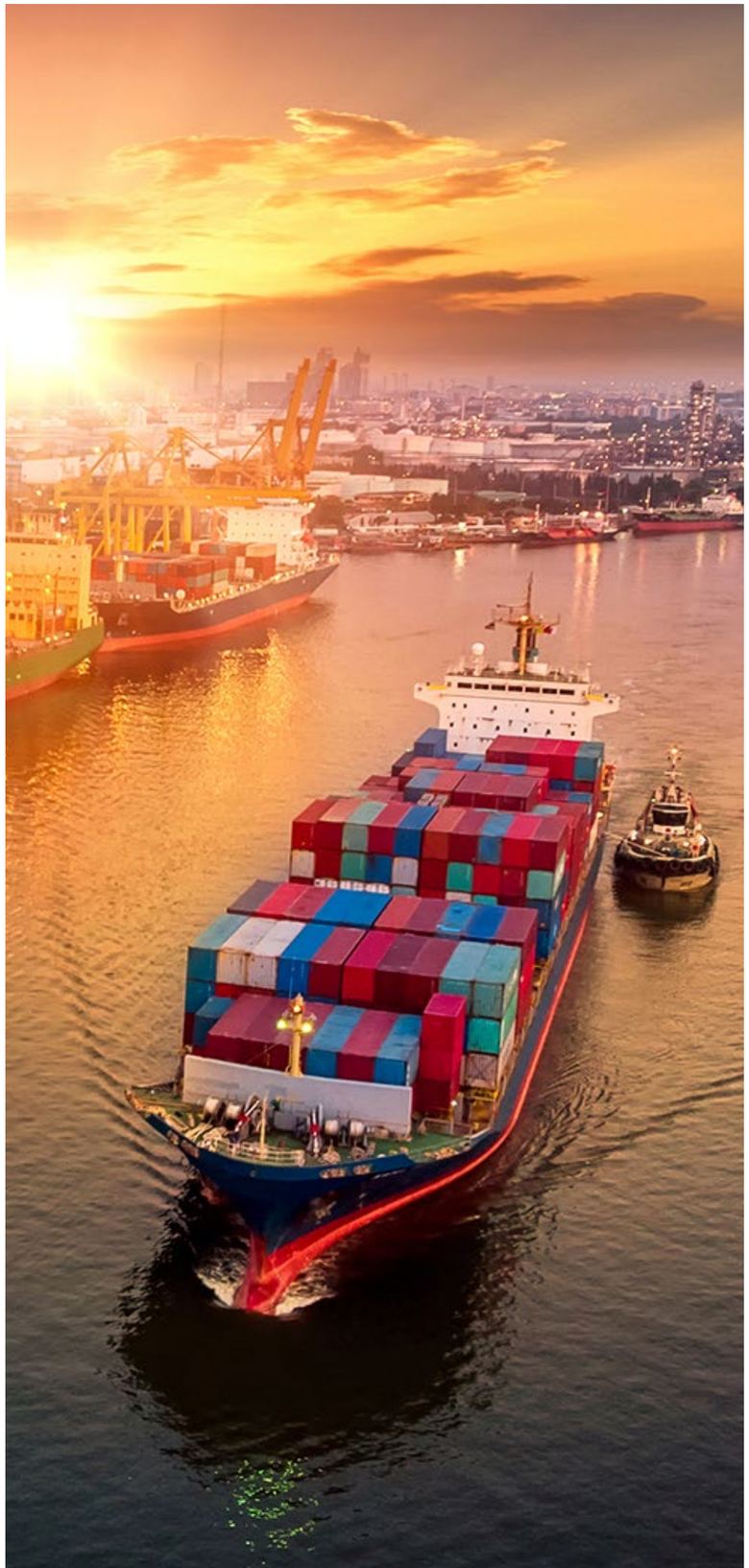
Piet Dircke
Global Leader of Water Management & Resilience - Arcadis

The potential impact of the Covid-19 virus

The research for ICC 2020 was conducted as the COVID-19 virus (coronavirus) has been spreading around the world at an accelerating rate. As this report goes to press, there is a growing risk the virus will have a significant effect on the global economy and the construction industry. Even with the enormous stimulus measures unveiled by many governments, bodies like the International Monetary Fund have warned about the risk of global recession in 2020, with the pace of recovery being determined by the speed at which the spread of the virus is stopped and the resilience of industries during these difficult times.

As a result, unlike previous years, this report does not contain forecasts for construction activity for the coming year (2020). This is because there are two main ways in which COVID-19 could affect construction activity. The first is a supply shock. This is the result of companies not being able to source materials and labor. The construction industry is less reliant on global supply chains than other industries, but some projects will be exposed to sourcing delays – potentially related to long lead-in items including curtain wall or plant. Projects could also be subject to shutdowns as a result of public health protocols being put in place, as well as decisions by people to avoid worksites for fear of contracting the virus.

If such disruptions occur, they will delay the delivery of assets and potentially create cashflow issues for the industry. An increase in insolvency cases and disputes is very likely to affect the industry. Delayed projects will eventually be completed, but a sharp drop in demand, caused by a recession, is a much greater risk. At the time of writing, this risk is increasing. Governments will have a key role in maintaining demand levels in the first stages of recovery, as the Chinese government did with its infrastructure stimulus program during the Great Recession, which began in 2007.



ICC 2020
RETHINKING RESILIENCE

Market risks – looking beyond the turbulence

Looking back to 2019, many construction markets had a disappointing year, after a strong 2018. While very few countries saw a fall in construction output, the growth rate across many construction markets was weak. In Europe, this was the result of a slowdown in housing markets as well as a broader decline in commercial investment. Falling volumes of trade, particularly affecting trade routes between China and the US, placed further pressure on commercial development across Asia, which was already facing over-supply. Many markets in Asia were able to switch the focus of investment to infrastructure and affordable housing. This switch was harder to achieve in western markets, including Europe, where a long-promised increase in infrastructure investment has still not materialized. One bright spot was the UK where, paradoxically, the construction market grew at twice the speed of the wider economy, driven by housing and infrastructure.

Even before the COVID-19 threat emerged, economic conditions looked uncertain. Monetary policy, particularly interest rate cuts in the US and the resumption of quantitative easing in many markets, had stabilized what appeared to be a gathering global slowdown. This background weakness suggests that the recovery from the pandemic will require further stimulus on top of the emergency economic measures being put in place from March 2020 onwards.

One of the consequences of the 2019 slowdown and the coronavirus is that some of this economic stimulus will automatically come into play. In addition to the support from Central Banks and governments, investors fleeing to safety have driven bond yields and borrowing costs to new lows. Furthermore, in early March, oil prices were down over 50%, compared to peak prices seen in 2019. Copper prices have also fallen by over 10% since the beginning of 2020. Lower commodity prices combined with lower financing costs will be positive for both public and private investors focused on the delivery of long-term programs rather than one-off assets.

On top of the pandemic, political uncertainty will also play a major role in the economy in 2020. The US presidential election has already taken center stage and while President Donald Trump will do his utmost to stage a recovery through 2020, it may not be possible to sustain strong growth into the following years. In Europe, many countries, including Germany and Italy, are suffering from an increasingly fractured electorate. The 27 member states of the EU face the difficult task of agreeing on long-term expenditure plans for 2021 to 2027, balancing the redevelopment needs of eastern countries and establishing a €1 trillion euro (EUR) European Green Deal against the constraints of a sharply reduced budget. Climate change also creates a level of uncertainty, as demonstrated by the recent UK Court of Appeals decision to delay the development of London Heathrow Airport's third runway. The court found that the planning process which led to approval of the runway did not account for the Paris Climate Agreement. This opens the door for other lawsuits to delay or prevent other planned infrastructure projects.

For the global construction industry, this all means that 2020 is the year in which construction clients and their project teams need to try to see through the huge turbulence of current markets to focus on longer-term opportunities ahead. In particular, infrastructure shows great promise, with programs like the HS2 rail line being approved in the UK and offshore wind capacity accelerating in parts of Europe, as part of the energy transition.

The Arcadis International Construction Costs Index 2020

London has emerged as the most expensive construction location in the world in 2020. Continuing investment in some of the highest quality residential, hotel and commercial developments in the world has bumped up London's cost range. The latest data from the US, particularly from New York and San Francisco suggests an easing of cost levels – particularly in connection with over-supplied market segments such as mid-town apartments.

This analysis does not account for the recent explosive increase in the value of the dollar. We view this as a short-term phenomenon, albeit one that will be heavily influenced by the scale and duration of the coronavirus outbreak.

Drivers behind movements in the index this year include a reappraisal of cost levels in some markets as well as the well-known relationships between costs, currency and inflation. Construction inflation was less of a differentiator during 2019, although a strong market in Ireland has placed Dublin in the top ten for the first time.

Scandinavian, US and UK cities are well represented in the top 25. By contrast, European cities, typified by Frankfurt, Paris and Brussels are more economic locations to build, reflecting long-established differences in specification standards, combined with high levels of productivity. Southern European construction markets, particularly Spain, Portugal and Greece are some of the most affordable locations to build in the developed world – supporting continuing investment in the residential and hospitality sectors.

There have also been some shifts in the ten least expensive cities, with Bangkok and Sofia being replaced by Jakarta and Bucharest. The cost range at the lower end of the index is narrow with a difference of plus or minus 45% across the bottom 25 cities. As such these differences are relatively minor.

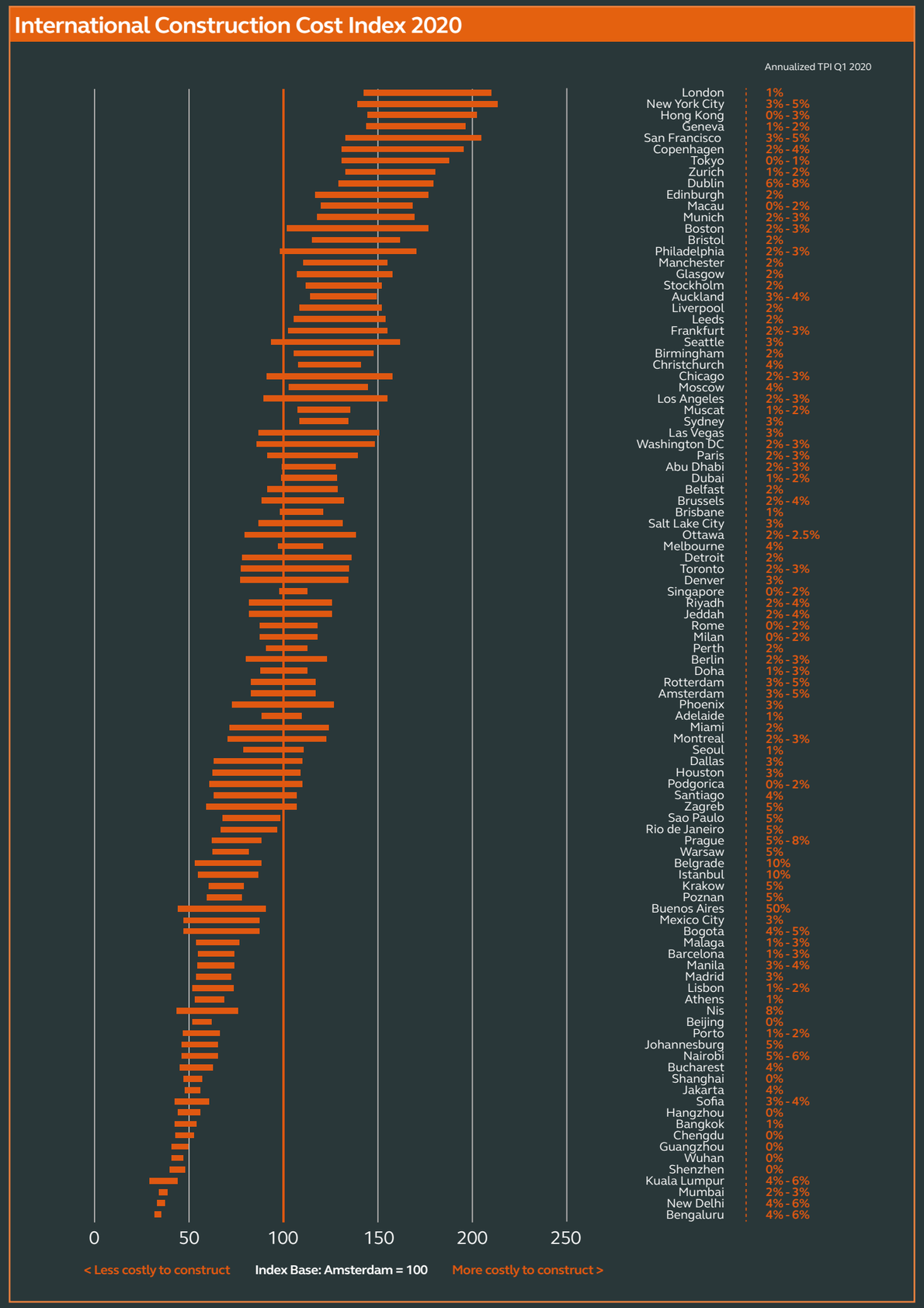
Key factors influencing city positions in the index

Multiple factors influence a city's position in the index. The main factor is the level of specification and quality, which can vary over time. For example, the costs of high-end hotels and residential buildings have increased significantly in cities such as London, reflecting a global market for luxury developments that only affects a small sub-set of the cities. Looking forward, enhancements to specifications to deliver low-carbon developments are likely to further increase differentials. We expect to see this effect emerging first in Europe, with the universal adoption of the requirement for the delivery of near zero-energy buildings (nZEB) in the public and private sector from 2020 onwards.

Comparing costs across countries such as the United States and the UK highlights that even when specifications are relatively similar, there is still plenty of scope for variation. Costs in Houston, for example, are half the level seen in New York. Explanatory factors include the cost of labor, materials and other construction resources. For example, Texas has a low-cost, flexible workforce in contrast to the heavily unionized New York construction market. Another variable is the cost of management and allowances for profit and risk. Some countries with a fragmented construction supply chain will have many more levels of sub-contractors – each adding extra allowances for 'on-costs', including management, risk and profit. These additional layers of on-cost contribute to premiums in some locations.

Productivity is also an important consideration. Continental Europe has a very productive construction sector, which benefits from a focus on high levels of mechanization and the use of simple, effective construction techniques. Lower-cost, US markets also achieve relatively high levels of productivity compared to some higher-cost locations.

Finally, currency fluctuation and annual inflation will always play a role in determining the relative position of cities. Given recent dramatic changes in the value of global currencies, clients are advised to review currency movement before applying the published factors. Currencies were set on 13 February 2020, before the broader implications of COVID-19 were evident.



The construction industry and the climate crisis

Over many years, the climate change agenda has evolved to become the greatest challenge of the age. However, even after the conclusion of the Paris Climate Agreement in 2015, with its commitment to cut carbon and other greenhouse gas (GHG) emissions by at least 40% from 1990 levels by 2030, progress on many of the changes necessary to eliminate greenhouse gas emissions has been slow.

With the global disruption of the COVID-19 pandemic, there is a real risk that the momentum towards climate action will be lost. Environmental awareness and the need for collective action must remain at the top of the agenda, alongside the recognition that time is running out.

It has long been recognized that buildings and infrastructure are the single, largest contributor of total global, energy-related CO2 emissions, responsible for nearly 40% in 2018. Despite great improvements in the energy efficiency of buildings around the world, the sheer increase in floorspace required to house growing urban populations means that building-related emissions are growing rather than shrinking.

Furthermore, the 11% of embodied carbon emissions related to construction activity, including materials production, are particularly difficult to eliminate, given the energy-intensive processes associated with manufacturing metals, cement and other critical materials.

In 2020, there are positive signs that the construction industry is responding. Regulations in Europe for example are on course to mandate near zero-energy buildings (nZEB) this year. However, wider decarbonization, particularly the elimination of embodied carbon, is not yet being adopted widely.

It will only be possible for the construction industry to play its part in meeting the Paris goals if businesses continue to chart a course toward a carbon neutral future, even as they implement their post-pandemic resilience plans.

And there are many compelling reasons for the industry to accelerate its path towards decarbonization as part of the recovery.

The most important is the sustainability of the business model. If it is unlikely for a business to be allowed to be a big carbon emitter in 10 years' time, then businesses that change secure a sustainable future. This is the opportunity that the automotive industry is already pursuing.

The second issue is finance. Banks, pension funds and other institutions are increasingly concerned that their long-term investments and loans are at risk of accelerated obsolescence as a result of climate change. Projects that are near carbon-neutral will be increasingly more attractive to investors.

Public opinion and consumer sentiment are equally important. Many consumers are already showing a strong preference for low carbon businesses and products. In particular, younger generations are demanding that companies take steps to address climate change and other critical issues. They are the decision makers of tomorrow and they will reward businesses that have gone carbon neutral and avoid the ones that have not.

Finally, the backstop provided by regulation is also changing rapidly. In June 2019, the UK became the first country to set a legally binding net-zero target for 2050. This step is already affecting UK infrastructure programs. Furthermore, the 196 countries that signed the Paris Climate Agreement should be updating their Nationally Determined Contributions (NDCs) during 2020. It is likely that more national construction industries will be brought within the scope of GHG emissions reductions. Tougher NDCs will be reflected in more ambitious regulations such as the zNEB requirement being adopted across Europe from 2020 onwards.

COVID-19 may cause delay, but all of these trends are moving inexorably towards the establishment of a carbon neutral global economy.

A key area which the COVID-19 pandemic has highlighted is the need for resilience against public health crises and the dependency not only on emergency services, but community resilience and the increased awareness and appreciation of public services and key workers. The industry must learn from this most recent unpredictable event to build in resilience for the uncertain future.

So, thinking long term and with all these good reasons to act, why is it so hard to take carbon out of construction?

The main reason is that global construction output has never been higher. With each new building adding both embodied and operational carbon emissions, future projects will need to be even more carbon efficient. Even though building standards have improved a great deal and many high-performing projects are being delivered, there are simply not enough of the best projects to make a difference. Globally, the whole industry, from client and financier, through consultant team and contractor to resident or occupier needs to change fast. Like the European automotive industry that is having to transform its entire product range to electric vehicles by 2035-2040, the construction industry faces fundamental change.

Matters are more challenging in this sector because the construction industry has historically operated with a short-term focus. Asset performance typically improves when regulations or standards mandate action or where markets are providing a specific signal, such as the market premium that can be secured for high-rated Building Research Establishment Environmental Assessment Method (BREEAM) or Leadership in Energy and Environmental Design (LEED) buildings. The temptation to stick to a short-term focus on survival will be strong post COVID-19. However, the industry must adopt a long-term perspective in order to achieve net-zero carbon.

To maximize the chances for a successful carbon challenge response, there needs to be a move to broader metrics of financial, environmental and social returns. It will require all parts of the industry to become more productive, delivering projects with greater levels of cost and program certainty. Investment will depend on all firms being more stable and profitable, to enable a longer-term view to prepare for the transition to the carbon neutral economy.

With the net-zero target being only 30 years away, long-term thinking is needed now. Buildings that are not delivered in 2020 to near net-zero carbon standards will add to the many billions of buildings around the globe that will need to be retrofitted between now and 2050. Given that the structure and fabric of most buildings exceeds 50 years, specifying to older standards poses a significant risk of obsolescence to asset owners and operators. Similarly, owners increasingly need to think about how their asset will be repurposed to extend its life as well as how the asset can be dismantled at end-of life – minimizing emissions throughout the asset life cycle.

So far, the construction sector's response to the climate crisis has been inadequate. A further delay following the coronavirus could make things much worse. This industry needs to embrace future forms of competitive advantage associated with the emerging, carbon-neutral economy. By significantly reducing carbon emissions today, it will be possible to reduce future liabilities and risks while delivering assets that are less at risk of obsolescence. Doing so can also increase this sector's brand value through association with a massive investment to confront the climate challenge.

So, where to start?

As we come out of the pandemic, project teams need three things in order to embrace the forthcoming, carbon neutral economy.

First, they need to adopt smart ways to increase productivity and control costs to create the profits and headroom to invest in sustainability measures and solutions. This means having both the certainty there will not be cost overruns on projects and the confidence to invest in the capabilities needed to play a part in reducing carbon. This is likely to require a much more collaborative approach to project delivery.

Second, clients and their teams need to adopt a broader recognition of value, going beyond capital costs and financial returns. Increasingly a broader set of metrics aligned to the five capitals (natural, human, social, manufactured and financial) will be used to support investment cases for all projects. These assessments are likely to include environmental and societal outcomes, whole life cost and value, as well as wider financial metrics, which include total operations, energy and the costs of talent acquisition and retention. Decision makers will need access to much more information about the carbon performance of their projects and what that can mean, in the long term, for the asset, business operations and their people. This will create further challenges for the industry, with respect to performance management and data reporting.

Third, construction companies need assurances that their investments in carbon reducing solutions are deliverable without additional risk and that they will yield the promised lifetime net-zero carbon results. In particular, early adopters need solutions in which they can invest with confidence. This will require further innovation in procurement to share risk and to incentivize collaboration.

These three actions are not simple, and they do not describe the technologies and business models that will evolve to deliver net-zero carbon. They are however essential preconditions for this sector to be able to invest in the future and in the future resilience of the industry.

Arcadis has a proven track record and tools to help clients control costs, make smart decisions about where to spend money to increase value, reduce carbon and maximize the positive, sustainable outcomes of an asset. Sustainability is not only a core value, it is a fundamental part of the Arcadis passion for improving quality of life. The following case studies highlight how Arcadis has worked with clients and projects teams to address three key aspects of the carbon-neutral agenda:

- transitioning new construction projects and assets towards carbon neutrality,
- decarbonizing the operations of existing buildings,
- enhancing climate resilience.

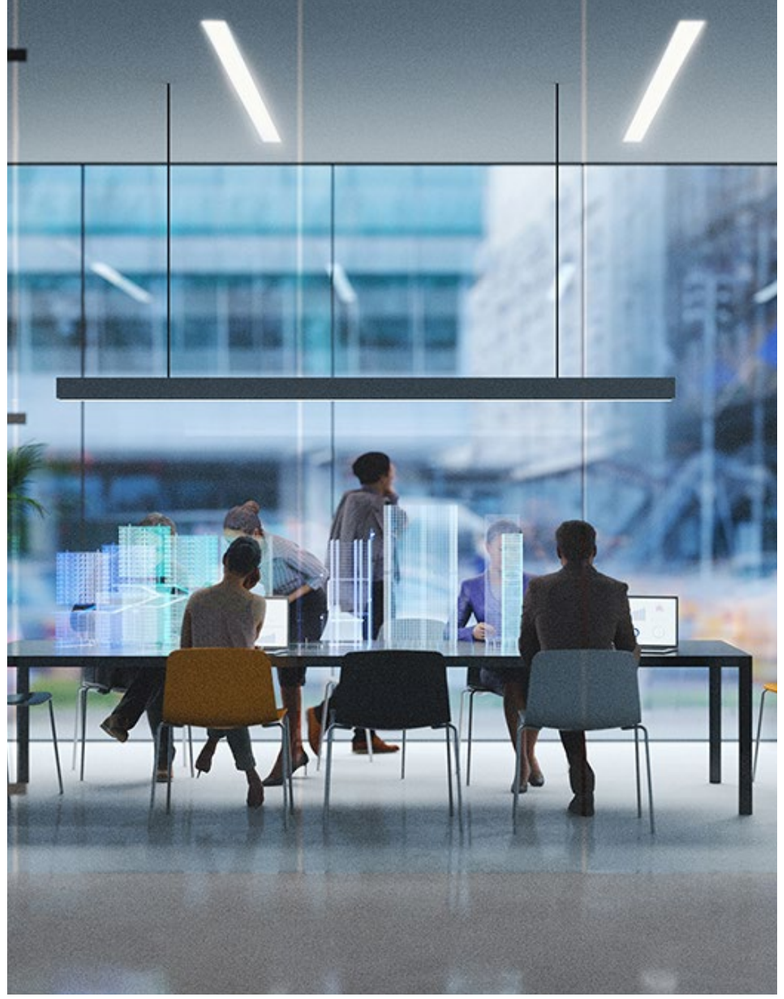
Towards carbon neutral construction

Triodos Bank Headquarters, the Netherlands *(pictured right)*

Triodos Bank needed a new head office for their expanding workforce: a building that exemplifies the bank's commitment to sustainability and transparency. The new office also needed to be a good fit for Landgoed de Reehorst, the estate upon which it has been built. To achieve this, Arcadis and Architect Bureaus RAU and Odette Ex created an integrated plan, for a modern, highly sustainable office, including the restoration of cultural and historical elements of the estate. The result is a state-of-the-art building, constructed and operated in harmony with the surrounding environment and wildlife. The 135,000 square foot office is an energy neutral building, made of sustainable materials. The modular, demountable, wood-hybrid construction technique employed for this project means the building can be deconstructed and moved to another location, with essentially no waste. Additionally, the BIM-based Material Passport included in this project provides a record of all materials used to construct the building, which will make it easier to reuse them at the end of the asset lifecycle. Arcadis delivered the masterplan and the landscape plan for this project.

Moorebank Logistics Park, Australia

Qube Holdings, Australia's largest logistics provider, sought expert advice on the best way to construct a sprawling logistics facility, with minimal negative impacts on the environment. The plans needed to be developed on a tight timeframe, while minimizing costs. Arcadis prepared a comprehensive sustainability strategy for the Moorebank Logistics Park (MLP), which included a range of carbon reduction measures, across the 850,000 square meter import-export terminal. Arcadis enabled the client to reduce greenhouse gas emissions during the construction and on-going operations of the facility. Arcadis experts also built a carbon emissions model, which was used to clearly demonstrate the environmental benefits of transporting freight via rail instead of via trucks on roads. MLP is also outfitted with long-term carbon reduction innovations such as the use of electric forklifts, instead of diesel, and the harnessing of the regenerative power of cranes used at the facility. As a result of Arcadis' sustainability strategy, the MLP will cut freight truck emissions by more than 110,000 tons of CO_2 per year, the equivalent of burning 52,000 tons of coal or removing around 11,000 vehicles from the road for an entire year.



The Art Institute of Chicago Modern Wing *(pictured above)*

The Art Institute of Chicago's Modern Wing is dedicated to modern and contemporary collections, housing new galleries, an education center including classrooms and studios, and a café. Designed by Renzo Piano, the Modern Wing uses sustainable design, as well as architectural and mechanical systems to control temperature, humidity and light. Most notably, the carefully engineered, whole-roof shading device, known as the Flying Carpet, comprises project and site-specific computer-modeled blades, oriented to filter daylight into upper level galleries. These systems save energy costs as artificial light is only used when necessary. As these systems also block a large amount of sunlight during summer months, much less energy is needed to cool the building. Transparent exterior walls consist of a structural double skin glazing system, which meets the temperature and humidity conditions required for the artwork and surpasses energy code requirements. As a result, the Modern Wing uses 50% less energy than the Art Institute's older buildings. As a LEED Silver certified addition, it is a model of sustainability. Arcadis provided project management services for multiple aspects of the modern wing.

Hong Kong's first Smart Green Building Guidebook

Arcadis has been commissioned, by the Hong Kong Green Building Council, to provide business advisory services, smart city thinking, stakeholder engagement services and strategic research, to develop a Hong Kong Smart Green Building Best Practice Guidebook. The guide will be the first of its kind for Hong Kong. It will include a set of practical suggestions and strategies for developing smart, low carbon buildings. There will also be design and operational best practices for optimizing the performance of new and existing buildings. Arcadis is assisting with comprehensive research, benchmarking analysis and stakeholder engagement that will ultimately be used to develop 30 key recommendations on energy performance, as well as building design, operations, occupant comfort, material, waste and water management, and mobility.

CAALA: Unlocking Sustainable Design

The German digital start-up, CAALA, is leading the way in parametric life-cycle optimization, which can be used to drastically reduce the energy consumption and carbon emissions of buildings. For architects, developers, asset owners, and investors, CAALA's software creates unprecedented transparency around the impacts of design decisions on the energy and carbon footprint throughout the asset lifecycle. This includes modelling of the impacts of resource extraction, the production of building materials, constructing the building, operating the building and, at some point, its decommissioning. Considering all these factors from the earliest stages of the planning process provides decision makers with the information they need to make smart decisions to reduce the operational and embodied carbon impact of a building. Geometry, orientation, materials and heating and cooling systems are all taken into consideration at a phase when it is still possible to optimize the building, with an eye towards energy demand, investment and operational costs, as well as carbon emissions. Research demonstrates that using CAALA'S software can yield up to a 40% reduction in carbon emissions over the entire asset life cycle and with the right incentives in place, carbon neutrality can be achieved using this platform. In light of the massive potential CAALA has to help drive down carbon emissions from buildings, Arcadis has invested in the firm through its City of 2030 Accelerator, powered by Techstars.

www.caala.de

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Decarbonizing existing buildings

Funan in Singapore

CapitaLand Mall Trust's Funan integrated development, in Singapore, offers a synergistic combination of retail, office and serviced residential areas that are designed to appeal to digitally savvy consumers, while providing a sustainable and creative environment. The transformation of a 31-year-old mall was accomplished using a combination of Building Information Modelling (BIM) and Virtual Design Construction (VDC) technologies. Funan also incorporates an ecosystem of sensors that optimize the building's performance, making it highly energy efficient. More than 6,000,000 kilowatt hours of power is saved each year, giving the building a much lower carbon footprint than similar-sized facilities. This has earned Funan a Green Mark Award for Buildings Gold Plus rating. Arcadis delivered cost management services for Funan, a complex project that required a high level of coordination to manage cost drivers and contract management.

A new city hall for Beringen, Belgium

The City of Beringen, in Belgium, decided to move its city hall back into the city center. A derelict site including an abandoned school and an old chapel was chosen for the new facility. In keeping with the Flemish government's regulations for new and renovated buildings, the city hall needed to have a small carbon footprint. To help Beringen achieve its goals, Arcadis conducted a holistic study of sustainability for the site, with a focus on energy-use resulting from the building design. The old chapel has been retrofitted and incorporated into the design of the city hall, which includes insulation that performs better than current building requirements. Arcadis also employed an Aquifer Thermal Energy Storage (ATES) solution to heat and cool the building. The heat stored in underground water during summer months is recovered in winter with a heat pump and used to heat the building. That same water, cooled during winter months, is then used in summer to cool the building. Together with a solar panel installation, the implemented solutions made Beringen's city hall a nearly zero-energy building. The energy performance is very high, and any additional energy used comes from renewable sources. The city hall's energy use is 50% lower than what is required by the strict governmental regulation. In total, this more sustainable design will save 107 tons of CO_2, each year.

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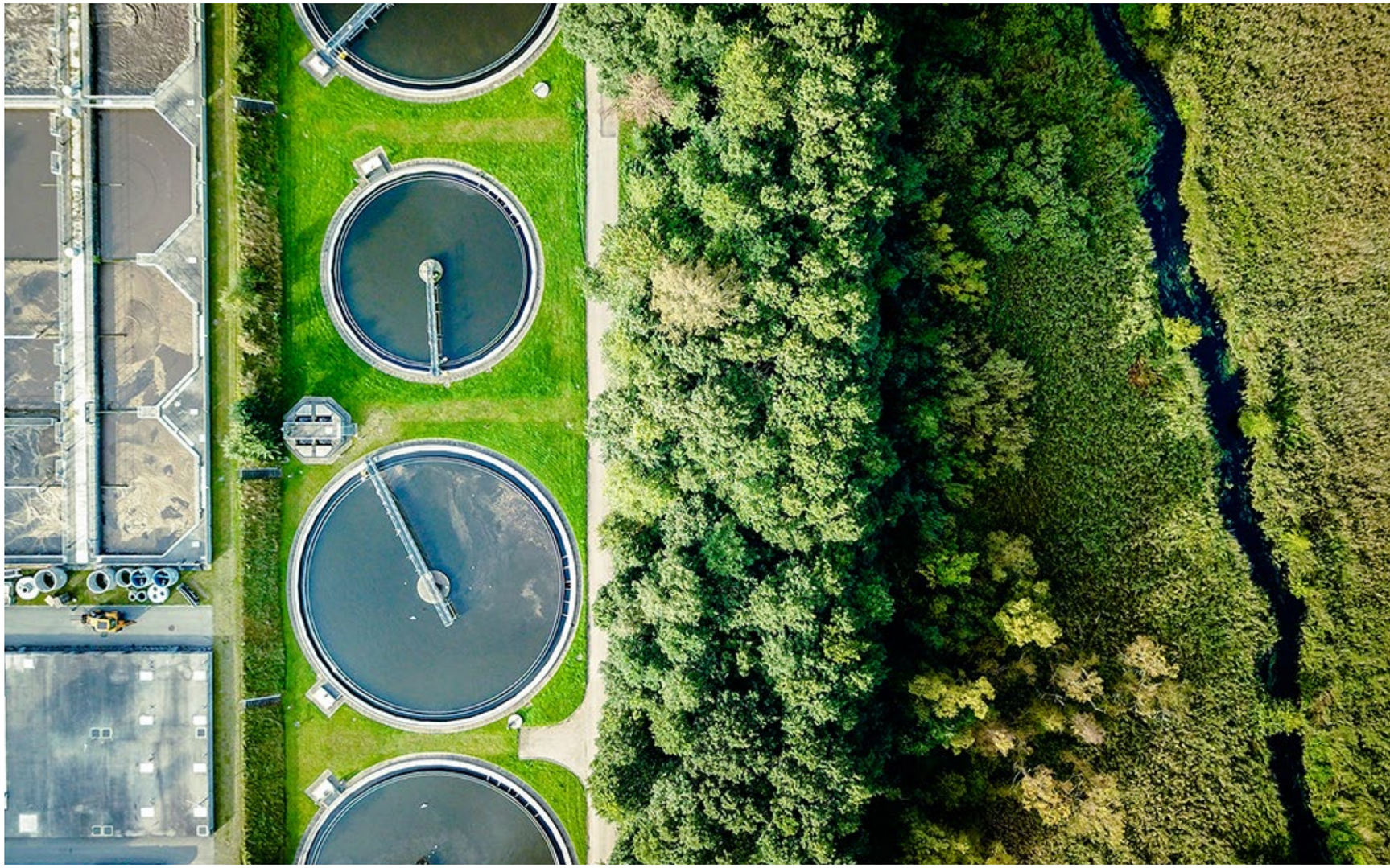
Arcadis Gen: Advanced analytics to optimize decision making across broader metrics leading to reduced carbon emissions

Once asset owners and operators have made the decision to reduce energy use and carbon emissions, they are often unclear about how best to accomplish this goal across their complex portfolios. The smart use of data is the key to optimizing decarbonization expenditures, in order to secure sustainable returns. Arcadis Gen's Enterprise Decision Analytics (EDA) solution enables asset intensive organizations to better understand their portfolios and balance risk, costs, customer service, societal needs and the environment, to create the optimal investment plan.



Yorkshire Water example:

To deliver enhanced business performance and customer service, Yorkshire Water wanted to consider more than just CAPEX and OPEX when making investment decisions. They wanted to be able to capture the full implications of their investment on the natural, human, social and intellectual capitals. For example, opting for more sustainable schemes typically increased the capital costs of some projects, but would use and produce less carbon, plant trees and support good placemaking. The slightly more expensive solution becomes preferable if the customer values these additional benefits.

To help Yorkshire Water achieve their vision, Arcadis Gen developed a valuation framework within EDA capturing the five capitals approach to cost benefit analysis. This was integrated with the optimization engine to enable Yorkshire Water to consider the broader five capitals benefits in their whole life cost. As a result, Yorkshire Water are now able to quantify the benefit of their asset investments to their customers, for example stating that for every £1 (GBP) invested the customer received £4.66 of benefit.

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Enhancing climate resilience

Climate Ready Boston

Over the entire Boston Metropolitan Region, communities and assets are exposed to significant risks from climate-related, extreme weather events. In particular, rising sea levels and flooding from storms pose existential threats to swaths of the city. This includes neighborhoods such as South Boston and East Boston, as well as key assets like Logan International Airport. With Boston's iconic, downtown buildings, neighborhoods and attractions at stake, Arcadis is working with the city to help create the future vision for Boston. As part of its Climate Ready Boston initiative, the city selected Arcadis to assess its vulnerabilities related to climate change. Arcadis is leading the project team responsible for technical assessments, design and stakeholder engagement for the initiative. As a follow up to Climate Ready Boston, Arcadis completed comprehensive planning studies for South Boston. This including Fort Point Channel. Arcadis is also supporting the Downtown resilience plan, while developing concrete solutions for high rise properties, office buildings and the New England Aquarium, all located at Boston Harbor.

Resilience retrofitting for NYC hospitals

In October 2012, Superstorm Sandy caused extensive damage to New York's major hospital facilities. Metropolitan, Bellevue, Coler and Coney Island hospitals are all located in the once in one hundred (1:100) years floodplain and were all severely damaged during the storm surge. Basements were inundated with sewage and contaminated sea water and the loss of power and critical services led to the evacuation of many patients and staff. After the storm, Arcadis worked to develop innovative solutions to protect each facility at both a masterplan and critical asset level, incorporating the principle of multiple lines of defense. The result of our work helped secure a record high grant of $1.5 billion dollars (USD) to restore critical functions and construct more robust hospital facilities, up to a one in five hundred (1:500) years storm surge event. At all facilities, critical mechanical, electrical and plumbing systems have been strategically elevated or hardened against floodwater, while the buildings themselves are being protected by perimeter defenses that are seamlessly integrated into the surrounding neighborhood. Besides comprehensive flood protection services for critical facilities such as hospitals, Arcadis performed risk and vulnerability assessments with planning and design work for a large number of high-rise offices in Lower Manhattan, including Verizon Telecommunications and Brookfield Properties.

Americas

Construction around the world

This section is a review of activity in selected markets with a focus on in-market initiatives that are promoting the adoption of sustainable construction practices. At the time these reviews were produced the spread of COVID-19 is accelerating around the world. The true impacts of the virus on society, the environment and the economy are not yet known. Nevertheless, these reviews should serve as a reference baseline for assessing impact over time.

Brazil

Brazil's economy entered 2020 at risk of recession, following a sharp decrease in output during the presidential election in late 2018. GDP growth was marginal in 2019 at 0.9%. Interest rate cuts, lower inflation figures and economic reforms were supporting a return to growth prior to the pandemic. In 2019, the construction sector stagnated. There is longer-term potential for growth associated with the government's stated commitment to invest in renewing old infrastructure. The "Brazil's Infrastructure for Sale" policy highlights the priority being placed on privatization, refurbishment and extending the life of existing assets, with new build taking a back seat. Unemployment in Brazil is high, especially in the construction sector, and when demand returns, it is unlikely to result in strong inflationary pressure. Nevertheless, over the long term, the loss of skilled labor, resulting from the country's five-year downturn and low productivity, will likely drive inflation once the long-hoped for recovery is in full swing.

Canada

Canada's GDP growth was 1.5% in 2019. In addition to COVID-19-related stimulus measures, the re-elected national government is expected to increase spending, especially on affordable housing and support for manufacturing. All things being equal, the residential market will be boosted by a scheme for first-time buyers, and industrial construction will benefit from public investment in steel and aluminum manufacturing. Furthermore, over the next two years, large infrastructure projects worth more than $20 billion dollars (USD) will be delivered. Canada is ranked second in the world in terms of the amount of LEED certified square footage. New public sector buildings must be LEED Silver or Gold and many private and commercial developers are achieving LEED Platinum certifications.

Americas

Mexico

Mexico fell into recession during 2019, with annual GDP growth falling to 0.4%. The slowdown followed the election of President Lopez Obrador, who cancelled major investments such as Mexico City Airport. The new administration also reversed the previous administration's decision to open up the oil and gas industry to private capital. Trade disputes with the US also took their toll, but with the new trade deal between Canada, the United States and Mexico almost in place, longer-term prospects should improve. Mexico's construction sector shrank by 5% in 2019, leaving it in poor shape to face the COVID-19 challenge. The potential recovery will be driven by investments in infrastructure, such as the $42 billion dollar (USD) national infrastructure plan for 2020 to 2024. The plan includes multiple projects for roads, railways and telecommunications – but relies heavily on private investment. The speed with which the plan can be implemented will depend on private sector willingness to support the current government. Mexico has a robust renewable energy sector, which is focused primarily on large-scale wind and solar farms. The country still has a long way to go in terms of encouraging less carbon-intensive construction practices.

The United States

The interim trade agreement with China is unlikely to eliminate all tensions between the two largest economies in the world. GDP growth decreased in 2019 by 0.5% to 2.4%. With the forthcoming US Presidential election, the sitting administration may well seek to provide even more economic support in the run up to the vote in November. Even before the virus, and despite a strong housing market, construction was expected to cool off over 2020, due to slowing growth, a lack of clarity around public budgets and skilled labor shortages. Looking beyond the election, both Republicans and Democrats claim they want to see significant federal investment in infrastructure, but it is far from certain that the two parties will be able to move a substantive piece of legislation through Congress. This prospect is even less likely given the massive amount of government spending currently being aimed at supporting citizens and the economy during the pandemic. Should investment take-off, the skilled labor shortage will remain one of the main inflationary factors. The uptake of modular construction and prefabrication is increasing but will require more time to stimulate sufficient supply and a broad enough skills base. Once these construction methods take hold, they have tremendous potential to drive down the industry's carbon footprint.

Asia

CONSTRUCTION AROUND THE WORLD

China

The Chinese economy slowed down over 2019, largely the result of the trade war with the United States. GPD growth was 6.1% in 2019, down from 6.6% the year before. Despite an interim trade agreement with the US being put in place at the beginning of 2020, US tariffs and sanctions were expected to continue to place a drag on the Chinese economy in 2020. China is the first country to face a COVID-19 lockdown, which resulted in a widespread demand and supply shock. Even on the most optimistic forecasts, growth is expected to contract to around 5.5% in 2020. The depth of the slowdown will depend as much on the speed at which the global economy bounces back as the success of containment of the virus in China. The Chinese government will likely continue stimulating the economy by investing in infrastructure, and there will be growth in both logistics and data centers.

Hong Kong

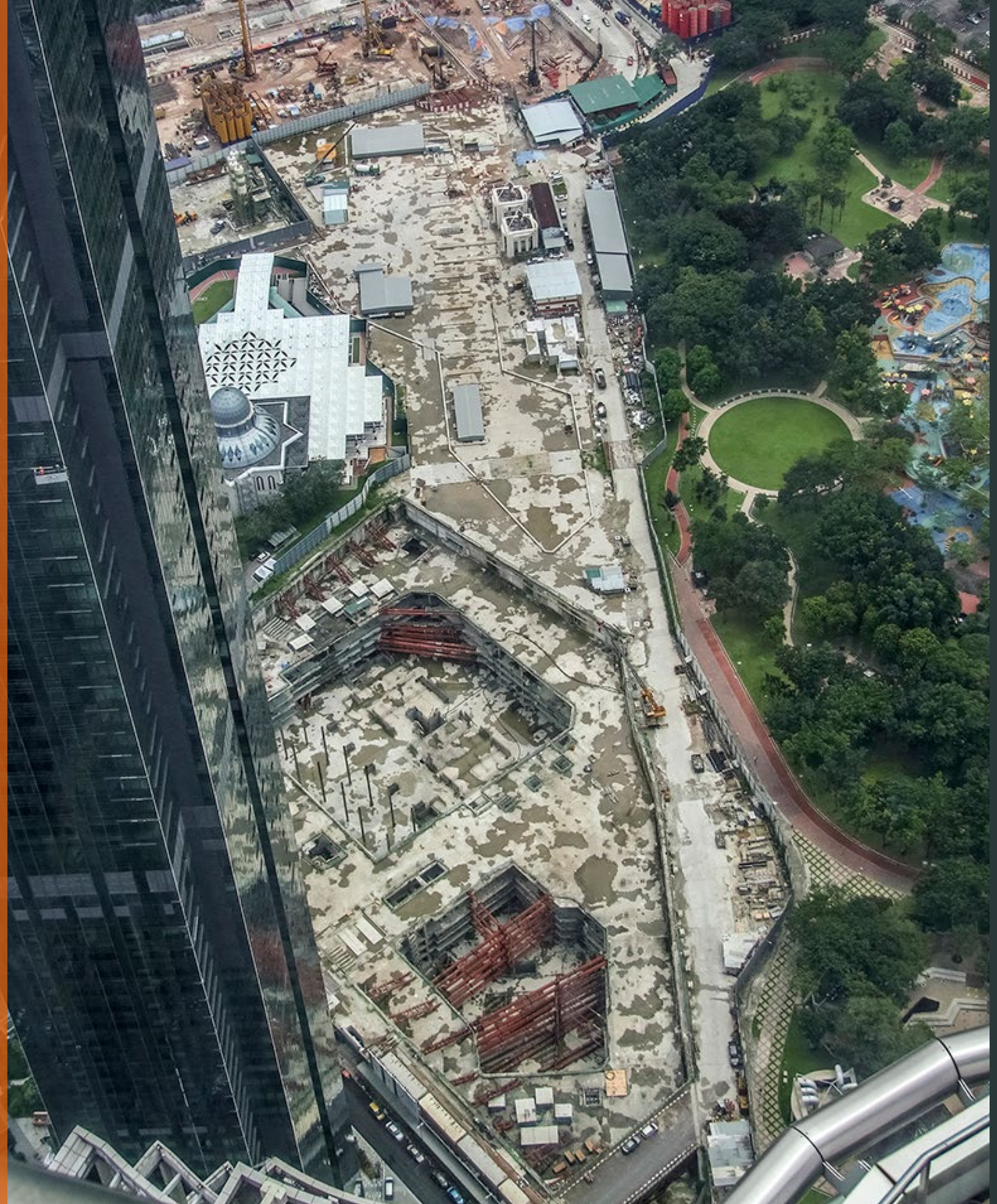
The Hong Kong economy contracted by 2.9% in 2019, with ongoing social unrest playing a role in the slowdown. A steep decline in tourism and business travel, combined with a drop in consumer spending, contributed to the economic slowdown. The construction market declined by 7% year-on-year in 2019, largely because of a downturn in public sector output. The value of new, public sector orders fell by almost 30% and this trend is expected to continue, with only a limited number of projects having been approved by Hong Kong's Legislative Council. The outlook for private investment also remains uncertain. Subdued demand will help offset inflation related to the ageing, resource-constrained workforce. The government is actively promoting construction practices that minimize waste, such as granting more generous floor space allowances to developments that use modular, integrated construction techniques.

India

The Indian economy grew by 4.8% in 2019, well shy of the country's stated goal of at least 8% GDP growth. A slowdown in local demand and problems in the non-banking, financial sector are responsible for the disappointing result. Looking forward, high demand for housing, infrastructure and real estate projects should support long-term construction sector growth. In its February 2020 budget announcement, the government proposed adding five cities to the Smart Cities Mission project, further highlighting the role of construction in supporting growth. The public sector contribution to construction demand will decrease, though private sector initiatives may well compensate for this decline. Up to 70% of the buildings and other assets projected to be needed by 2030 have yet to be built. Though most of these assets will be built to low specifications, the high demand creates an opportunity to position India as one of the world's largest green buildings markets. A combination of policy incentives, regulation and access to green finance will determine the extent to which this potential can be realized.

Asia

CONSTRUCTION AROUND THE WORLD



Malaysia

Malaysia's GDP was 4.3% in 2019, slightly down from 4.7% in 2018. Household spending, private investment and tourism are the major factors driving the Malaysian economy. Construction activity was flat in 2019, with only marginal growth of 0.3%. Political unrest and subsequent delays to major public infrastructure spending played a role in the lackluster growth. Looking longer-term, greater political stability could usher in growth in both private and public investment, with a shift towards affordable housing and an effort to restart stalled infrastructure projects. Labor costs are expected to be the main driver of inflation, with earnings growth underpinned by a statutory minimum wage. Materials costs could be affected by a disruption of imports from China. However, prices fell by 3% in 2019.

Singapore

Singapore experienced an economic slowdown in 2019, with GDP growth at 0.7%, the lowest figure in the past decade. This was a sharp drop from 3.4% in 2018. The US-China trade war, a slump in export manufacturing and a cyclical downturn in the electronics industry have all adversely affected Singapore's economic performance. Nevertheless, the construction sector grew by 2.8%, buoyed by both public and private sectors construction activities. Singapore is making strides towards becoming a global leader in green buildings. The city-state's BCA Green Mark Pearl Award encourages developers, building owners, landlords and tenants to work together to help buildings achieve better environmental performances.

The Philippines

With GDP growth of 5.9% in 2019, the Philippines remains one of the fastest developing economies in Asia. Growth was mainly driven by services, with the construction sector making a smaller contribution than anticipated. Delays in the country's budget approval process and a ban on election spending both hindered the start of public infrastructure projects. Despite the delays, the construction industry still grew by 7.7% in 2019. This was largely the result of growth in the private sector, including a number of public / private partnership projects, within the current government's "Build, Build, Build" program. Construction costs increased by approximately 10% in 2019, driven by increased demand and rising labor costs. The Philippine Green Building Code, promulgated in 2015, focuses on improvements to the energy performances of buildings. The code recommends specifications such as double-glazed windows and high-efficiency lighting. These modest performance upgrades highlight the scale of the challenge that many developing markets face in moving towards more sustainable construction practices that are already prevalent in many other markets.

Australia Pacific

CONSTRUCTION AROUND THE WORLD

Australia

Australian GDP growth was 1.7% in 2019. The volume of construction work has been declining steadily over the last three years, especially in the residential sector in Sydney and Melbourne. This was countered by an increase in demand for non-residential and infrastructure projects in other places such as Adelaide, Brisbane and Perth. In the aftermath of widespread bushfires, rebuilding efforts could potentially create a stable source of construction demand. Additionally, the New South Wales and Victoria State governments are planning a new wave of investments in education and the health sector. Increasing labor costs could drive construction price inflation, with most pressure in Sydney and Melbourne. The Burwood Brickworks mixed-use development in Melbourne stands out as an example of private sector leadership in transitioning to carbon neutral construction. Designed to meet the Living Building Challenge, the scheme generates 105% more energy than it consumes and features a rooftop farm which meets the challenge requirement of incorporating 20% agricultural land use. At a time when the retail sector is struggling, Burwood Brickworks is an example of how a low carbon approach can lend itself to creating an asset that is highly attractive to the public.

New Zealand

New Zealand's GDP growth was 2.5% in 2019, slightly down from 2.8% in 2018. With interest rates low and efforts to stimulate longer-term investment in place, the country's economy was expected to see faster growth in 2020. The residential sub-sector contributed almost 60% of the total output for the construction sector in 2019. New Zealand's government has recently published the Construction Sector Transformation Plan, with the aim of increasing workforce retention rates and improving sector productivity. There are some efforts being put in place to promote more sustainable methods of construction, including streamlining the consent process for prefabricated buildings. There have also been amendments to government procurement recommendations, which can help the industry move from a "lowest price model" to a "broad outcome" criteria. This may incentivize better environmental and social outcomes.

Europe

Sustainable construction in the EU

The European Union is unique in the world in its role in driving pan-regional regulations. These are being used to promote low-carbon construction through requirements for near-zero energy buildings (nZEBs). Regulations for nZEBs were set in 2010 and come into force in 2020, requiring the adoption of minimum fabric performance standards and the use of low-carbon or renewable heating systems. Standards are set and monitored locally, so sustainable performance levels will continue to vary. Nevertheless, the EU is making noteworthy strides in driving cross-sector improvements.

Czech Republic

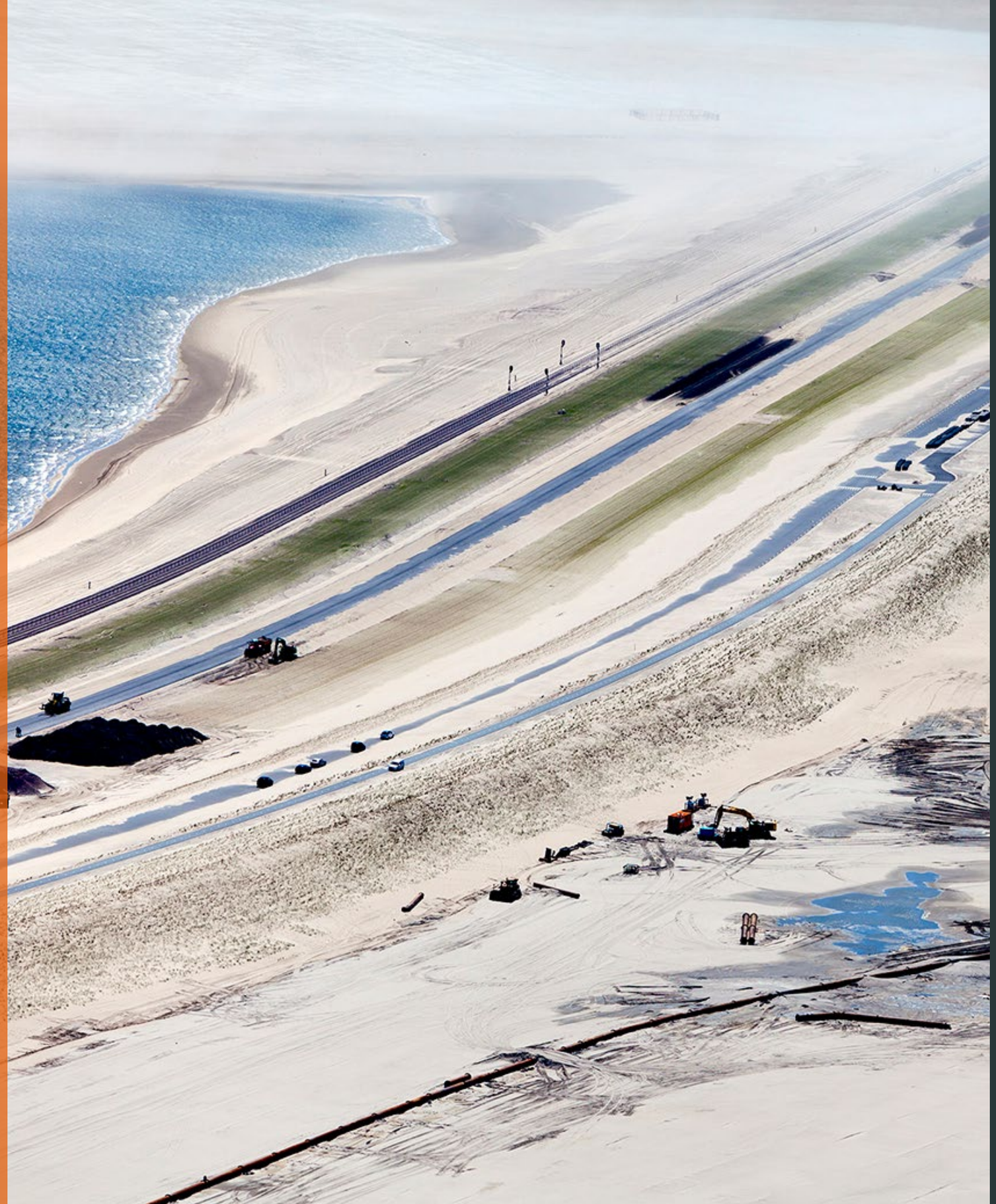
In 2019, GDP in the Czech Republic was 2.5%. Interest rates were increased by 0.25% in 2019, in order to reduce inflation, which is currently 3.5%. The construction industry grew by 2.3% in 2019, the third consecutive year of growth. This is significantly lower than the industry's 8.4% growth in 2018. The number of building permit requests was rising, with growth coming in particular from the affordable housing sector. The European Union is set to reduce funding to the country for infrastructure projects, a move which may further hamper longer-term growth prospects. Progress towards meeting EU sustainability standards has been slow but from 2020 onwards, every new building construction permit must demonstrate compliance with near-zero energy building standards. BREEM and LEED building certificate applications are also on the rise, in particular among industrial and commercial asset owners.

Poland

In 2019, Poland's GDP growth was 4.1%, down from 5% in 2018. A further slowdown was forecast before the COVID-19 pandemic. The construction sector grew by 3.6% in 2019, signaling more stability in the market after a massive 20% increase in 2018. In 2020, political uncertainty, stemming from the next EU budget negotiation process and presidential elections in May 2020, is likely to limit the levels of investment. In late 2019, Kraków became the first city in Poland to introduce a ban on burning solid fossil fuels. Poland is also implementing near-zero energy building standards.

Europe

CONSTRUCTION AROUND THE WORLD



The Netherlands

Economic growth is slowing down in the Netherlands. GDP growth was 1.7% in 2019, down from 2.6% in 2018. Prior to COVID-19, the main risks to the Dutch economy were US trade policy and the post-Brexit trade deal between the EU and Great Britain. After a buoyant 2018, the construction sector in the Netherlands began slowing down in 2019, mainly due to skilled labor shortages and problems associated with the implementation of a long-term plan to reduce nitrogen emissions. The latter has severely impacted the construction and agricultural sectors. Stricter regulations regarding the handling of construction materials contaminated with perfluoroalkyl and polyfluoroalkyl substances (PFAS) have also resulted in a number of construction projects being put on hold.

Spain

Spain's GDP growth fell to 2.2% in 2019, down from 2.6% in 2018. This is the result of political uncertainty, which has contributed to a protracted contraction of the manufacturing sector and subdued private sector investment. Construction output increased by 4.7% in 2019, outpacing the overall economy. Highlighting the role that the financial sector can play in the decarbonization agenda, the Green Buildings Council of Spain announced last year that it will partner Santander Bank. The partnership is aimed at stimulating demand for green mortgages, which operate on flexible interest rates that are set according to a building's energy performance.

The United Kingdom

In the UK, the GDP grew by 1.2% in 2019. A substantial Conservative party win in parliamentary elections initially generated a boost to private sector optimism. Yet, the return of long-term private investment will depend on the outcome of the COVID-19 outbreak as well as Brexit negotiations with the EU. Following a stagnant 2018, the construction industry had a year of accelerated growth in 2019, with output up by 3.4% year-on-year. Public investment will increase by at least £175 billion pounds (GBP) from 2020 to 2025 according to recent budget announcements, based on ambitious transport and social infrastructure plans to boost the UK economy. The Future Homes Standard, published in 2019, proposes that from 2025 all new homes will have best-in-class, energy-efficiency performances, incorporating low-carbon heating systems.

Middle East

CONSTRUCTION AROUND THE WORLD

Saudi Arabia

Saudi Arabia's economy grew by only 0.2% in 2019, but construction growth was over 3%. Future diversification plans anticipate that the private sector will make a significant contribution through investments in tourism and entertainment. Saudi authorities have a stated ambition to diversify the economy beyond oil. This includes the Red Sea Development, Amaala, Qiddiya, Al Ula, Diriyah Gate and Neom City projects.

United Arab Emirates

GDP growth in the United Arab Emirates (UAE) was 1.6% in 2019, which is similar to 2018. The expected 12 month postponement of Expo 2020 means that the forecast economic boost will now not happen until 2021. After the expo, the facilities will be converted into a business park, with a number of prominent companies already signaling they will open offices in this space. Estidama is a building design methodology, which is mandatory in the UAE, and has a focus on sustainability. Within the methodology the Pearl Rating system is used to determine the sustainability performance of buildings. All new private buildings must achieve a Pearl Rating of 1 and all government buildings must achieve a Pearl Rating of 2, which is a more stringent standard.

ICC 2020
RETHINKING RESILIENCE

Methodology

Arcadis developed its comparative cost index for 100 cities, covering 20 building functions, based on a survey of construction costs, review of market conditions and the professional judgement from its global team of experts. Ranges of indicative prices for each building function are collected for each city. Low and high range costs are converted into US Dollars (USD), normalized and indexed against the price range for each building type for Amsterdam, where Amsterdam = 100. Average low and high index ranges are calculated for each city based on the 20 building types.

The data was collected between December 2019 and February 2020.

Costs used to calculate the index are based on buildings delivered to local specification standards, meeting both functional requirements and quality expectations. As a result, while the index compares the relative costs of delivering the same building functions in a city, it also reflects the different levels of quality expectation reflected in a specification.

The index does not take into account purchasing power parity. The construction cost data used in this index is current as of Q1 2020. The exchange rates used to calculate the index were current on 13th February 2020.

Inflation rates set out in this report were annualized rates assessed in Q1 2020 prior to an assessment of the impact of COVID- 19. They do not represent a forecast of likely price changes in 2020 as a result of the pandemic.

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The cost comparison index represents a snapshot in time and is for illustrative purposes only. While every effort has been made to ensure the accuracy of the index, Arcadis is not liable for any loss or damages associated with the use of the index for decision-making purposes.

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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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