SmartCitiesWorld City Profile

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AVEVA

Executive summary

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In this edition, we focus on Sydney, the state capital of New South Wales and most populous city in Australia. With the largest economy in the country, Sydney is known for its strengths in finance, education, manufacturing, technology, trading and tourism. The city is a leading hub of business and professional services in the Asia-Pacific region. It is currently ranked 14th (globally) in the Digital Capitals Index and Sydney's Central Business District (CBD) – the country's largest financial centre – is home to the Australian Stock Exchange and the Reserve Bank of Australia.

Located on Australia's east coast, Sydney surrounds Port Jackson and is endowed with an enviable climate and the natural beauty of parks, beaches, Sydney Harbour and the Blue Mountains. The city is considered "Australia's face to the world" – with seven of the country's top 10 most popular tourist attractions – and is consistently named as a favourite international destination. In 2019, the Sydney metropolitan area hosted more than four million international visitors. The tourism industry contributes about AU$15bn per year to the Sydney economy and employs 70,000 people.

Sydney is praised for its liveability and economic opportunities. In the 2020 Smart City Index (SCI) by the Institute for Management Development (IMD), in collaboration with Singapore University for Technology and Design (SUTD), the city is ranked 18 out of 109 cities. The ranking is based on citizens' perception of the impact that technology has on their quality of lives as well as economic and technological data.

In response to the Covid-19 emergency, Sydney's economy was locked down in March 2020. Geoff Roberts AM, chief commissioner of the Greater Sydney Commission (GSC), said the pandemic tested the city's residents – known as "Sydneysiders" – "in ways never seen in our lifetimes". In June, lord mayor Clover Moore unveiled a three-part plan for post-pandemic recovery with support for vulnerable communities, economic revitalisation and business innovation.

Population
5 million
in Greater Sydney

(1.3 million in the City of Sydney and its local area)

Population density
1,172 per km²
(in the Greater Sydney built urban area)

Main languages
English, Mandarin, Arabic, Cantonese, Greek, Vietnamese

Median age
36 years

GDP per capita
AU$84,000

Introduction

The Sydney metropolitan area is divided into local government areas with councils responsible for public services and functions delegated by the New South Wales (NSW) state government. The City of Sydney, a local government area, includes the CBD and adjoining inner suburbs. The City – led by an elected council and lord mayor – is responsible for promoting development in the local area, delivering local services and providing infrastructure for commerce and tourism. Greater Sydney has no distinct local government for the metropolitan area, and the state government is responsible for urban infrastructure and services such as roads, traffic management, public transport systems, education, policing and emergency services.

As one of the fastest growing areas in NSW, Sydney is experiencing changes driven by urbanisation, climate threats, new technologies and recovery from the pandemic. In 2020, the City of Sydney released a Smart City Strategic Framework to harness the opportunities brought about by digital disruption, to plan for uncertainty and to sustain its global reputation as a leading place to live, work, learn and visit. In her introduction to the framework, lord mayor Moore said "we have developed a shared vision for the future of technology and our city. We see digital technology as a tool to support our diverse community to address pressing challenges and unlock new opportunities".

Greater Sydney's population is forecast to grow to about eight million by 2050. Community and business leaders recognise – with almost half the population living in Sydney's western suburbs – it is time for a rebalancing of economic and social opportunities and a more equitable distribution of services and quality of life. In a major step toward this rebalancing, the GSC was established in 2016 to lead the strategic planning process for the Greater Sydney area. In its first year of operation, the GSC created a 40-year vision for the city's evolution. Two years later, the GSC published its Greater Sydney Region Plan: A Metropolis of Three Cities, proposing a transformed metropolitan region where "most residents live within 30 minutes of their jobs, education and health facilities, services and great places".

Professional services firm KPMG says the plan for Greater Sydney reflects "an emerging national agenda of more connected urban policy to drive the global competitiveness of Australian cities". Development of the plan required partnerships among the GSC, Infrastructure NSW and Transport for NSW. The plan for a three-city metropolis "is a bold vision for three, integrated and connected cities that will rebalance Greater Sydney," said Gladys Berejiklian MP, premier of New South Wales, and will serve as a guide for "much-needed investments in transport, infrastructure, services and affordable housing".

Economy

- Greater Sydney's GDP exceeds AU$450bn – about 25 per cent of the national GDP.
- In 2019, the Global Power City Index ranked Sydney's economy 9th based on market size, attractiveness and human capital.
- Researchers predict emerging tech, including AI, IoT, blockchain and 5G, will add AU$30bn to Sydney's economy by 2029 (an 80 per cent increase from 2019).

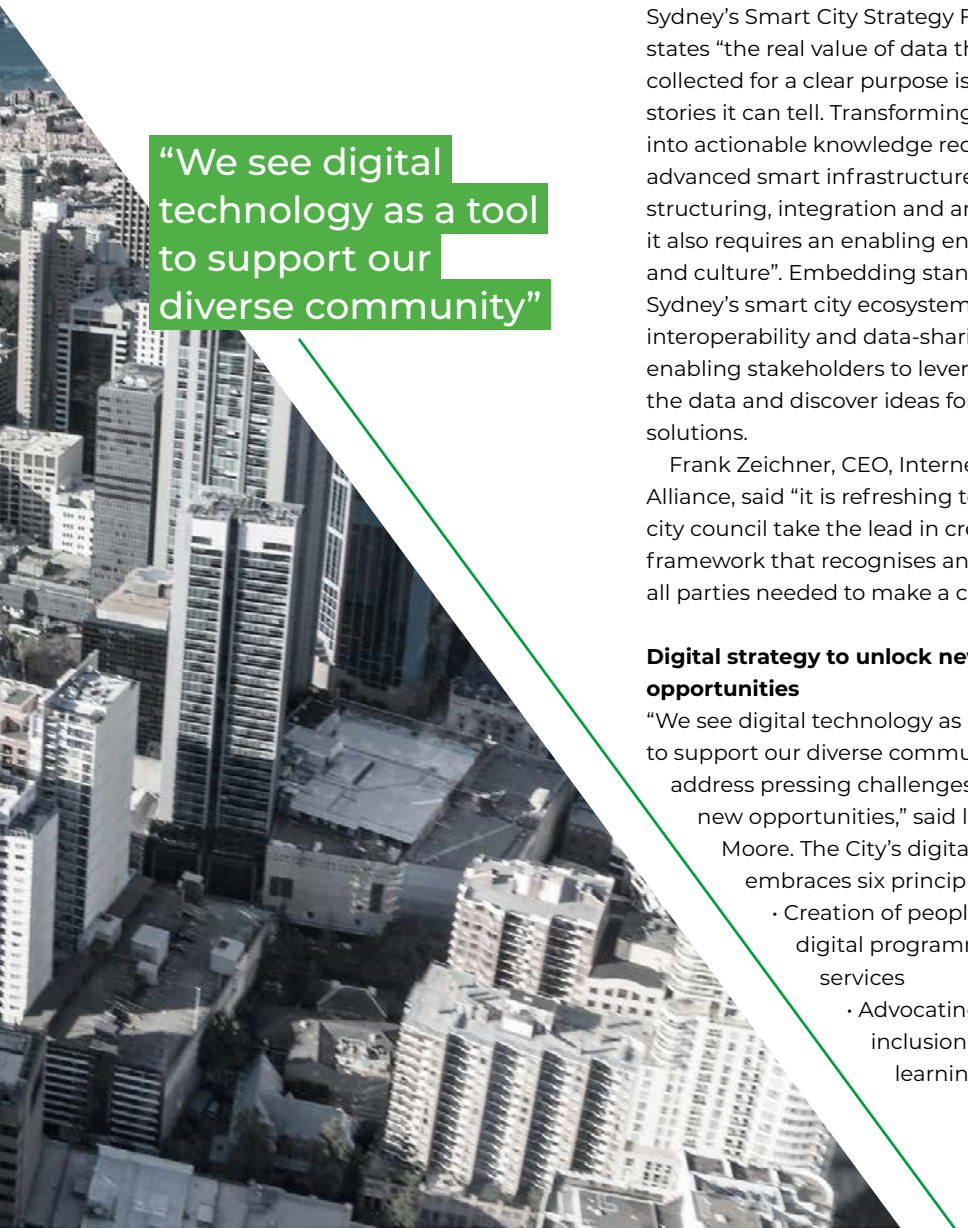
Mobility

- Public transport users in Sydney spend an estimated 82 minutes commuting each workday, and 31 per cent ride for more than two hours per day.
- The Sydney Harbour Bridge, a national icon, carries more than 160,000 vehicles per day and generates significant tourism benefits.
- Sydney is ranked as the most congested city in Australia and 23rd most congested in the world, according to the Inrix 2019 Global Traffic Scorecard.

City Challenges

- Sydney has a shortfall of more than 80,00 social housing dwellings and 55,000 affordable rental homes.
- Disadvantaged neighbourhoods, joblessness and public transport weakness in Western Sydney are among Sydney's most persistent socio-economic issues.
- Sydney is working to increase digital inclusion – especially in light of the pandemic-driven impact on digitally excluded residents.

Data



"We see digital technology as a tool to support our diverse community"

Sydney's Smart City Strategy Framework states "the real value of data that is collected for a clear purpose is in the stories it can tell. Transforming raw data into actionable knowledge requires advanced smart infrastructure capable of structuring, integration and analysis, and it also requires an enabling environment and culture". Embedding standards in Sydney's smart city ecosystem facilitates interoperability and data-sharing, enabling stakeholders to leverage the data and discover ideas for urban solutions.

Frank Zeichner, CEO, Internet of Things Alliance, said "it is refreshing to see a city council take the lead in creating a framework that recognises and includes all parties needed to make a city smart."

Digital strategy to unlock new opportunities

"We see digital technology as a tool to support our diverse community to address pressing challenges and unlock new opportunities," said lord mayor Moore. The City's digital strategy embraces six principles:

- Creation of people-centred digital programmes and services
- Advocating digital inclusion and lifelong learning
- Transformation of community engagement
- Support for businesses in building digital skills, knowledge and infrastructure
- Participation in urban renewal and provision of smart infrastructure
- Ethical innovation in the information marketplace

Data-sharing, digital engagement and urban smartness

In 2018, the Committee for Sydney released a report on effective citizen engagement, a core building block of smart city success. The authors of Smart Engagement: Leveraging Technology for a More Inclusive Sydney claim that to improve people's lives, "we must understand the issues that impact them most". The report recognises that deployment of smart sensors, data-sharing, analytics and automated services drive urban smartness, but smart city success ultimately depends on how these technology solutions improve the quality of urban life.

The City of Sydney was one of the first local councils to establish an online hub to ensure public consultation is supported by digital engagement. The Sydney Your Say engagement platform encourages citizens to participate and contribute to decision-making in city planning, wellbeing, culture, the arts and

Timeline

November 2020:
The NSW Government announces a massive funding plan for renewable energy infrastructure and services.

October 2020:
National Narrowband Network (NNNCo) launches a citywide LoRaWAN network in Sydney to accelerate IoT adoption and deployment.

October 2020:
Ausgrid, an electricity distribution company serving Sydney, announces a partnership with JoLT, an electric vehicle charging network company, to develop free, fast EV charging stations in Sydney.

September 2020:
The NSW Government announces new metro stops in Western Sydney to connect a new airport to the rest of the city.

August 2020:
The NSW Government awards an AU$80m contract to Siemens Mobility to upgrade Sydney's heavy rail network, one of the busiest rail networks in the southern hemisphere.

July 2020:
The City of Sydney switches to 100 per cent renewable electricity for city operations, including streetlights, buildings, pools, sports facilities and the town hall.

July 2020:
Research reveals an estimated 50 per cent of households in Sydney connected to the National Broadband Network (NBN) are serviced by outdated coaxial copper (rather than high- speed fibre optics).

June 2020:
The City of Sydney announces a post-pandemic recovery plan to improve public spaces, help vulnerable citizens, revitalise the visitor economy and support innovation.

urban strategy. The platform continues to evolve through the adoption of new technologies, social media, smartphone applications and virtual reality. Sydney supports the principle of "open by default" and its platform provides open data sets on transport, public domain, communities, planning, culture, regulation, economics and the environment.

Research programmes in data infrastructure, urban models and sensing networks

The University of Technology Sydney (UTS) works at the frontline of smart city planning to harness Internet of Things (IoT) technology and assist local councils in creating more liveable communities. TULIP is a smart city research programme led by UTS in cooperation with partners from local, state and national governments, industry and civil society. Through the TULIP programme, public access networks and sensors are deployed in cities and "supported by an innovative new approach to data architecture", which collects hyper-local data on urban heat, air quality and noise levels. TULIP serves as a blueprint for local governments to deliver smart city infrastructure.

With a goal of establishing smart city leadership in digital twin technologies, the NSW Government and Sydney are creating a Spatial Digital Twin model of Western Sydney's built and natural environment. This model "will enable planners, developers and policy-makers to make more informed decisions". The technology and data behind a digital twin can help smart city leaders to better communicate infrastructure plans.

The NSW Smart Sensing Network (NSSN) was established to bring together world-class sensing research and position NSW as a leader in sensing technologies. In future, it could play a key role in emergencies and national disasters such as bushfires. In 2020, the NSSN launched its Grand Challenges research programme "to respond to some of the most gripping challenges of our time," covering the urban environment, economy, public health and society. The Grand Challenges – selected for the innovative and game-changing role of smart urban sensing – include research programmes for prevention, response and mitigation of bushfires and pandemic emergencies and new solutions for the ageing population.

Data

- A smart sensor research pipeline valued at more than AU$16m is in development at the NSSN.
- Sydney's Data Hub released a collection of 19 city-related data sets to allow citizens to explore the city with data-driven tools.
- Sydney is a signatory of the Declaration of Cities Coalition for Digital Rights.

"We must understand the issues that impact people's lives most"

June 2020:

The NSW Government designates a large area north of Sydney as the site for three gigawatts of renewable energy, the first step in a planned 17.7-gigawatt renewable energy system.

June 2020:

Sydney releases its delivery programme – a four-year plan of activities and financial estimates to implement Sustainable Sydney 2030.

May 2020:

More than AU$1bn is approved (through the Central Sydney Planning Committee) for skyscraper development projects to boost construction activities and facilitate economic recovery in Sydney.

April 2020:

The NSW Government forms a partnership with NEC to co-create a Digital Safer and Smarter City environment and develop an Innovation and Technology Precinct near Sydney's Central Station.

April 2020:

Smart City Council launches Bounce Lab, a think-tank for advancing a digitally enabled and data-driven economic recovery in Australian cities.

March 2020:

NBN announces a plan for increased broadband capacity to handle surging demand caused by the pandemic.

February 2020:

NSW and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) launch a digital twin visualisation model of Western Sydney.

January 2020:

Smart Cities Council unveils the Centre for Data Leadership to help leaders allocate data resources where it delivers the greatest impact.

Connectivity

In terms of broadband connectivity, the National Broadband Network (NBN) – wholly owned by the Commonwealth of Australia – is a wholesale-only, open-access network providing broadband capacity and services to retail phone and internet providers. Although originally planned as a high-speed fibre-to-the-premises (FTTP) network, the NBN receives mixed reviews. Today's NBN is a mixed-technology network with users connected to the service via a hotchpotch of seven methods – including those that rely on old copper telephone wires – but it has been criticised for network quality, speeds and reliability varying wildly. Research by the Australian Housing and Urban Research Institute found around half of households in Sydney are served by outdated coaxial copper rather than high-speed fibre.

Shortly after the onset of the pandemic, the Australian Communications Consumer Action Network (ACCAN) issued a plea to broadband and internet service providers (ISPs) to help citizens with online challenges. The NBN responded by temporarily offering more bandwidth to retail broadband service providers to alleviate increased demands on residential networks, serve more customers working remotely, and reduce network congestion. Communications minister Paul Fletcher said the NBN "proved its value during the Covid-19 lockdown." In an interview with The Australian Financial Review, Fletcher said the NBN "withstood a huge spike in usage as workers and students operated remotely".

Connectivity and digital inclusion challenges

Improving broadband services and internet connectivity is fundamental to improving digital inclusion across the Greater Sydney area. The 2019 Australian Digital Inclusion Index (ADII) states that "digital inclusion is based on the premise that everyone should be able to make full use of digital technologies". The ADII provides an assessment of online participation by measuring three dimensions of digital inclusion: access, affordability and digital ability. The 2019 Index indicates that digital inclusion is improving nationally and in Sydney. Since 2014, the nation's digital inclusion average score has risen by 7.9 points, from 54.0 to 61.9, and NSW and Sydney mirror this trend. People are

"Pre-pandemic, the city was already very active in providing digital literacy programmes"

Connectivity

- More than 70 per cent of Sydney survey respondents believe 5G networks will improve access to business and government services online.
- In early 2020, the NSW Government requested expressions of interest with requirements for a proposed package of regional digital connectivity services under the Gig State programme.
- Australians spend about 40 hours per week online, with social media accounting for one in every three minutes online.

"connecting more devices to the internet, consuming more data and participating in a greater range of social, cultural, and economic activities online".

A gap, however, remains between digitally included and excluded citizens. Those with lower ADII scores include citizens with low levels of income, education, and employment; people aged 65 and above (the least digitally included age group); and mobile-only users (who access the internet solely through a mobile connection). For mobile users, Telstra, Optus, and Vodafone launched 5G networks and services with the potential to increase digital inclusion. By delivering faster wireless connectivity, 5G should facilitate increased use (and hopefully more inclusive use) of smart technologies. A key offering from Optus is 5G home wireless broadband, potentially serving as an alternative to the NBN.

Opportunities for 5G and public Wi-Fi

A connectivity survey by BAI Communications revealed that "Sydneysiders expect 5G networks to have a positive impact on their ability to access business and government services; access entertainment services; stay connected with friends and family and access business and educational content online". The survey results indicate that 94 per cent of Sydney residents support public investment in smart city infrastructure. BAI claims "there's never been a more important time for government and mobile network operators alike to invest in smart network infrastructure, including 5G, which can support smart city devices and applications". Only 61 per cent of respondents, however, believe Sydney is taking advantage of smart network and 5G opportunities.

With a pandemic-driven increase in remote working, Sydney became more reliant on digital technology and connectivity. Kate Deacon, executive manager, strategy and communications for the City of Sydney, says: "Many people in our local area use the Wi-Fi and computer facilities that the City of Sydney offers in our public libraries. Because these were closed during the lockdown, it doubled-down on the digital inclusion issues which the most vulnerable in our community were experiencing."

Deacon explains that "pre-pandemic, the city was already very active in providing digital literacy programmes, and we continue to focus on this as a priority to address digital inclusion issues. We are now working to extend free Wi-Fi service in our community centres, and we are conducting a tender for the provision of free Wi-Fi in the public domain".

May 2020:
The Inrix Global Traffic Scorecard ranks Sydney as the world's 23rd most congested city, with drivers losing an estimated 119 hours per year due to traffic congestion.

December 2019:
Sydney announces its 2019 Community Engagement Strategy.

November 2019:
NSW fire authorities issue a catastrophic fire warning for the Greater Sydney area and nearby regions when bush fires reach the suburbs of Sydney.

November 2019:
The NSW Government announces it will order 23 new metro trains to extend Sydney's first driverless Metro railway, delivering a 66km line by 2024.

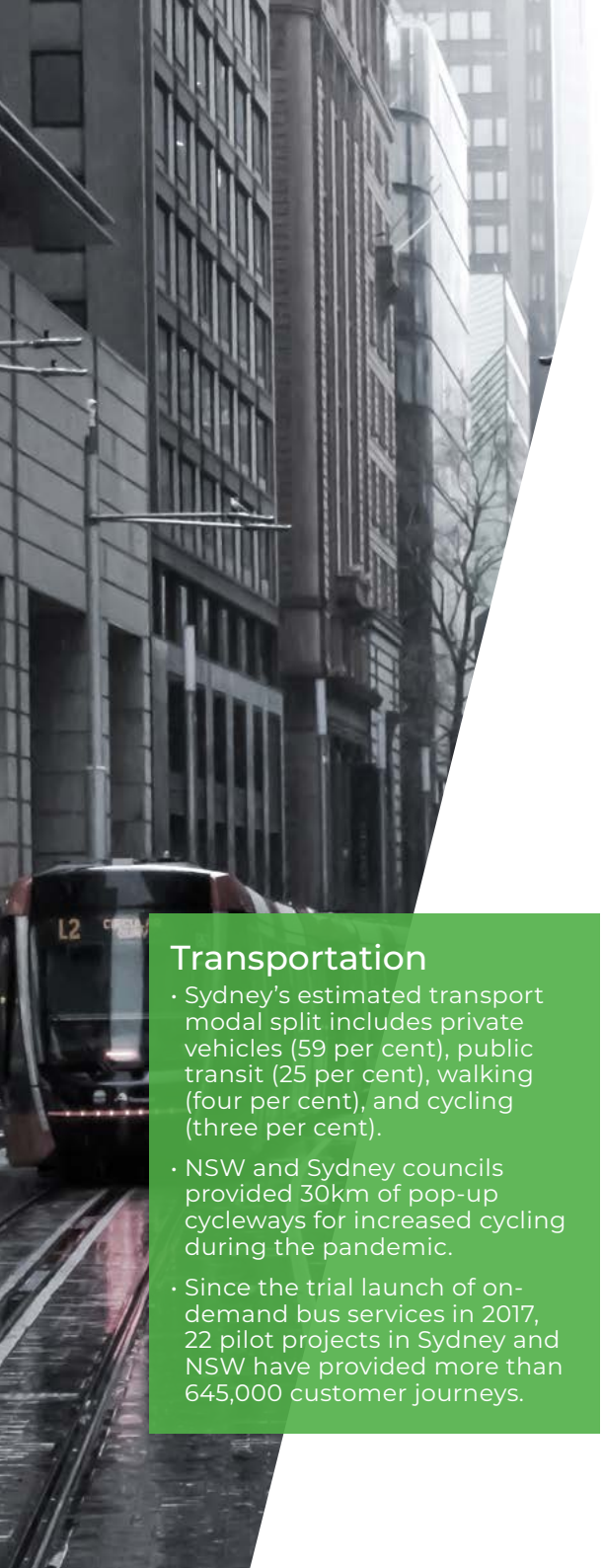
October 2019:
Smart shuttles operating at Sydney Olympic Park are the first vehicles in Australia to interact autonomously with live traffic conditions.

October 2019:
Sydney's first on-demand ferry service begins a six-month trial.

August 2019:
The University of Technology Sydney announces the deployment of more than 100 environmental monitoring devices in the City of Sydney and Lake Macquarie – making this the largest near-real-time sensor network in Australia.

June 2019:
Lord mayor Moore declares a climate emergency in response to the continuing threat of climate change.

June 2019:
In a first-of-its-kind trial, Sydney and university researchers use industrial waste from coal-fired power stations and steel plants to create a green roadway.



Transportation

More than 50 per cent of commuters in Sydney rely on private cars, and the city has an average of 1.7 vehicles per dwelling. Despite a reliance on privately owned vehicles, Sydney has the highest usage of public transport in Australia with an estimated 23 per cent of commuters using it. The city's public transport network, operated by the NSW Government, includes trains, buses, metro links, light rail and ferries. Airport links, sightseeing buses, taxis and ride-sharing services provided by multiple operators complement the public transport network.

Reliable public transport, reduced traffic congestion

In an average workday, Sydneysiders spend about 82 minutes commuting via public transport, and 31 per cent ride for more than two hours per day. In terms of performance and resilience, the Deloitte City Mobility Index indicates that "Sydney has a highly reliable public transport system" although the system is under stress from growing numbers of commuters in some areas. A net outflow of 200,000 Western Sydney commuters leave the area each workday day, growing to 340,000 per day by 2041. Deloitte says the city's investment in the Sydney Metro and expansion of light rail services should allow further growth in transit ridership and reduce traffic congestion.

Changes in travel patterns affect mobility scenarios

According to the Greater Sydney Commission, Sydney's changes in travel patterns in the pandemic "could open up a range of opportunities to improve overall transport network efficiency and customer satisfaction". The major change in Sydney's transport from March to July 2020 was in cycling and walking. "Data from 10 Sydney cycleways with counters revealed approximately a 106 per cent increase in cycling during April 2020, compared with April 2019. [...] Since the start of the pandemic, 62 per cent of people are walking more." The shift to walking and cycling can be sustained by reducing speed limits and retaining pandemic initiatives such as:

- Pop-up cycleways
- Dedicated road space to support adjacent businesses
- Prioritised traffic signals for pedestrians and cyclists

The national government granted AU$55m to the iMOVE Cooperative Research Centre (CRC) – with members from industry and research entities – to explore intelligent transport systems including autonomous vehicles. Key members of the iMOVE CRC include the University of Sydney's Institute of Transport and Logistics Studies (ITLS) and the Faculty of Engineering and IT.

Through a research project – Working from Home: Revising Metro Strategic Transport Models – iMove is striving to predict travel preferences in a post-pandemic era. Researchers hope to identify how changes in travel patterns can prevent a return to urban gridlock.

A Greater Sydney challenge is how to improve access to public transit. A report on liveable cities from the Centre for Urban Research reveals that only 35 per cent of homes in Sydney "are within 400 metres of a public transport stop with a scheduled service at least every 30 minutes". By nurturing micro-mobility improvements, Sydney has an opportunity to provide better access to public transit, diversify transport options and reduce car dependency.

Autonomous shuttle innovation and trials

As an Australian leader in autonomous vehicle technology, Sydney has smart shuttles communicating with urban infrastructure in a trial at the Sydney Olympic Park. During the trial, the vehicles communicate autonomously with live traffic signals and carry passengers for short journeys to and from Olympic Park Station, restaurants and car parks. Andrew Constance, minister for roads, said: "We are dedicated to expanding trials to get the technology right, which is why we invested AU$10 million in additional testing."

Transportation

- Sydney's estimated transport modal split includes private vehicles (59 per cent), public transit (25 per cent), walking (four per cent), and cycling (three per cent).
- NSW and Sydney councils provided 30km of pop-up cycleways for increased cycling during the pandemic.
- Since the trial launch of on-demand bus services in 2017, 22 pilot projects in Sydney and NSW have provided more than 645,000 customer journeys.

Energy

"All City of Sydney operations run on 100% renewable electricity"

Traditionally, the NSW electricity system has been powered by coal which continues as the primary source, generating almost 80 per cent of the State's electricity. The availability and adoption of renewable energy, however, is gathering momentum. In a recent five-year span, the share of wind and solar power tripled, accounting for about seven per cent of total electricity. The renewables share of generation "is expected to grow as 14 large-scale renewable energy projects totalling about 2,100 megawatts currently under construction enter the market and more households install solar panels".

Locally sourced clean energy

Since July 2020, all government operations in the City of Sydney – including streetlights, buildings, depots, sports fields, pools and the historic Sydney Town Hall – run on 100 per cent renewable electricity from locally-sourced clean energy. The switch to renewables – supported by sourcing renewable energy from three different generators – should save up to AU$500,000 per year and reduce carbon emissions by an estimated 20,000 tonnes per year.

Affordability and energy poverty

A survey found that NSW currently has the fourth most expensive retail electricity prices in the world, and a growing challenge is how to provide affordable energy services for vulnerable households. Elderly citizens, those with chronic health problems or a disability, and low-income households suffer most from energy poverty. Researchers at the University of Technology Sydney (UTS) point to low energy efficiency of the existing housing stock as a barrier to affordable energy, and a 2019 article in the Sydney Morning Herald reported that Sydney homes have the lowest energy ratings in Australia. UTS researchers contend that a stimulus programme to subsidise energy retrofits can mitigate energy poverty. In a state-wide action, the NSW Government announced a planned investment of AU$32bn in new renewable energy infrastructure. Based on comments from energy minister Matt Kean on Australia's ABC News website, "the new infrastructure will put NSW in the top 10 for the lowest industrial electricity prices in the OECD".

The Sydney CleanTech Network (SCN) is the local operation of a national hub of cleantech activity. The network provides international access to global partnerships and market entry for international investors. The SCN "provides a forum for investors, companies, government and academia to meet, learn about the sector and collaborate".

The City of Sydney is a member in C40 Cities, a global network of more than 90 cities working to achieve Paris Agreement goals, and the Carbon Neutral Cities Alliance, a coalition committed to reducing greenhouse gas emissions by 80 to 100 per cent by 2050.

Energy

- Through a community-owned project, 520 kilowatts of solar power was installed at Sydney's International Convention Centre (ICC).
- An area north of Sydney is designated as the site for three gigawatts of new renewable energy.
- The City of Sydney is one of five local governments with a net-zero-by-2050 target supported by an interim emissions reduction target.

May 2019:
Sydney Metro services launches rapid transit services on the Metro North West Line – Sydney's first metro link.

September 2018:
The Committee for Sydney publishes Smart Engagement: Leveraging Technology for a More Inclusive Sydney.

August 2018:
The Reputation Institute ranks Sydney as the second most reputable city in the world.

March 2018:
The Western Sydney City Deal, a 20-year partnership across three tiers of government, is formed to improve the prosperity, sustainability and liveability of Western Sydney.

March 2018:
The NSW Government finalises three integrated plans for Greater Sydney's future growth – the Greater Sydney Region Plan: A Metropolis of Three Cities, Future Transport 2056 and a State Infrastructure Strategy.

December 2017:
The Australian Government launches the first National Cities Performance Framework to provide a snapshot of smart city performance.

November 2017:
The Australian Government allocates AU$340,000 in smart city funding to the City of Sydney and AU$433,000 to the University of Technology Sydney.

November 2017:
Sydney is ranked 12th in smart city rankings, according to an EasyPark survey in 500 cities.

August 2017:
The NSW Government's Smart Innovation Centre begins an autonomous shuttle bus trial in an off-road environment next to Sydney Olympic Park.

Buildings

Within a decade after the global financial crisis, Sydney showed its resilience with a resurgence in the design and construction of new buildings. By 2018, an unprecedented level of new building projects valued at AU$4.8bn were in progress in the CBD alone, with an additional AU$3.8bn of approved projects scheduled.

Changes to the iconic skyline

Bob Ell, a Sydney developer, said in the Australian Financial Review that "the new projects are long overdue. [...] The city of Sydney looks like an old city – there aren't many buildings that would meet world standards". According to The Urban Developer, "Sydney is set to add a spate of new development projects to its iconic skyline over the coming years".

However, Sydney's construction industry – like many others in the world – was forced to pause during the Covid-19 emergency. The city demonstrated its resilience again in May 2020 when "more than AU$1bn of projects across the City of Sydney were given the green light" for new skyscraper developments to boost local construction activities and bolster economic recovery. In an article in the Financial Review, Moore said "it's hard to look beyond a crisis while you're in the middle of it, but we must. By keeping the pipeline of development flowing, we are ensuring inner-city construction projects form a part of our economic recovery".

Sydney's tallest tower and creative hub

In September 2020, Moore announced a long-term lease on a new, state-of-the-art creative hub in what will be Sydney's tallest residential tower. Spanning 2,000 square metres over five storeys, the new facilities will include sound-proofed rooms for music rehearsals and editing suites for filmmakers and new media artists. "In addition to the [creative] hub, the 67-storey development will feature 490 residential apartments and ground-floor retail space".

Sydney's smart green apartments programme is an award-winning initiative designed to make buildings more energy- and water-efficient. Lighting upgrades, rooftop solar panels and installation of innovative drives for fans and pumps have helped owners and tenants in more than 170 buildings reduce their energy costs. Through the city's sustainability plan, apartment dwellers can reduce greenhouse gas emissions, divert waste from landfill and decrease water consumption.

Legion House, located in the heart of Sydney's CBD, is a heritage listed site due to its social and cultural significance. During redevelopment, new technologies were deployed in the building, making it one of the most sustainable designs in the world", according to the people and workplace specialist firm, Comfy, which listed it in its top eight smart buildings in the world. It was certified by the Green Building Council of Australia and its air-conditioning relies on chilled beam technology. Ventilation delivered through this system uses fresh outside air to ensure a high level of indoor air quality.

Buildings

- Sydney's CBD office market was resilient in the first six months of the pandemic, with a vacancy rate less than six per cent (despite an increase in remote workers).
- Australia's smart building market was valued at AU$7.5bn in 2018, with a prediction to reach AU$32bn by 2021.
- 80 per cent of residents in the City of Sydney live in apartments.

"Sydney is set to add a spate of new development programmes to its iconic skyline"

Demographics

In 2019 the population in Sydney's metropolitan reached five million. In a recent decade, the population increased by 18 per cent. An article published during the pandemic in The Sydney Morning Herald, however, claims the city's near-term population growth "is set to plummet with international migration to Australia effectively halted and the birth rate likely to dip due to heightened economic uncertainty".

Almost one-fifth of the population in Sydney is under 18, and 14 per cent are 65 and older. The city is multicultural, with the percentage of foreign-born residents at an estimated 43 per cent, and more than 250 languages are spoken in the Greater Sydney area. With an estimated 2.3 million people employed in Sydney, the major occupational categories (comprising about 75 per cent of total employment) include professionals, management, clerical and administrative, technicians and trades, and community and personal services. The NSW public sector is Australia's largest employer, with a workforce of more than 390,000 people. A 2020 survey of workers commissioned by NBN indicates 67 per cent of respondents expect to work from home more after the coronavirus crisis ends.

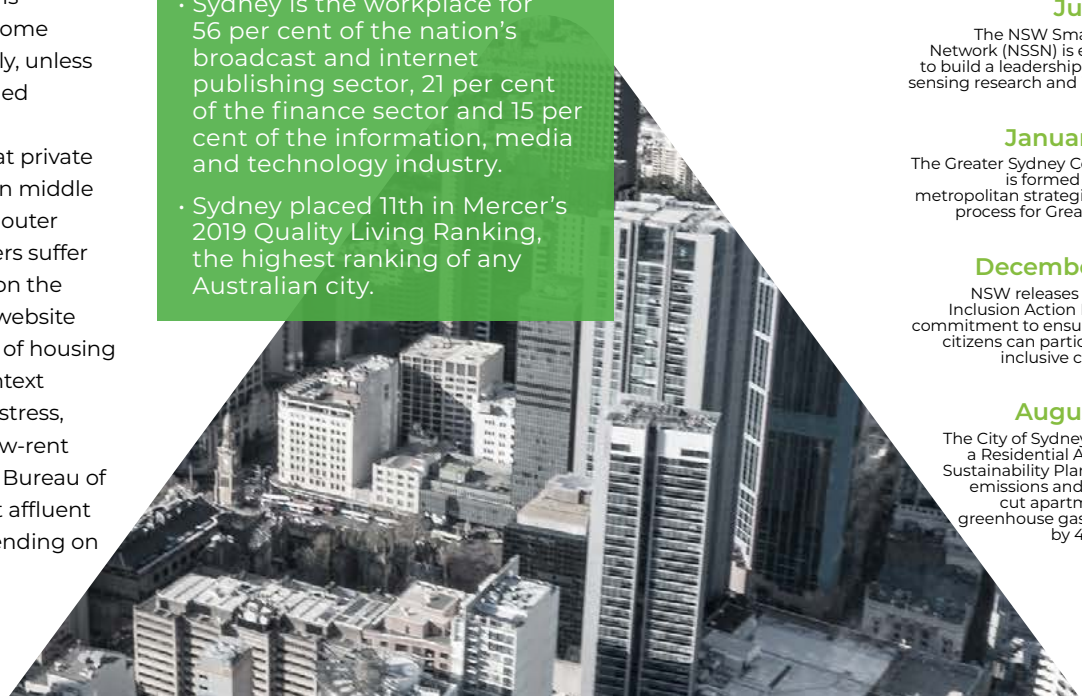
Regrettably, many residents in Sydney suffer from affordable housing challenges. Based on an article in The Sydney Morning Herald, "people on social housing waiting lists today might finally reach the top of the list by 2030. Sydney has a shortfall of 80,800 social housing dwellings and 55,300 affordable rental homes". The number of people still on the waiting list in 2036 is predicted to reach 141,000 for social housing and 75,800 for affordable homes. In the article, Dr Somwrita Sarkar, a University of Sydney researcher, says "we need [housing] options which ensure we're not segregating the city into rich areas and poor areas. A diversity of housing and financing options that encourage more mixing of people are most desirable, because then it's intergenerational".

Planning minister Rob Stokes is concerned that "Sydney will become divided both spatially and socially, unless its need for lower-density attached housing is met".

An academic study reveals that private renting in Sydney is expanding in middle and inner suburbs and low-rent outer suburbs, and many private renters suffer from financial hardship. A blog on the University of New South Wales' website reported that a long-term trend of housing cost-pressures "provides the context for a high incidence of financial stress, particularly among tenants in low-rent areas". Data from the Australian Bureau of Statistics indicates – for the least affluent fifth of households – "typical spending on housing increased from 23 to 29 per cent of income [in the past decade]. In contrast, typical spending on housing by the top fifth was unchanged at 10 per cent." The study highlights that even when financially stressed tenants find a vacancy in a low-rent area, the likelihood of hardship is still high. The Metropolis of Three Cities plan identifies how the implementation of housing strategies must ensure diversity in affordable rental housing.

Demographics

- In 2019, Sydney was ranked as the 5th safest city in the world.
- Sydney is the workplace for 56 per cent of the nation's broadcast and internet publishing sector, 21 per cent of the finance sector and 15 per cent of the information, media and technology industry.
- Sydney placed 11th in Mercer's 2019 Quality Living Ranking, the highest ranking of any Australian city.



June 2017:
The City of Sydney publishes Sustainable Sydney 2030, a strategic plan for a more liveable, prosperous and sustainable city.

April 2017:
The Sydney Business Chamber, in collaboration with Deloitte and the University of Technology Sydney (UTS), announce the release of ImagineSydney: Create – a report on Sydney's innovation hotspots and how to activate them.

March 2017:
The Sydney School of Entrepreneurship (SSE) opens its doors – offering experiential learning and skills development for student entrepreneurs, intrapreneurs and start-up founders.

February 2017:
An urban living lab opens at the Sydney Science Lab.

September 2016:
Clover Moore is re-elected to a fourth term as lord mayor of Sydney.

July 2016:
The NSW Smart Sensing Network (NSSN) is established to build a leadership position in sensing research and innovation.

January 2016:
The Greater Sydney Commission is formed to lead the metropolitan strategic planning process for Greater Sydney.

December 2015:
NSW releases a Disability Inclusion Action Plan with a commitment to ensure disabled citizens can participate in an inclusive community.

August 2015:
The City of Sydney publishes a Residential Apartments Sustainability Plan to reduce emissions and waste and cut apartment sector greenhouse gas emissions by 40 per cent.

Skills & ecosystem

Skills & Ecosystem

- Sydney is home to more than 25 per cent of Australia's start-up firms.
- The city is recognised as a leading centre of knowledge and innovation, with a rating of 15th in the 2019 2thinknow Innovation Cities™ Index.
- Sydney is rated first in the Asia Pacific and third globally for top 100 ranked universities.

With a skilled workforce, universities, partnerships and entrepreneur ecosystem, Sydney is positioned for further progress and evolution as one of the world's leading smart cities. Public universities in the city include the University of Sydney, University of New South Wales, University of Technology Sydney, Macquarie University and Western Sydney University. Five more universities have secondary campuses in Sydney for domestic and international students.

The University of Sydney is a leader in researching urbanism, policies and urban solutions to improve cities. The university conducts multidisciplinary research through the Urban Housing Lab, comprising a mix of urban planners, geographers, economists, architects and computer scientists. The lab focuses on housing issues and the use of digital technologies in smart city transformation.

The Sydney School of Entrepreneurship (SSE) – a leading entrepreneur school in Australia – "offers experiential learning activities to develop the skills and mindsets of student entrepreneurs, start-up founders, intrapreneurs and anyone with a passion for innovation". SSE connects students with academic and industry leaders, policy-makers and mentors. Topaz Conway, director, Cicada Innovations and StartupAus, says that Sydney's tech ecosystem will enable responsible management of a growing population and economic strength and stability into the future".

With industry and university partners, Sydney plans to develop a world-class innovation and technology precinct – intended as the "home of the biggest technology hub of its kind in Australia". The NSW Government predicts this initiative will create 10,000 new jobs by 2036. NSW Premier Gladys Berijiklian, said "technology and innovation are key planks" of the government's strategy to attract investment and create the jobs of the future." According to Berijiklian, the new technology precinct "will cement Sydney as the technology capital of Australia".

At the Sydney Science Park, an urban living lab was launched by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in collaboration with park developer Celestino. The lab will serve as an urban environment where planners perform smart city research. In a government inquiry on smart city development, Guy Barnett, principal research consultant at CSIRO, said that urban living labs empower researchers "to try new and different things you can't do at a household scale and which might be too big to try and do at the metropolitan scale". In the new Sydney lab, researchers from academia, industry, government and local communities can investigate sustainable urban greening, energy efficiency and community wellbeing.

> "The precinct will cement Sydney as the technology capital of Australia"

The Western Sydney Planning Partnership is conducting infrastructure and precinct planning for the Western Sydney Aerotropolis, intended as a thriving business centre near the new Western Sydney International Airport. Serving as a high-skill jobs hub across aerospace and defence, manufacturing, healthcare, freight and logistics, agribusiness, education and research sectors, Aerotropolis is expected to add an estimated 200,000 new jobs.

Bounce Lab – formed by the Smart Cities Council – is a think-tank designed to re-imagine a data-driven recovery for smart cities. The Digital Benefits Districts Playbook is a Bounce Lab project with the goal of enhancing digital-enablement and helping neighbourhood centres, main streets and urban precincts create a framework for sustainability. Bounce Lab founders believe Digital Benefit Districts will support economic revitalisation through six core strategies addressing connectivity, insights, data and digital literacy, resilience, impact reporting and governance.

Conclusion

Like other cities in Australia and throughout the world, Sydney faces challenges in regaining smart city momentum in a post-pandemic era. With a history of responding to crises emerging from global conflict, economic disruption, climate change and a health emergency, Sydney has repeatedly shown it is a resilient city. Now it is applying its strengths as a smart and innovative city to set the stage for future growth and improvements.

Recovery, discovery, and resilience personify Sydney. In the light of its ambitious plans, government initiatives and civic energy, the city is poised for pandemic recovery and urban rebalancing. Across a spectrum of investments in research and innovation, citizen engagement and technology trials, Sydney is discovering new opportunities – some of them a consequence of the pandemic. After analysis of the Covid-19 impact and consultation with state agencies, local councils and private sector stakeholders, Sydney identified critical areas of city-shaping essential to resilience and recovery, including digital technology and infrastructure, recalibration of jobs, community wellbeing, remote work solutions, and investment in transport and public spaces.

How will Sydney's smart city story unfold? Perhaps the city's recent history provides a clue. The Australian government believes Sydney's leaders responded to the pandemic with the most sustainable model in the country – making their strategy the gold standard in smart coronavirus management and suppression. As a centre of commerce and innovation – with the country's leading knowledge-based economy, world-renowned universities, a thriving start-up environment and visionary leadership – Sydney has the ingredients to accomplish a post-pandemic recovery and establish the city as a gold standard in smart planning, partnering and rebalancing.

Case studies

Sponsored by AVEVA

How digital resiliency is enabling smart cities of the future

Asia-Pacific is home to some of the smartest cities in the world. These three real-world examples show how AVEVA's technology is helping cities in the region to digitally transform

AVEVA is helping Sydney (left) realise its digital vision for water; its technology is also used to enable predictive maintenance for the Seoul Metro (above) and as the infrastructural backbone of Nava Raipur (below), India's greenfield smart city

Rapid urbanisation, global lockdowns and the shift to digital-first lifestyles are challenging urban planners worldwide. Technology helped keep civic amenities running during the disruptions of 2020, but beyond resiliency smart city infrastructure has a huge role to play in shaping the cities, and communities of the future.

In the competition for liveability, sustainability and operational agility, Asia-Pacific's smart cities lead the pack. From Singapore to Shanghai, digital innovation is enabling more efficient and sustainable amenities than ever before. AVEVA's world-leading software is helping cities from Sydney in Australia, to Seoul in South Korea and Nava Raipur in India to respond to their populations' changing needs. Be it cloud-based apps that update citizens on amenity availability or predictive-monitoring of Seoul's subway, or Sydney's SCADA-enabled desalination plant, software is making smart cites a daily reality.

Sydney – a smart city of the future

One of the largest projects of its kind in the world, Sydney's desalination plant produces 250 million litres of water per day, helping to combat the city's reliance on rainfall and secure a sustainable source of drinking water for its residents. As well as the infrastructure challenges of designing and building such a comprehensive processing plant, underwater tunnels, outlet diffusers, an electrical substation and high voltage distribution – to move, store and treat the water – the team wanted to innovate. They wanted to automate the day-to-day plant functions and sought a solution that would integrate all energy management systems to realise

efficiencies across the entire operation.

The vision was for a highly digital approach and interoperability of the plant's 8,500 devices. An integrated SCADA solution provides operators with a user-friendly interface so they can manage and optimise plant operations, production and water flows. Real-time overall equipment effectiveness (OEE) data on uptime, downtime and usage are tracked and analysed, so the team can drive efficiencies across the supply chain.

One hundred per cent of the plant's energy footprint is offset by wind power, ensuring compliance with stringent regulations and equating to considerable energy savings of around 1500 MWh per month. With expertise in the renewable energy sector, AVEVA's Plant SCADA solution provides 24/7 real-time monitoring of the 67 turbine windfarm, optimising efficiencies in line with variances in demand, with the scalability to ensure the project will continue to be a model in renewable excellence well into the future. Other innovative techniques used to increase operational efficiency and sustainability included the use of bio-degradable vegetable oils and improved air cooling.

Nava Raipur, India's sustainable, smart, state capital

Nava Raipur in central India is the country's first metropolitan greenfield smart city. It's also a beacon for smart city planning, development, and operation worldwide and a jewel in Prime Minister Narendra Modi's smart cities vision.

> "With the acceleration of digital-first amenities, Asia Pacific's smart cities are leading the way"

Nava Raipur was planned from the ground up to deliver quality of life through safety, efficiency, sustainability, and liveability. Adopting world-class land-use planning principles, the city has established a dedicated zoning system for residential, commercial, and industrial sectors, with recreational space accounting for nearly 30 per cent of the geography. The city was designed to be a model for smart growth and resilience to accommodate a population of 600,000 citizens by 2031.

To form the city's infrastructural backbone, AVEVA experts connected the city's eight primary operational systems into an integrated command-and-control centre (ICCC) powered by AVEVA Unified Operation Centre. This platform acts as a hub for real-time system information, situational awareness, and response, including water, power, streetlighting, public transportation, traffic management, CCTV, contact centres, and e-governance. The combined smart city solution enhances sustainability and operational efficiency, delivering civic services to citizens, communities, businesses, and other stakeholders.

"Using the ICCC, we now have real-time insight into all critical infrastructure systems across the city. This enables us to match supply and demand with greater accuracy, and respond to emergencies as they arise, cutting response times by 60 per cent on average. During the recent lockdowns, the ICCC, combined with the smart city portal and app, made it easier for municipal authorities to communicate with the general population and respond to the needs of affected citizens, supporting the containment process," said Salil Srivastava, engineer-in-chief and municipal manager, Nava Raipur.

Through a digital approach, Nava Raipur is delivering value to its citizens as well as the municipal authorities with agile, resilient and sustainable civic services. It is considered a beacon for India's smart city programme.

Predictive maintenance keeps Seoul moving

Seoul has the world's longest metro system and the second highest passenger volume, transporting 7.3 million passengers every day. The high-tech system features ubiquitous connectivity, driverless trains and customer service robots. It's widely seen as the safest and most efficient metro in the world, founded on the Seoul Metropolitan Government's 2017 commitment that safety would overtake punctuality as the system's key metric.

Seoul Metro is moving from time-based maintenance, where assets are upgraded according to a fixed schedule, to a predictive system which prevents problems before they happen. Fixing issues as soon as they occur is essential for maximising uptime and preventing small problems becoming big ones. Four of the nine lines are now benefiting from a Smart Automatic Mechanical Big Data Analysis system (SAMBA). This system uses AVEVA solutions to integrate, analyse and visualise data from existing systems and drive efficiencies.

As a result, mean time to repair (MTTR) has reduced – on one line, pilot tests revealed a reduction of more than a third 34 per cent. The team also conducts fewer manual inspections, which contributes to a safer, more efficient service for passengers. The remaining five lines will benefit from lessons learned during the first four deployments and deliver a 30-40 per cent reduction in engineering costs.

AVEVA: a trusted partner for smart cities

Working in partnership with AVEVA, Asia-Pacific's cities are making smart sustainable living a reality, with leading-edge infrastructure and processes that respond faster, optimise efficiencies and streamline resource management, while improving costs and services for citizens. With the acceleration of digital-first amenities in 2020, Asia-Pacific's smart cities are leading the way for the rest of the world to follow.