



**Infrastructure
Australia**

Infrastructure beyond COVID-19

A national study on the impacts of the pandemic on Australia

An Interim Report for the 2021 Australian Infrastructure Plan

December 2020

Produced in collaboration with



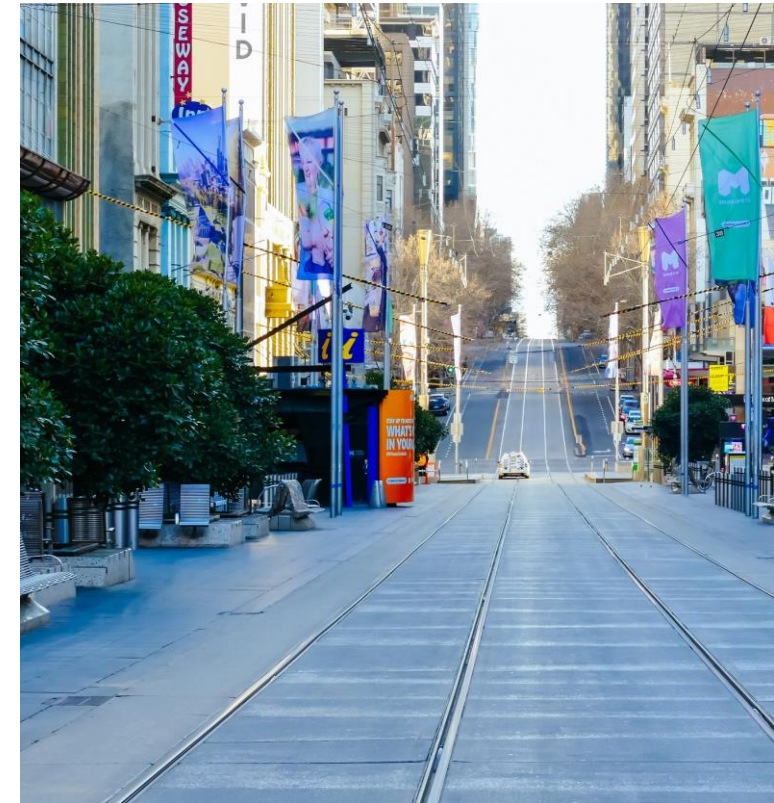
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Executive Summary

The COVID-19 pandemic revealed the resilience and adaptability of Australia's infrastructure

- The silver lining of the COVID-19 pandemic is that to date Australia has handled the pandemic well, supported by critical infrastructure services and networks that were able to reconfigure quickly and deliver differently, and showed a resilience beyond many other OECD nations.
- As the COVID-19 pandemic spread, Australian governments took early action, introducing travel bans, lockdowns, and border controls and supporting domestic supply chains. Communities adopted social distancing and moved to working from home. While these early measures successfully contained national case numbers, they prompted profound changes to the way people moved, consumed, and worked, changing patterns of infrastructure use.
- Adapting domestic supply chains was a core element of our resilience and will be critical for underpinning productivity and supporting the long term move to a circular economy.
- This report identifies the impacts of migration changes and the consequences for skills and infrastructure demand. It reviews a wide range of infrastructure trends, their geographic distribution, and their likelihood of returning to historical trend after the pandemic. It is an interim report for the 2021 Australian Infrastructure Plan, and complements the 2019 Audit.
- The report provides an imperfect view; available data is not always up to date, so may not give a complete picture of what is an evolving story.
- Anticipating the future during a period of uncertainty is fraught with difficulty, and many predictions made in past crises have not eventuated. Nonetheless, many of the trends show a redistribution of existing demand, a mode or channel switch, or an acceleration of an existing longer term shift.



Trends emerged across the community that have shaped the infrastructure sector



Digitisation

100% growth

Monthly online retail growth was 5-6 times the annual growth in 2019

9 in 10 Australian firms

Adopted new technology including collaboration tools and cyber security

A rapid shift from physical to virtual interaction, with increased convenience for users and providers



Decentralisation

163,459 new PV solar panels

under the small-scale renewable energy scheme in first half 2020

200% increase

in net migration from capital cities to regional areas

A redistribution of demand for utilities, and increased vibrancy in regional centres



Localism

Growth in suburban last mile trips

With loading zone use falling to less than half in the Sydney CBD

23% increase

in utilization of national parks and green spaces nationally

Better use of local infrastructure, and local and regional vibrancy were evident, with more local trips and travel remaining in regional and local areas of WA, SA and TAS



Service innovation

Public transport improvements

such as increased cleaning, social distancing initiatives and real time occupancy data

17.2m telehealth consults

(Mar–Jun) comprising 35% of all Medicare Benefits Schedule services

Providers responded by moving teaching curricula and students online, telehealth consultations grew, and transport services introduced new protective measures



Adaptability

40% extra broadband capacity

NBN released latent capacity to service providers to address network congestion

4600 new ICU beds

Health infrastructure repurposed to create 291% increased capacity

A responsive repurposing of infrastructure and assets, and quickly scaling up latent capacity



Opportunities

There are unique opportunities that arise from the COVID-19 pandemic that Australian Governments should consider in policy, planning and investment

The following opportunities are directly driven by the COVID-19 pandemic, and by service provider and customer responses to the pandemic, and are new priorities that are additional to those identified by the Infrastructure Australia Audit in 2019.

A HEADSTART ON RECOVERY



Low national case numbers give Australia a head-start on the 'return to new normal'. For instance, on attracting global share of international students, reskilling unemployed, reopening industries and safely delivering stimulus projects

FLEXIBILITY AND RESILIENCE



COVID-19-related responses demonstrate how infrastructure can be better used, not what new infrastructure could be built. Bus service schedules changed, stations were cleaned more; broadband capacity was released to providers, and ICU capacity was repurposed in hospitals. Capital need not solve everything – customers, providers, employees, and staff flexed to deliver much of the change themselves

REGIONAL RENAISSANCE



Some regions are seeing a local boom of regional tourism and population growth, and are experiencing less severe COVID-19 impacts. Strengthened regional cities, hub-and-spoke service models, and improvements to liveability and affordability can refocus regional investment

LOCAL COLLABORATION



Greater flexibility across health, education, energy and water was driven by local collaboration that improved capacity and business continuity. Regional water utilities for example were able to train staff in adjacent regions to safeguard critical service delivery; while permissions were given to freight operators to ensure critical deliveries could be made throughout the day.

DIGITAL SERVICE MODELS



2020 saw a shift from physical to virtual services at a rate that was previously considered impossible, with students accessing online learning, city and remote patients accessing mental health care through telehealth, and online shopping growth in remote areas matching cities. Capitalising on this change could transform the delivery of services in new and novel ways, and improve efficiency.

ENVIRONMENTAL SUSTAINABILITY



Emissions were reduced in 2020, people visited and valued national parks and other 'green and blue spaces' more regularly, and more people adapted their homes to small-scale solar energy generation and storage. Policy reforms and programs supporting access and uptake could drive even greater sustainability



Challenges

COVID-19 related challenges will need to be addressed as a priority, using innovative solutions

The following challenges are made more critical now as a result of the COVID-19 pandemic, and should be addressed in the 2021 Australian Infrastructure Plan.

MITIGATING GROWING CAR DEPENDENCY



Private motor vehicle use was the first mode to rebound to pre-COVID-19 levels, with more people driving to work and a significant number of households purchasing a second-hand car. To avoid congestion problems, safe and/or trusted alternatives to driving need to be provided and encouraged

IMPROVED SORTING AND PROCESSING FOR WASTE



With the waste export ban coming into effect in 2021, circular economy reforms that were urgent before COVID-19 are now critically so. Efforts to improve waste economics by reforming collection and sorting, to reduce municipal waste contamination and to promote new technology investment are needed

SUPPORTING FINANCIAL SUSTAINABILITY



Some critical infrastructure services have struggled through COVID-19 – as distancing requirements reduced their operating capacity, and as working from home reduced their revenue. A legacy of COVID-19 may be fresh challenges to the longer term financial sustainability of critical services.

ADDRESSING AREAS OF INVESTMENT UNCERTAINTY



Uncertainty about the timing and shape of economic and health recovery risks deferral and indecision on critical infrastructure projects. Difficulty with strategic planning and decision making will risk future unmet needs, if service and infrastructure capacity is not available when it is required. Ongoing trade tensions and uncertainty over border openings amplify this uncertainty for certain sectors

MANAGING SEVERE CBD IMPACTS



While office occupancy and commuter movements are returning towards pre-COVID-19 levels, an outflow of tenants and activity and reduced tourism could lead to a sluggish rebound for Australia's CBDs, particularly in relation to commercial and retail property. Efforts to re-purpose real estate and revitalise CBDs may be required.

REAL-TIME DATA AND INSIGHTS



In general, private sector data has been more current, granular and insightful in revealing the real-time impacts of COVID-19 and the distribution of those impacts across the country. By comparison, public and national datasets are often being released months or years after their reporting timeframe. The need for better data for public decision makers to manage crises is a major priority.

Across sectors, infrastructure providers navigated dramatic changes to user behaviour and network requirements, and rapidly adjusted their services



Transport: *Less Travel with Mode Shift to Roads*

- Public transport in most cities fell to 10-30% of normal levels in the initial lockdown but settled at a 'new norm' of ~60-70% in the second half of the year. This reflected people *partially* returning to work, and working and travelling more flexibly across the day
- Overall road traffic levels were quick to rebound, but with less CBD focused congestion. An uplift in second-hand car purchases could indicate that higher car mode share may persist for some time
- Decentralisation away from CBDs and more online shopping/food orders boosted demand for last mile deliveries. Localisation has seen more people walking and cycling
- While air freight has been impacted due to a lack of capacity, container freight has remained steady and increased in 2020
- Passenger aviation has been badly impacted with border openings and effective vaccines both critical for recovery



Social: *Fast pivots triggering new service models*

- The health system rapidly repurposed intensive care unit (ICU) capacity and equipment, however workforce capacity was harder to secure, and deferrals increased as patients avoided care e.g. mammograms dropped 98%
- Medicare funding for telehealth drove widespread adoption, growing from 0.04% to 35% of all Medicare Benefit Schedule (MBS) services
- Across schools, universities and vocational education, the transition to online was made quickly, with new service models and staff training a significant ongoing priority
- Demand for social housing has not yet materially increased but more up to date data is required
- Higher education is addressing two major disruptions: a sharp decline in international students, and a rapid pivot to online learning



Telecommunications: *The rush to decentralise*

- The pandemic catalysed rapid adoption of digital collaboration tools – accelerating existing trends – and triggered investment in Cloud-based systems and cyber security
- Firms embedded new operating models and 'ways of working' through COVID-19, some of which are likely to be sustained beyond the pandemic, supporting more flexible working in future
- NBN network congestion grew to an average 60 minutes per week per service in March 2020 with increased levels of customer complaint. Interestingly, NBN responded by releasing latent network capacity
- Higher internet usage was evident both during work hours and in the early evenings as more people stayed home

COVID-19 exacerbated some longer term policy challenges, and may be the catalyst for needed reform



Energy: Greater decentralization

- Overall demand for electricity and gas remained level, with differences in the distribution of demand between households and business
- In Victoria, lower commercial demand was offset by higher residential demand due to the prolonged lockdown, with flexible working driving a softening in the early evening peak. QLD and NSW data shows that consumption largely recovered once lockdown measures were removed
- COVID-19 added to longstanding uncertainty in energy, and saw delays to investment in large scale renewable generation and some delayed maintenance works
- The trend towards distributed and on-site generation strengthened, with strong demand for small-scale solar installation in 2020 supporting a 7% midday reduction in average National Electricity Market (NEM) operational demand



Water: Making the quiet recovery from drought

- Water infrastructure responds largely to long term population growth and rainfall. Population shifts during the pandemic have been relatively minimal in impact
- Water consumption has seen little impact from COVID-19, with infrastructure capacity already in place to accommodate significant peaks
- Regional water utilities managed minor delays to their capex program and initiated new collaboration and digital tools to support business continuity
- 81% of utilities surveyed have seen a rise in hardship calls from households and businesses, which may undermine revenue sustainability in future
- Planned drought response projects are well-timed to support stimulus investment post-COVID-19



Waste: Shifts put households at the centre of the circular economy

- COVID-19 has reversed a long-term trend, increasing household waste by 20% during 2020
- High levels of food delivery and online shopping have generated sizeable increases in paper and plastic packaging waste and single use waste e.g. refrigerator grade cardboard
- The shift in volumes from commercial to municipal waste has placed additional pressure on the sector adapting to Chinese import bans, and may bring forward the horizon for policy reform
- Suppressed commodity prices (reducing the value of recycled materials) and contamination from household waste have made recycling facility economics more marginal, risking the achievement of national targets

This review found that a number of behaviour changes linked to infrastructure outcomes could become 'hard-wired' persisting beyond the pandemic

- Several first-order behaviour changes are directly and indirectly driving many of the trends analysed in this report:
 - Long distance and international travel restrictions have impacted business-related travel, access to skilled labour, education and tourism "staying at home", which reduces regular weekday mobility in cities and disperses consumption of essential utilities
 - Social distancing reduces the effective capacity of infrastructure spaces and services, and drives avoidance of certain services
 - Health and hygiene requirements are increasing operating costs and contributing to greater generation of waste
- There are strong and somewhat unexpected linkages between behaviour trends and infrastructure impacts, for instance:
 - Growth in online shopping and home food delivery has driven growth in residential waste
 - Greater online collaboration is linked to a reduction in business-related trips on the transport network (local, domestic and international)
- These changes flow into behavioural changes that could 'stick' either partially or permanently. Behavioural psychologists point to the importance of habits and the enduring commitment of personal transition costs. Examples include:
 - Shoppers who purchase online may find they continue to do so where retail shopfronts have closed during the pandemic or converted to 'e-businesses'
 - Businesses that downsized CBD office space or closed their office altogether, will likely embed working from home and flexible working beyond the pandemic
 - Households that bought an additional car or a bike to avoid public transport are likely to use them more once the pandemic is over
 - A person who invests in establishing their home office is more likely to work from home in the future

Work from home, social distancing, infection control and recession are 'curveballs' in critical infrastructure sectors that need long term planning certainty

			Transport				Social infrastructure				Telco	Energy	Water	Waste	Property		Arts/Rec		
			PT	Cars	Freight	Aviation	Health Care	Aged care	Social Housing	Higher Ed.	Other Ed.					Comm.	Resi.	Events	Green Space
Pandemic effects	Border closures		Fewer tourists / students		Inter-national / domestic delays	Less Leisure / Business / VFR	Reduced access to facilities			Fewer intern'l students					Less hotel demand		Less tourists	Less tourism	
	Stay at home	Work from home	Fewer trips / peak spread	More suburban	More suburban					More online	More online	More suburbs / digital collab'n	More suburbs / peak spread	More suburbs / peak spread	More suburbs / more contam'n	Lower office demand	Increased demand for larger homes		Increase in local recreation
		Online shopping		Fewer personal trips	More last mile										More packag'g	Lower retail footfall			
		Eat at home	Fewer personal trips	Fewer personal trips	More last mile								More suburbs	More suburbs	More packag'g	Less restaurant dining			
		Home entertain.	Fewer trips	Fewer trips								More streaming in evenings	More suburbs			Empty venues		Less demand	
		Decentralisation	Longer trips	More trips / mode shift						Move online	Pressure on regional schools	More regional demand	More regional demand	More regional demand	More regional demand				
Health Measures	Social distancing		Less capacity	More trips	More spacing		Lower capacity	Social isolation		Lower capacity	Lower capacity	Increased demand				Lower capacity		Lower capacity	More demand
	Infection control		More Cleaning		More cleaning	More cleaning	More PPE & cleaning	More PPE & cleaning	More PPE & cleaning	More PPE & cleaning	More PPE & cleaning	More online			More PPE	More cleaning		More cleaning	Closures/restrictions on use
Economic Impacts	Unemployment / lower incomes		Fewer trips	Fewer trips		Less travel	More demand (e.g. mental health)		More demand	More demand		More hardship	More hardship / lower C&I demand	More hardship / lower C&I demand	More hardship	Some downsizing	Mortgage / rental stress	Lower demand	More demand

Work from home and infection control were major drivers of change across sectors, with work from home able to be sustained beyond the pandemic

LEK customer research indicates stronger reluctance to return to past behaviours relating to PT and Arts

Legend: ■ Strong impact ■ Moderate impact

Section 1

About this report

This report documents the emerging impacts of COVID-19 on Australian infrastructure and assesses the implications for future reform and investment

Purpose of this Report

- The economic and social disruption of the COVID-19 pandemic is unprecedented and is a moment of unique uncertainty. As of early December, there have been 65m cases globally
- Australian Governments took early action, introducing travel bans, lockdowns, and border controls, while communities adopted social distancing, working from home and other restrictions, resulting in low national case numbers relative to comparable countries
- Yet these successful and profound changes to how people moved, consumed, and worked in 2020 have also radically changed existing patterns of use for transport, water, energy, waste, telecommunications, digital, and social infrastructure
- Major infrastructure decisions are made on the basis of expected future need, often spanning a 20 to 50 year planning horizon and based on where people are expected to live, work and recreate – and how firms will transact their businesses
- This report is the first comprehensive catalogue of the impacts of COVID-19 on Australian infrastructure sectors and explores the legacy these could leave for infrastructure planning and delivery
- Three questions addressed in this review
 1. **What changes has COVID-19 catalysed across infrastructure sectors in Australia?**
 2. **Are these trends and behavioural changes likely to endure and impact on long-term infrastructure requirements?**
 3. **Do these changes support desirable or undesirable outcomes (from an infrastructure perspective), and what strategic priorities could be promoted as a consequence?**
- Importantly, in assessing the future consequences of COVID-19 related trends, this report has considered the differential impact of potential scenarios, in relation to the uncertain duration of the pandemic, and the uncertain nature of economic recovery.

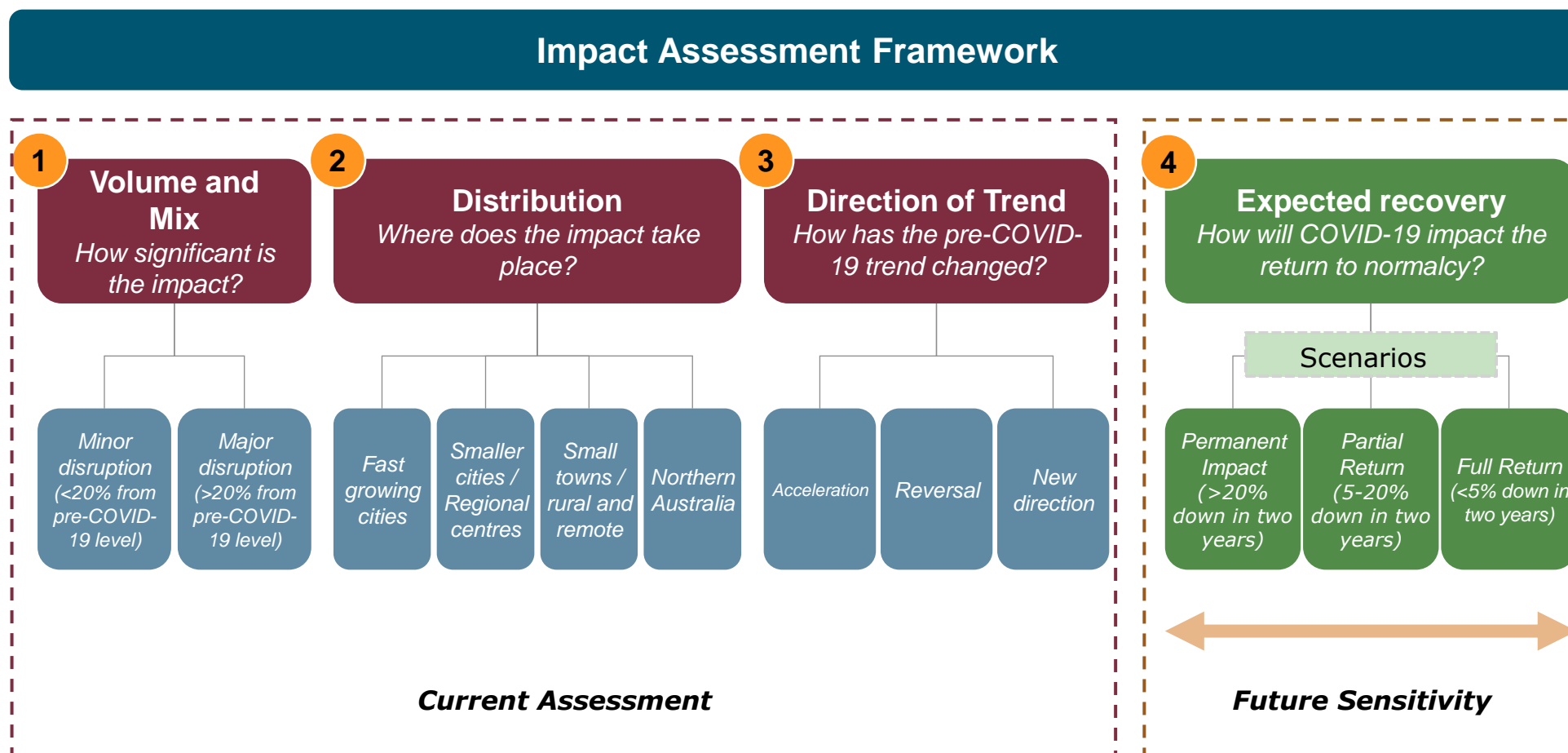
A wide ranging review of public data and targeted consultation was used to identify emerging trends and to inform the assessment of those trends

- Infrastructure Australia worked with L.E.K. Consulting Australia to undertake an independent assessment of the impact of COVID-19 on infrastructure in Australia
- The review was conducted to assist Infrastructure Australia in evaluating the initial, semi-permanent and permanent impacts of COVID-19 across several sectors including Transport, Social Infrastructure, Energy, Digital & Telco, Waste, and Water
- The results from the Infrastructure Australia 'COVID-19 Infrastructure Market Impact Survey' in September and November 2020, across 170 senior industry leaders, were incorporated
- Two time-series surveys were undertaken by L.E.K. Consulting on the impacts of COVID-19, the first of more than 1500 consumers, and the second a survey with hipages of 562 tradespeople
- The report summarises findings from the research and analysis undertaken over 7 weeks from October to early December 2020
- Importantly, in some fields of enquiry, publicly available data was not current or available

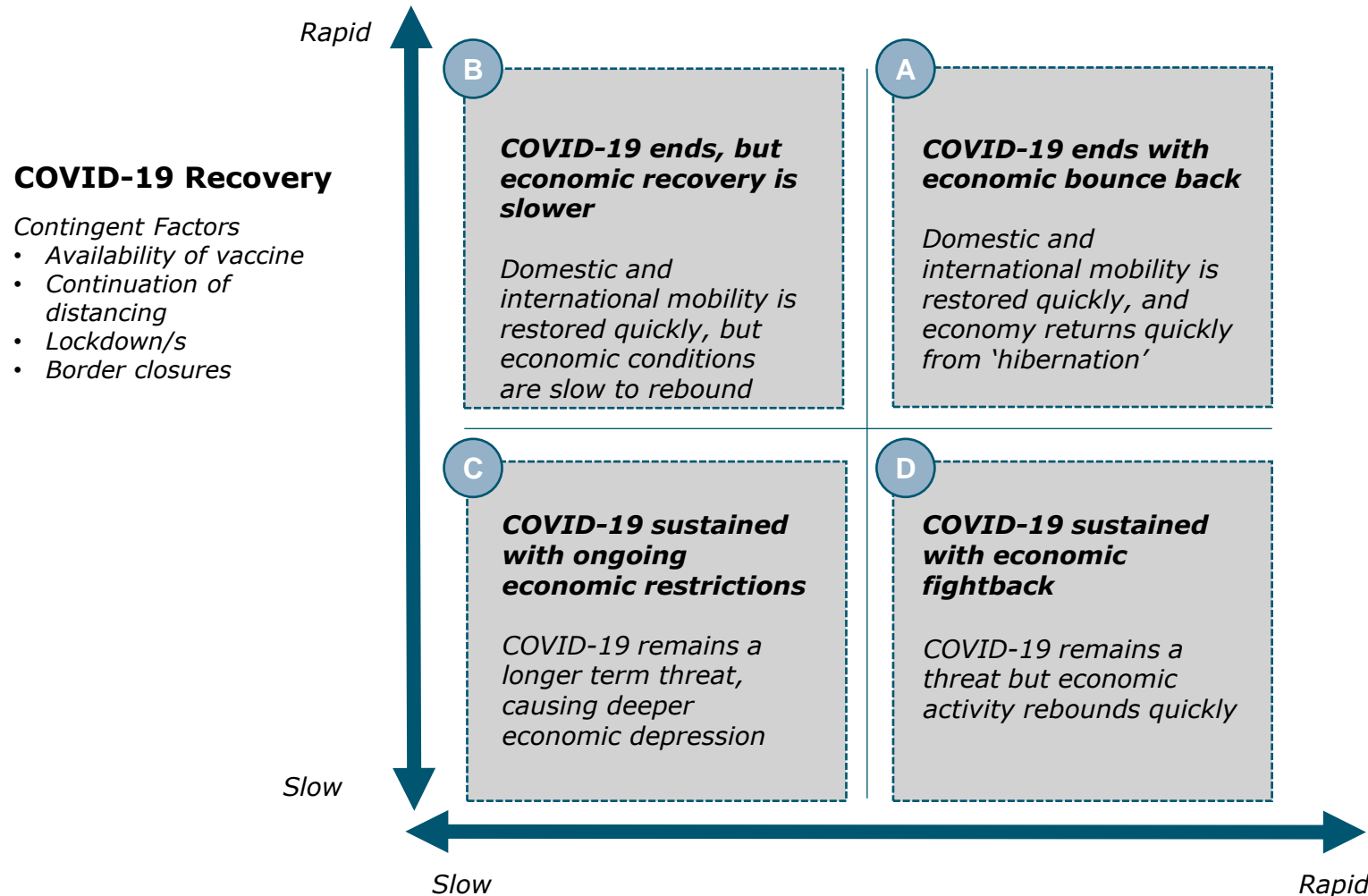
Market data & secondary research

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| <ul style="list-style-type: none"> • 9 News • Air New Zealand • Apple - Mobility Index • Auckland Airport • Auckland Transport • Aurizon • Australia Post • Australia Water Association • Australian Broadcasting Corporation (ABC) • Australian Bureau of Agricultural and Resource Economics (ABARES) • Australian Bureau of Statistics • Australian Competition and Consumer Commission (ACCC) • Australian Energy Council • Australian Energy Market Operator (AEMO) • Australian Energy Regulator • Australian Financial Review • Australian Government Bureau of Infrastructure, Transport and Regional Economics • Australian Government Department of Education • Australian Government Department of Health • Australian Government Department of Home Affairs Australia • Australian Housing and Urban Research Institute • Australian Institute of Health and Welfare • Australian National University • Blue Environment, National Waste Report, 2018 • BridgeU Limited • Bureau of Meteorology • Citymapper • Clean Energy Regulator • Communications Chambers • Consumers' Health Forum of Australia • Google Mobility • Housing Victoria • IBISWorld • IFC • Infrastructure Australia – COVID-19 Infrastructure Market Impact Survey • Infrastructure Magazine • Inside Waste | <ul style="list-style-type: none"> • International Association of Public Transport (UITP) • IT News • L.E.K. Consulting – Australian Consumer Survey • Linfox • Medical Journal of Australia • Medicare Statistics • Mirus Australia • National Broadband Network (NBN) • National Centre for Vocational Education Research • New York Times • NSW Environmental Protection Agency • NSW Ministry of Health • NSW Roads and Maritime Services • Port Botany • Port of Melbourne • Property Council of Australia • Special Broadcasting Service (SBS) • SQM Research • Statista • SunWiz • Sustainability Victoria • Sydney Morning Herald • The Age • The Australian • The Conversation • The Guardian • The Mitchell Institute • The Royal Australian College of General Practitioners (RACGP) • The Telecommunications Industry Ombudsman • Tourism & Events QLD • Tourism Research Australia (TRA) • Transport for NSW (TfNSW) • Transurban • UBER • Universities Australia • University Admissions Centre • Vancouver Sun • Water Services Association of Australia |
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Infrastructure trends were assessed for their size and distribution of impacts, the direction of change against pre-COVID-19 trend, and expected recovery



Future experience driven by two critical 'unknowns' – the duration of pandemic health risks, and the speed and economic recovery



- Two factors will shape the nature of recovery: the duration of the COVID-19 pandemic and the duration and elasticity of economic recovery
- Each of these dimensions represents a number of factors, such as the availability of an effective vaccine, the presence of ongoing lockdowns, and the level of unemployment and effect of stimulus.
 - Each trend identified in this report is considered for its level of sensitivity to each
 - For example, freight is heavily exposed to economic factors, whereas public transport usage is heavily dependent on health risks

Economic Recovery

Contingent Factors

- Unemployment
- Public and Private investment
- Fiscal Stimulus
- Trade

Section 2

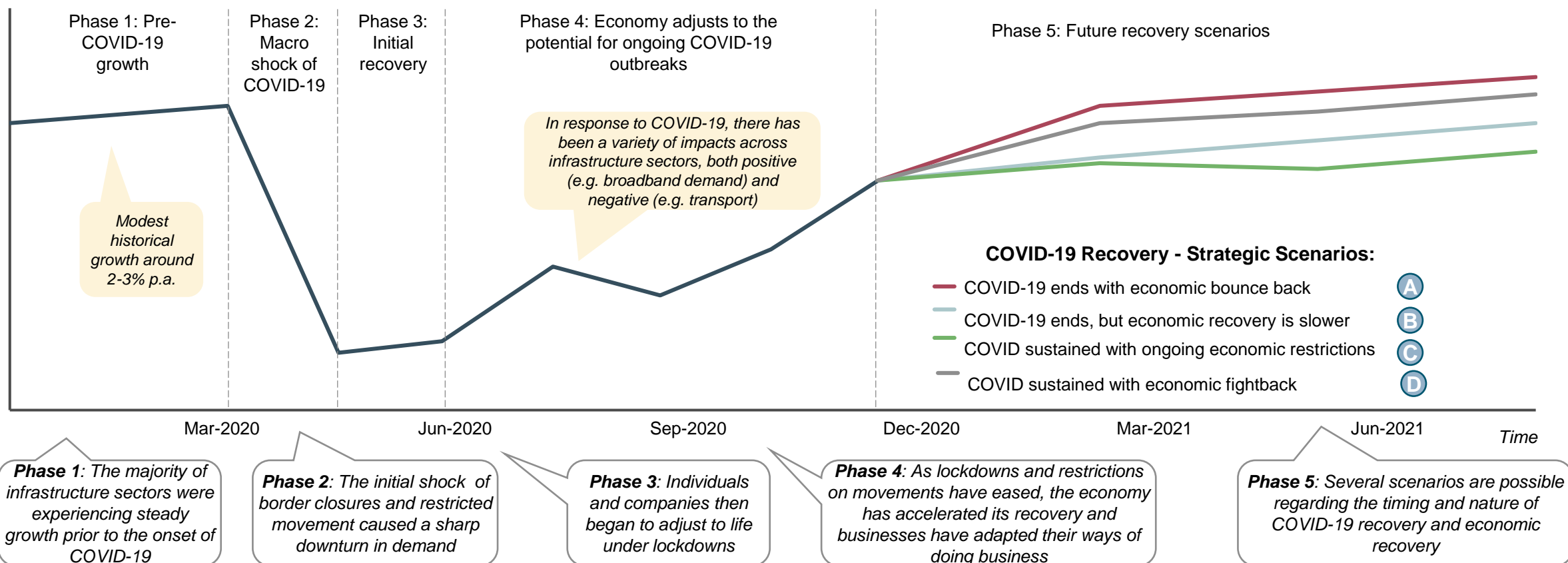
A National Overview

Australia has emerged from the first shocks of the pandemic and adjusted to a 'new normal' – however the nature of future recovery remains unclear

General sector trajectories

Size (volume or revenue)

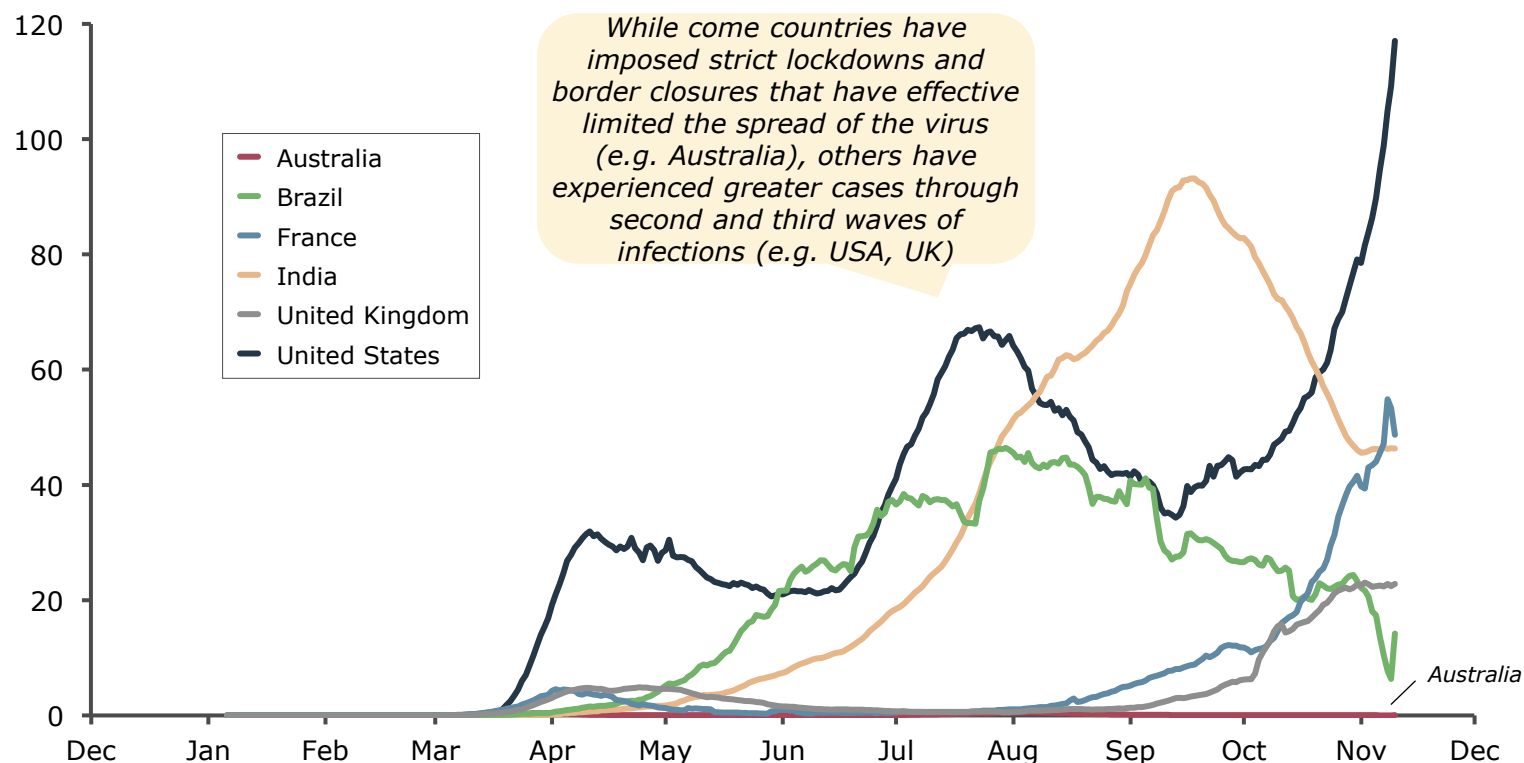
INDICATIVE



As the global pandemic unfolded, different national responses determined materially different health outcomes

Daily cases of COVID-19, by country (selected countries only) (Dec-19 to Oct-20)

Thousands of daily new cases, rolling 7-day average



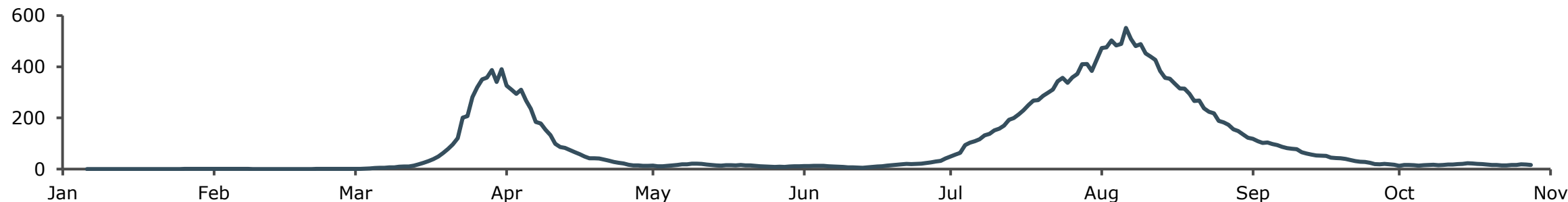
Global Timeline of Events

- In January 2020, the first cases of COVID-19 were reported in Wuhan, China, with the first cases of transmission outside China recorded later that month
- In March, the WHO declared the outbreak a pandemic, as numerous countries introduced travel bans, border closures, and some lockdowns, including Australia
- To date*, around 65m cases of COVID-19 have been recorded globally
- While some countries such as Australia have effectively contained the spread of the virus, others such as the United States and in Europe have experienced pronounced second and third waves
- The USA currently has the highest number of infections at around 100,000 per day and India has recorded the second highest peak of daily infections

As the first wave of infections grew in Australia, protective health and travel measures were introduced by Australian and State Governments in March 2020

Australian timeline of domestic COVID-19 cases (Jan-20 to Oct-20)

Number of new daily cases (7-day rolling average)



Key Australian Milestones

25-Jan

First Australian case detected in a man returned from Wuhan

19-Mar

Full international border closure

30-Mar

JobKeeper wage subsidy announced to keep Australians in jobs and avoid severe downturn

6-Jul

NSW shuts borders to Victoria to contain spread of virus, only due to reopen in late November

25-Oct

Victoria announces lifting of restrictions to allow people to gather outside

1-Feb

Arriving flights from China blocked

24-Mar

Australians to WFH while non-essential businesses ordered to close

8-May

Australian Government establishes three-stage plan to ease Australian lockdowns

8-Jul

Victoria enters second lockdown as the second wave poses large threat

Late-Nov / Early-Dec

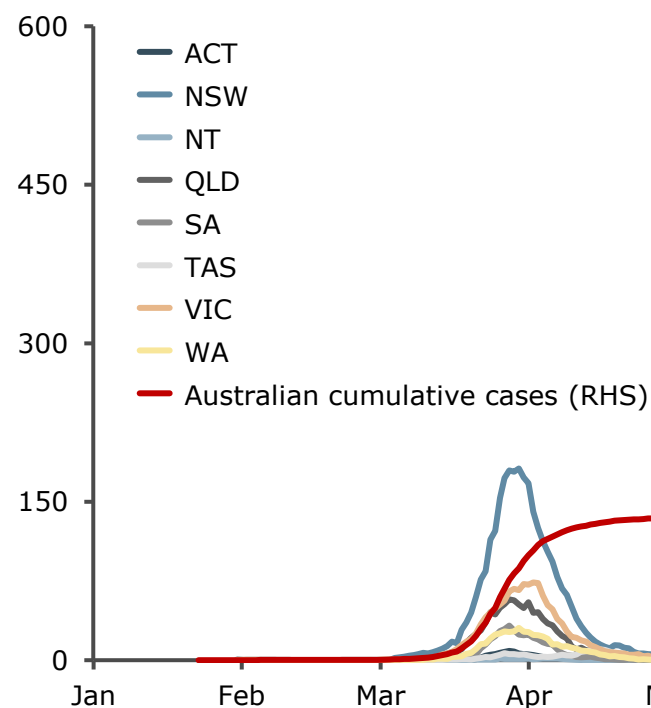
NSW, VIC, QLD, WA domestic border re-openings

While Victoria experienced a second wave, restrictive measures such as border closures have thus far prevented a second national wave of infections

- Australia had a first wave of COVID-19 infections across the country in March and April, totalling around 6,000 cases, with around 50% in NSW
- Since then, state border closures restricted the second wave of infections from the virus to Victoria
- Victoria's second wave totalled around 20,000 cumulative cases before lockdowns were eased and the spread of the virus was contained

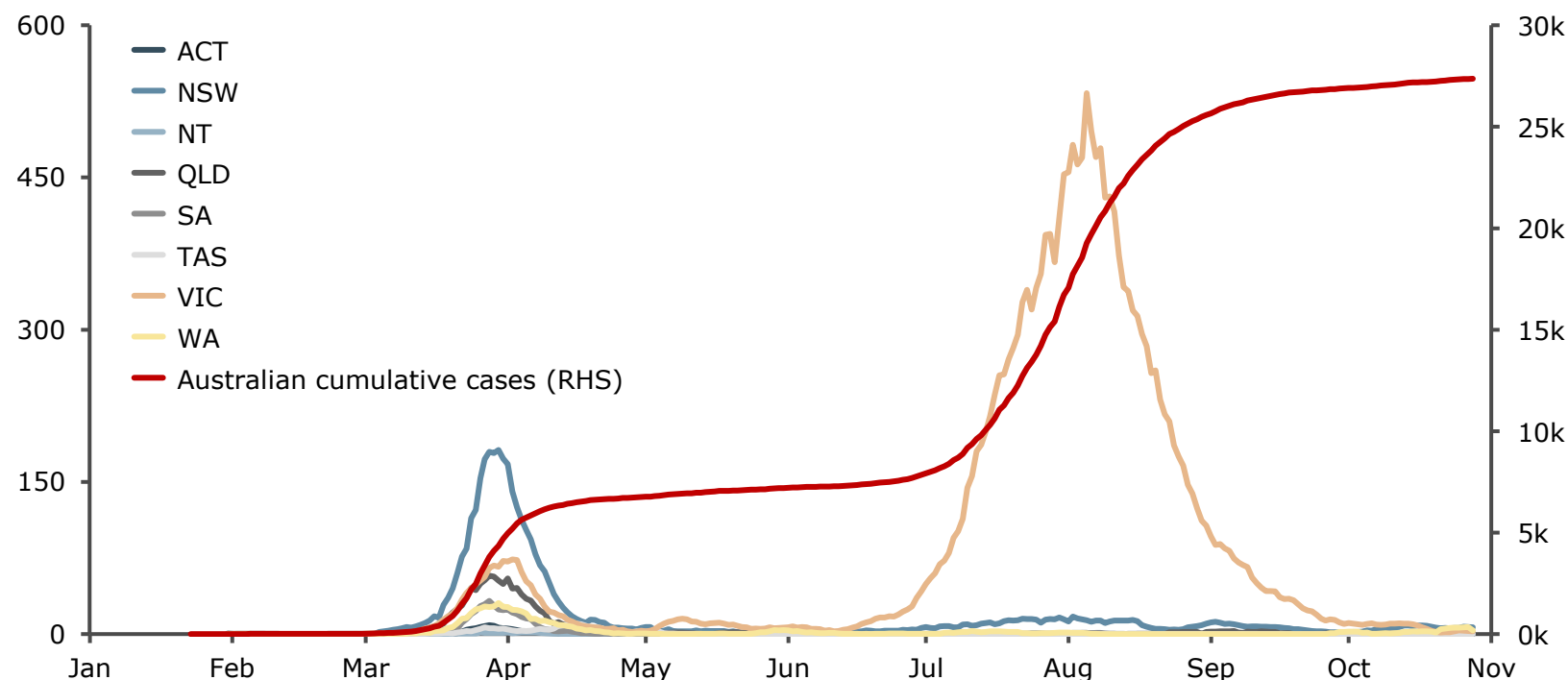
Daily COVID-19 cases, by state (Jan-20 to Oct-20)

Number of new cases (7-day avg.)



Australian cumulative cases

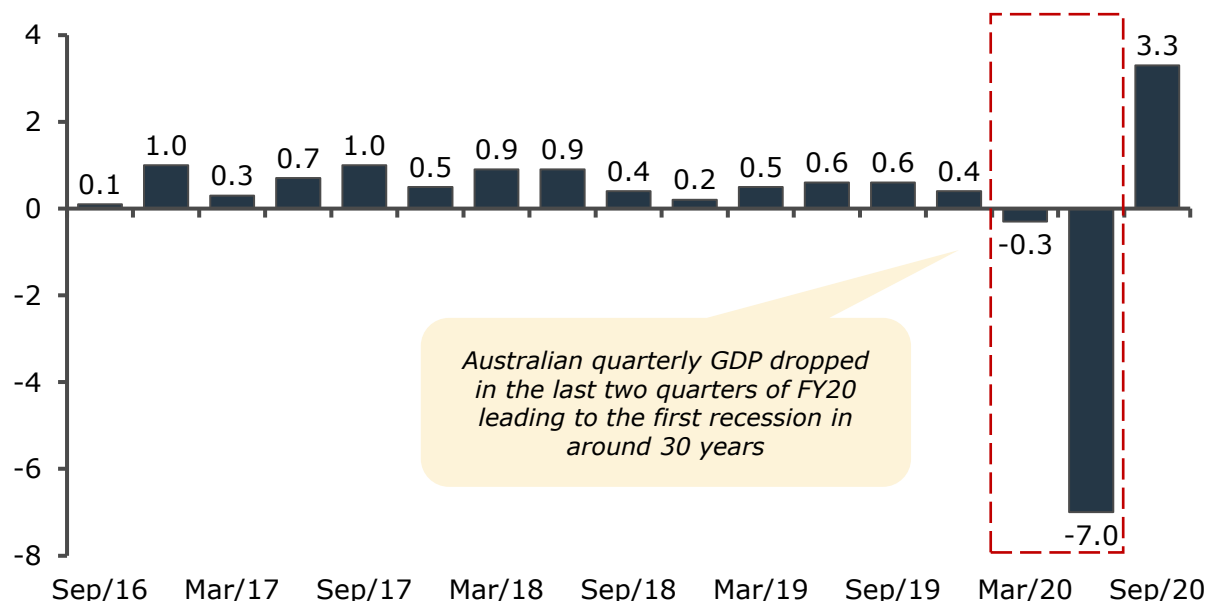
Thousands of total cases



Lockdowns and movement restrictions had severe economic impacts, with Australia entering a recession and forecasting negative growth in FY2021

Australian GDP change from previous quarter (seasonally adjusted) (Sep-16 to Sep-20)

Percent change from previous quarter (seasonally adjusted)



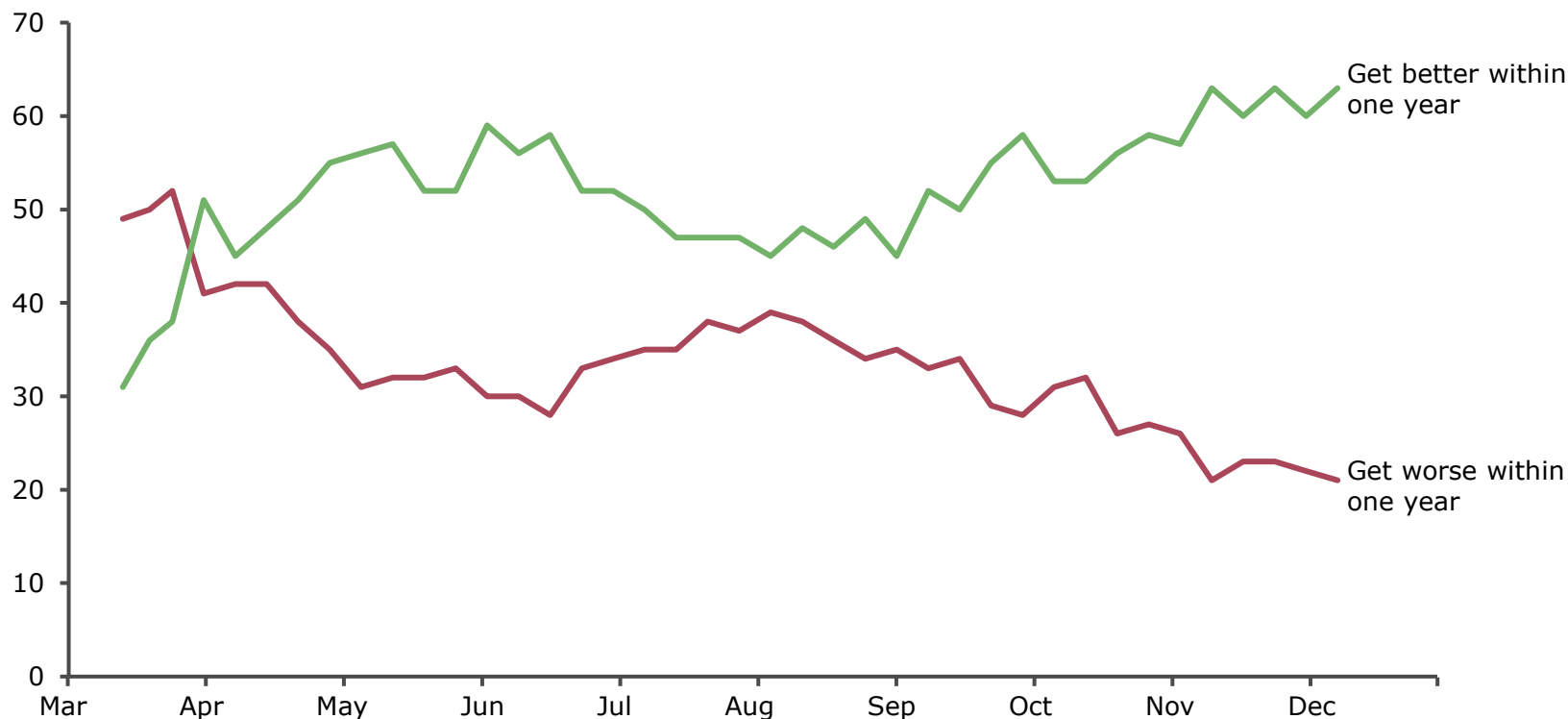
464	465	468	473	475	480	484	485	486	489	492	495	497	496	461	476	Australian GDP*, \$bn
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- In 2020, COVID-19 led to country-wide lockdowns and ultimately negative GDP growth of (0.3)% and (7.0)% in the last two quarters of FY2020
- In addition, lockdowns in major trade partners have led to supply chain and trade disruptions, as well as restrictions on movement that impact Australian tourism, economic migration and international students
- The Australian Government reported that the economy contracted by (0.3)% in FY2020, with the recent Budget forecasting further declines in FY2021 of (1.5)%, before a sharp recovery in FY2022 with 4.8% GDP growth
- While the timing of the recovery remains uncertain, it will likely depend on the timing of an effective vaccine becoming widely available, which the Australian Government** anticipates in late 2021, with the potential for early release to 'high risk' segments of the population in the first half of 2021

Economic concerns have eased and optimism continues to grow

Predictions for the economy (March-December 2020)

Percent of respondents*



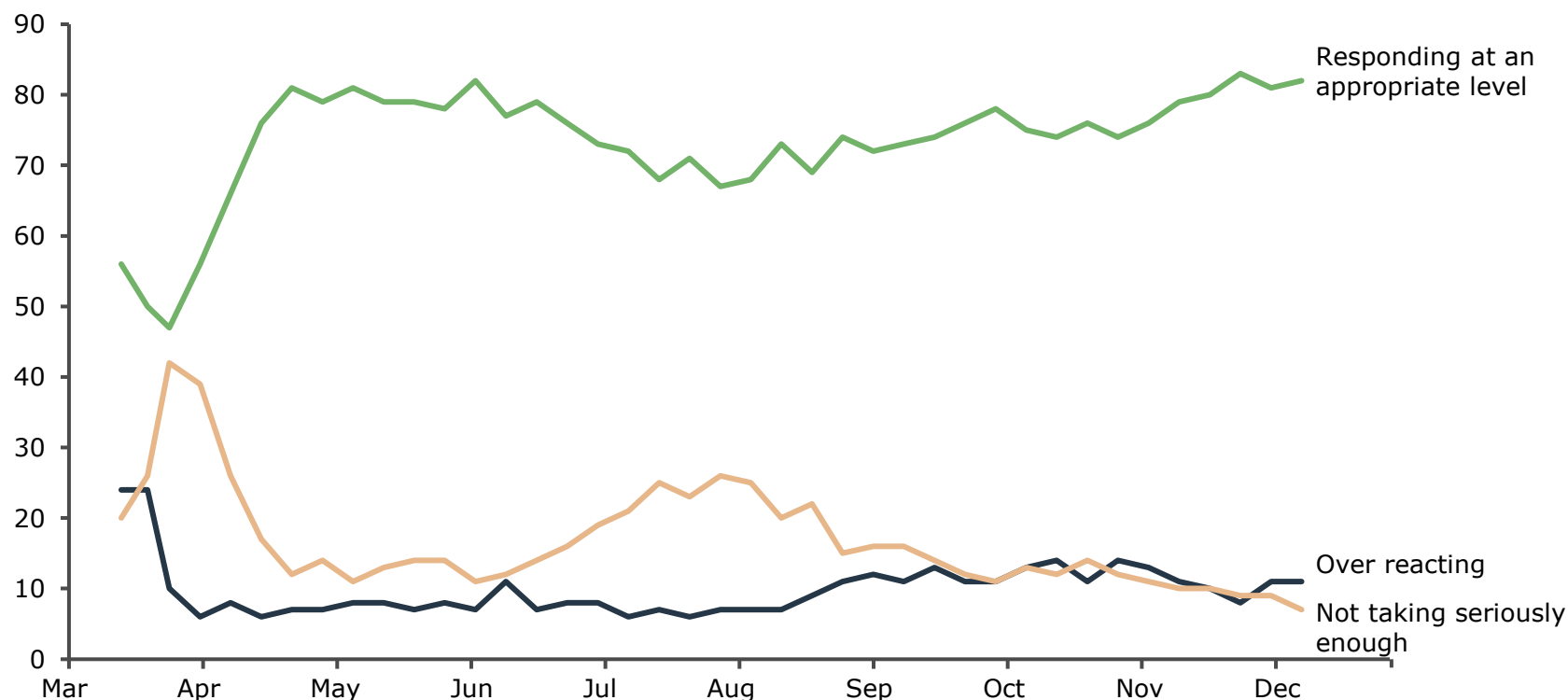
- Consumer sentiment has steadily improved since the lows when border restrictions and lockdowns were introduced in March
- As of December 2020, the majority (63%) expect the economy will get better in a year, compared to 46% three months earlier
- In related findings, recession concerns are easing and only 23% say they are spending less than usual, down from a peak of 55% in April

Most Australians feel that Australia's reaction to COVID-19 has been appropriate

- The overwhelming majority of Australians (82%) agree that Australia's reaction to COVID-19 has been appropriate
 - Compared to 11% who consider it over reacting, and 7% who don't think it's being taken seriously enough
- While COVID-19 remains the number one unprompted issue that Australians remain most concerned about, it has fallen down the list of prompted concerns and now sits below the economy, cost of living, bushfires and quality of aged care

Australia's overall reaction to COVID-19 (March-December 2020)

Percent of respondents*

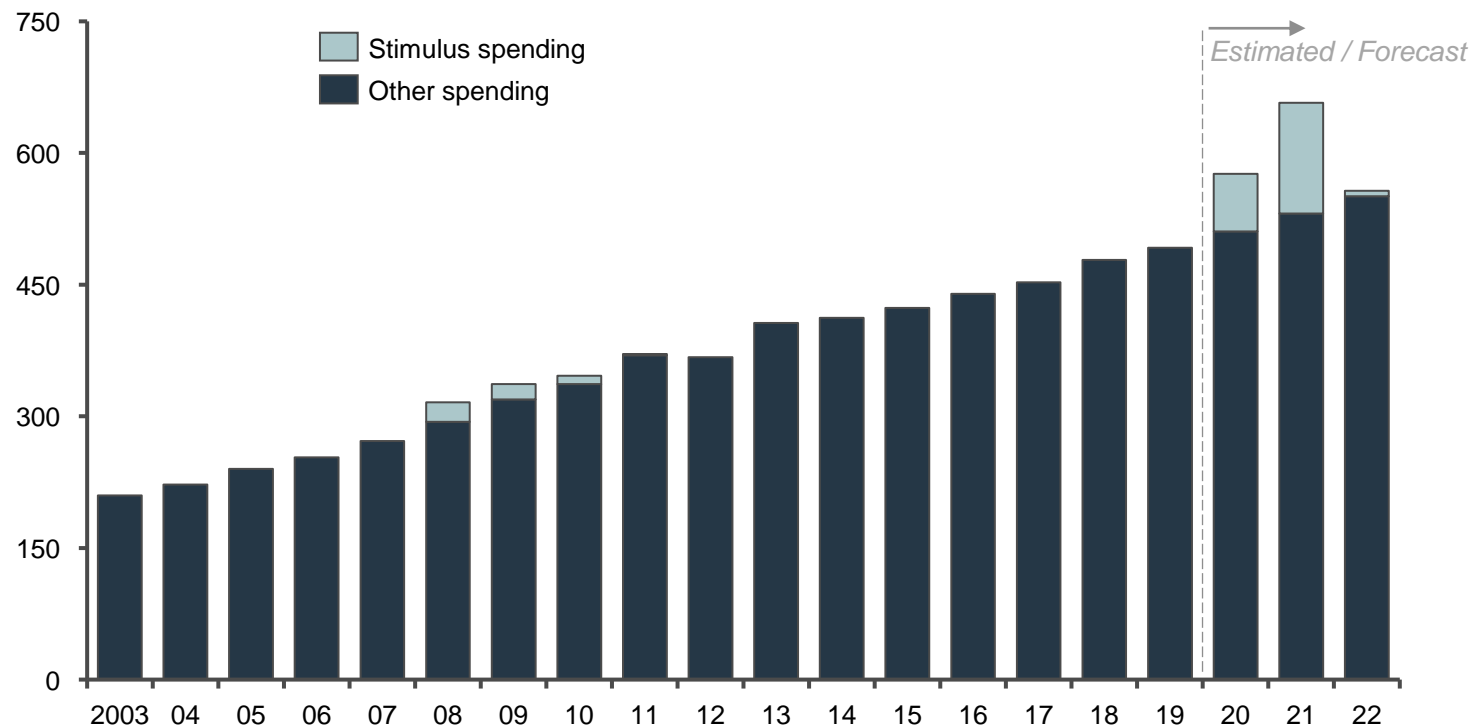


Australian Governments have injected substantial, time-limited stimulus support, including relief payments, wage subsidies, and loans

- Significant stimulus and other support measures have been announced, with total expenditure of around \$200b planned for FY2020 and FY2021
- While economic recovery will depend on the duration of the COVID-19 pandemic, it will also be impacted by the efficacy, duration and size of fiscal stimulus
- One-off support measures include JobKeeper and the Coronavirus Supplement and targeted industry support (DANS* and RANS*)
- Infrastructure investments that were announced include:
 - Additional investment of \$14b towards accelerated projects over the next four years including transport infrastructure of \$1.5b for shovel ready projects and \$500m for Targeted Road Safety Works
 - \$3.5b additional investment in NBN Co. to increase the availability of higher speeds
 - Energy investment including “Gas-led” recovery and support for emerging technologies
- State Governments have also announced stimulus packages, such as NSW’s Small Business Grants or Victoria’s CBD Business Support Fund as well as infrastructure investment

Australian Government spending including fiscal stimulus (FY2003 to FY2022F)

Billions of AUD

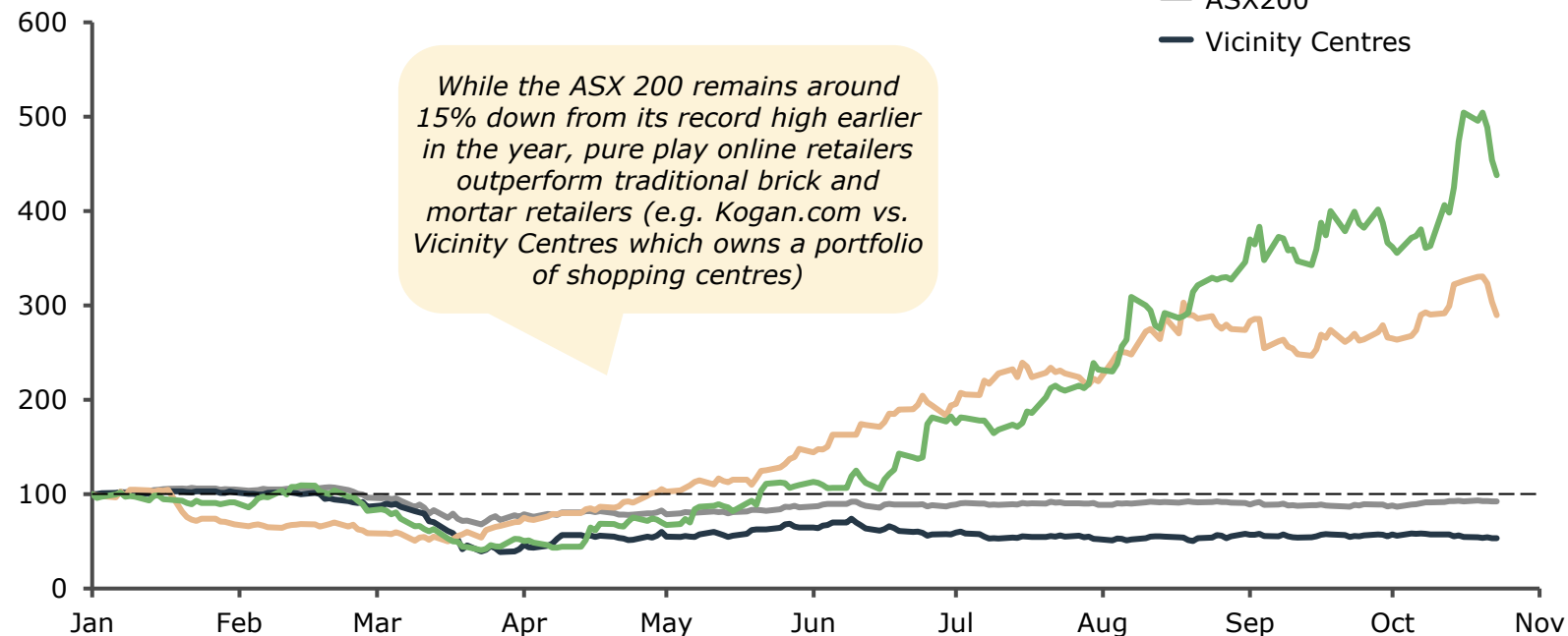


The impacts of COVID-19 restrictions have been uneven across the economy, with some sectors experiencing strong growth, others stagnation or contraction

- A 'multi-speed' economy has emerged through COVID-19. For example, companies with greater exposure to digitisation have been more resilient, and in some cases experienced accelerated growth
- This can be seen in investor sentiment towards pure play online retailers compared to traditional brick and mortar shopping centres
- Online only retailers such as Kogan.com or Redbubble have seen share price growth of around 300-450% over 2020, while shopping centre owner Vicinity Centres' share price has declined by around 50%

Share price performance, ASX200 vs KGN, RBL, VCX (2020)

Index, 100 = share price at 01/Jan/2020

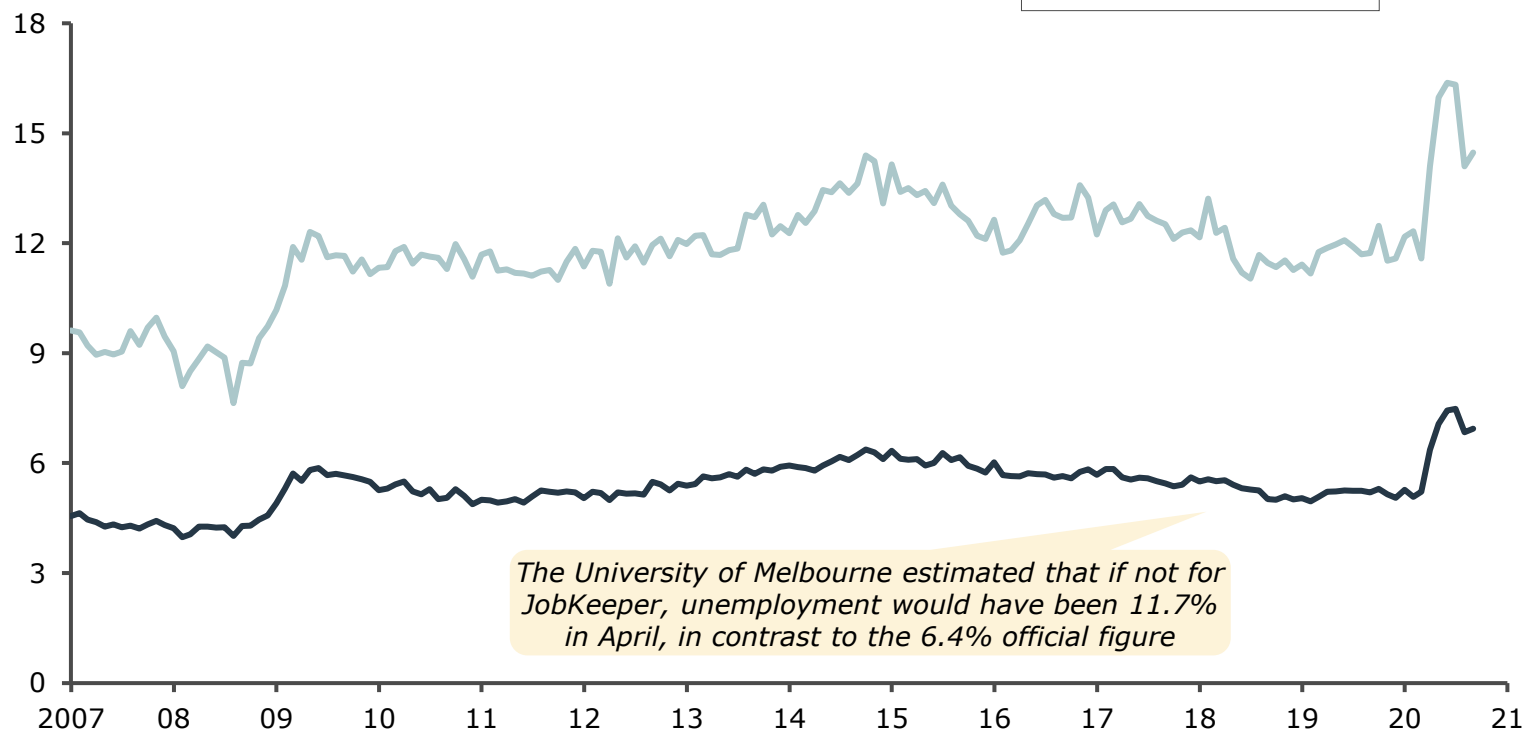


Unemployment has also been unevenly distributed, with youth unemployment more than double the general rate of unemployment

- Youth unemployment (currently around 14.5%) has consistently been more than double the general rate of unemployment (currently around 6.9%)
 - This reflects the greater exposure of young people in sectors that are worst hit by the pandemic, including retail, hospitality, events, fitness and entertainment, and higher rates of part-time and casual employment
- Unemployment reached a peak in July of 7.44%, and has since slightly recovered. However, this may understate workforce capacity due to:
 - Reduced hours worked
 - Reduced participation where individuals temporarily or permanently left the workforce during the pandemic
 - Impact of JobKeeper on labour market
- Self-employment grew more quickly in the first quarter of FY2020, with the ABS reporting in Sep-2020 that self-employed persons added 50,200 jobs

Australian Unemployment rate (Jan-08 to Sep-20)

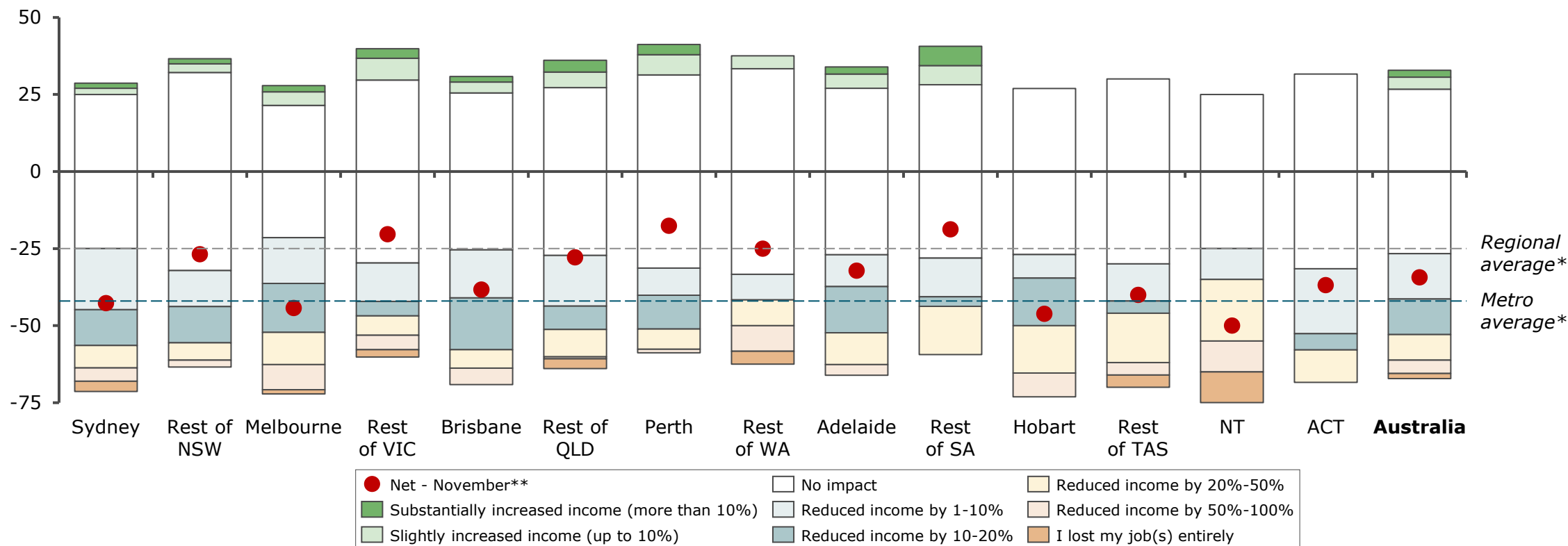
Percent



Household incomes in most metro areas were on average more negatively impacted than incomes in regions

Impact of COVID-19 on Household income, by area of residence (November 2020)

Percent of respondents (n = 1,531)



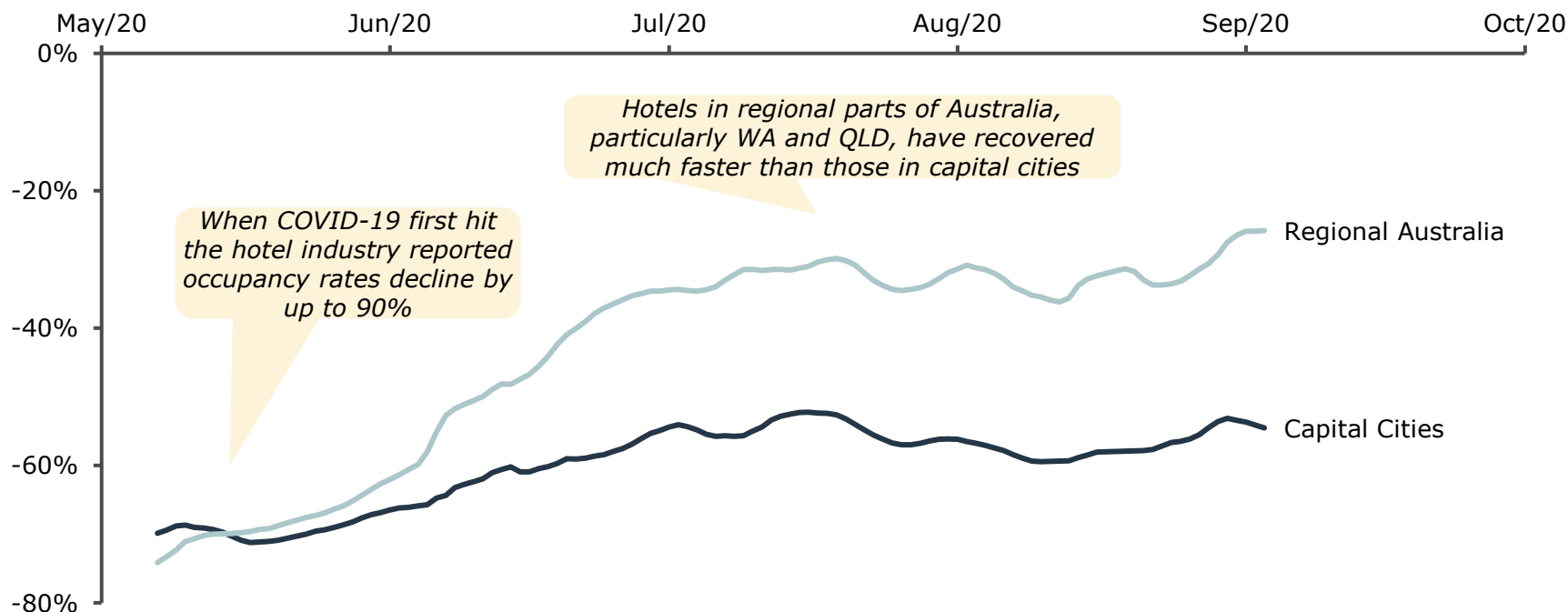
Notes: * Metro average calculated across Sydney, Melbourne, Brisbane, Adelaide, Perth, Hobart and Darwin. Regional average calculated across rest of NSW/VIC/QLD/WA/SA/TAS/NT/ACT; ** Net intention is the sum of the proportions of the positive and negative responses

Source: L.E.K. November 2020 Consumer Survey

Domestic travel was severely curtailed but began to recover in May 2020, with regional areas rebounding more quickly than capital cities

Hotel room demand 7-day average vs 2019 (May-2020 to Sep-2020)

Percent difference compared with same date in 2019



While hotel demand is still trending lower than 2019 levels, demand for regional hotels has been more resilient than demand for hotels in metro areas

- Popular holiday destinations such as Fraser Island and Hervey Bay have reported up to a 200% increase in demand over 2019 levels and higher prices

Intrastate leisure travel appears to have partially resumed, while capital cities' hotel occupancy remain substantially down on prior year levels driven by the lack of international tourism, very limited business travel and limited interstate travel

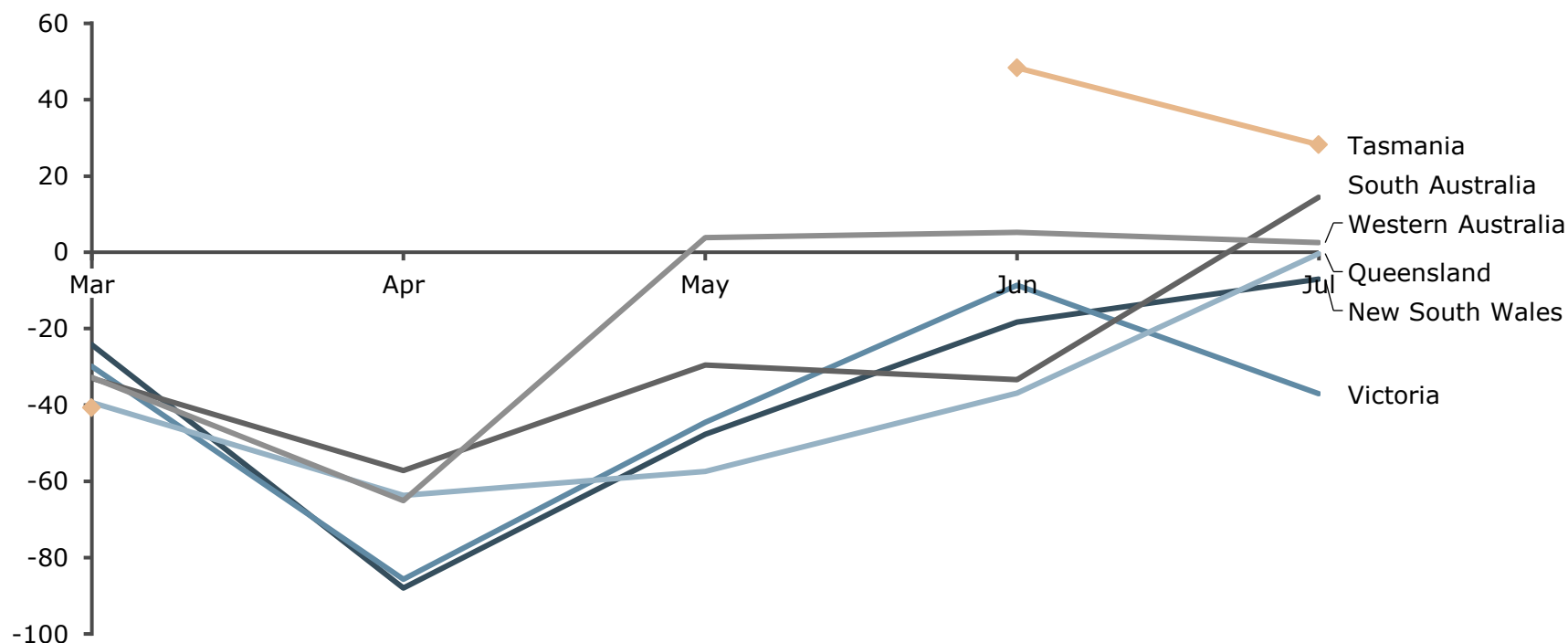
- The Brisbane to Cairns route has been the busiest airline route in the country during COVID-19

State border restrictions catalysed a rapid recovery in intrastate trips, especially in Western Australia, Tasmania, Queensland and South Australia

- The number of intrastate nights declined sharply when the pandemic first hit, reducing by 80-90% in April across NSW and VIC
- However, as lockdowns have eased across states, domestic intrastate nights have returned quickly.
- Western Australia and South Australia have experienced growth above previous years of around 5-15%, while Tasmania saw 30-50% growth above prior year levels in June and July
- The east coast has had a slower return. Victoria was most affected, with its second lockdown from July
 - However there has been some material tourism within QLD, as Brisbane-Cairns has been the busiest air route within Australia

Month on Month variation to pre-COVID-19 baseline in Intrastate nights, by State (2019 to 2020)

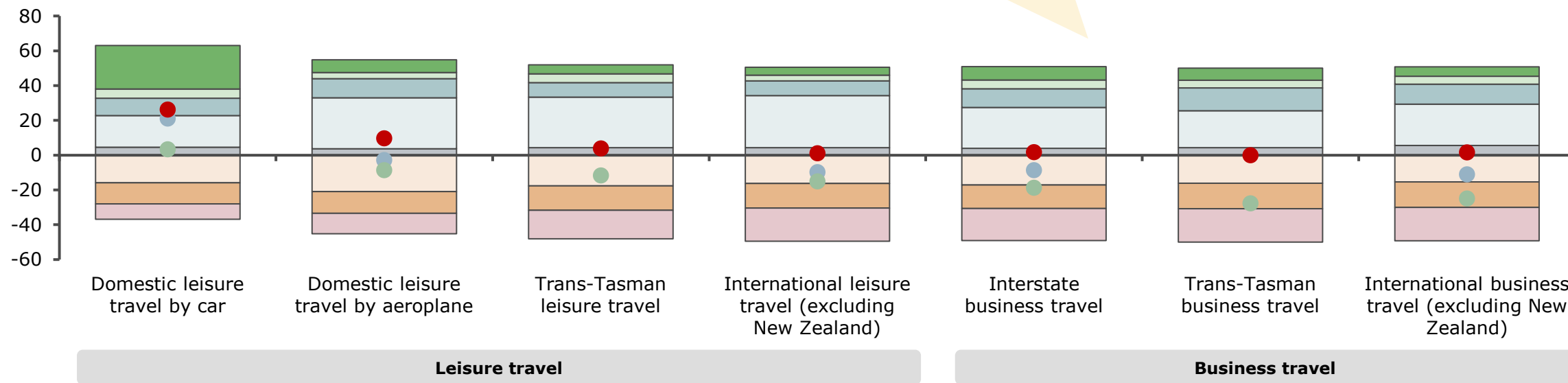
Percent (2019 to 2020 month on month difference)



By November 2020, signs of consumer confidence were growing, with more intending to return to past leisure and international travel behaviour

Intention to return to previous travel behaviour (November 2020)

Percent of respondents (n=1,531), not including N/A responses



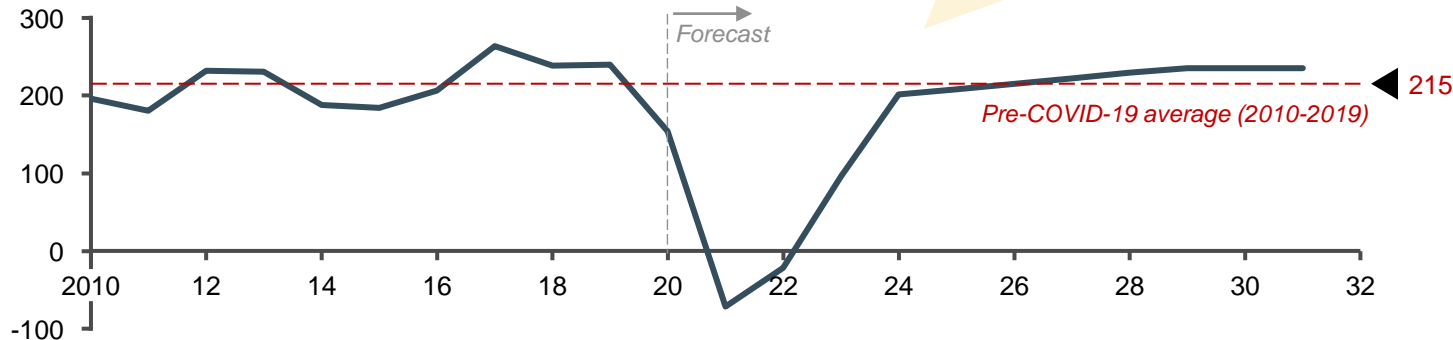
- Net - April
- Net - July
- Net - November
- I have already returned to my previous travel habits
- I expect to return to my previous travel habits over the course of the next few weeks
- I expect to return to my previous travel habits over the course of the next few months

- I expect to return to my previous travel habits over the course of the next year
- I expect to travel more than I did prior to the restrictions being put in place
- I will travel on occasion, but not with the frequency I used to due to the lingering health risks
- I will travel on occasion, but not with the frequency I used to due to financial pressures / concerns
- I do not expect to return to my previous habits

The impact of 2020 international border closures will be sustained reduction in Australia's level of population growth, with implications for economic recovery

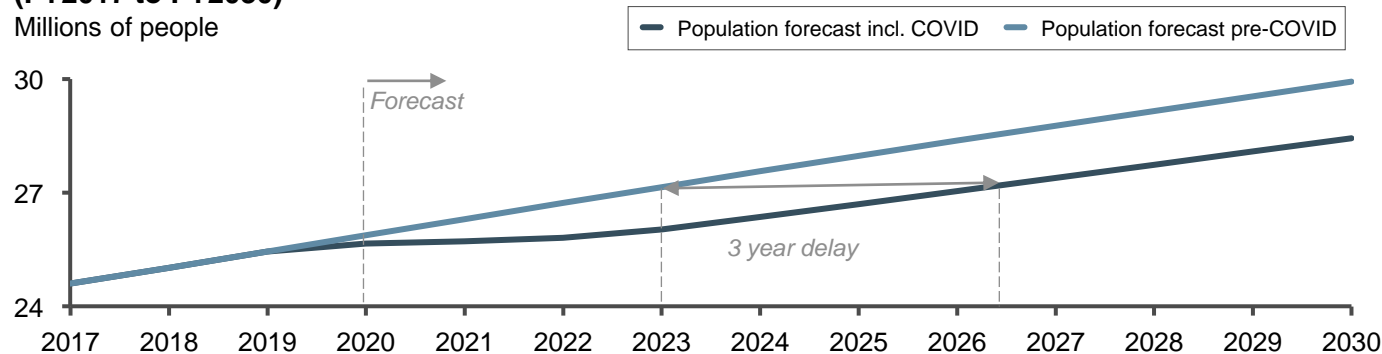
Net Overseas Migration (2010A-2030F)

Thousands of people



Australian Population Forecast Change* (FY2017 to FY2030)

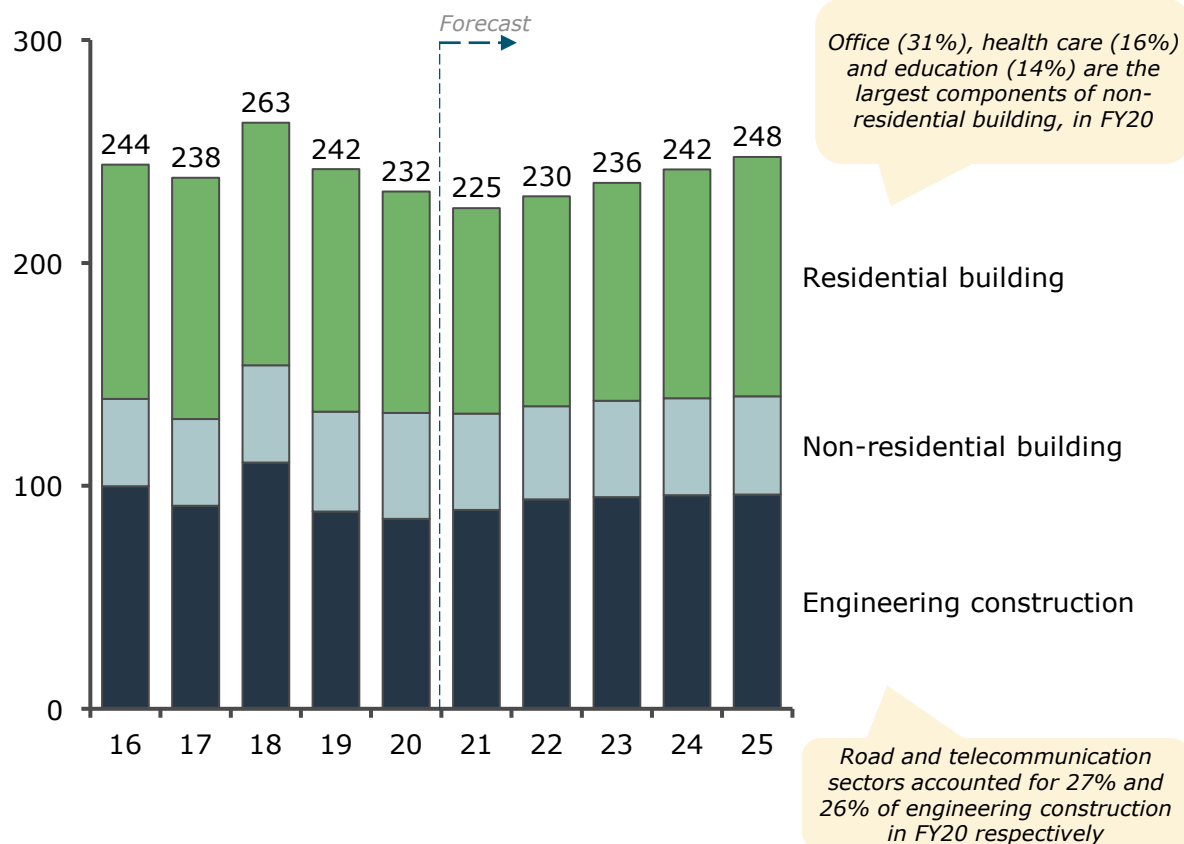
Millions of people



- The Centre for Population estimates that the COVID-19 border closures will see a net reduction of 1.1 million overseas migrants from the Australian economy, with enduring impacts on the national workforce, population age structure, and growth
- Economic migration is a driver of economic and population growth in Australia
- The number of Temporary Skilled Visas has declined from around 142,000 to around 128,000 over the period from Jun-2019 to Jun-2020
- Certain industries are reporting acute labour shortages, especially those which typically rely on travellers to Australia on a 'working visa'
- In mid-2020, the National Farmers Federation warned that fewer backpackers would impact farmers' fruit picking and shearing activities
- The temporary shortage of international students will impact sectors that rely on casual workers such as hospitality

The pandemic triggered a \$5b reduction in construction and building projects, with industry expecting to recover to pre-COVID-19 levels by 2023

Value of building and construction work in Australia, by type (FY16-25F)
Millions of AUD



- Total building & construction work is expected to fall by 4.2% to \$232bn in FY20, with a further around 3.2% fall expected in FY21.
 - a fall in the level of residential building projects occurred due to a tightening of macro-prudential and credit controls
 - deferrals in new non-residential projects particularly in accommodation (around 34% fall), entertainment & recreation (around 23%) and education (around 11%) occurred
 - private sector construction work rose around 0.1% while public sector work fell by around 3.2% in the June quarter. However, deeming the sector as 'essential' allowed many projects to continue as planned

"... I think the designation of construction as an essential service made a big difference. Less of an impact on productivity from social distancing than we thought..."
Head of Economics, ANZ

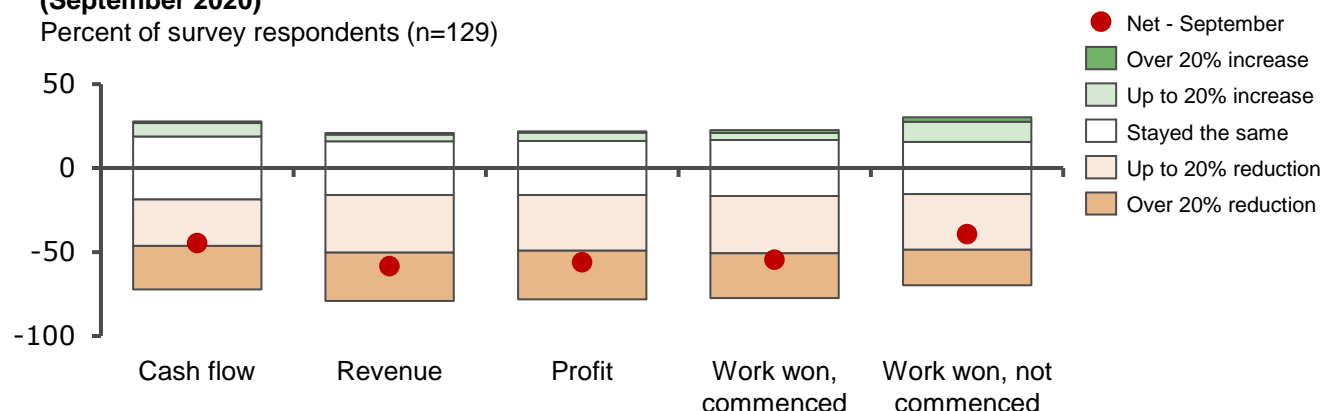
"... We expect privately funded work to continue trending upwards, supported by a rebound in mining investment particular in WA..."
Senior economist, BIS Oxford Economics
- In contrast, the increased value of new industrial projects (e.g. manufacturing, storage, warehousing) may reflect e-commerce growth

"... While there are continued challenges in many sectors, industrial property is showing strong resilience and as a result construction actively remains comparatively strong ..."
Deputy chair, ACIF
- ACIF projections expect the construction industry to return to pre-COVID-19 levels by 2022-23, driven by strong public investment

Businesses in the construction and building industry report revenue losses, and anticipate lower productivity due to COVID-19

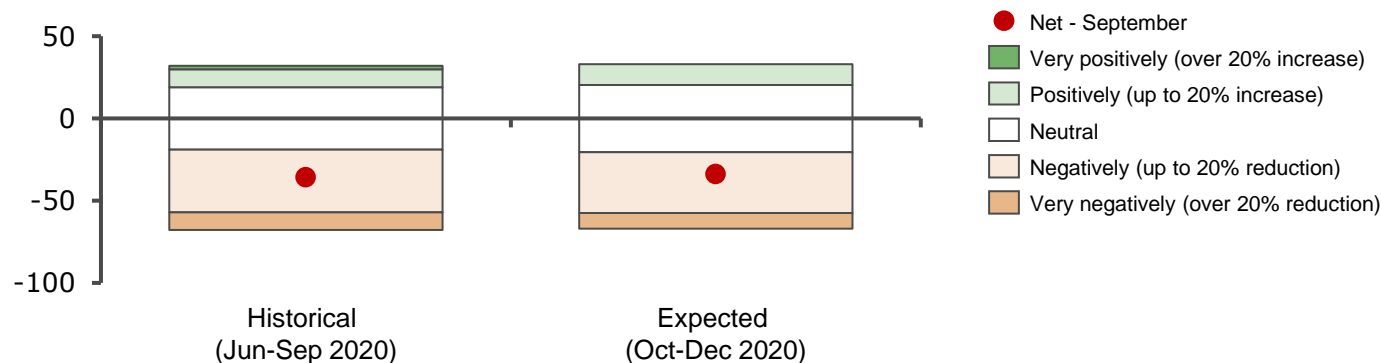
Impact of COVID-19 on organisational performance (Jun to Sep), by category (September 2020)

Percent of survey respondents (n=129)



Impact of COVID-19 on organisational productivity, historical vs expected (September 2020)

Percent of survey respondents (n=129)



The construction sector experienced a large level of volatility in projects undertaken due to the COVID-19 pandemic, leading to poorer financial performance amongst construction businesses

- around 25-30% of construction businesses surveyed claimed to have experienced significant declines of over 20% in cash flow, revenue and profitability
- impacts varied across sectors with greater negative impact reported further down the supply chain, for example with sub-contractors and suppliers

The sector, which accounts for around 9.6% of Australian employment, experienced increases in unemployment concentrated in VIC, NSW and QLD

- total employment in building and construction activities fell by 0.4% in 2020
- employment is projected to fall a further around 3.6% with 42,000 jobs forecast to be lost by 2021 according to the Australian Construction Industry Forum (ACIF)

Further, a number of businesses reported productivity losses and an inability to perform contracted work

- around 45-50% of businesses claimed to have their productivity negatively affected by the pandemic
- around 26% of respondents were unable to fulfil certain contractual obligations since June due to COVID-19, while 46% claim that other contracting parties have been unable to fulfil such obligations

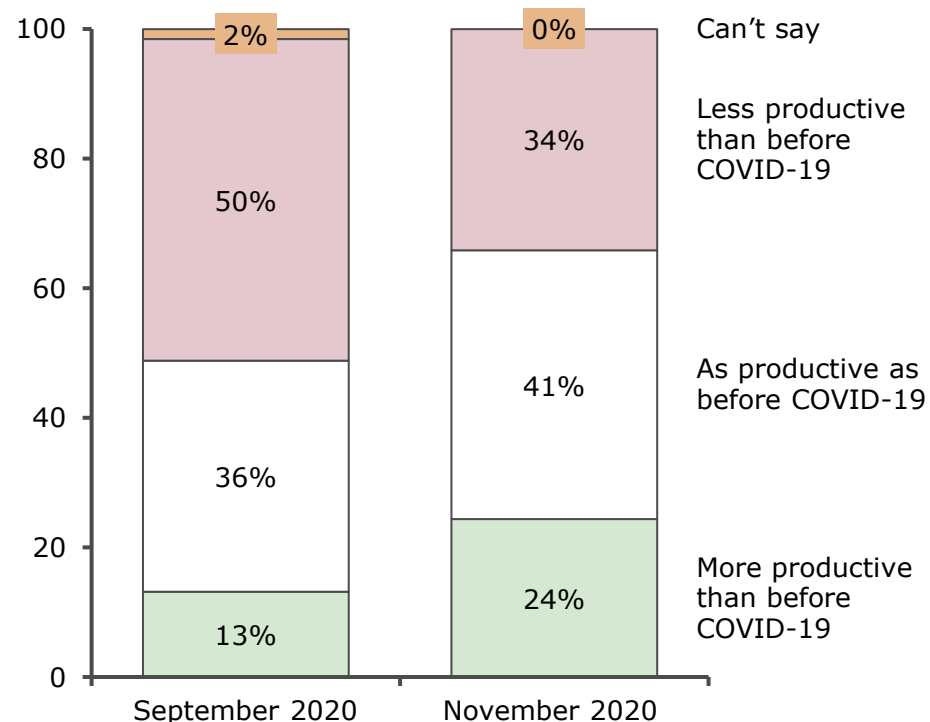
Note: Net intention is the sum of the proportions of the positive and negative responses

Source: Australian Construction Industry Forum; AFR; Infrastructure Australia – COVID-19 Impact Survey September

The construction and building sectors saw improved business confidence in late 2020

Expectation of COVID-19 on organisational productivity (September and November 2020)

Percent of respondents (n=129 in Sep, n=41 in Nov)

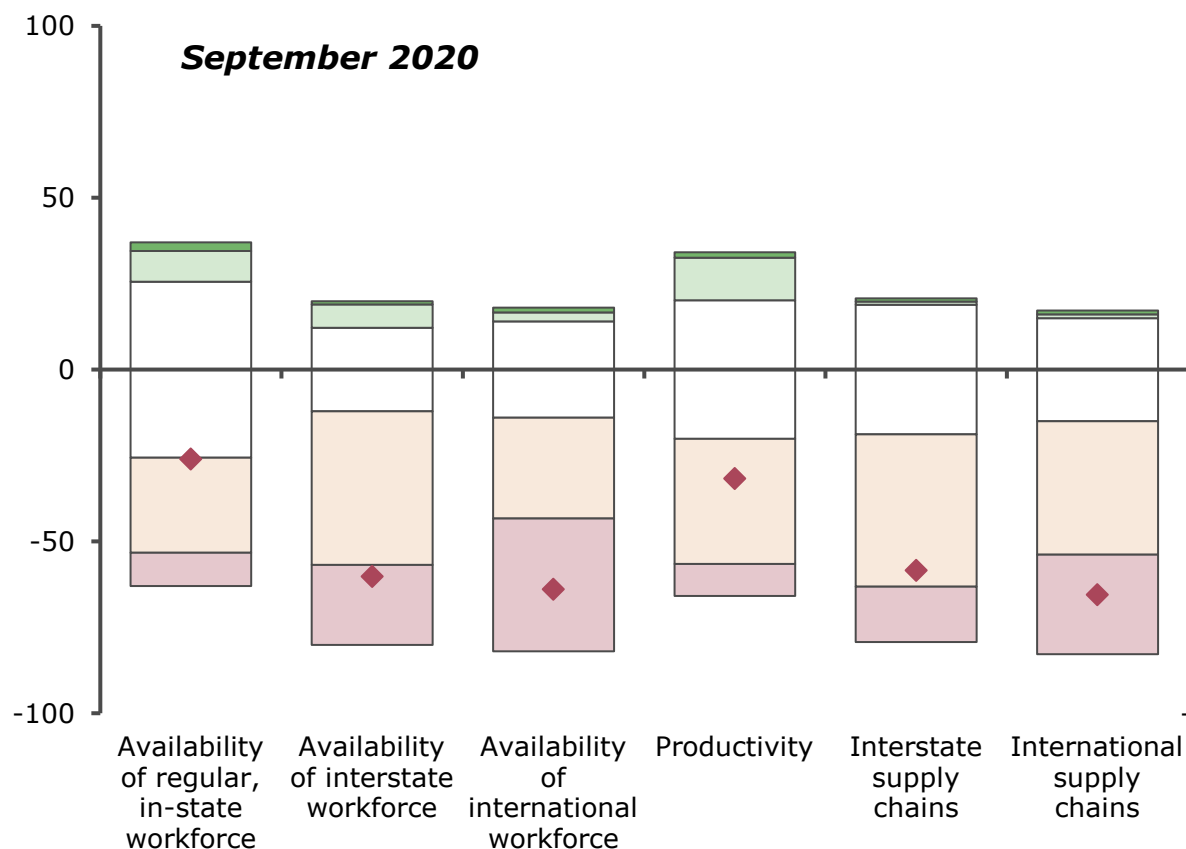


- Indicators point to improvements in business confidence in late 2020 across exposed building and construction sectors
 - In September 2020, 50% of respondents reported that they were less productive when compared to before COVID-19
 - By contrast, in the following months to November 2020, 65% reported that they were now as, or more productive compared to before COVID-19
- Organisations indicate that the impact of COVID-19 on productivity is less severe in the three months to November compared to earlier in the year
 - That is reflected in a relatively more positive view of more recent impacts on cash flow, revenue and profitability
 - The impact of COVID-19 on work won and commenced, and work won and not yet commenced, has also been less severe with a greater percentage of respondents indicating a positive increase in these areas in November relative to those responding in September
- While challenges clearly remain, a more positive outlook is also indicated by organisations reporting improvements in the availability of interstate workforces and supply chains relative to the three months prior to September 2020
- In September 2020, over 50% of organisations reported over 10% of work days lost due to COVID-19, by November that had dropped to 20%, with 70% of businesses reporting less than 5% of work days lost
- Organisations report that the practices they have put in place to manage the impact of COVID-19 (for example, social distancing, masks, cleaning, changing shift patterns and avoiding public transport) are having less impact on productivity, culture and mental health.

By November 2020, infrastructure organisations had growing confidence about near-term workforce availability, supply chains and productivity

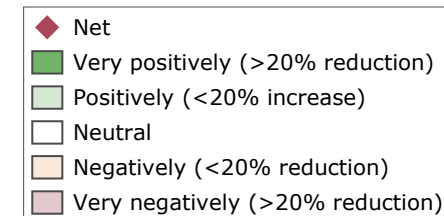
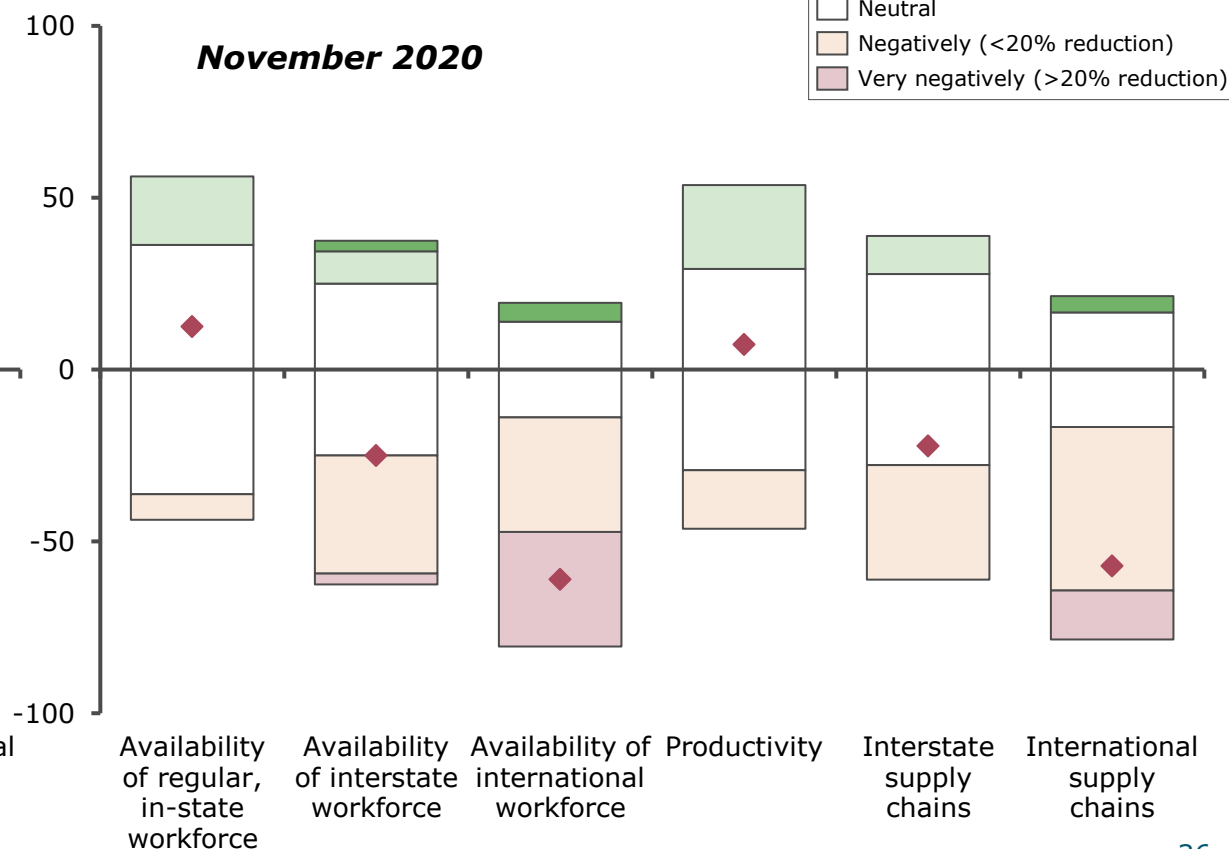
Expectation of COVID-19 on various infrastructure organisation's workforce over the next three months (September 2020)

Percent of respondents (n=129 in Sep)



(November 2020)

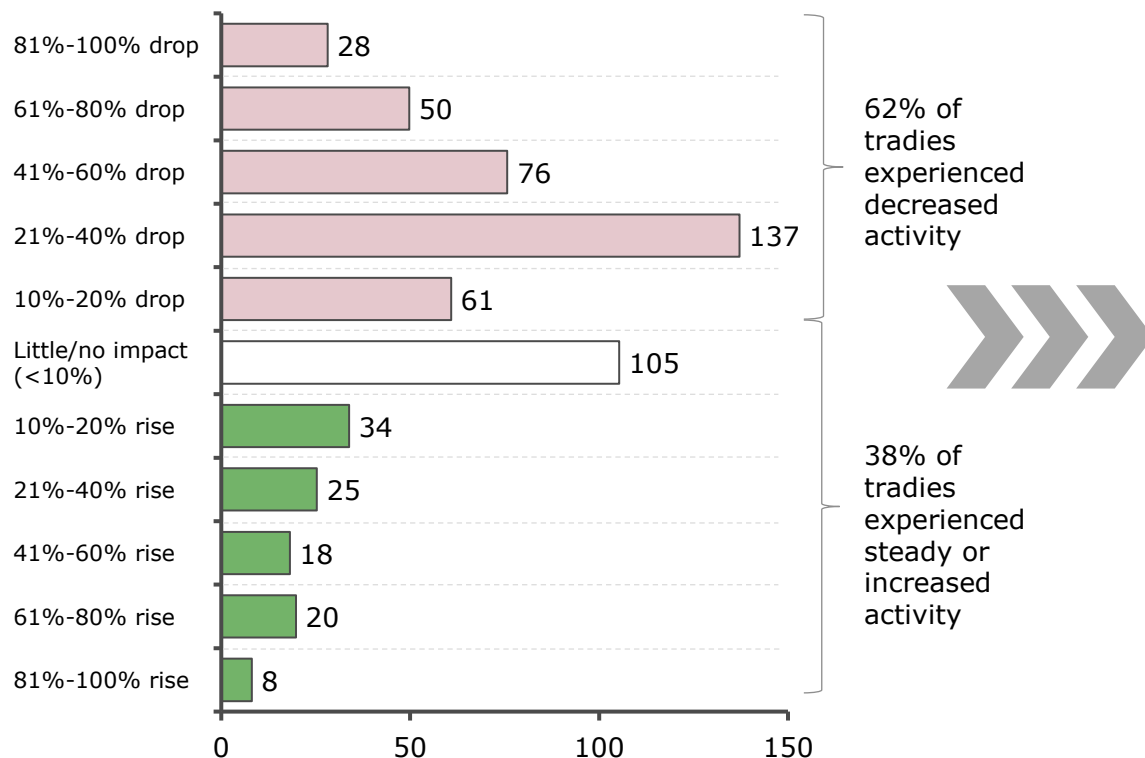
Percent of respondents (n=41 in Nov)



Tradespeople also identified a 19% reduction in activity during April, with modest recovery by June

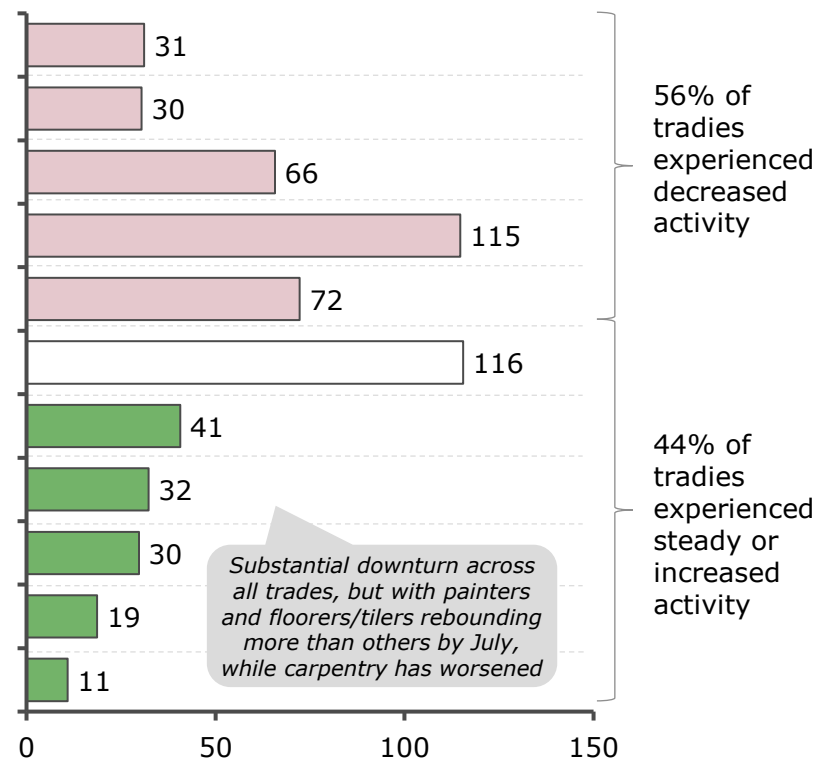
Impact on activity levels compared to pre-COVID-19 conditions
(April 2020)

Number of responses (n = 562)*



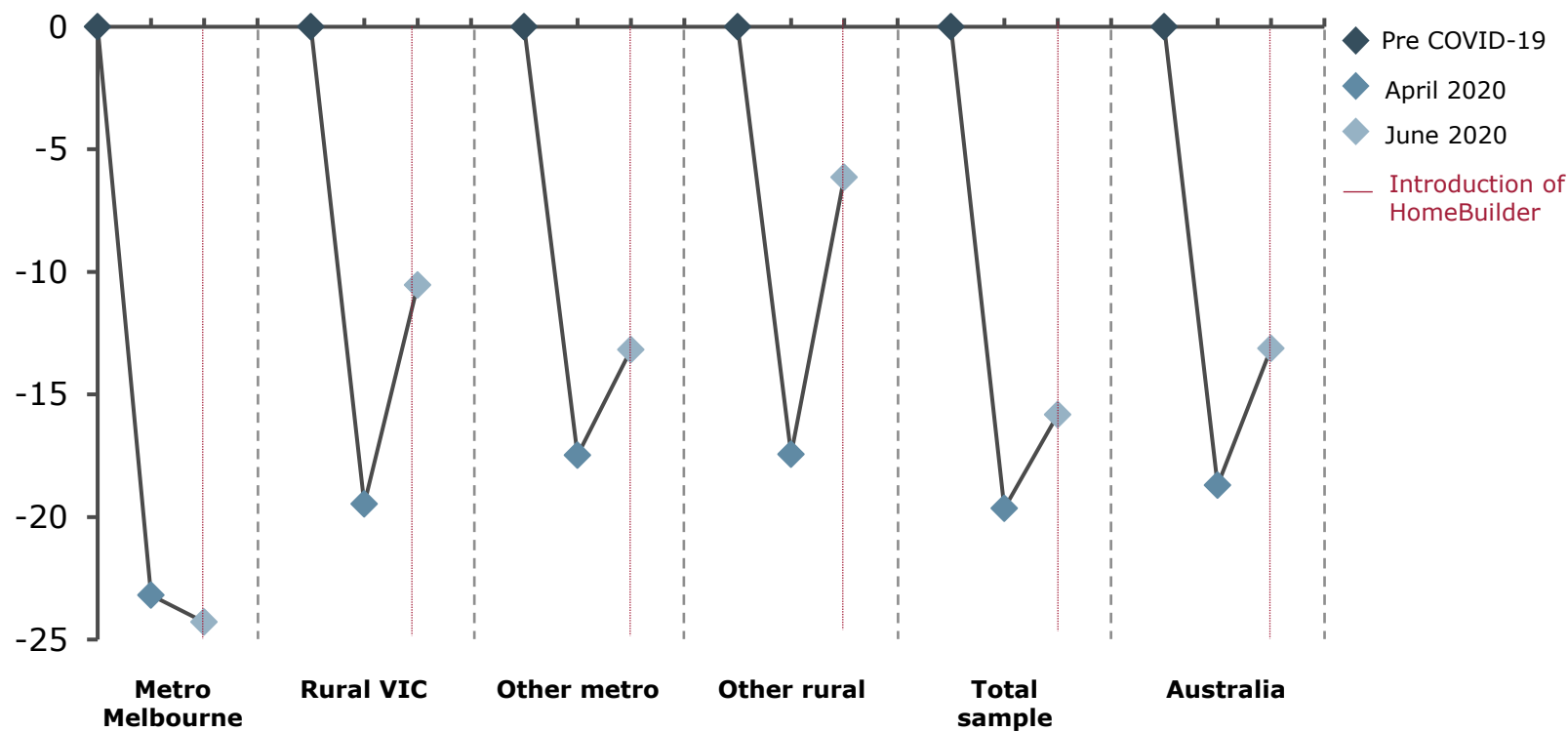
Impact on activity levels compared to pre-COVID-19 conditions
(June 2020)

Number of responses (n = 562)*



All states saw a significant downturn in trades activity in April. Regional areas typically showed greater turnaround by June than metropolitan areas.

**Activity level changes[^], by region
(Pre COVID-19, April 2020, June 2020)**
Percentage change in activity levels



- Nationally, tradespeople reported a 19% downturn in activity levels to April 2020, with some recovery underway by June when the Government's HomeBuilder scheme was introduced
- Melbourne experienced a deeper downturn in both April and again in the June survey. However, regional Victoria returned more strongly, as did regional areas in other states
- The HomeBuilder scheme supports the residential construction sector through grants for new home building and renovations. In November 2020, an extension of the program was announced to March 2021[^]

Q: In what state/region did you perform most of your work in construction/contracting in 2019?; What was the impact of the pandemic on your company's activity level and revenues in April 2020 compared to normal operating levels (before COVID-19)?; What was the impact of the pandemic on your company's activity level in June 2020 compared to normal operating levels (before COVID-19)?

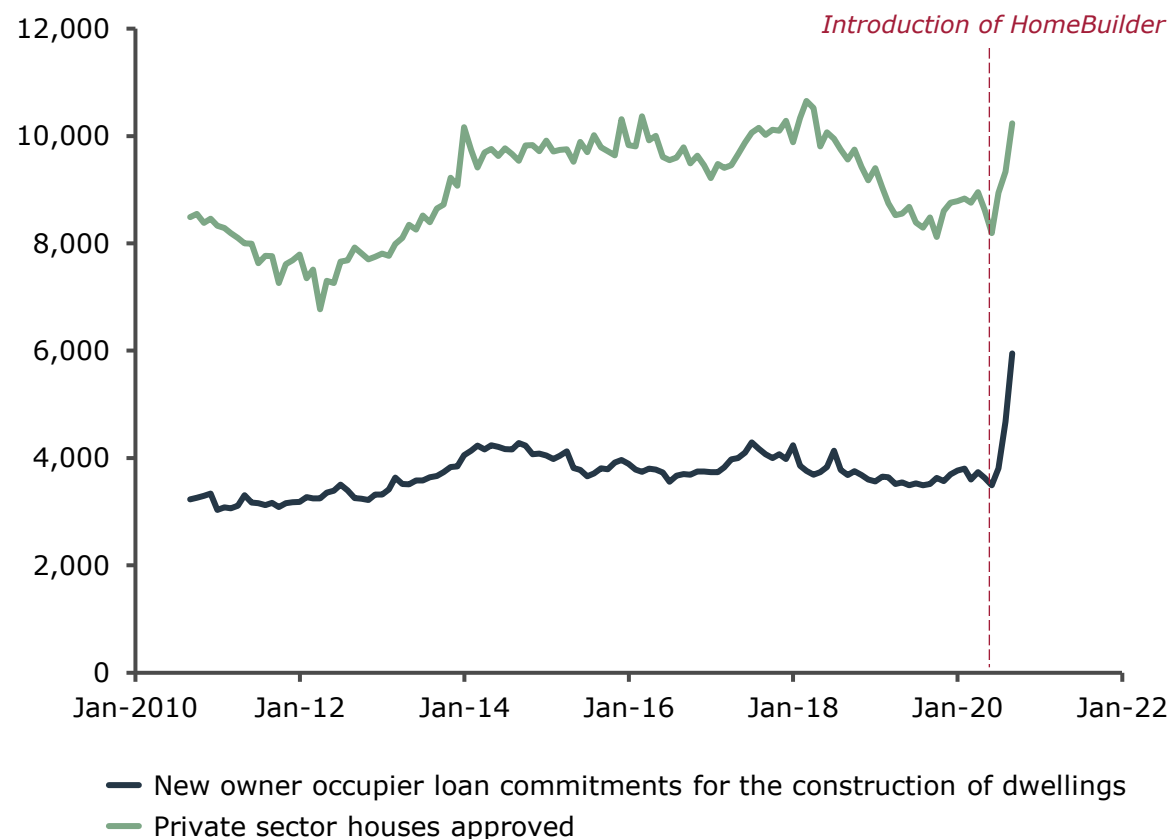
Note: *Total sample responses weighted to reflect the distribution of the Australian population by geography; ^ Given the strong participation of tradies in Melbourne, Victoria the survey and the impacts of the second wave of COVID-19, responses showing totals across regions have been reweighted to reflect the distribution of the Australian population by geography ^ HomeBuilder currently provides \$25,000 grants to eligible people building a new home or renovating their existing one, but this amount is being reduced to \$15,000 for the additional three months.

Source: L.E.K. Tradies Survey 2020 (n = 562)

The HomeBuilder policy has supported an uplift in planned residential construction activity

Number of private sector houses approved and new borrower accepted commitments* Sep-2010 to Sep-2020)

Number of house approvals and number of owner-occupier loan commitments

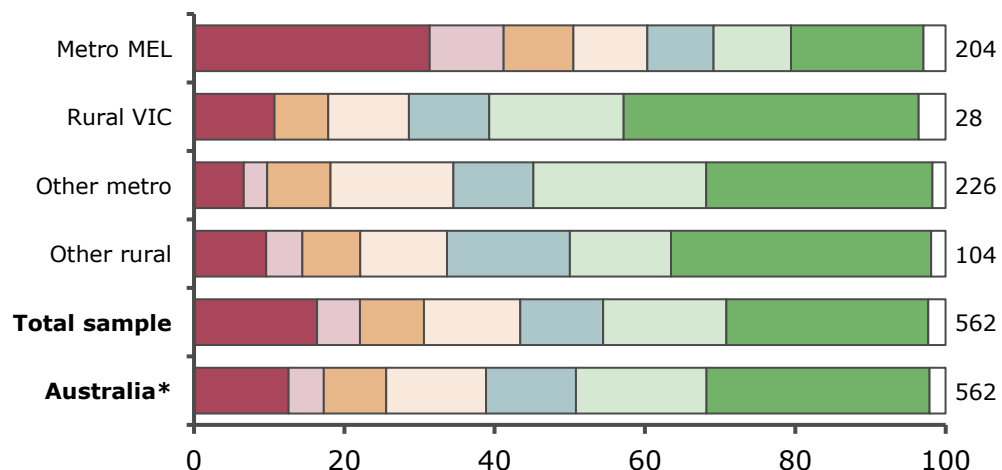


- Since the introduction of HomeBuilder, there has been a significant increase in demand for new home-building activities
- One developer, Mirvac, reported a 40% lift in housing lot sales in the September quarter, linking strong demand in part to stimulus policies such as HomeBuilder and the First Home Loan Deposit Scheme
- This is consistent with recent commentary from the RBA that stimulus policies (i.e. HomeBuilder) are supporting detached housing construction, with some builders reaching capacity for the remainder of 2020

Across states, trade-related supply chain delays have had minimal impact nationally, but disruption from social distancing was most pronounced in Melbourne

Ability to access work sites due to social distancing (2020)

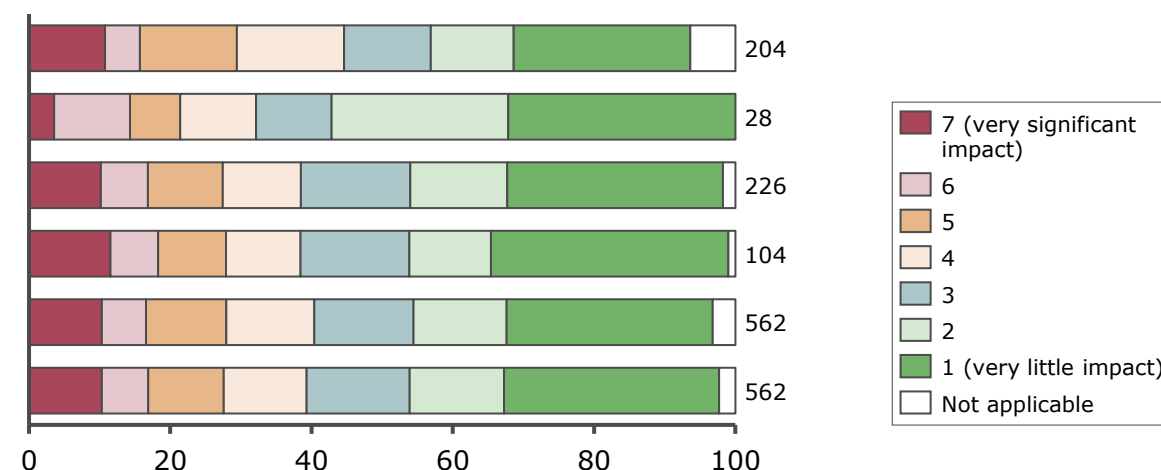
Percentage of responses (n = 562)



- Those tradies who were unable to access worksites were more likely to expect that recovery to pre COVID-19 levels would take longer than six months (around 67% of these respondents) than those who were not impacted (around 53% of these respondents)
- Affected trades were also more likely to have a shorter order book than pre-COVID-19 levels (around 87% vs around 62% of respondents)

Ability to source critical materials without supply chain delays (2020)

Percentage of responses (n = 562)



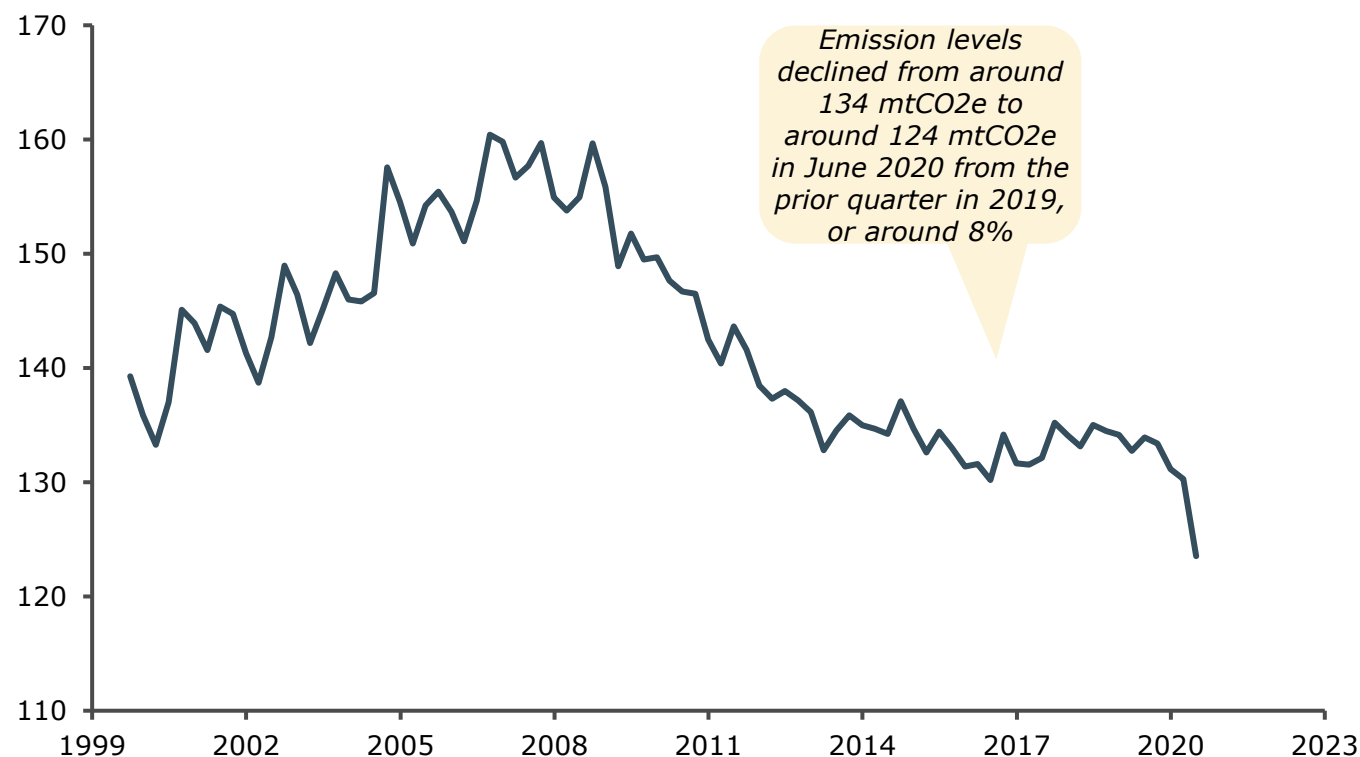
- Those who experienced a negative impact on the ability to source critical materials without supply chain delays were more likely to have decreased their purchasing of materials from new vendors or online, and were less likely to order materials to the worksite
- The Infrastructure Australia survey in November 2020 identified around 40% of infrastructure organisations who reported having lost 5-20% of workdays in the past three months

Greenhouse gas emissions are expected to be around 8% lower for the June quarter, reflecting the impact of restrictions on transport and energy use

- The Australian Government expects total greenhouse gas emissions in the June 2020 quarter to be around 8% lower than the June 2019 quarter
- This temporary emissions reduction reflects lower power usage in that quarter overall, with COVID-19 lockdowns and movement restrictions also impacting on the transport sector
 - Around 30% less petrol and around 80% less jet fuel was consumed in the June 2020 quarter
 - Emissions from the National Electricity Market (NEM) which supplies electricity to the east coast of Australia declined by around 2%* compared with the previous quarter
- In the year to June 2020, emissions were estimated to reach their lowest level since 1998

Australia's National Greenhouse Gas Emissions (Sep-1999 to Jun-2020)

Million tonnes of CO₂e, Quarterly figures



Section 3

Insights into Individual and Household Behaviours

Behavioural changes responding to the pandemic are driving impacts across infrastructure sectors, and could continue beyond the pandemic

Health fears as a driver of behaviour

- Health concerns have impacted behaviours such as riding public transport and willingness to be in other crowded spaces (e.g. restaurants or shops). This change is likely to endure at least for as long as social distancing is required and there is no vaccine. Businesses have had to adapt quickly to create COVID-19 safe operating plans, including hygiene methods (e.g. hand sanitiser, daily cleaning) and QR codes

1

Working from home

- Around 30% of employees have been working from home to slow the spread of the virus, resulting in widespread office vacancies, greater internet / broadband strain on the network, greater energy and water consumption in residential areas and generally increased local activity (e.g. more intense use of local greenspace and demand for local cafes)

Likelihood of trend 'stickiness'

- As companies prepare post-COVID-19 flexible working strategies, part of this impact is expected to be semi-permanent

2

Regionalisation

- As a result of social distancing and work from home measures, some households have displayed a willingness to move away from dense, metro areas. This caused an immediate increase in capital city vacancies, while regional and coastal towns experienced a decline as demand increased. Additionally, regionalisation is expected to lead to reduced demand on urban public transport and roads as well as increased pressure on broadband networks if the trend persists.

- Some of this impact is expected to be semi-permanent as some employees continue to seek more affordable housing outside inner metro areas, with less pressure to frequently commute to a central office

3

Consumer buying behaviour

- As a result of lockdowns, consumers have adopted online retail channels and new digitised financial services products, resulting in a substantial uplift in online sales. The uplift in home deliveries indicates greater demand for 'last-mile' freight delivery increasing micro-freight operations in urban areas. Lastly, consumers switched from traditional entertainment to digital media (e.g. cinemas to Netflix), placing further pressure on broadband infrastructure

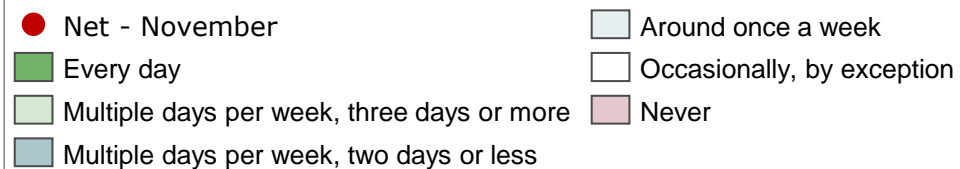
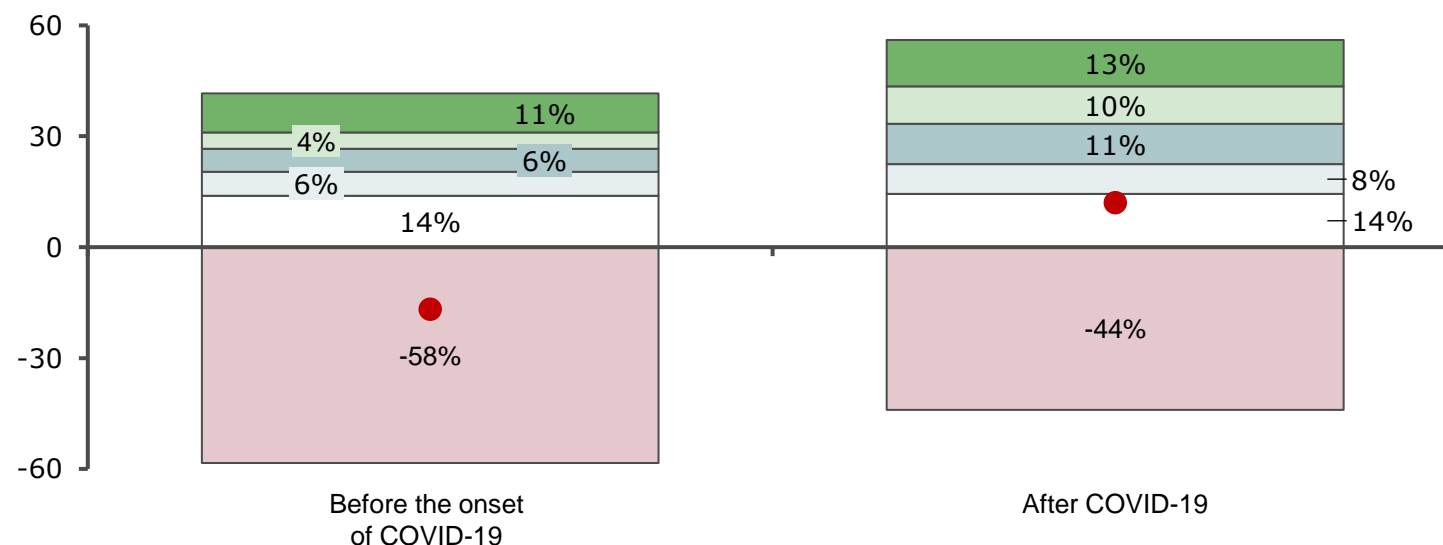
- Increased demand on the broadband network is expected to persist as consumers permanently adjust some of their purchasing behaviours

Almost a third of Australia's workforce worked from home during the pandemic, with a third of these hoping to continue post COVID-19

- It is estimated that around 4m employees have been working from home since March 2020, representing around 30% of the total workforce
- The proportion of respondents who wish to work from home once per week or more has grown from 27% prior to COVID-19, to 42% post-COVID-19
 - increased lifestyle flexibility and uncertainty about the resolution of COVID-19 were the driving factors
 - this is likely to drive a 'hybrid structure' that will see a split of working time between the office and home
- Around 15% of respondents would like to increase their level of working from home post-COVID-19 compared with pre-COVID-19

Intention to work from home, before vs after COVID-19 (Survey taken November 2020)

Percent of respondents (N=1,531)



Note: * Post-COVID-19 responses excluding those who answered N/A in their pre-COVID-19 responses

Source: L.E.K. Consumer Survey (November 2020; N=1,531); Property Council of Australia – July 2020 Office Market Report; ABC; ABS; CBRE

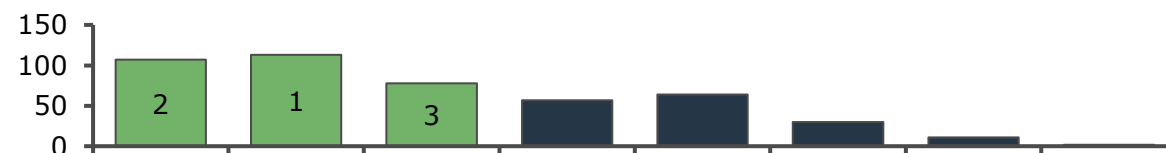
The top benefits of working from home were reduced commutes and greater flexibility. People aged over 35 reported they had limited dis-benefits

The benefits and dis-benefits of working-from-home (for the period of lockdowns during COVID-19), by age cohort (November 2020)

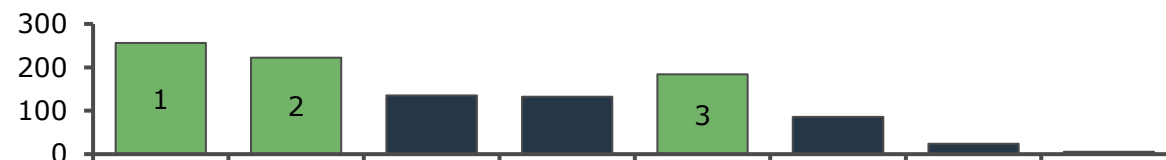
Number of responses (n = 1,531)

Benefits of working-from-home

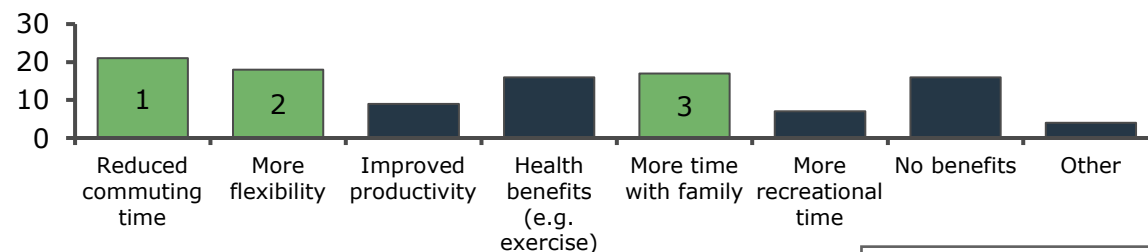
Under 35 year old's



35 – 64 year old's

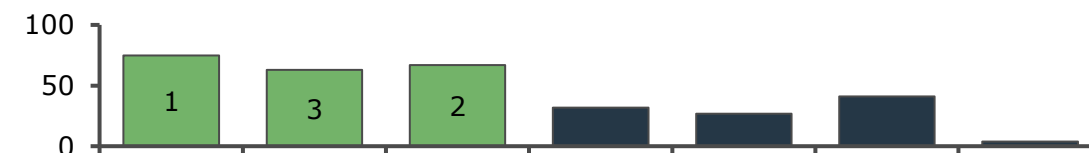


65 + year old's

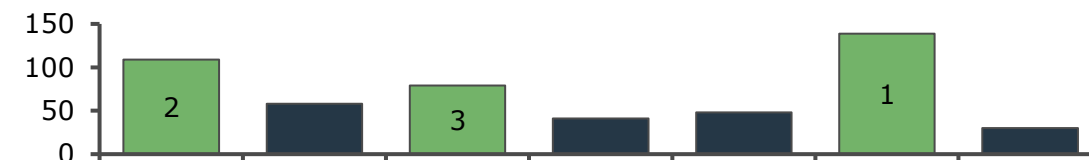


Dis-benefits of working-from-home

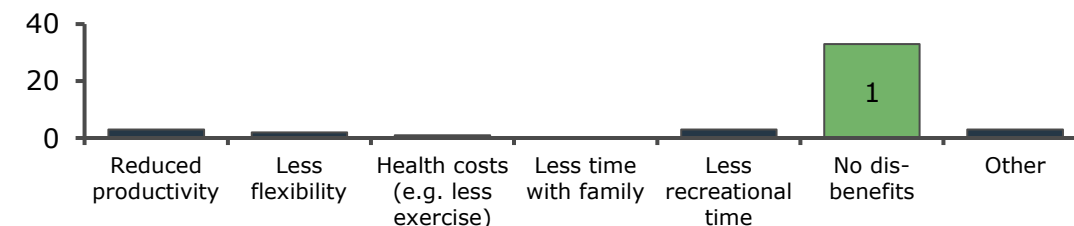
Under 35 year old's



35 – 64 year old's



65 + year old's

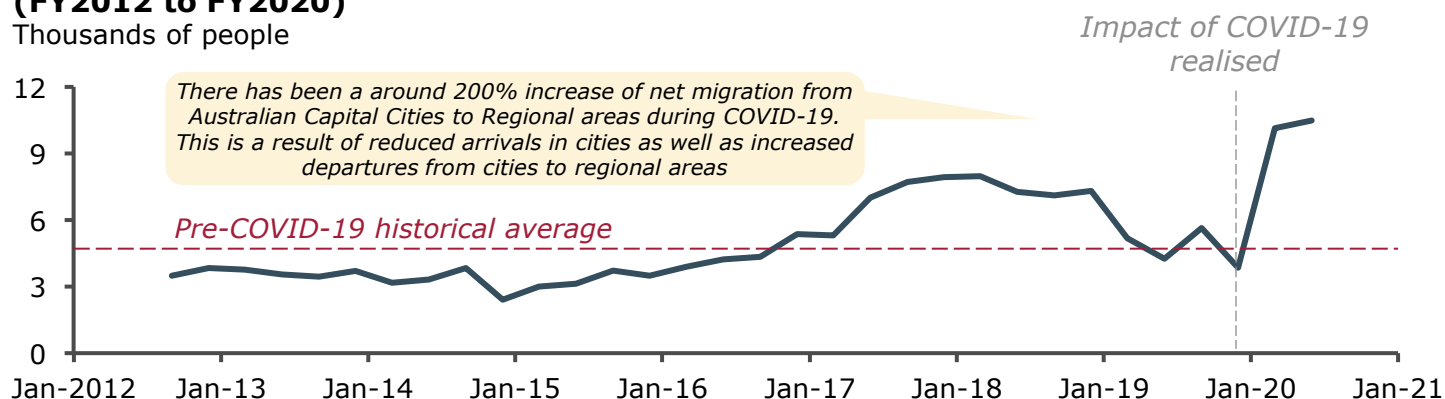


Top three benefits / dis-benefits, by age cohort

Some households moved away from major cities to regional cities and centres during the pandemic, but it is unclear if this is temporary or more permanent

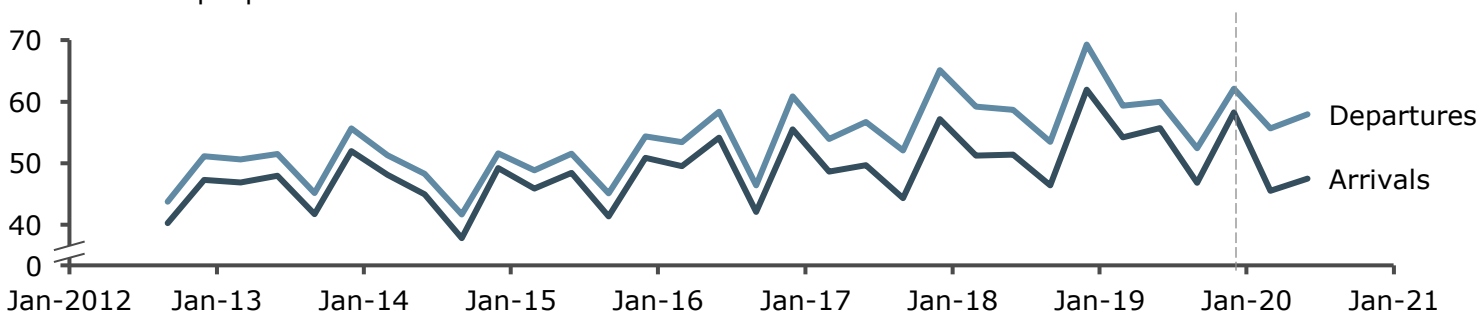
Net migration from Australian Capital Cities to Regional areas (FY2012 to FY2020)

Thousands of people



Arrivals to and Departures from Australian Capital Cities (FY2012 to FY2020)

Thousands of people

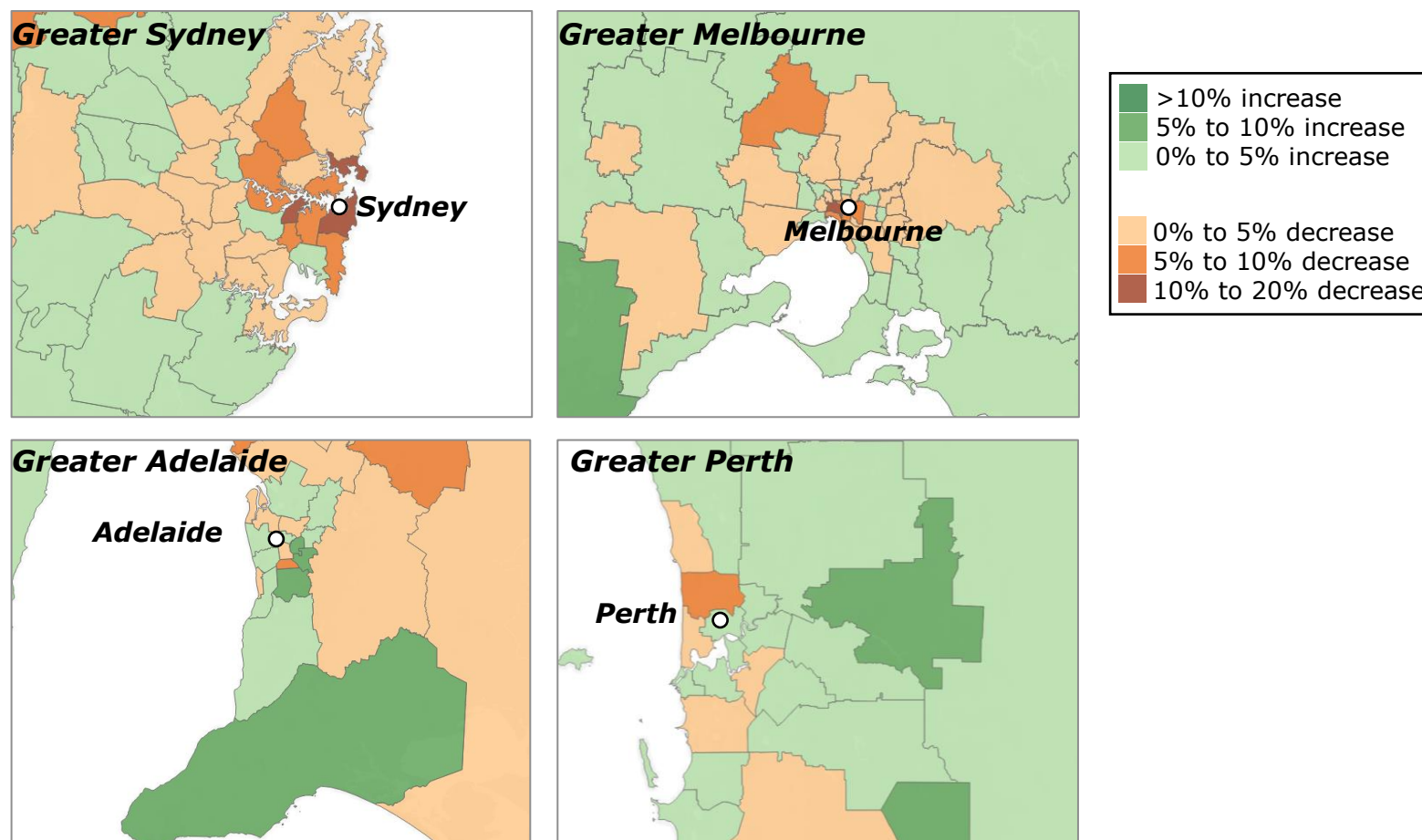


- Widespread 'working from home' reduced demand by workers to live in close proximity to their workplace, with more city dwellers moving to regional areas, and less regional households moving to cities
- While some have reported this is only a temporary move during COVID-19, others report a desire to permanently move away from busy inner city areas, to coastal or regional areas
 - This is enabled by the adoption of digital workplace tools and flexible working location policies not widely taken up prior to the pandemic
- The result is relatively weaker inner-city housing demand stemming from both regionalisation and reduced overseas migration
 - Vacancy rates increased in capital cities
 - Anecdotal evidence of regional property price increases of 10% or 20% due to increased demand
- A change of residential area can indicate a potential shift in locational preference, and a semi-permanent intention to continue working remotely or flexibly
- Domain reported that Regional NSW outperformed Sydney in demand for both houses and units, up 30.5% and 25.9% respectively

The trend of some households to move to regional areas has resulted in rental declines in metro areas and rental uplifts in outer suburbs

Growth in advertised rents* (Mar-20 to Jun-20), by Capital City Region

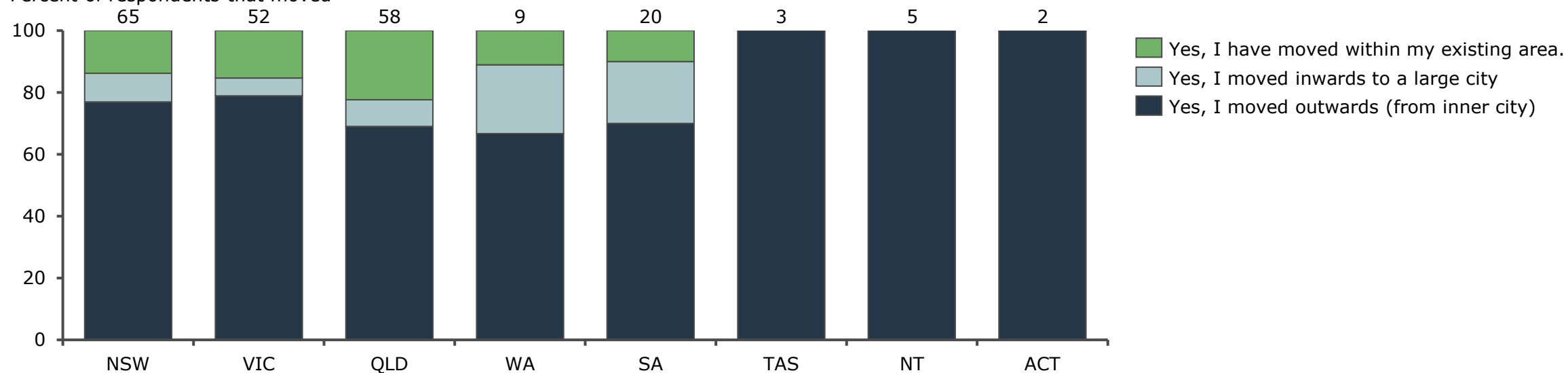
- Rental data from CoreLogic shows a decline in rental values across metropolitan centres
- Melbourne and Sydney saw rental declines of greater than 10%, the largest falls in the country
- Perth and Adelaide were less affected, as lockdowns were less severe. Adelaide experienced a 0-5% decrease in rents while Perth experienced a small uplift of 0-5%
- Inner city areas were hardest hit in Sydney, Melbourne and Perth
- Regionalisation has led to strong increases in rental values in regions surrounding capital cities. These uplifts in rent were, in part, due to the impact of households moving away from dense, metro areas.



Over 1 in 10 survey respondents moved during COVID-19, with most of these households moving away from inner cities

Respondents that moved since the onset of COVID-19, by type of move, by state* (November 2020)

Percent of respondents that moved

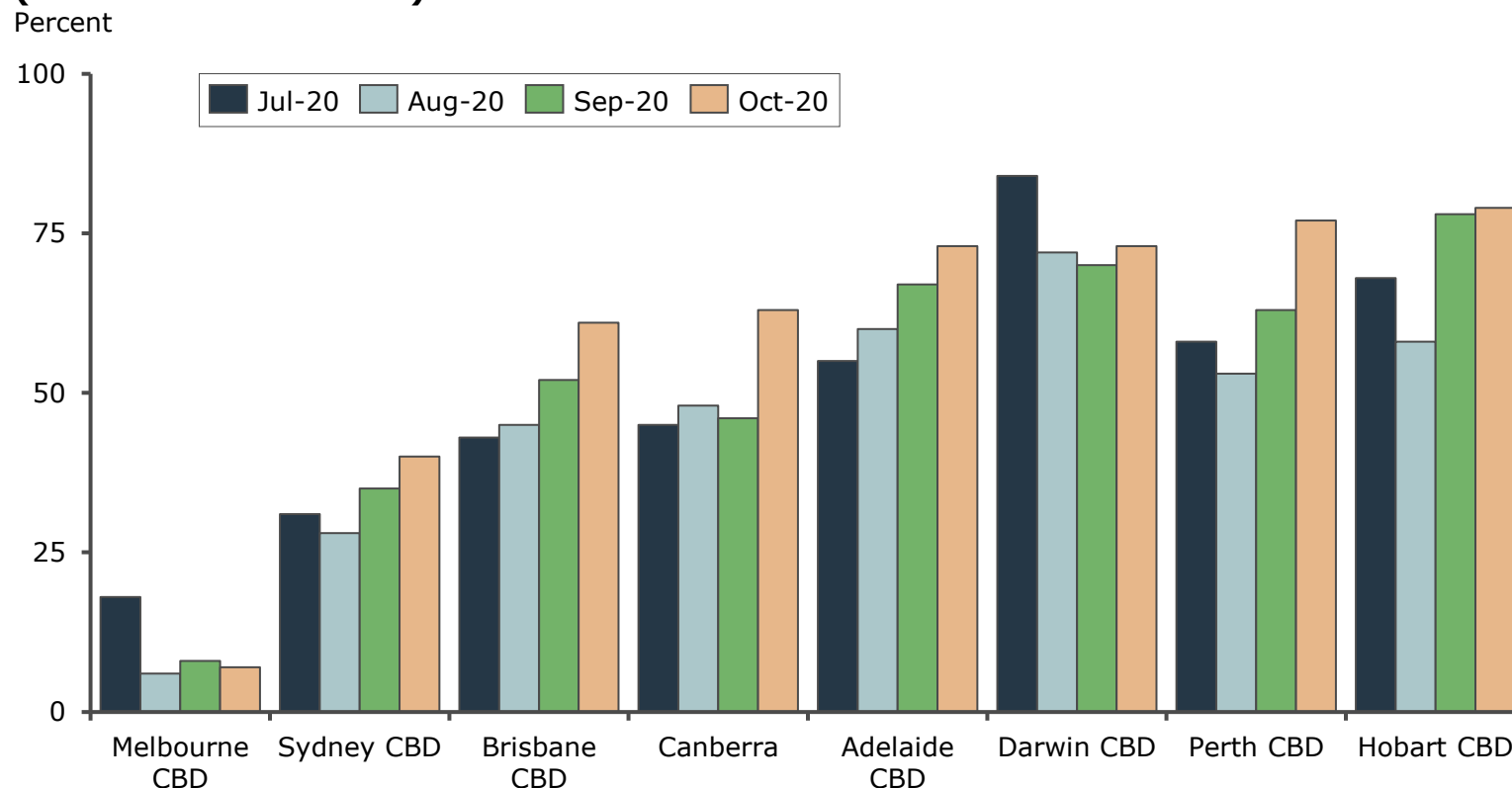


14%	12%	18%	8%	17%	8%	50%	11%	Proportion of respondents who <u>did</u> move, by state Proportion who <u>did not</u> move, by state <i>(not shown in chart)</i>
86%	88%	82%	92%	83%	92%	50%	89%	

Office occupancy rates have been slowly returning following the easing of lockdowns, but still remain well below prior year levels

- A 2020 Gartner CFO survey reports that 74% (CFOs) expect a shift whereby some employees remote work permanently, indicating significant uncertainty for CBDs following COVID-19
- However, data from the Property Council of Australia shows that Australians are returning to CBD offices as lockdowns are lifted across states (other than Victoria)
- CBD offices were reported to increase from an average of around 50% occupancy in July to around 70% occupancy in October across all capital cities (excluding Victoria)
- Notably, the eastern seaboard CBDs were most cautious. CBD occupancy in Melbourne was especially low, reflecting its second lockdown, averaging around 10% through Jul to Oct

Current level of occupancy* in CBD office buildings compared to pre-COVID-19 period (Jul-2020 to Oct-2020)



Notes: * Survey results are based on responses from 102 Property Council members who collectively own or manage the majority of CBD office buildings. Question asked was "What is the current level of occupancy in office buildings compared to the pre-COVID-19 period (%)"

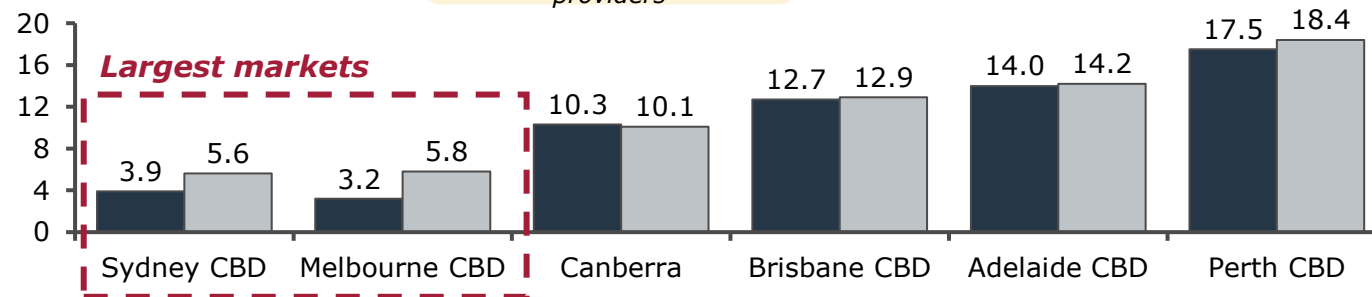
Source: Property Council of Australia – News Articles – Jump in Australians Returning to CBD Offices

Increased commercial vacancies in CBDs indicate that firms are beginning to 'lock in' decisions to work remotely or to downsize their space requirements

- Many companies located in Australian CBDs are not renewing commercial leases or are downsizing floor space
- While reported market metrics have not yet moved dramatically (e.g. net absorption, vacancy and effective rents) CBRE expects more significant changes to flow through in 2021 as the full impact of the crisis takes effect
- Sublease vacancies* across the country increased by 90% in the five months to September 2020. Around 80% of this sublease space is in prime locations
 - In June and July this year, Telstra reduced floorspace by 10 floors through subleasing at its Sydney CBD offices on George Street
 - Macquarie Bank, Ashurst and AECOM are amongst other companies that have reduced office space since the pandemic began
- Cushman and Wakefield have reported declining office rental rates in the second and third quarter of CY2020. Prime gross effective rents in the Sydney CBD fell 5.4% quarter on quarter and 10.4% year on year in Q3 CY20

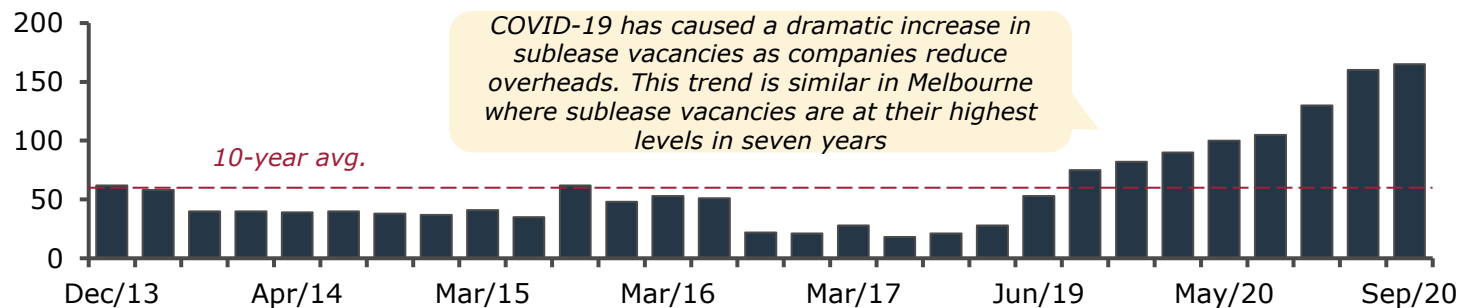
CBD Office Vacancy (Jan-2020, Jul-2020)

Percent



Historical sublease availability in Sydney (Dec-2013 to Sep-2020**)

Thousands of square meters available



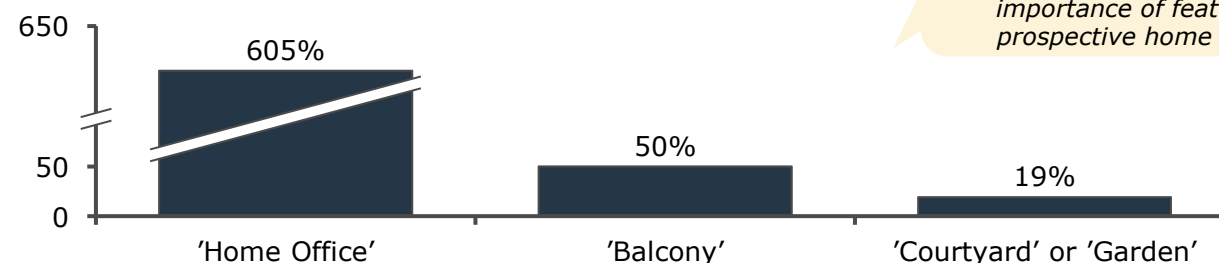
Work from home has marginally shifted housing preferences to larger dwellings, and increased the desirability of additional space for a home office or garden

Changing housing preferences

- As COVID-19 has increased the adoption of working from home policies and reduced the need to live relatively close to work, some workers are choosing housing with greater space for home offices and outdoor areas (e.g. balconies or gardens)
- The move towards lower density suburbs may indicate more challenging circumstances for cost effective infrastructure delivery

Change in key word frequency in house search criteria (Jun-2020 vs Mar-2020)

Percent increase



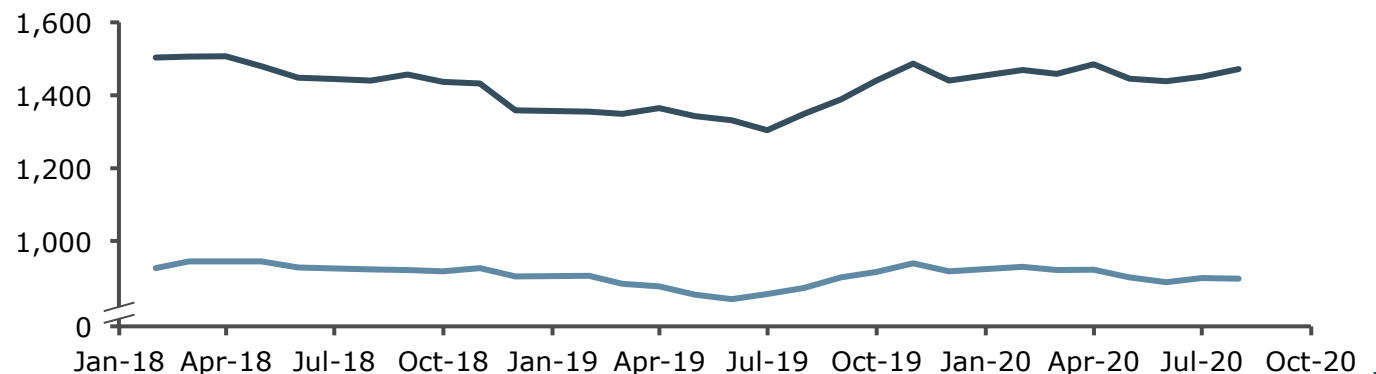
The substantial increase in the use of these key words in house search criteria displays changing importance of features to prospective home buyers

The move away from high density living

- Similarly, median apartment prices indicate there is stagnating demand for high density living in urban centres
 - The need to live in close proximity to the workplace is now competing with a stronger desire for more space (e.g. allowing for a home office) away from fast paced CBDs and urban centres
- Additionally, construction activity for high rise buildings near metro centres has slowed, as the outlook for real estate is uncertain and dependent on people returning to city lifestyles

Sydney's median auction price, Houses and Apartments (Jan-2018 to Aug-2020)

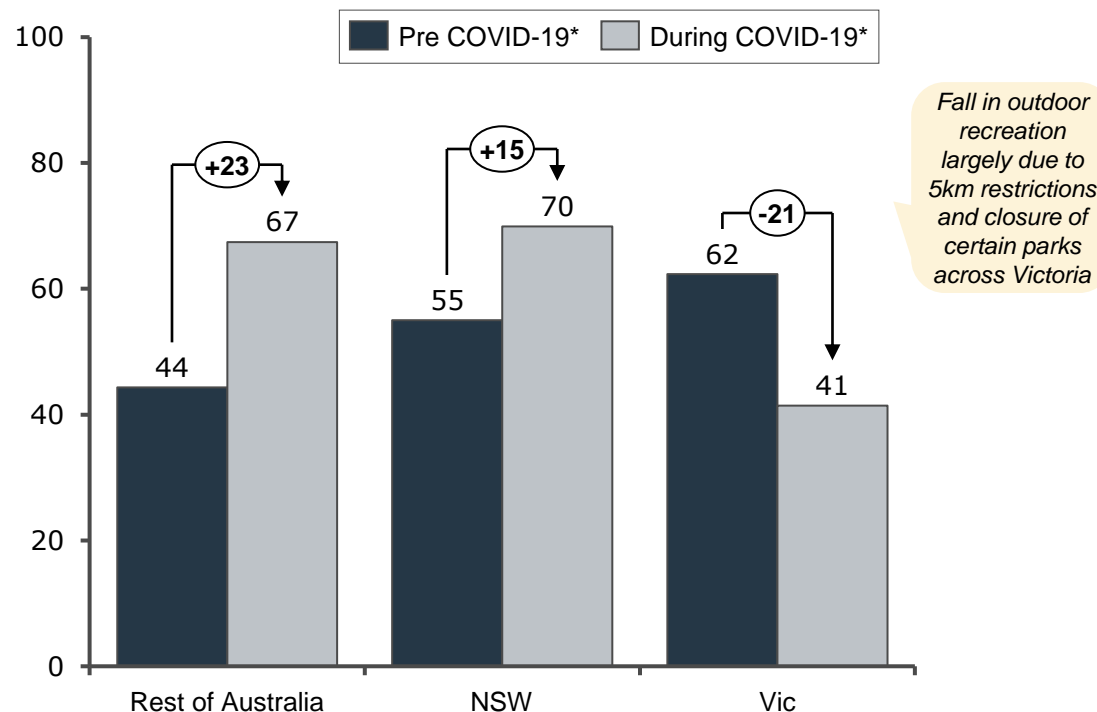
Thousands of AUD (rolling 3-month average)



There has been a sharp increase in the use of national parks and green spaces during COVID-19, with the exception of Victoria due to tighter restrictions

Visits to public park / recreation area at least once a week (March 2020 – October 2020)

Percent of respondents



- Visits to green spaces have increased significantly across Australia with the exception of Victoria
- In a survey conducted by the NSW Department of Planning, Industry & Environment, 46% of respondents** claimed to have spent more time in parklands and gardens with many (94%) using these spaces to undertake personal exercise
- Further, 72% of NSW survey respondents cited that local parks have been 'especially useful' or 'appreciated more' during COVID-19, with Hermitage foreshore and Western Sydney Parklands and Centennial Park visits up by around 144% and around 100% respectively compared to the prior year
- Given this evidence, it is likely that green spaces and corridors have also played an important role in supporting active and 'utility' transport
- Research also shows that 87%^ of Australians have noticed a positive shift in community attitudes towards urban green space, particularly amongst those living in high density areas

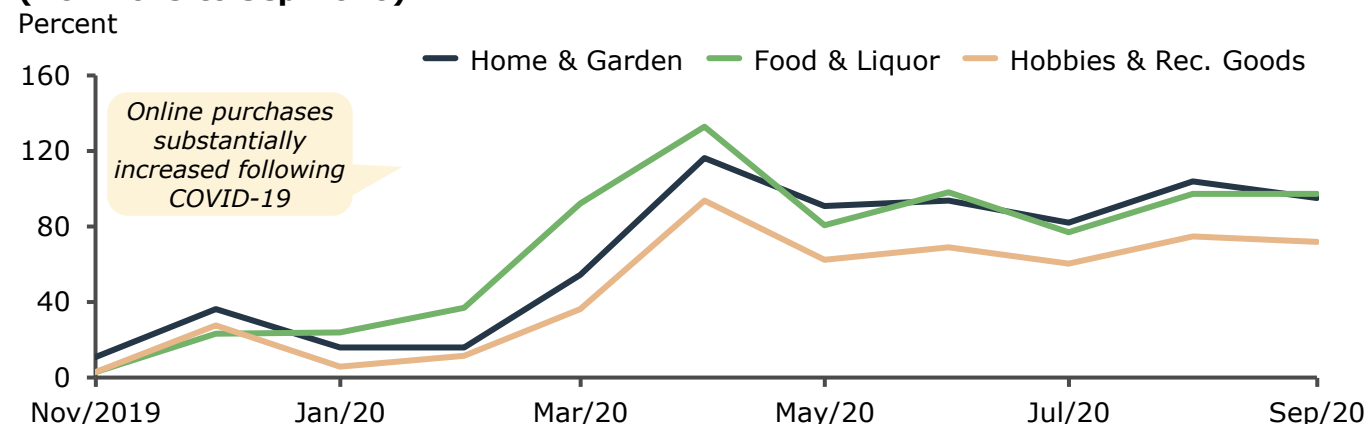
"... More people are becoming aware that getting outside fresh air is essential for mental health and wellbeing ..."
Green Spaces Better Places Report

"... Parks, promenades and open spaces have become vital community place. They are peoples' backyards for those living in denser suburbs with apartment blocks. Urban green space and the quality of residential spaces has never been more important." ..."
Green Spaces Better Places Report

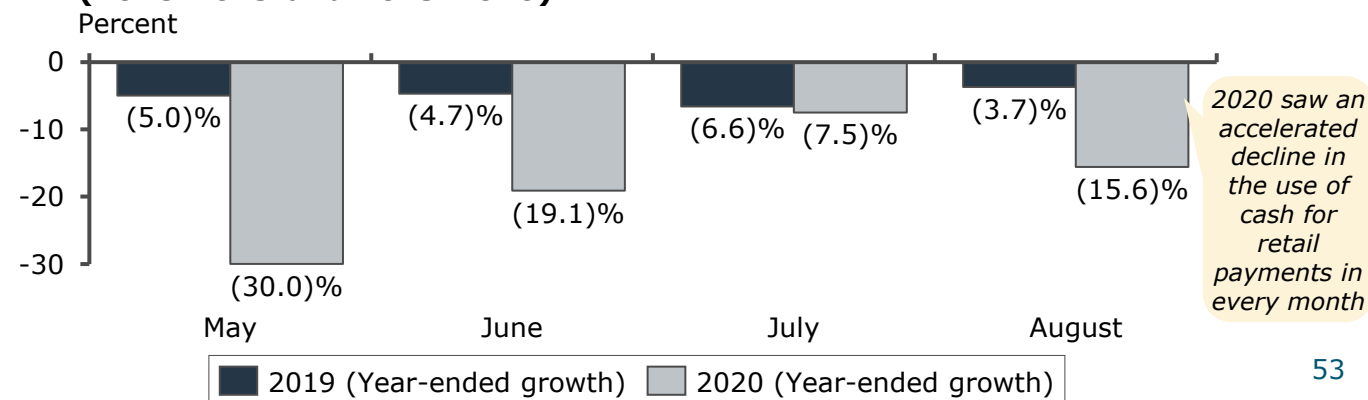
Consumers have shifted their essential and discretionary retail to online channels, and have embraced non-cash payments in response to the crisis

- COVID-19 has accelerated a shift towards digitisation throughout the economy, particularly in the retail sector
- Throughout lockdowns, consumers switched to purchasing goods online, causing a major uptick in sales through retail businesses websites and major e-commerce platforms
 - digital behaviours adopted during COVID-19 are expected to endure as consumers realise greater purchasing efficiency
- Recent NAB data showed online retail sales increasing at over 60% year-on-year, since Australia entered lockdowns in late-March
- The trend towards online purchasing and home delivery has placed pressure on businesses to compete digitally as well as putting greater stress on the overall supply chain with delivery companies expected to ensure timely delivery of goods
- Additionally, prior to COVID-19, cash payments' share of consumer purchases of retail goods and services had declined from 62% in 2010 to 27% in 2019 as debit and credit cards took substantial market share
- This trend accelerated during 2020 as the value of ATM withdrawals declined at a faster rate in every month than in the same period in 2019

Online purchases, year-on-year change, by category (Nov-2019 to Sep-2020)



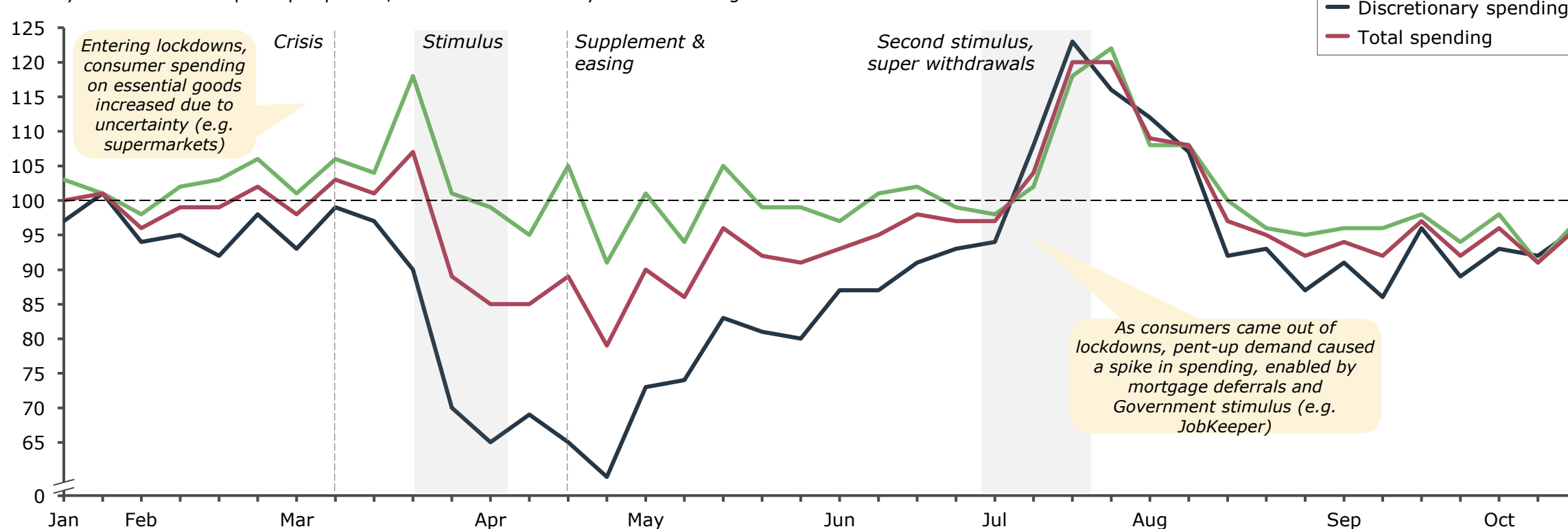
Growth in the value of ATM withdrawals for retail payments, by month (2018-2019 and 2019-2020)



Australian consumer spending substantially declined following the onset of the COVID-19 pandemic, however has largely recovered

Spending by consumers in Australia (2020)

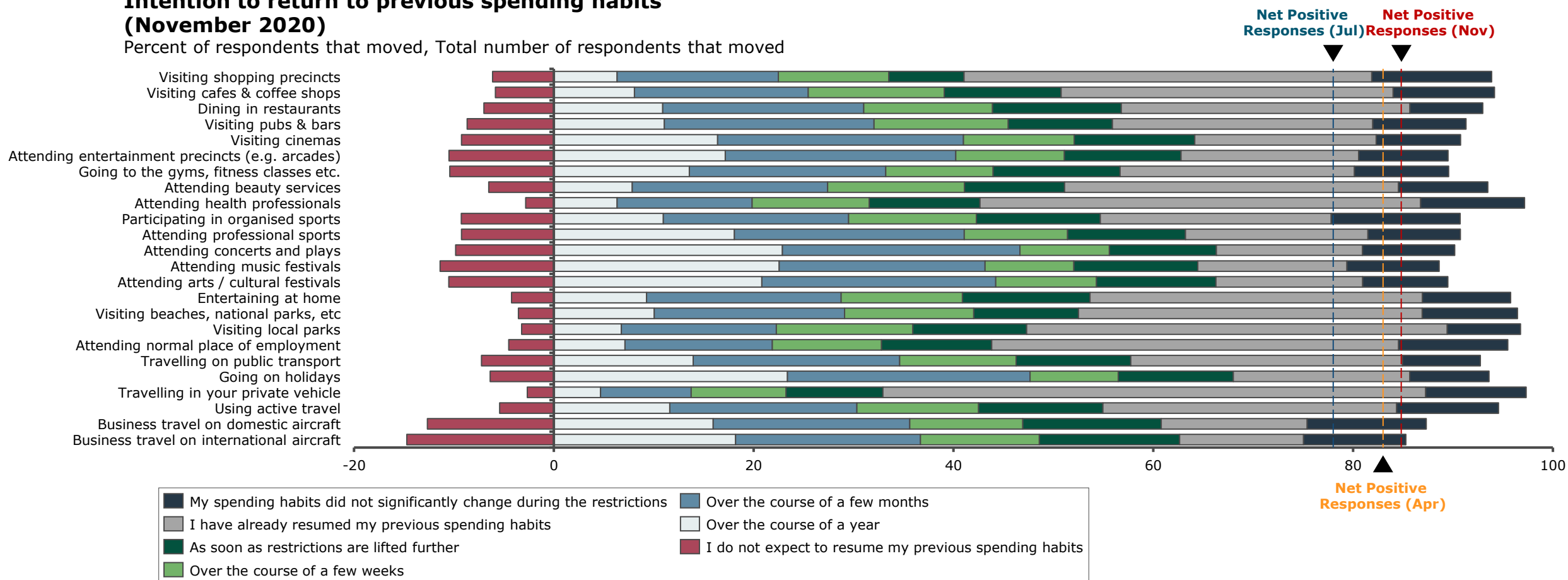
Weekly index of consumption per person, 100 = normal weekly base excluding Christmas



Since July, there has been significant uplift in intentions to return to previous behaviour, with business travel and entertainment the most likely to lag

Intention to return to previous spending habits (November 2020)

Percent of respondents that moved, Total number of respondents that moved



Section 4

Transport

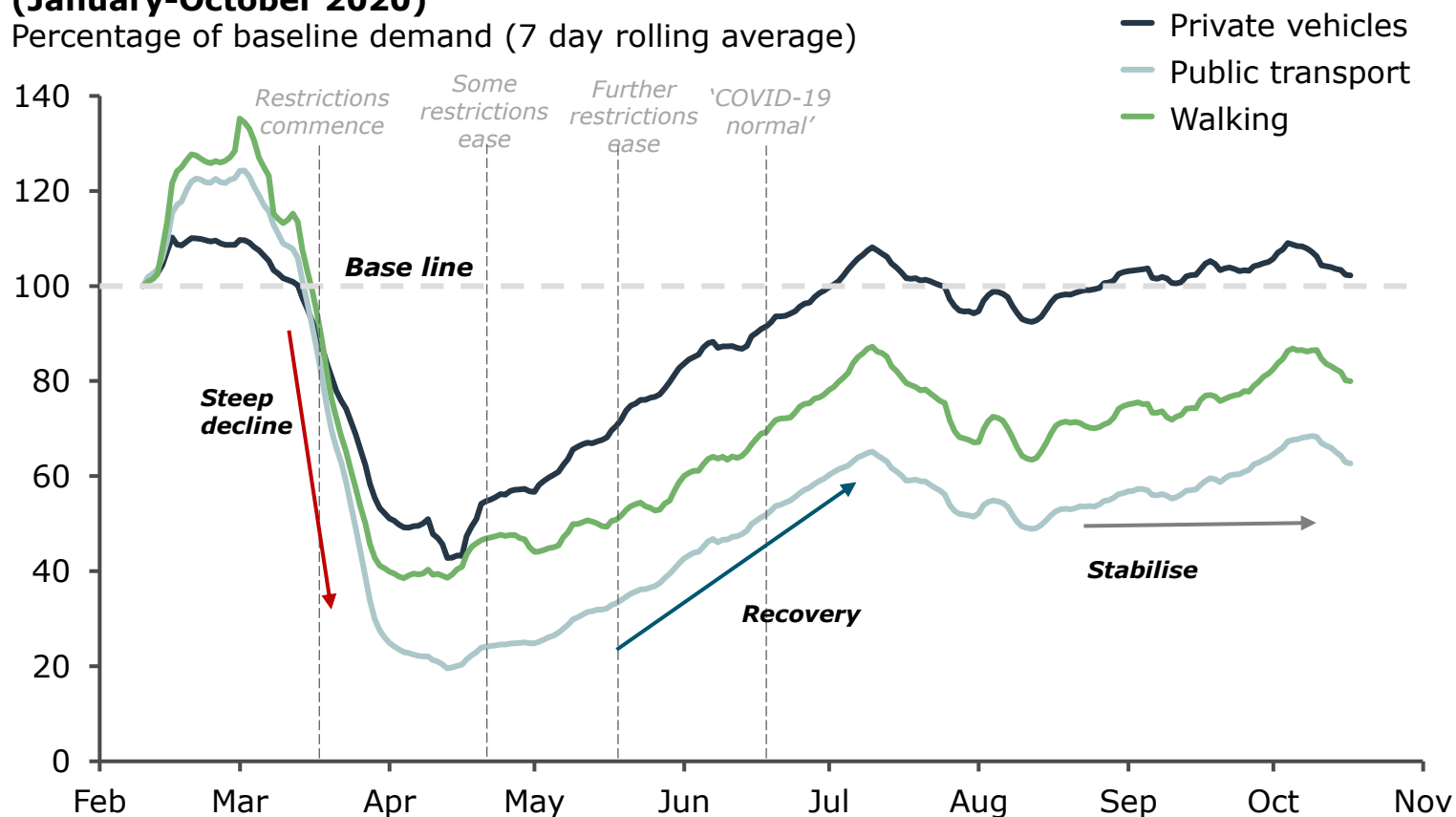
COVID-19 caused less travel and triggered a mode shift to roads

Category	Segment	Summary of trends
Personal Mobility	Public transport patronage	<ul style="list-style-type: none"> The lockdown in March 2020 forced a sharp decline in personal mobility, which stabilised at lower levels of public transport than walking and private vehicle use. Private vehicle use has now stabilised back at pre-COVID-19 levels Lower recovery of public transport use is a national trend, that is similar evident even in cities with fewer COVID-19 case numbers, with the exception of Melbourne which experienced a second wave In Sydney, the rate of public transport recovery has coincided with the rates of return to office-based commuting An increase in second hand vehicle registrations through to July suggests that increased private vehicle use may be sustained Australia's drop in PT use is comparable to North American cities, despite their different COVID-19 case numbers. In contrast, public transport use in Auckland has recovered more strongly following lockdowns There has been a strong switch towards cycling since March, with cities providing cycling infrastructure to support active transport Walking has displaced public transport for some short trips and to access local retail options
	Mode shift to private vehicles	
	Distribution of public transport trips	
	Active Transport	
Congestion	Network shift from CBDs to local centres	<ul style="list-style-type: none"> If the shift towards private vehicle use remains once pre-COVID-19 CBD volumes return, there could be a significant increase in congestion Traffic data implies that road transport is nearly back to pre-COVID-19 levels after initial reductions in traffic on major arterial corridors There has been some peak spreading on public transport, but more intense peaks on road corridors, suggesting commuters shifted to private car use Public transport providers responded quickly to support social distancing and improved hygiene, and quickly integrated new digital tools to manage real-time capacity
	Kerbside deliveries	
Freight	Last mile delivery	<ul style="list-style-type: none"> During the pandemic, online shopping grew five to six times the level of annual growth in 2019, increasing the last mile freight task The geographical distribution of last mile trips shifted heavily away from CBDs to residential and local areas Australia's merchandise imports have remained relatively stable despite air-freight volumes dropping, suggesting an increase in road and rail freight Australia's major ports have experienced relatively stable levels of throughput volume as maritime transport is subject to less stringent restrictions experienced a rapid increase in domestic travel after lockdown.
Tourism and Travel	Domestic aviation	<ul style="list-style-type: none"> Domestic and International aircraft movements have fallen dramatically due to border closures, with domestic travel now in a slow recovery phase as borders open Domestic overnight trips declined sharply, and have recovered at varying rates across the states and between city and regional areas. In contrast, Auckland Airport experienced a rapid increase in domestic travel after lockdown.
	International aviation	

The lockdown in March 2020 forced a sharp decline in personal mobility, private vehicle use has recovered however public transport and walking have stabilised

Sydney, indexed average transport demand* (January-October 2020)

Percentage of baseline demand (7 day rolling average)

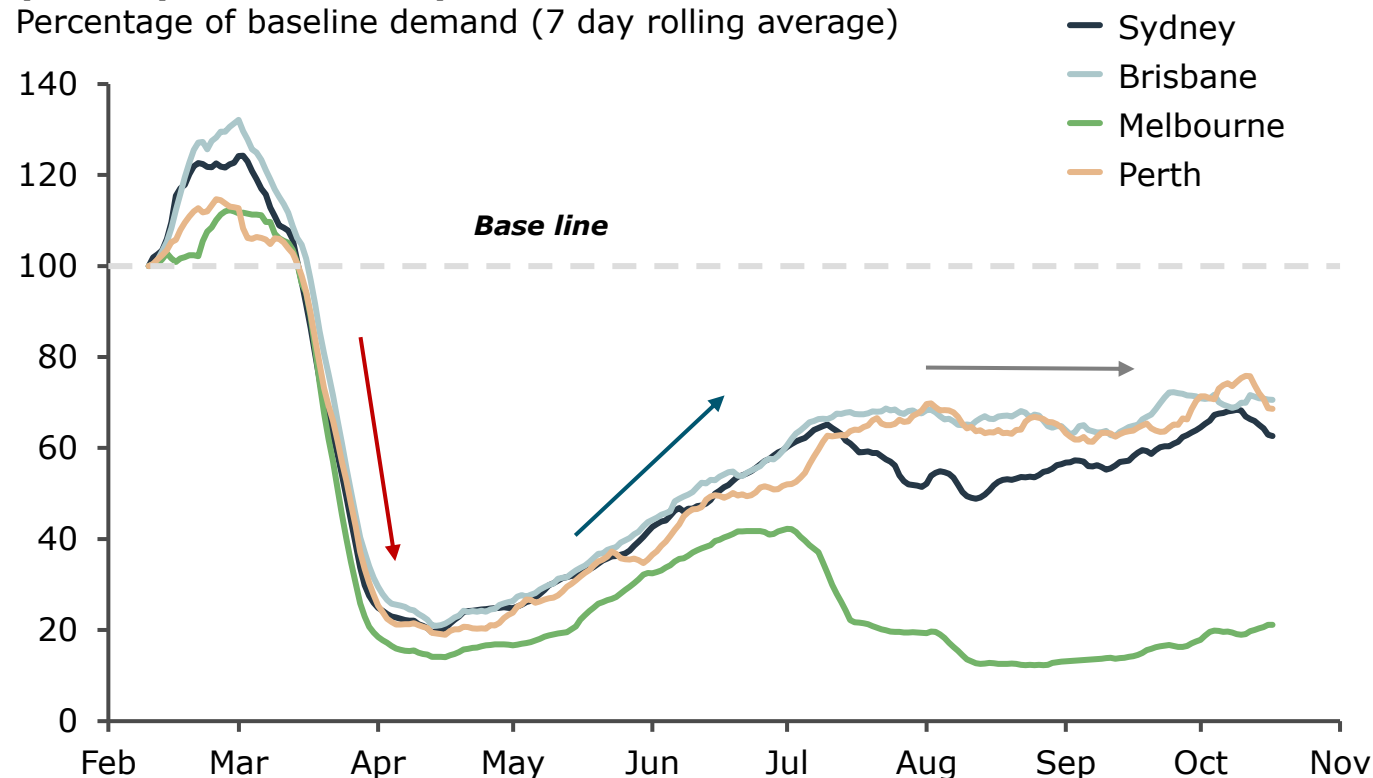


- Following the classification of COVID-19 as a pandemic and the first lockdown, there have been steep declines in all modes of transport, with the most significant decline in public transport
- Lower case numbers and eased restrictions resulted in all modes moving into a recovery period
- However, the threat of a second wave of COVID-19 in July resulted in a second dip in travel in Sydney before all modes
- Although stabilised, public transport use remains at around 60% only, while private vehicle use has recovered to pre-COVID-19 demand levels

Low recovery of public transport use is a national trend, and evident even in cities with fewer COVID-19 case numbers

Indexed public transport demand*, by city (January-October 2020)

Percentage of baseline demand (7 day rolling average)

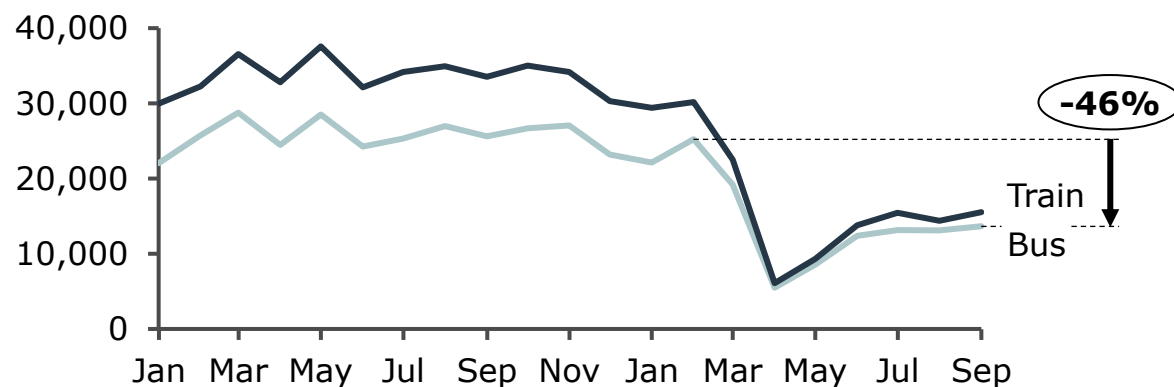


- After the first wave, there have been less COVID-19 cases in Brisbane and Perth than in Sydney, but all three followed a very similar 'decline, recover, stabilise' trend across transport modes
- This suggests that working from home and fear of infection are stronger drivers of public transport use than COVID-19 case levels
- It also suggests there is may be a baseload of people that are more reliant on public transport, regardless of COVID-19 health concerns
- Melbourne went through the initial decline and recovery phase but then declined again due to the second wave of COVID-19. It is likely to start a new recovery phase now lockdown restrictions have eased

In Sydney, the use of public transport has recovered with the rate of return to office-based commuting

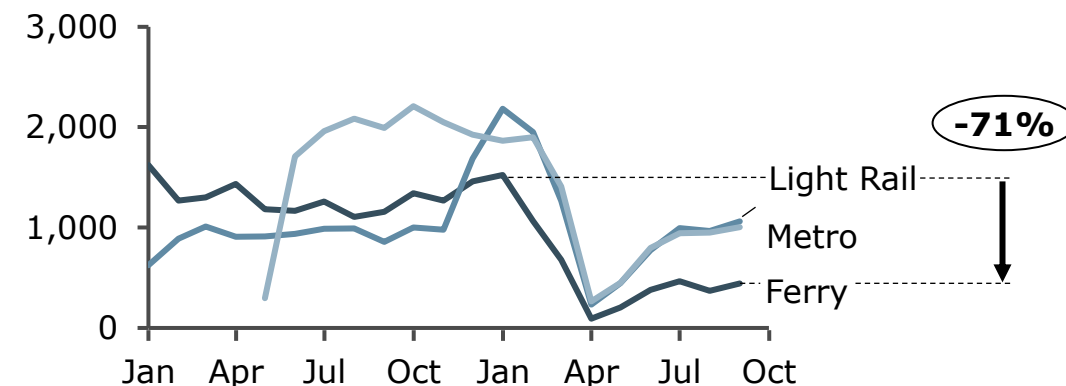
**Sydney Opal trips by mode
(2019-20)**

No. of trips, 000's



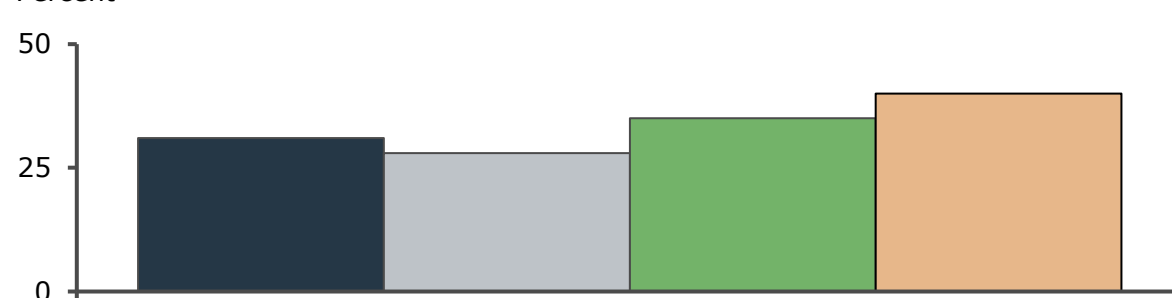
**Sydney Opal trips by mode
(2019-20)**

No. of trips, 000's



**Current level of occupancy in Sydney CBD office buildings
(Jul-2020 to Oct-2020)**

Percent

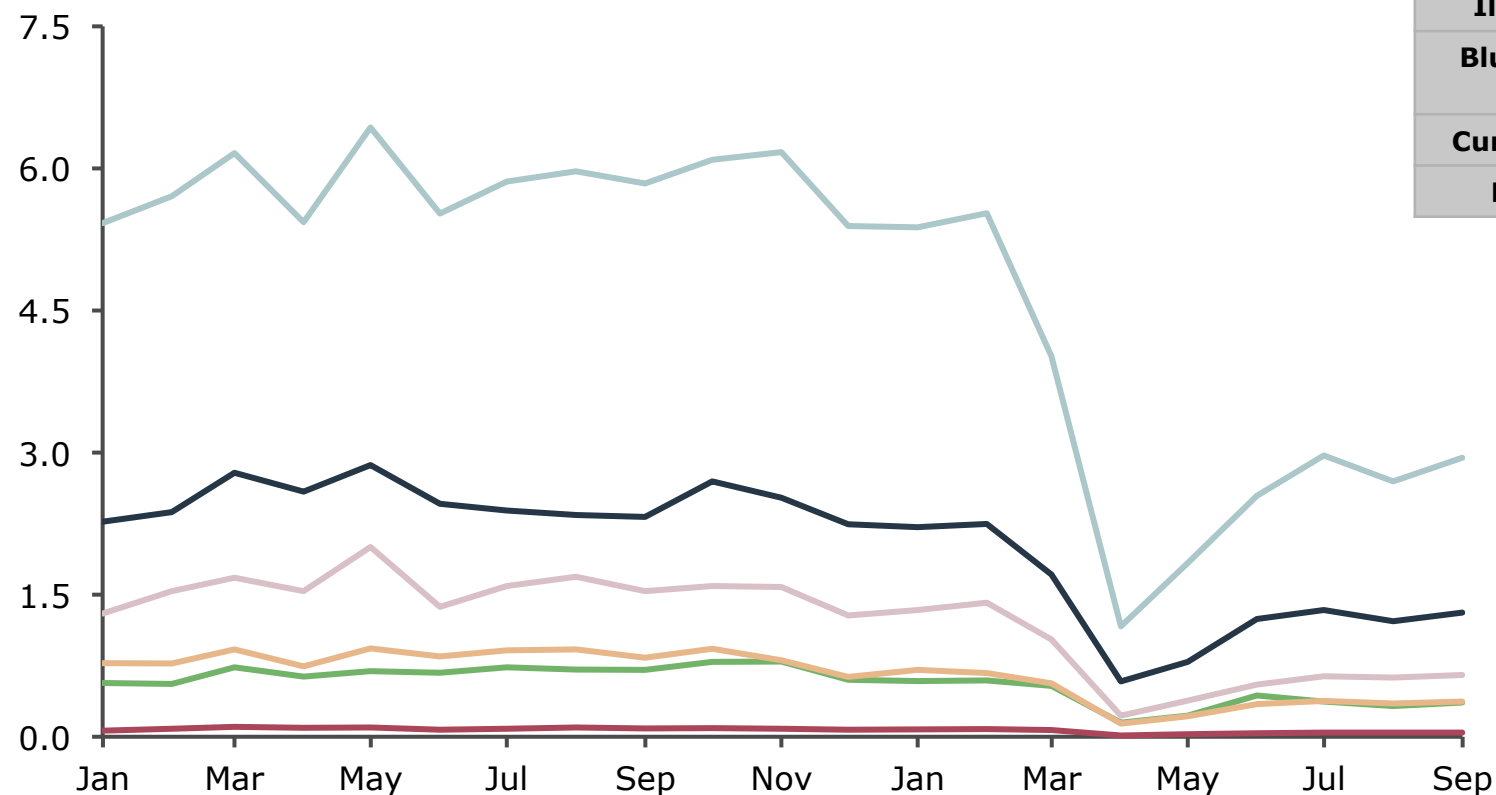


- Opal ticketing data demonstrates the steep decline, recovery and stabilisation trend that has occurred across all public transport modes
- Bus patronage remains 46% lower than pre-COVID-19 levels and ferry patronage 71% lower
- The public transport usage from July through to October appears broadly in step with the return of CBD occupancy through those months, indicating that public transport will return as people begin to work in the CBD more frequently

Public transport use drops were consistent across both urban and regional rail services in New South Wales

Opal train trips by line (2019-20)

No. of trips, millions



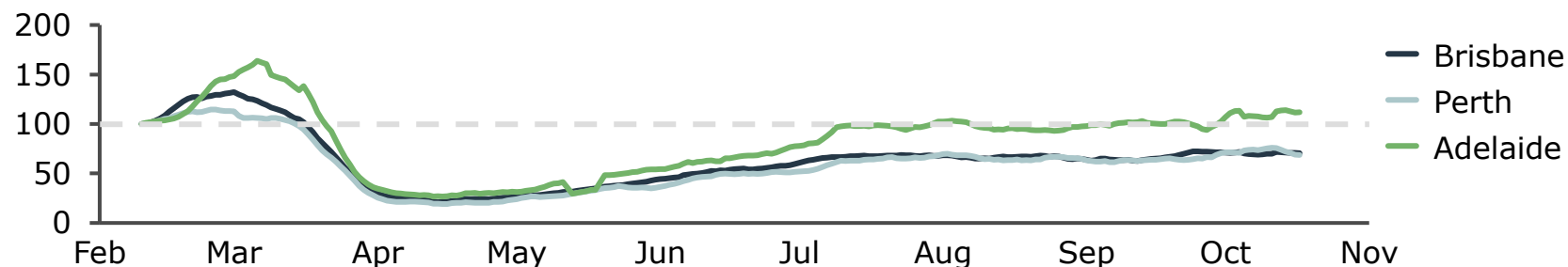
Source: TfNSW - <https://opendata.transport.nsw.gov.au/>

	Change in patronage between Feb and Sep (%)
Eastern Suburbs & Illawarra line	-47
Blue Mountains line	-45
Cumberland line	-39
Hunter line	-48

Public transport use in other major cities has generally followed the trend of CBD occupancy rates, although they have less reliance on public transport for CBD access

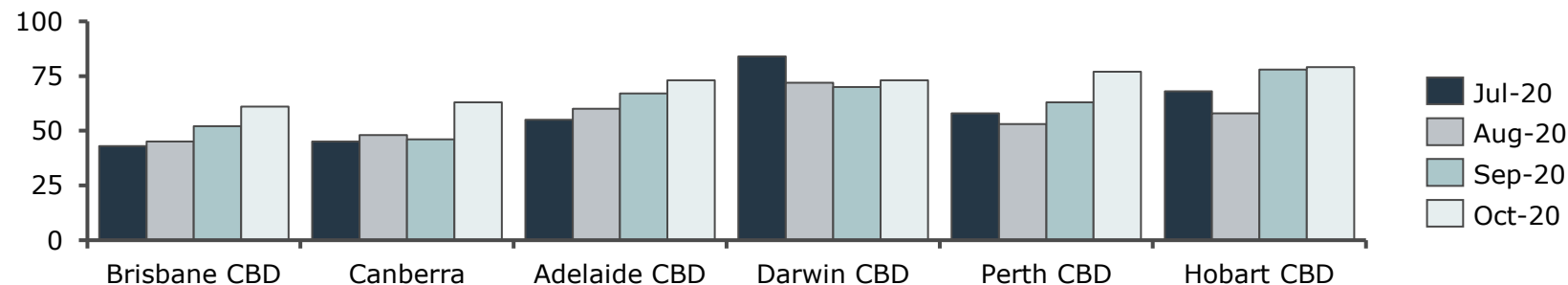
Indexed public transport demand*, by city (January-October 2020)

Percentage of baseline demand (7 day rolling average)



Current level of occupancy in CBD office buildings compared to pre-COVID-19 period (Jul-2020 to Oct-2020)

Percent

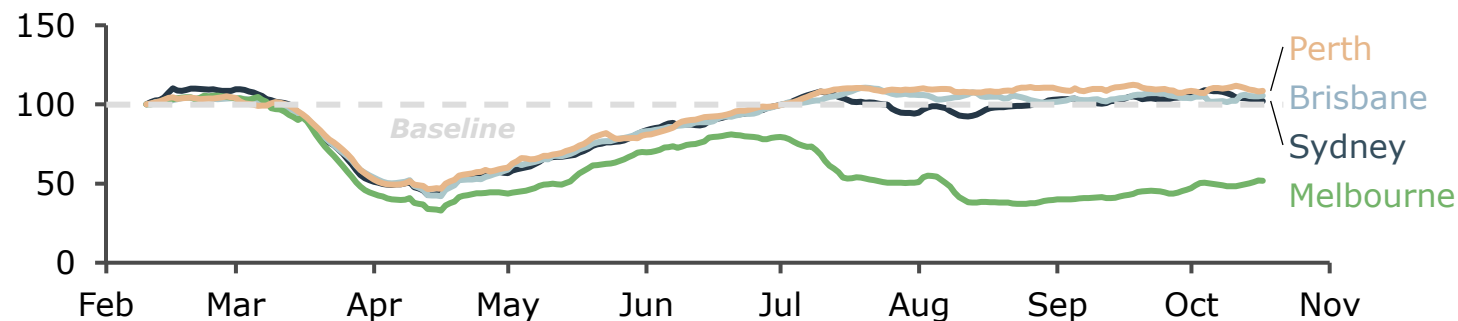


- Adelaide, Brisbane and Perth all saw increased CBD office occupancy rates from August through to October 2020, with public transport usage in these cities stabilising earlier from July 2020
- Public transport use was most resilient in Adelaide, where demand returned to its pre-COVID-19 baseline, prior to the second period of lockdown

Increased new and second-hand car registrations may indicate the 'lock-in' of mode shift to private car use may be sustained

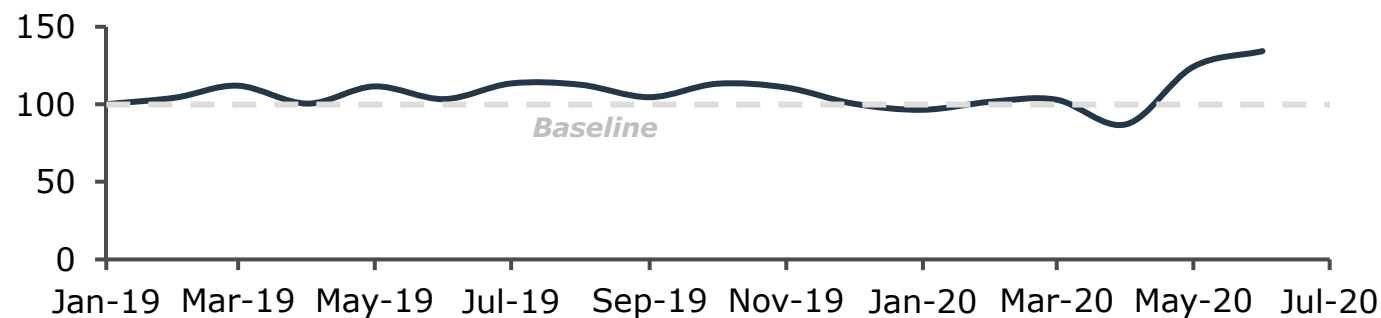
Indexed private vehicle demand*, by city (January-October 2020)

Percentage of baseline demand (7 day rolling average)



NSW, monthly second hand vehicle registrations, by customer type** (June 2017 – June 2020)

Percentage of baseline demand***

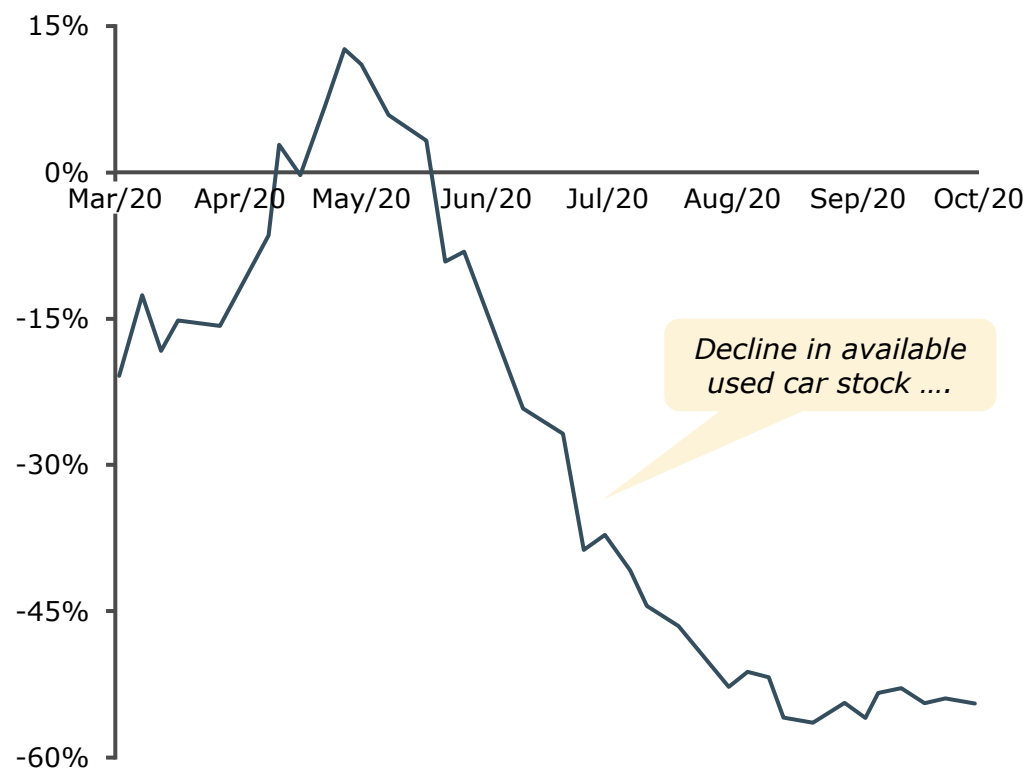


- Monthly second-hand vehicle registrations in NSW have historically been relatively stable with periodic peaks
- Registrations initially declined as COVID-19 was announced as a pandemic but quickly grew to c.35% above baseline demand
- The growth trend suggests that households were acquiring an additional vehicle.
- Increased private vehicle purchases indicate the increase in their use may endure beyond the pandemic due to perceptions regarding these purchases and the incremental cost of each journey.
- However private vehicle trips may also be more localised as more people work remotely

The shortage of used vehicle stock nationally led to an increase in used car prices

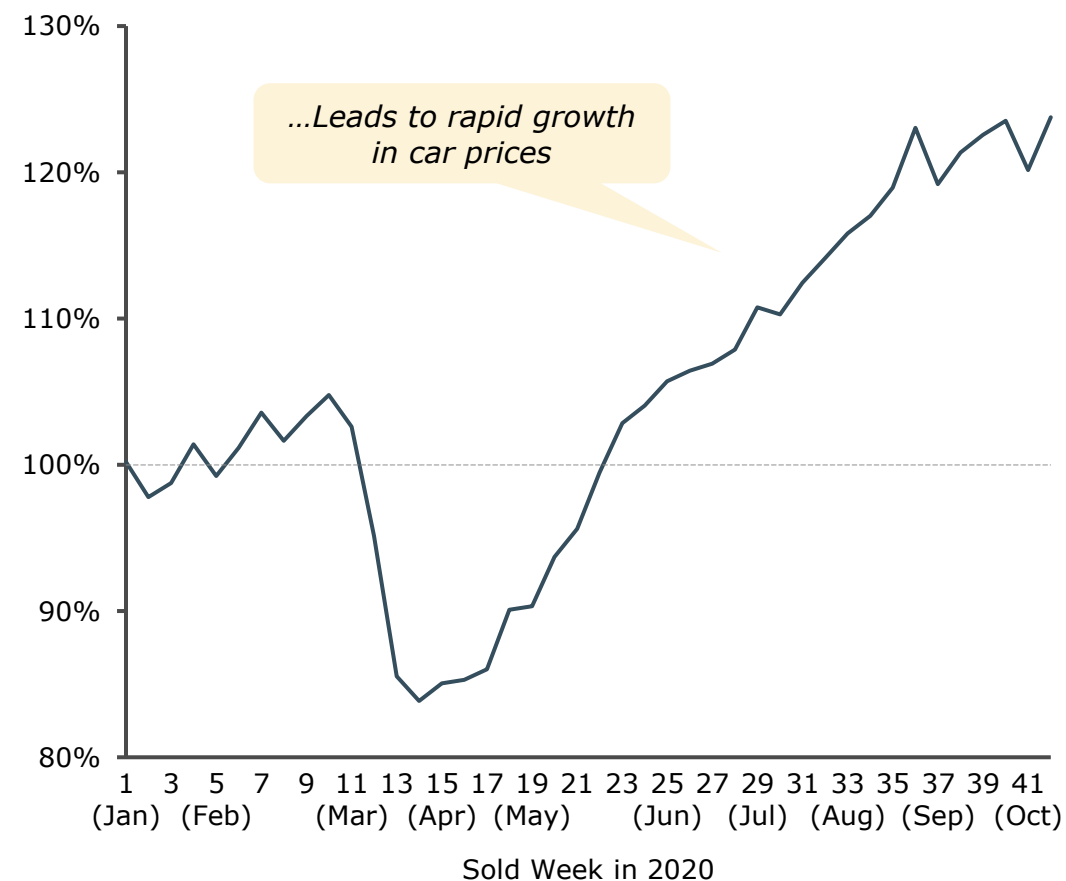
**Pickles Stock on Hand Volumes Movement
(2 Mar 2020 – 30 Sep 2020)**

Percentage change in volume



**Australia Weekly Used Car Price Index
(Jan 2020 – Nov 2020)**

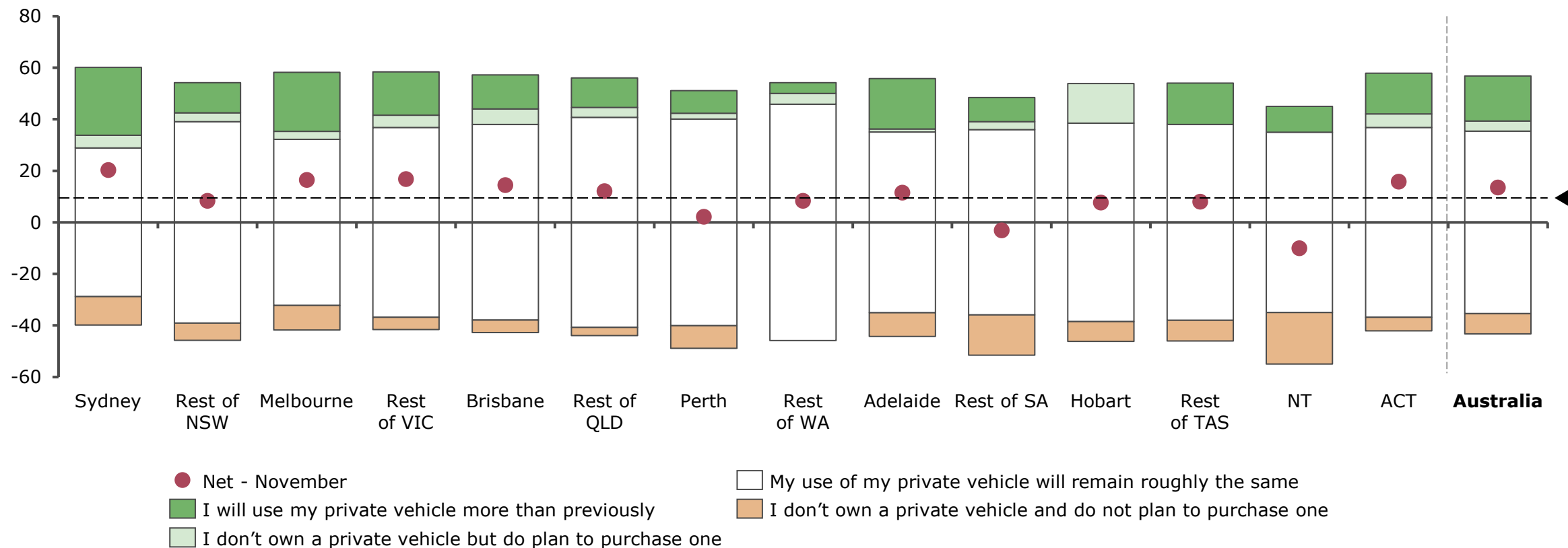
Index (Jan 2020 = 100)



Many people indicated they intend to use private vehicles more than before COVID-19, particularly in metro centres

Intention to use a private vehicle compared to before COVID-19 (November 2020)

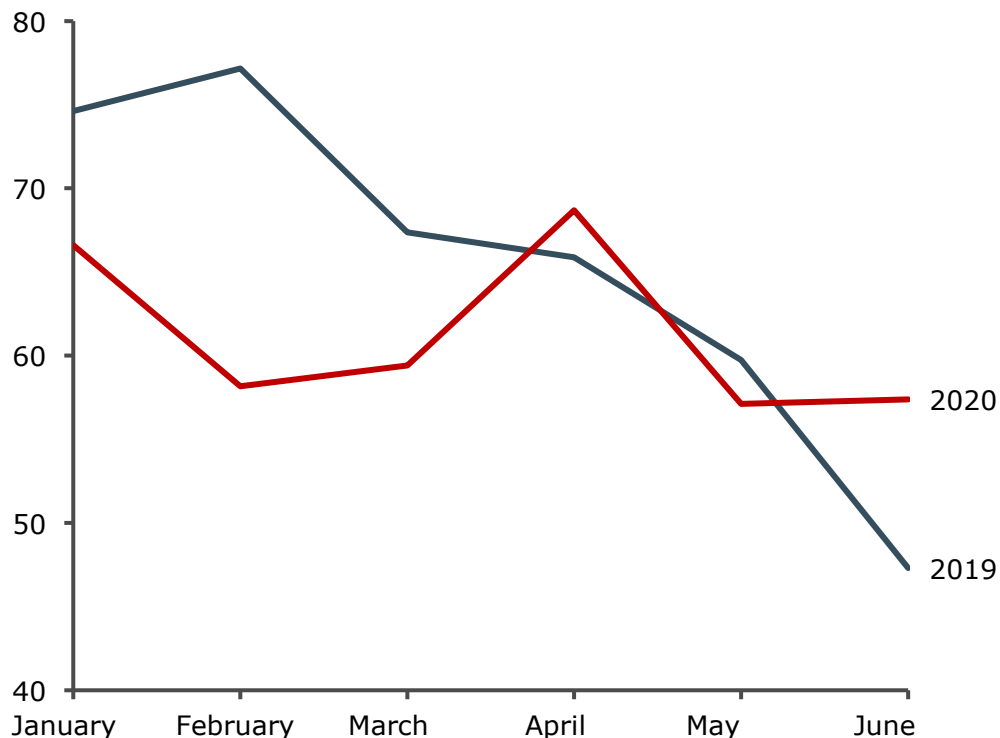
Percent of respondents (n = 1,531)



There has been a strong switch towards cycling since March, with cities responding by providing additional cycling infrastructure

Bicycle traffic volume in Queensland* (January 2019 to June 2020)

Average monthly cycling count



- There has been a significant increase in the volume of cycle traffic across Australia, both as a means for exercise / spending time with family, and for transport purposes
 - in Melbourne, there was a 270% increase in the number of riders on bike paths between November 2019 – April 2020
 - Sydney City Council reported an increase in cycle traffic of c.25-50%
 - Brisbane City Council data shows an increase of 1m bikeway trips since March
- This rapid increase in cycling is most pronounced in the commuter segment
 - online retailer Bicycles Online saw sales figures more than double during April, particularly in commuter bike sales which grew 210 per cent
 - mountain bike sales surged 170 per cent, while kids bike sales increased by 60 per cent at Bicycles Online

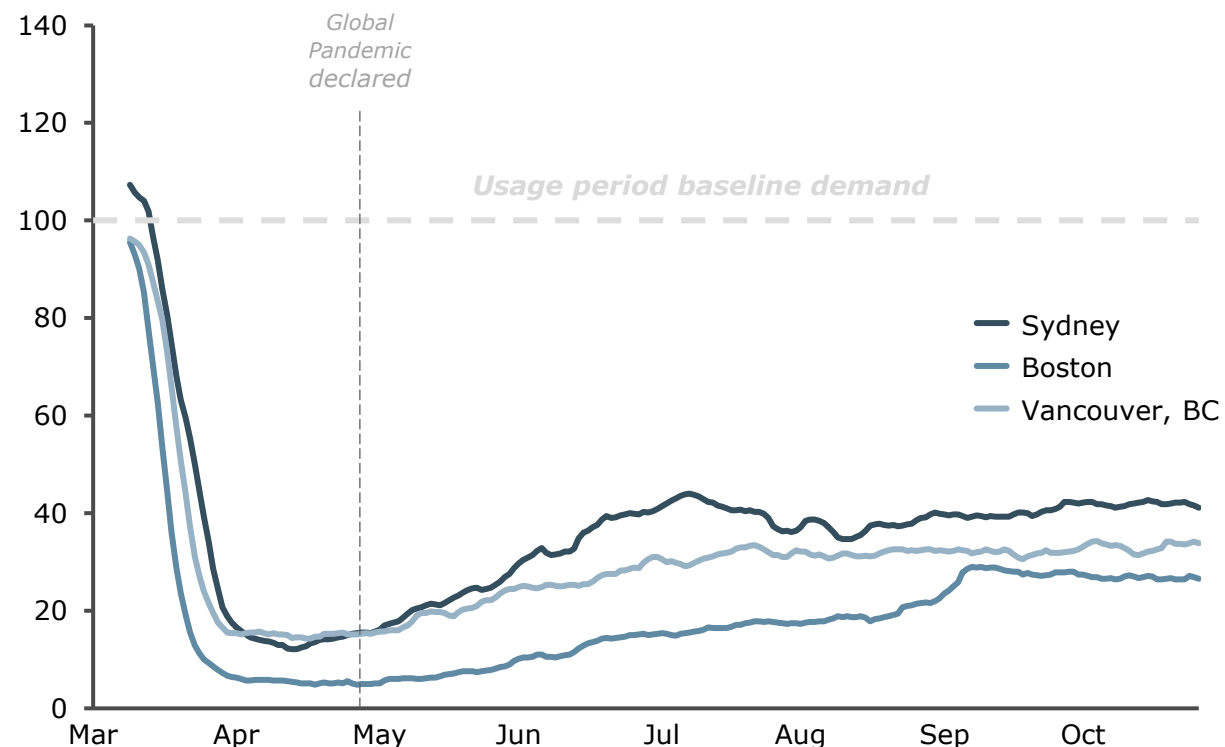
"... Sales are exceeding what we would expect to see at Christmas ..."
Co-founder, Bicycles Online

- Local councils have responded by installing new pop-up cycleways
 - the City of Sydney announced over than 10 kilometres of pop-up bike lanes including six temporary lanes in key commuter areas in the CBD
 - in Melbourne, 40 kilometres of bike lanes within the CBD have been fast-tracked
- Other global cities such as Berlin and Milan have promoted active transport by extending footpaths, redrawing road markings, removing carparks and installing temporary bike lanes

While the COVID-19 impacts vary, public transport response in Australia is comparable with some North American cities

Citymapper Public Transport Mobility Index* (January-October 2020)

Percentage of 'typical usage period' demand (7 day rolling average)



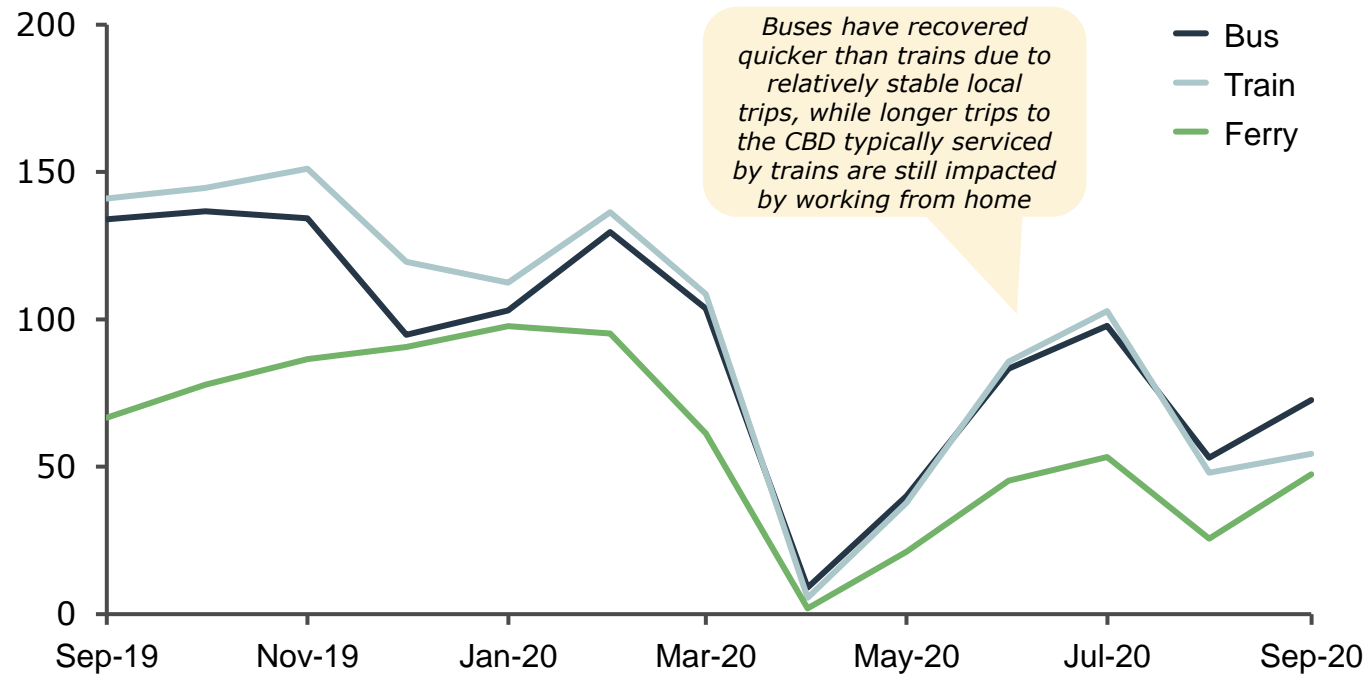
- Some North American cities saw comparable falls and recovery in public transport use to Sydney, such as Vancouver and Boston
- All cities experienced a strong decline in public transport demand following the declaration of a pandemic followed by a recovery period which has stabilised since July
- Boston has consistently recorded a higher number of daily new confirmed cases compared to the other cities. Boston has still followed a similar trend and has stabilised at a similar level, but with a slower recovery period prior to stabilising

	New confirmed COVID-19 cases, daily count	
	24 April 2020	1 October 2020
NSW	7	3
British Columbia	29	82
Boston	4,946	754

Public transport use in Auckland showed a similar recovery pattern to Melbourne, however recovery has been more rapid

Indexed Auckland Total Patronage (2019-20)

No. of Trips, 000's

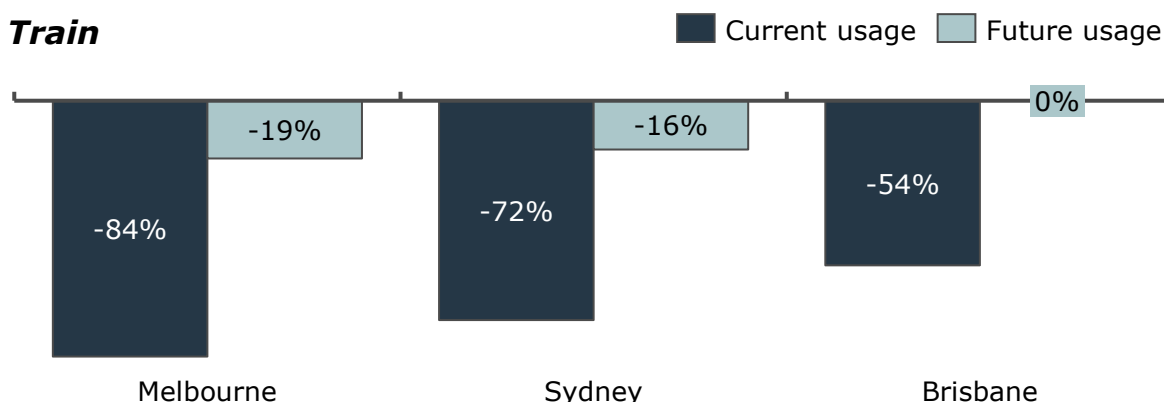


- The trend in Auckland is most similar to Melbourne with declines linked to the two periods of lockdown introduced by the government.
- Public transport use in Auckland experienced a sharp decline following New Zealand's nationwide lockdown in March 2020
- Patronage recovered quickly after the lockdown restrictions were lifted but declined again following a second wave outbreak and second lockdown in August
- In September, patronage was still in recovery phase and yet to stabilise
- Buses have recovered more quickly than trains, unlike in Sydney. This may reflect that the different roles of rail in supporting commuter trips into CBDs against buses which perform local and city journeys across the day
- The Auckland trends show the significant impact of lockdown on public transport patronage, but also that recovery can occur quickly once the community feels relatively safe

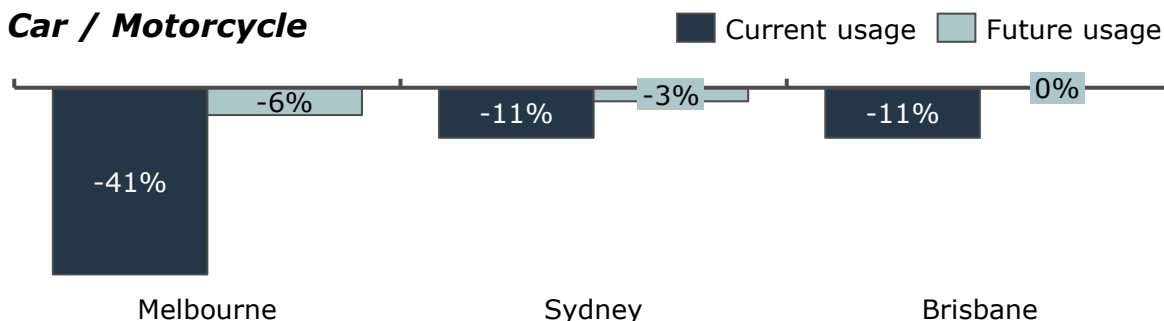
People may return to cars and motorcycles more quickly than public transport

**How daily users of transport expect their use will change
(% change pre- vs current / post-pandemic)**

Train



Car / Motorcycle

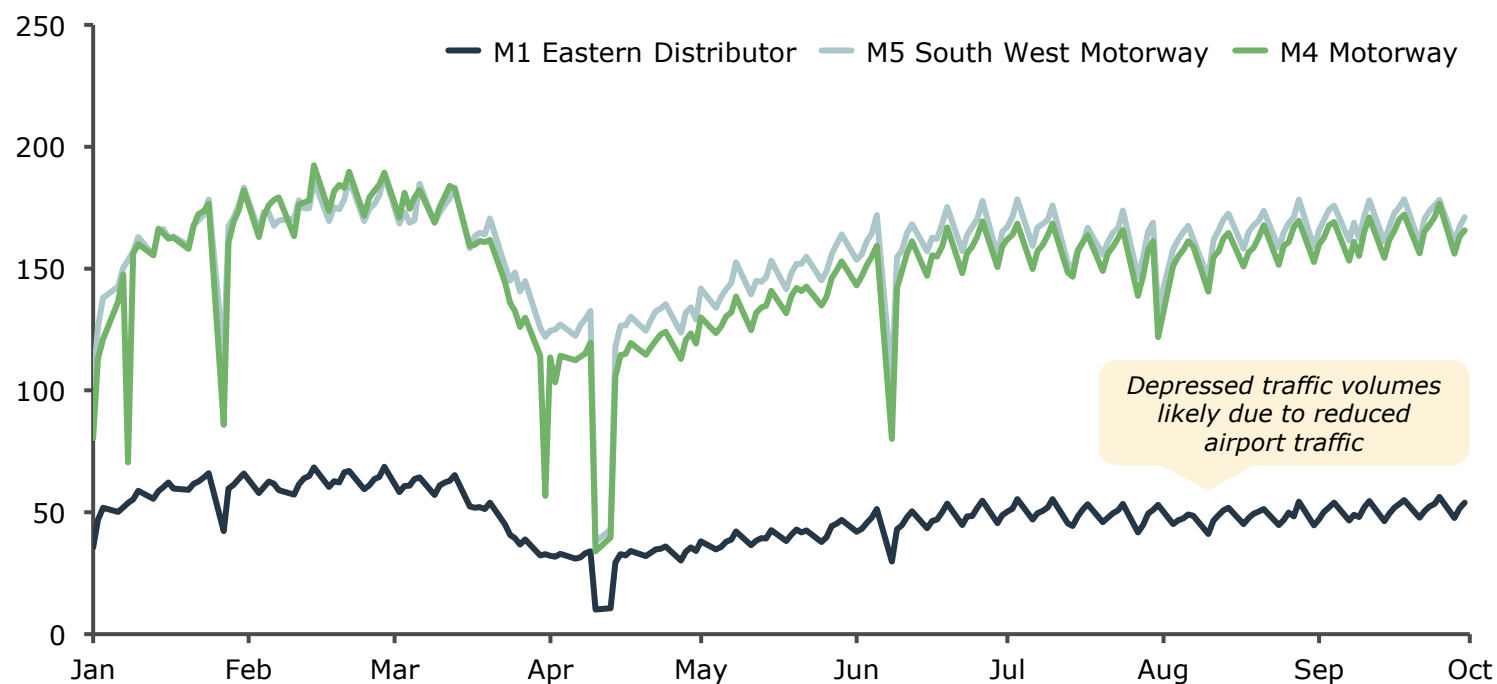


- As Australia exits the pandemic, fears of public health risks on public transport will remain and impact train usage at more moderate levels than the sharp decline experienced today
- Transurban survey data shows train usage in Melbourne is anticipated to fall by 19% followed by Sydney at a 16% reduction post-pandemic
- The survey also suggested Brisbane, one of few Australian regions with a very small number of COVID-19 cases anticipated no change in train usage post-pandemic, indicating that a reduction in future train usage is influenced by the number of cases a region has experienced
- However, the survey indicated that car usage is expected to return to near pre-pandemic levels for Melbourne, Sydney and Brisbane as the public feels a greater level of safety in private vehicle use compared to public transport

Sydney toll road traffic data indicates that road transport is nearly back to pre-COVID-19 levels after initial reductions in traffic

NSW toll road traffic (2020)

No. of Trips*, 000's



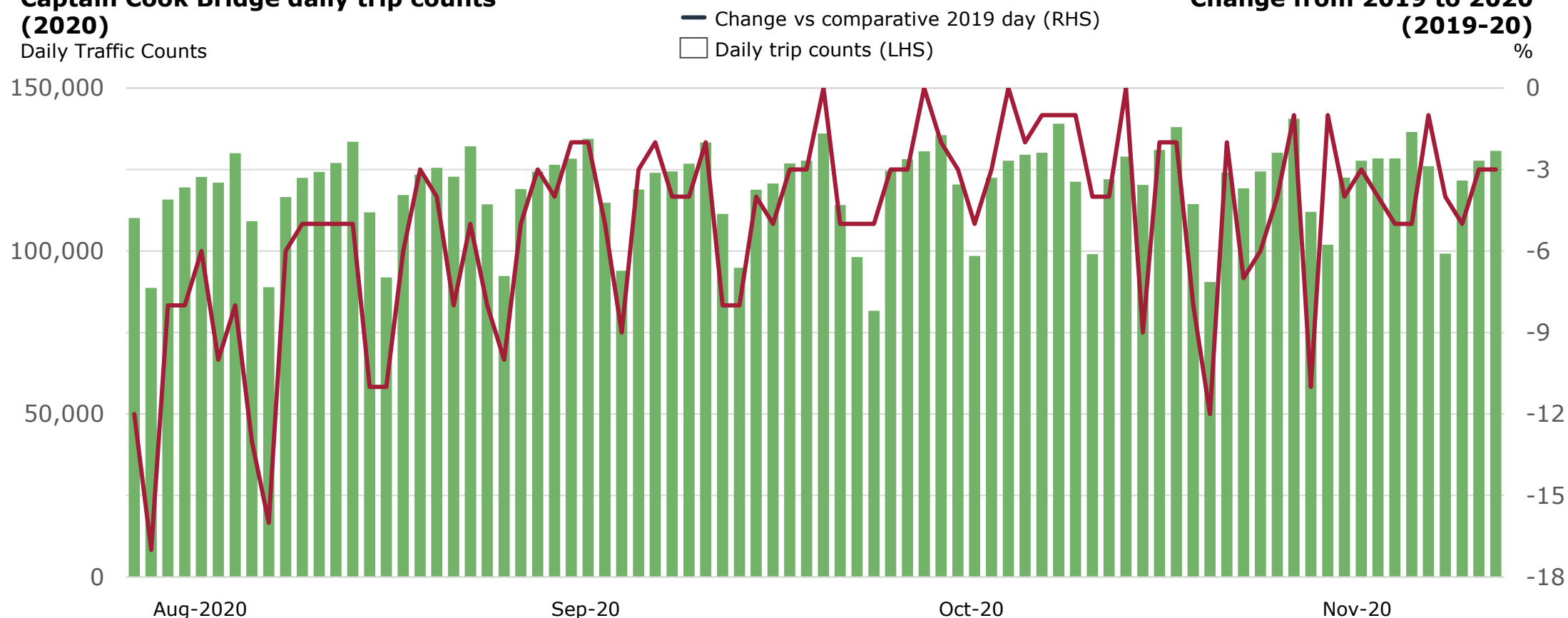
- Traffic volumes experienced an initial decline in March and quickly recovered to near pre-pandemic levels since late June
- Most of the fluctuation around the April-May period was driven by car use as the number of trucks has remained relatively stable on the roads despite supply chain disruptions

Brisbane's Captain Cook Bridge also experienced a traffic decrease during the first half of 2020 but has since stabilised slightly below 2019 levels

Captain Cook Bridge daily trip counts (2020)

Daily Traffic Counts

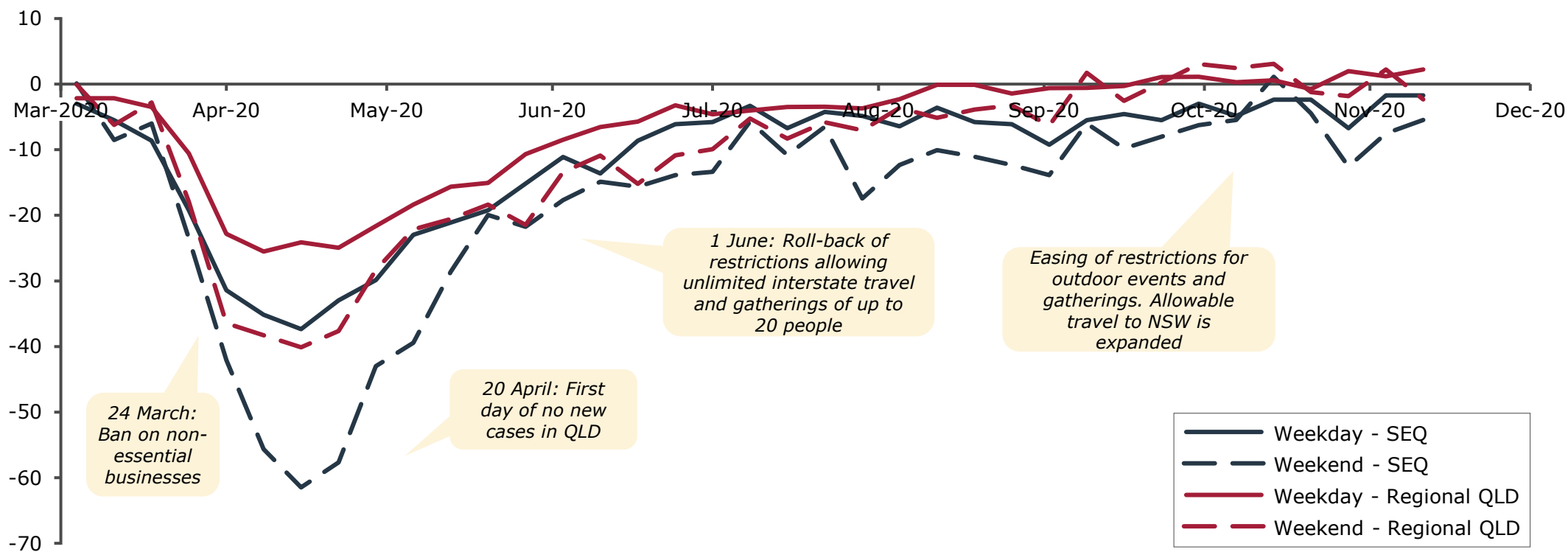
Change from 2019 to 2020 (2019-20)



Traffic volumes in regional QLD fell less than SEQ, with weekend traffic recording the biggest falls due to high discretionary trips

Average weekly traffic volume change, South East QLD vs Regional Centres of QLD (2020)

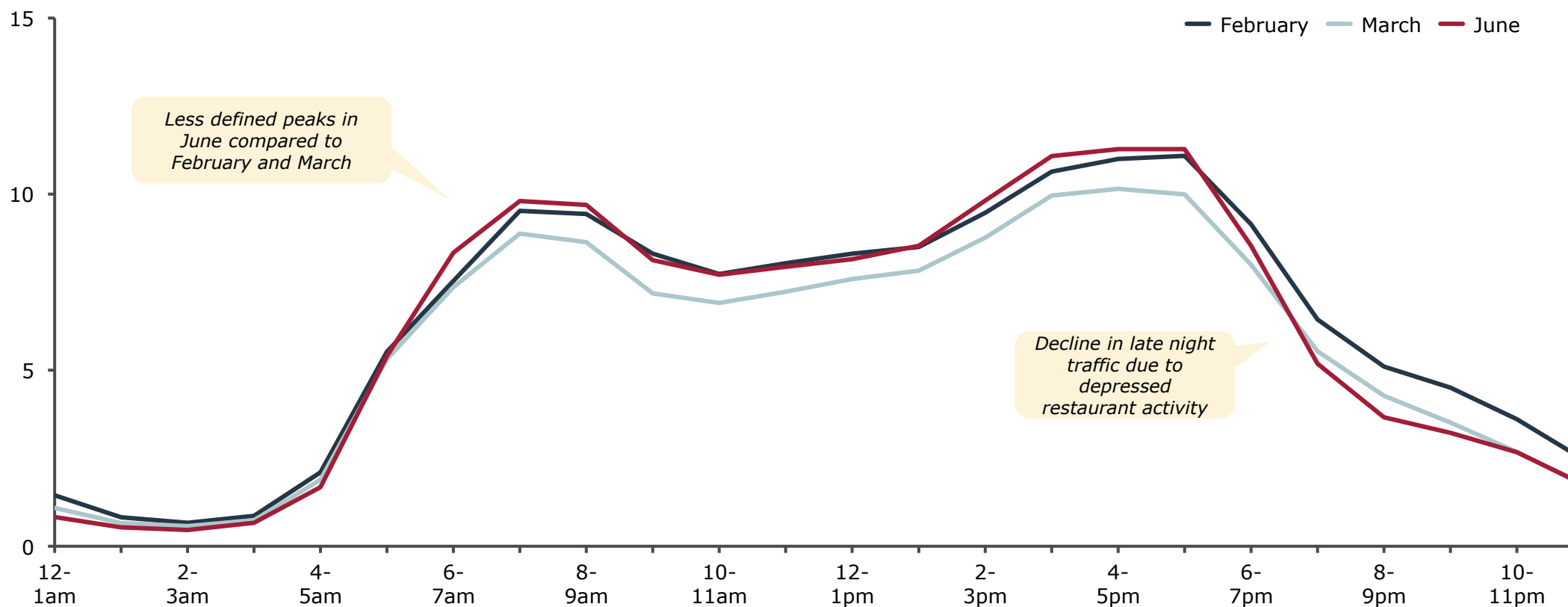
Percentage



People are travelling by road earlier, suggesting less CBD-based evening activity

M5 South West Motorway Car Traffic (2020)

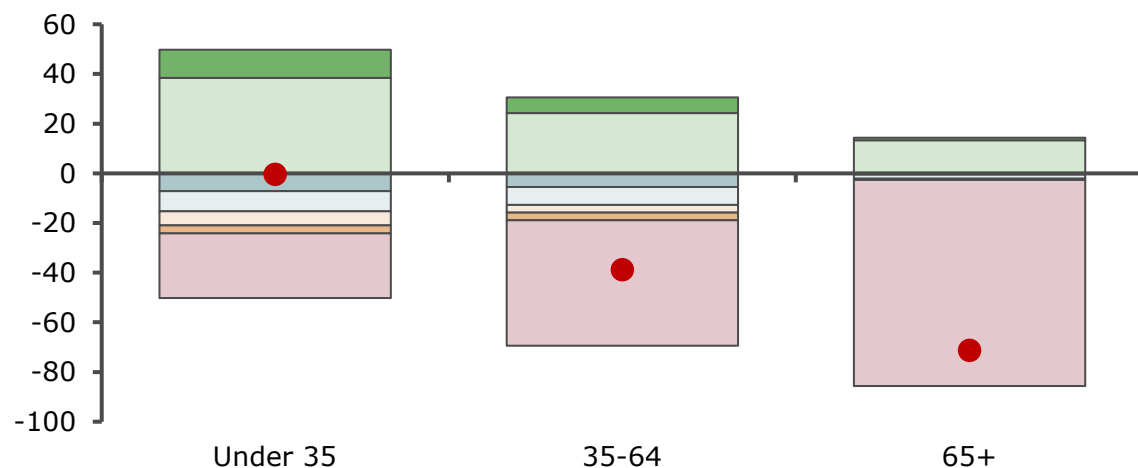
Weekday traffic volume, 000's



Australians expect ride-share use to be the same or less than pre-COVID-19, and private vehicle use to be higher

Intention to return to pre-COVID-19 use of ride share, by age cohort (November 2020)

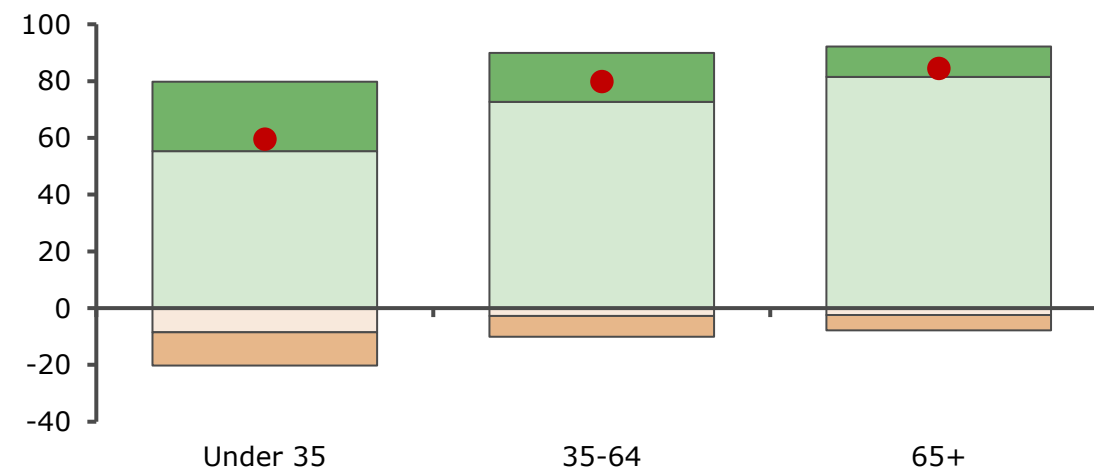
Percent of respondents (n=1,531)*



- Net - November
- I will use more ride share at the expense of public transport
- My use of ride share will remain roughly the same
- I will use less ride share, and more public transport
- I will use less ride share, and drive my own vehicle instead
- I will use less ride share and use active modes (e.g. walking, cycling) instead
- I will take less pooled rides due to health concerns
- I do not intend to use ride share services

Intention to return to pre-COVID-19 use of private vehicles, by age cohort (November 2020)

Percent of respondents (n=1,531)*



- Net - November
- I will use my private vehicle more than previously
- My use of my private vehicle will remain roughly the same
- I don't own a private vehicle but do plan to purchase one
- I don't own a private vehicle and do not plan to purchase one

Public transport providers responded quickly to support social distancing and improved hygiene, and used new digital tools to manage real-time capacity



TRANSPORT HYGIENE

- Posters and digital communication used to educate passengers to practice hygiene, wash hands and keep their distance across Australia's transport networks
- Daily disinfection of public transport commenced on 16 March 2020 in South Australia
- Introduction of hand disinfectant stations in Melbourne and over 300 hand sanitiser stations set up and maintained across the Sydney network
- TfNSW hired an extra 1,210 cleaners and increased to more than 590,000 extra hours of cleaning since March



CUSTOMER BEHAVIOUR

- Melbourne made public mask-wearing compulsory amidst the second wave of the virus
- NSW introduces real-time app and travel insights dashboard introduced with occupancy data and service trends uses Opal, capacity sensors and third party applications to share data
- Sydney Trains employs hundreds of staff at key transport interchanges to monitor physical distancing and manage behaviours to prevent crowding
- 'Sit here' green stickers used to guide passengers on social distancing on Sydney trains



CAPACITY MANAGEMENT

- In Melbourne, passengers are unable to access the front row of seats on trams and buses to protect drivers
- 80 staff deployed to monitor physical distancing measures via 11,000 cameras across Sydney's railway stations
- 4,300 additional services across bus and train in Sydney to increase capacity for physical distancing and provide more options for commuters
- Capacity limits on buses and trains across Australia



GOVERNANCE & INVESTMENT

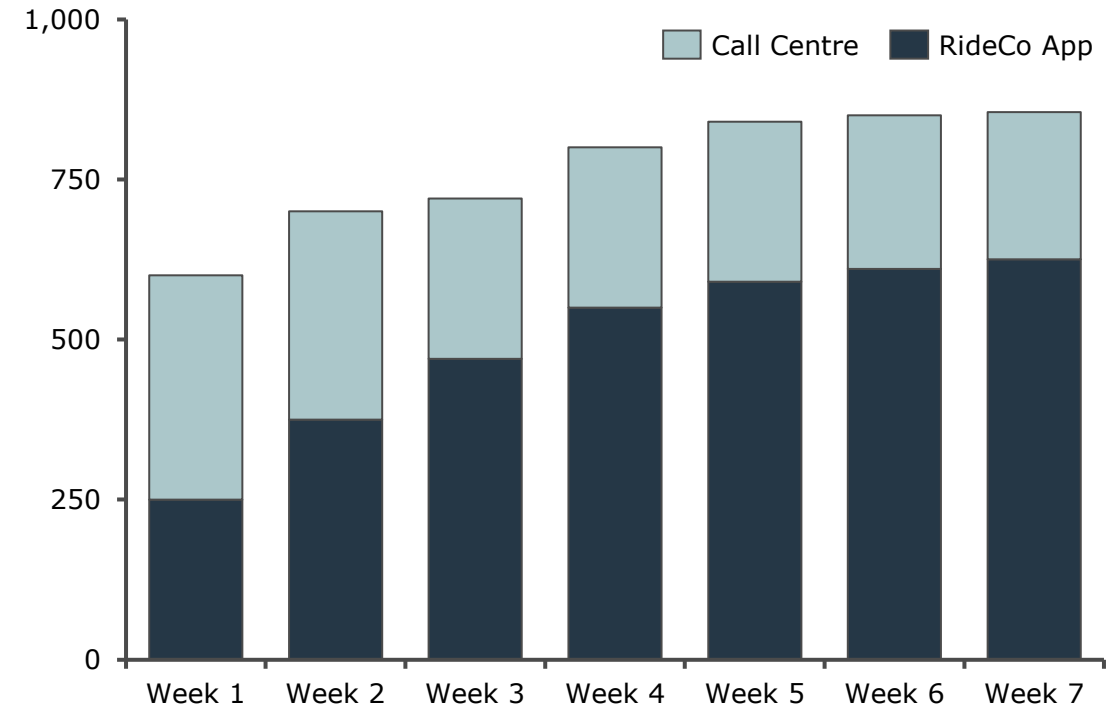
- Opal registrations in NSW used to contact trace those in proximity to infected passengers
- Commuter car parks fast-tracked for development for those who have to drive part way to transport
- \$80m invested into a new Traffic Management System to improve operations and reduce journey times
- Cash payments suspended for regional services

Innovative point to point services could support recovery; RideCo in Texas introduced a new digital platform for on demand, increasing patronage by 19%

Case Study: Introduction of digital public transport offering during COVID-19

- Since the onset of COVID-19, local bus services in Houston, Texas have experienced declines in patronage of around 50%
- In response to the health concerns around COVID-19, the Metropolitan Transit Authority of Harris County (METRO), which surrounds Houston, partnered with an on-demand software provider, RideCo
- RideCo digitised the "dial-a-ride" service which traditionally saw customers manually phoning a call centre to pre-book rides. They introduced on-demand software which enabled a fully automated transit system as well as allowing passengers to book rides through their mobiles
- The modernisation of "dial-a-ride" software resulted in a patronage increase of 19% despite the pandemic. It also delivered a 21% reduction in cost per passenger and wait times were reduced from 60 minutes to 10 minutes

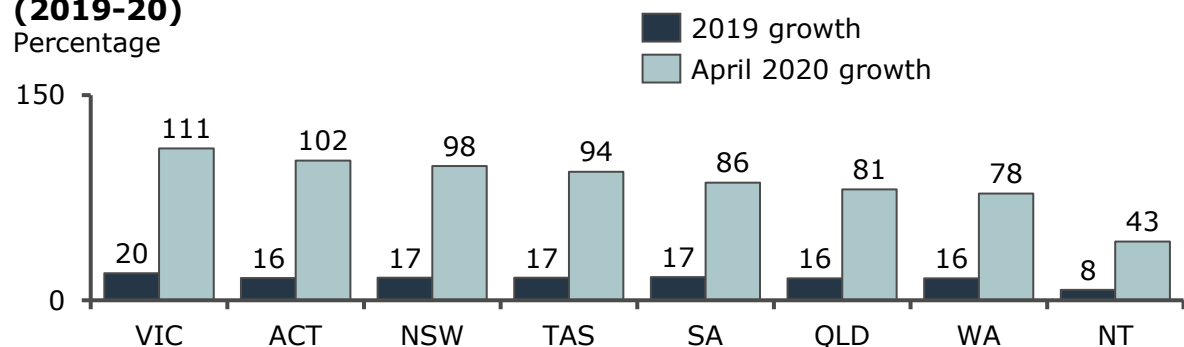
Completed rides, by booking source
(Weeks since launching digital "dial-a-ride" platform)
Number of completed rides



In the first full month of lockdown, online shopping grew up to six times the level of annual growth in 2019, increasing the last mile freight task

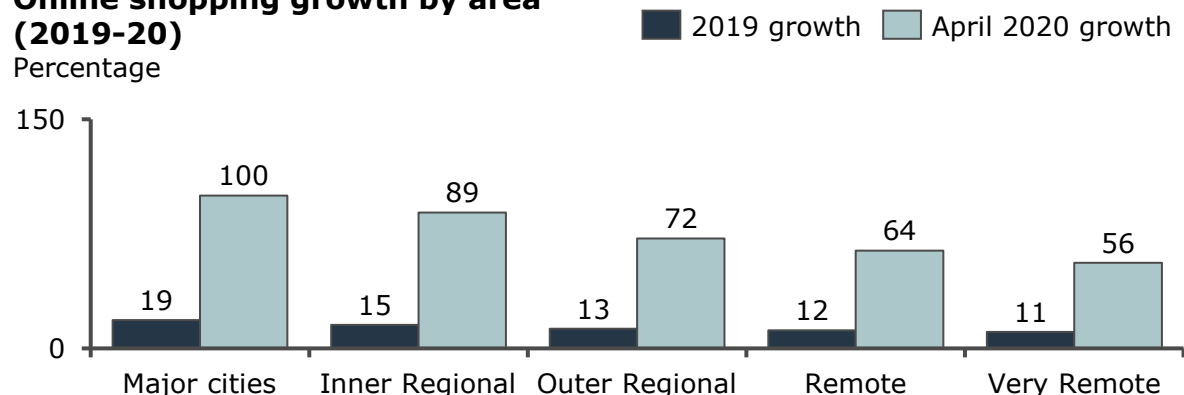
Online shopping growth by state (2019-20)

Percentage



Online shopping growth by area (2019-20)

Percentage



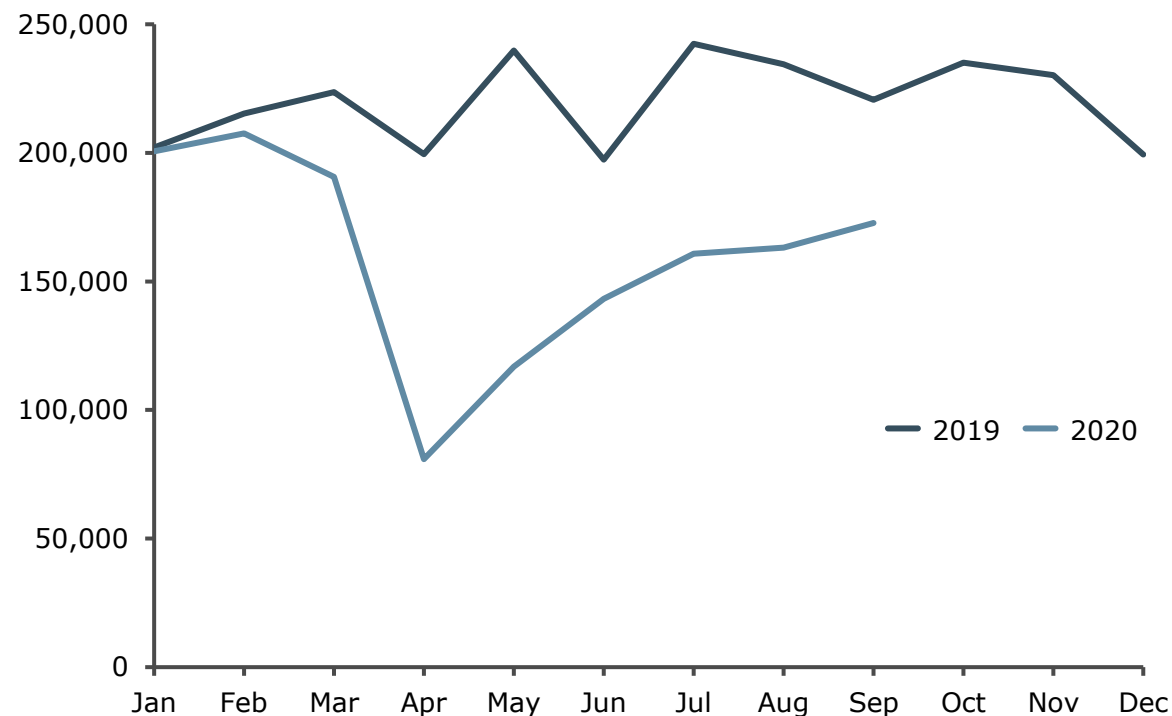
- Last mile freight grew significantly, with online shopping experiencing a material increase in all states of Australia in 2020 compared to 2019
- The increased demand for online retail shopping, online supermarket shopping and online food orders is increasing the last mile freight task. Uber Eats evening orders alone saw a 17% increase between June-July in Melbourne
- Victoria experienced the largest growth in 2020 with July recording the highest level of online shopping growth for the second half of the year, coinciding with Victoria's period of lockdown
- Australia Post recorded its third biggest day ever on August 17 2020 at 2.3m deliveries
- The L.E.K. survey found that respondents were more likely to not return to past habits in relation to shopping precincts. This trend is in line with aversion to crowded shopping centres and low appetite for public transport commuting to shopping hubs
- The shift has resulted in reduced density of freight routes, increasing the number of freight vehicles required and increasing driver / rider congestion in suburban areas

	July*	August	September
Australia year on year online shopping growth (%)	102	85	82

There has been a redistribution of kerbside congestion as last mile deliveries shifted away from the CBD

Sydney CBD Loading Zone Activity (FY2019-20)

Loading Zone Transactions

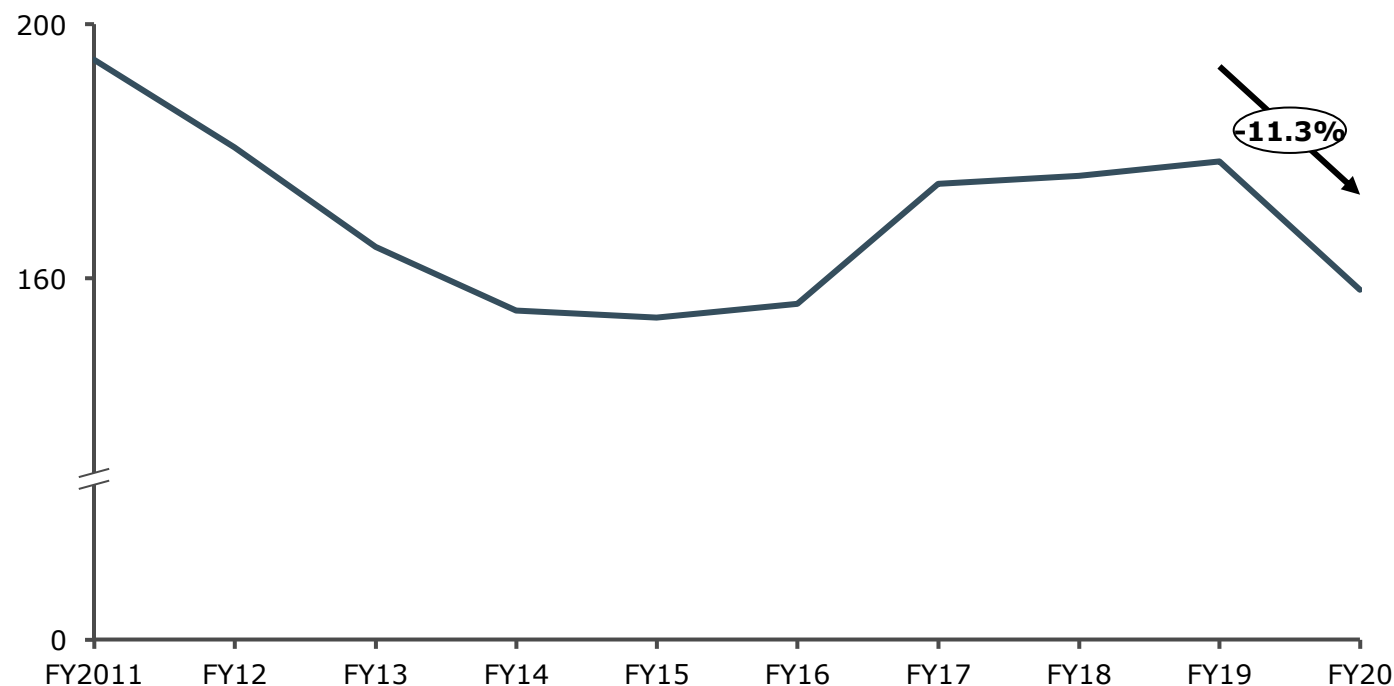


- Loading zone activity in the Sydney CBD has significantly dropped despite the growth in last mile deliveries. This suggests as CBD occupancy has dropped, freight has moved out of the CBD and followed individuals working from home back to their residential suburbs
- Increased deliveries in local areas contribute to suburban congestion alongside other contributing trends such as increased school drop-offs and pick-ups as well as increased local supermarket shopping
- In April 2020 Australia Post announced it would retrain 2,000 motorbike posties to process and deliver parcels in vans, suggesting an increase in demand for road freight

Australia's domestic air freight volumes have dropped while land freight operators reported an increase in demand

Australian domestic air freight volumes (FY2011-20)

Tonnes

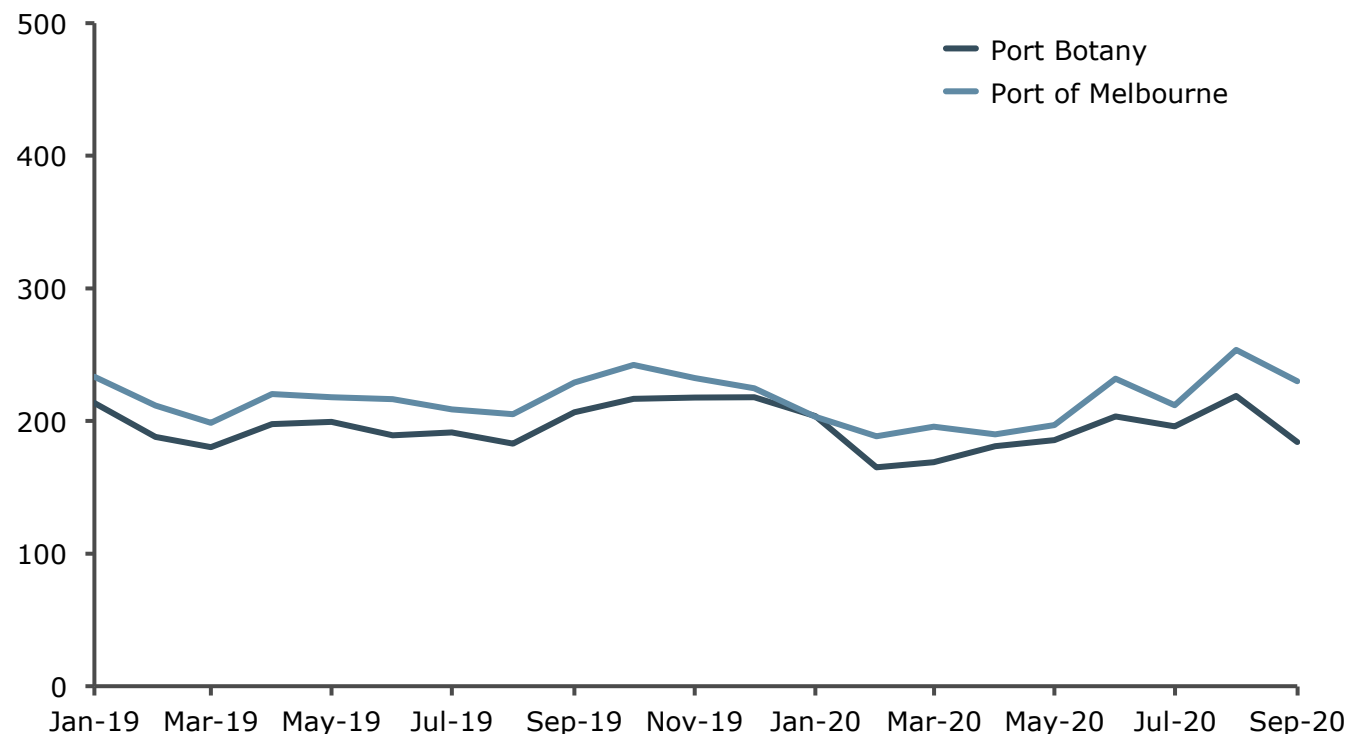


- Australia's domestic air freight volumes have dropped in 2020 as access to commercial aircraft belly freight has significantly reduced
- However, Australian transport companies Linfox and Aurizon announced in April 2020 that they had increased their services by 20% in order to deliver food and other essential goods to supermarkets during the COVID-19 pandemic
- Relaxed operational rules for truck freight in certain council areas may prove difficult to unwind and could then entrench the advantages of road freight delivery

Australia's major ports have experienced slightly higher throughput as maritime transport is subject to fewer additional restrictions

Monthly throughput volume (2019-20)

Twenty-foot Equivalent Units (TEUs)

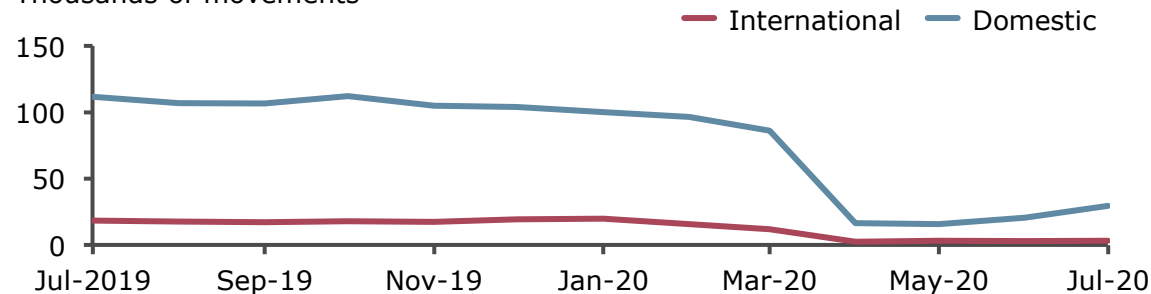


- Ports have remained open during the pandemic for imports and exports, and have seen a marginal increase in throughput volume by transporting goods typically transported by air freight
- While ports are still operating, there are a number of new regulations to manage the COVID-19 risk, such as the Public Health (COVID-19 Maritime Quarantine) Order (No 3) 2020, which sets out requirements for vessels entering NSW ports, including PPE requirements and circumstances where quarantine applies

Domestic and international aircraft movements fell dramatically with border closures, with domestic travel in a slow recovery as interstate borders re-open

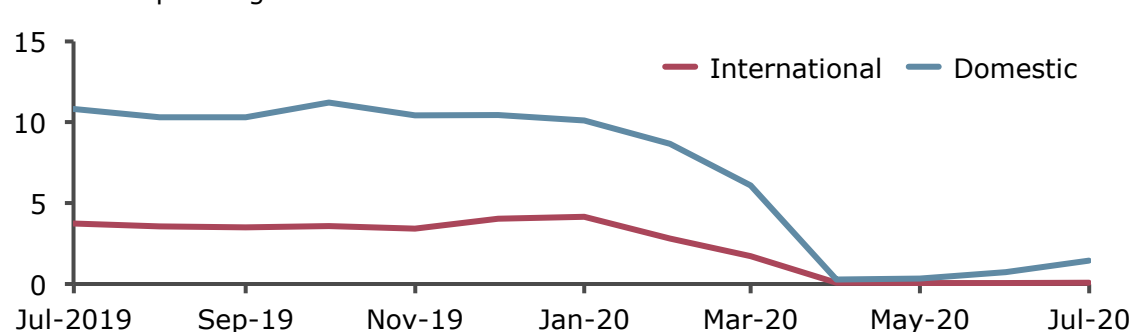
Monthly RPT* Aircraft Movement (2019-2020)

Thousands of movements



RPT* Revenue Passenger Movement (2019-2020)

Millions of passengers



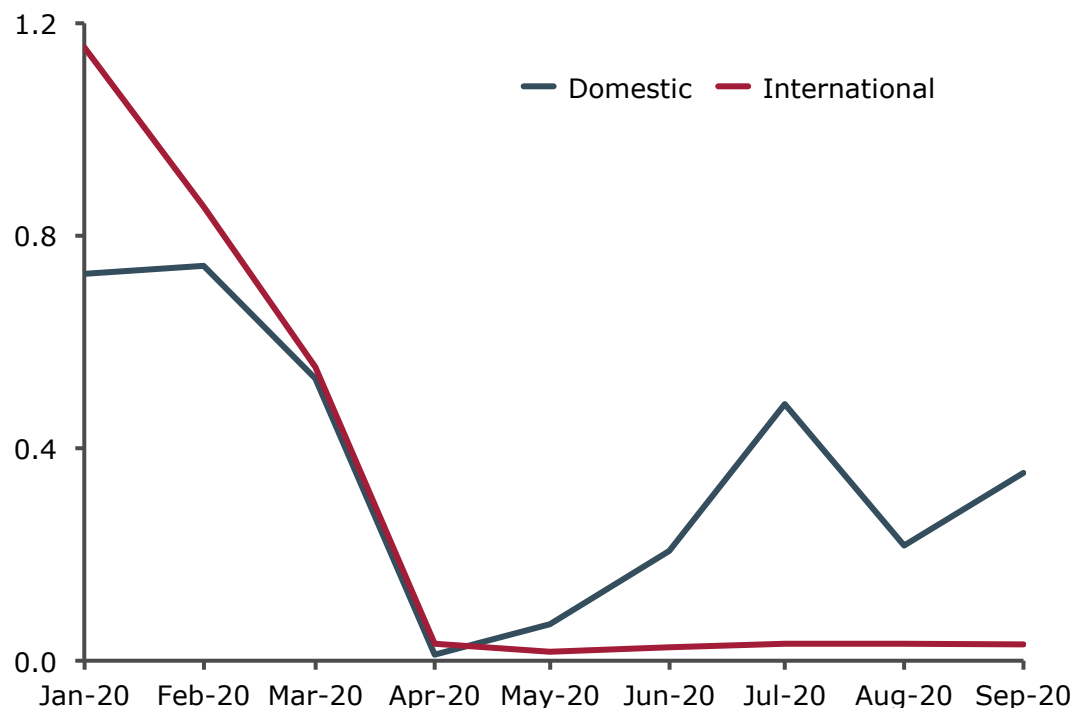
- Border closures due to COVID-19 disrupted the aviation industry, which has experienced sharp declines in volume to almost zero
- Domestic movements are in slow recovery phase with recent easing of interstate travel restrictions. Recovery in international movements is reliant on the easing on international travel restrictions
- While some domestic travel is permitted in Australia, COVID-19 continues as a public health risk and consumer attitudes to air travel remain cautious but are recovering. Domestic flight load factors have remained below 60% since April 2020
- Airports have closed down sections of existing infrastructure and delayed planned capex spend as a result of the downturn

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Australia domestic flight passenger load factor (%)	82.0	75.5	62.7	28.3	40.7	53.3	59.1	51.7

Auckland Airport experienced a rapid increase in domestic travel after lockdown, but regressed with a second wave and lockdown

Auckland Airport Passengers (2020)

Passengers, millions



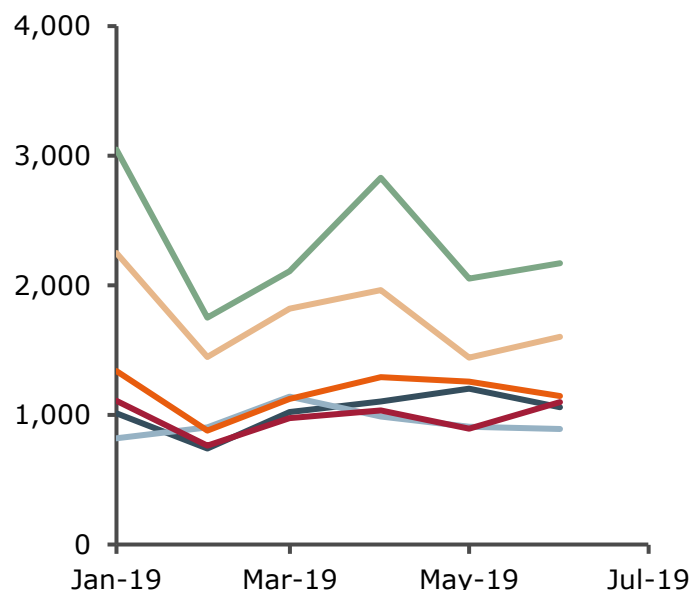
- Domestic aircraft movements from Auckland have followed a similar trend to public transport, where recovery has been strong after each lockdown event
- Australia's three most populous states have either restricted incoming interstate travel or are the subject of such travel restrictions from other states, greatly reducing the number of domestic aircraft passengers
- The quick recovery experienced in Auckland following the easing of restrictions suggests Australia could also experience a rapid increase in domestic travel once interstate travel restrictions are lifted
- Auckland's load factors reached its lowest during April due to lockdown restrictions, but have since recovered to levels higher than Australia
- Domestic recovery is somewhat capped due to the high volume of international visitors unable to enter the country who would typically then go on to take domestic flights, e.g. Auckland and Queenstown

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Air NZ domestic flight passenger load factor (%)	85.7	83.1	73.2	12.7	49.0	68.0	82.8	61.6

Domestic overnight trips in Australia declined sharply, and have recovered at varying rates across states and between city and regional areas

**Domestic overnight trips
(2019)**

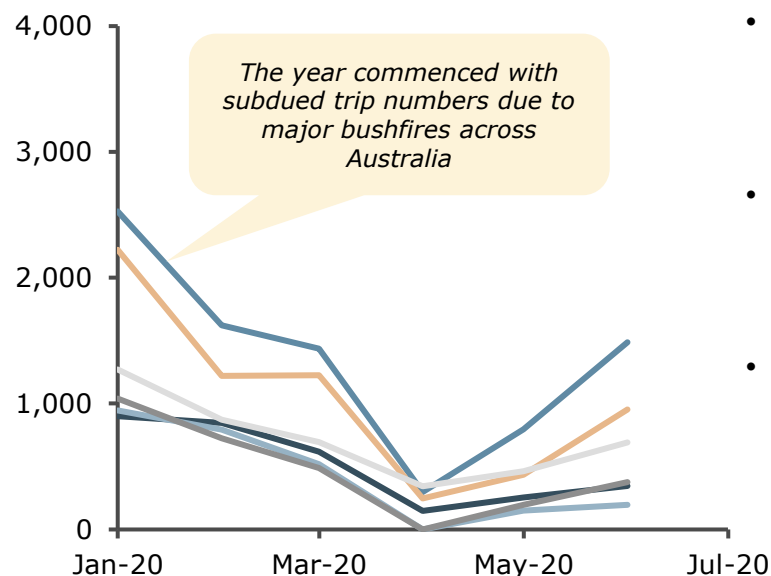
Visitors, 000's



— Sydney — Melbourne — Brisbane & Gold Coast
— Regional NSW — Regional VIC — Regional QLD

**Domestic overnight trips
(2020)**















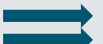









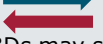





Visitors, 000's


















- International and state border closures have resulted in a significant increase in demand for regional travel and tourism which may fuel recovery for domestic aviation
- Both Regional NSW and Regional VIC have experienced a steady increase in domestic overnight trips, with Regional NSW experiencing the highest growth
- The opening of Queensland's border will support the growth in domestic travel, while the Trans-Tasman bubble arrangement is currently too restrictive to offer the same level of growth
- Overnight trips experienced an 89% decline from the previous year in April but have partly recovered in June, though still down c.50% from last year

	Jan	Feb	Mar	Apr*	May	Jun
year on year % change	-7	-6	-39	-89	-71	-49

Assessment and outlook for key trends: Transport (1 of 2)

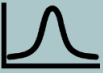



TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID-19)	Correlation of trend to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID-19
Public Transport	Decrease in public transport patronage	Major – volume down	 Fast growing cities, smaller cities/regional centres	 Reversal	 Public transport is most sensitive to COVID-19	 Total public transport use into CBDs is impacted by speed of economy	 Commuting is recovering with semi-permanent changes to WFH and mode choice
	Mode shift to private vehicle	Major – mix shift	 Fast growing cities	 Reversal	 Higher car use will be sustained throughout COVID-19	 Higher car mode share is relatively unaffected by economic downturn	 People will stay with private cars longer if COVID-19 remains
	More active transport for short trips	Minor – mix shift	 Fast growing cities, smaller cities/regional centres	 Acceleration	 Higher active transport will be sustained throughout COVID-19	 Increased walking and cycling is relatively unaffected by economic downturn	 Likely to embed new travel habits
	Increased digital / customer offerings	Minor – mix shift	 Fast growing cities	 Acceleration	 Public transport responses have adopted some digital offerings	 Improved app functionality will continue irrespective of recovery	 Improved product functionality will likely remain in use
Congestion	Drop in CBD congestion	Major – volume down	 Fast growing cities	 Reversal	 CBD volumes are sensitive to COVID-19 risk	 CBD activity will be sensitive to economic recovery esp in CBDs	 CBDs may see sluggishness but eventual return
	Increase in kerbside deliveries in suburbs	Major – volume up	 Fast growing cities	 Reversal	 More WFH is likely to sustain growth in kerbside deliveries	 Discretionary purchases may be impacted but in general less affected	 Semi-permanent with WFH and online shopping a clear shift

Assessment and outlook for key trends: Transport (2 of 2)

TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID-19)	Sensitivity to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID-19
Freight	Increase in last mile deliveries	Major – volume up	 All	 Acceleration	 WFH and travel aversion are major drivers of last mile deliveries	 Speed of economic recovery will not play much role in last mile trip volumes	 Semi-permanent with WFH and online shopping a clear shift
	Decrease in domestic aviation	Major - Volume	 Fast growing cities	 Reversal	 Domestic aviation has been quick to rebound post lockdown in NZ and China	 Loss of business travel will be impacted by economic recovery	 Relatively quick rebound expected, but business travel reduced
Travel	Decrease in international aviation	Major - Volume	 Fast growing cities	 Reversal	 Timing of the return of international aviation will depend heavily on COVID-19 risk	 Some dependency on global economic recovery	 International aviation is likely to be hit harder and for longer than domestic aviation

Future directions for consideration: Transport

Opportunities and Challenges

	Flattening the peak	<ul style="list-style-type: none"> Public transport customers have re-timed journeys during COVID-19, reducing the 'peakiness' of public transport use. This is a significant efficiency for existing infrastructure, as new major projects are planned to serve peak period activity. Redistribution of last mile trips away from the CBD
	Mode shift	<ul style="list-style-type: none"> Public transport has been uniquely impacted by COVID-19, with higher degrees of caution about future public transport use than for other activities. The increase in car usage including for commuter journeys would be retrograde outcome for growing cities, with evidence of congestion impacts returning.
	Service changes	<ul style="list-style-type: none"> Service and timetable changes were made quickly to support essential workers, digital service offerings increased and minor adjustments to fleet and rolling stock ensured public safety and health.
	Leveraging digital capabilities	<ul style="list-style-type: none"> Rapid product development was able to provide additional digital features such as real-time occupancy information.

Future Directions for Consideration

<ul style="list-style-type: none"> ✓ Reducing travel overall ✓ Pricing strategies to attract usage across the day ✓ Better demand matching on services ✓ Deferral of major capex (e.g. new airport runways) ✓ Reallocate road space in CBDs to hospitality and active transport
<ul style="list-style-type: none"> ✓ Car parking policies ✓ Smart parking solutions for commuter parks to integrate with public transport ✓ Pop up and permanent bike lanes ✓ Road pricing reforms
<ul style="list-style-type: none"> ✓ Introduce more on demand and micro mobility services ✓ Introduce more public transport services in local areas ✓ Removing cash and reforming fare products towards zonal not radial networks ✓ All day timetables ✓ Avoid reimposing freight curfews ✓ Install permanent fixtures that are more virus resistant
<ul style="list-style-type: none"> ✓ Opportunities for customer engagement ✓ Promote digital products on regional services ✓ Real time information on service loadings

Section 5

Social Infrastructure

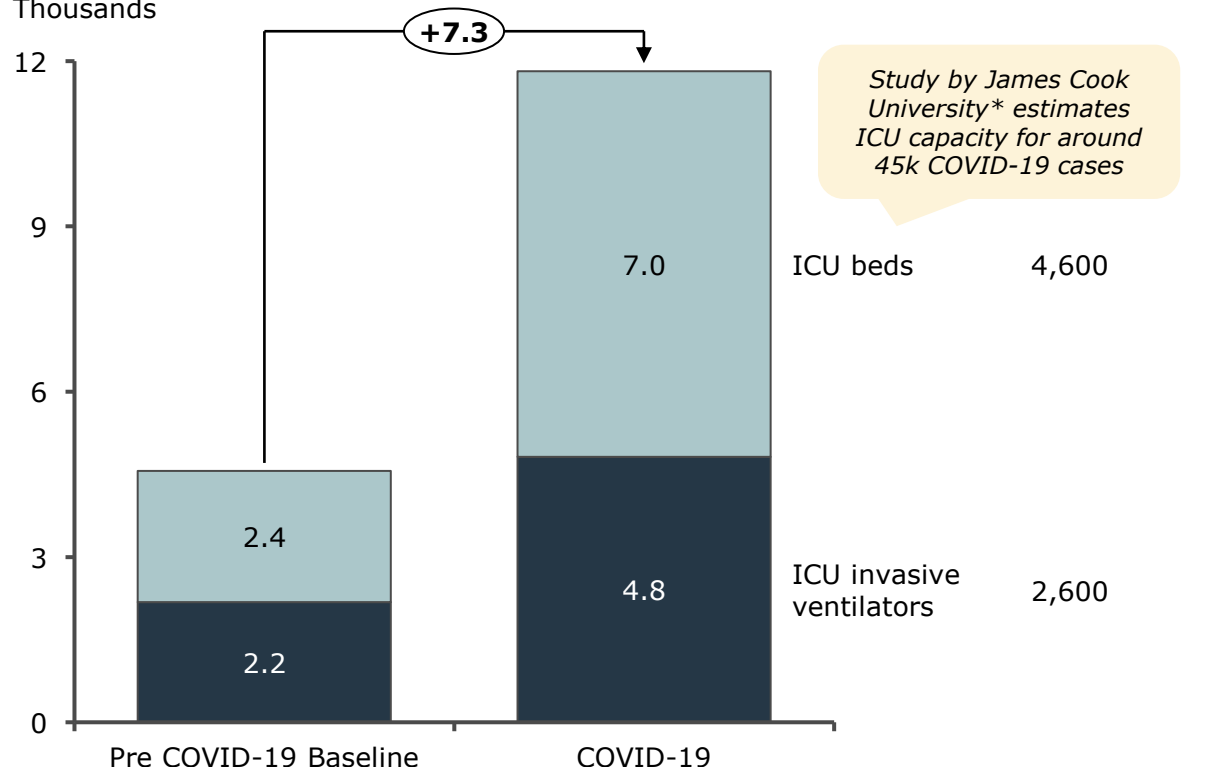
In social infrastructure there were fast pivots that triggered the development of new service models

Category	Segment	Summary of trends
Health	Flexibility / repurposing of resources	<ul style="list-style-type: none"> Existing health infrastructure was temporally repurposed to meet the demands of treating COVID-19, however there appeared to be areas of inflexibility in workforce management Access to other healthcare (e.g. cancer screenings) has decreased as a result of COVID-19, particularly amongst the elderly There has been a significant rise in telehealth services to support socially distant medical interactions There has been a steady decline in residential aged care occupancy rates, with COVID-19 accelerating this trend
	Disruption to other healthcare services	
	Telehealth	
	Aged Care occupancy	
Social housing	Social housing support	<ul style="list-style-type: none"> There has been minimal increase in the number of individuals seeking social housing and homelessness services support, with COVID-19 changing the demand profile of such applicants
Education	International students	<ul style="list-style-type: none"> International student enrolments and commencement have fallen in higher education Health restrictions have accelerated the shift towards online learning Regionalisation is likely to place pressure on school infrastructure in some areas
	Online education	
	Spatial shift	
Arts and culture, green, blue, sport and recreation	Park visitation	<ul style="list-style-type: none"> Park visitation in most states is higher than pre COVID-19 levels Participation in sports, arts & recreation experienced a rapid and significant decline, but is expected to recover quickly after the reduction in COVID-19 related health risks Reduced major events and sporting fixture visitation There may have been some increase in local level sporting participation
	Participation in arts & recreation	
	Sport	

The COVID-19 pandemic led to a significant repurposing of medical infrastructure in ICU units across Australia to accommodate increased demand

ICU infrastructure, by type (2019 to 2020)

Thousands



- In preparation for COVID-19 cases, intensive care units (ICUs) increased their capacity from around 4600 beds to almost 12,000 beds across 191 ICUs
 - in Victoria, although ICU beds reached 85% capacity in July, there were 4,000 additional beds that could be activated
- This surge capacity was met by adding new respiratory clinics, COVID-19 wards, emergency departments, and hospital beds. The Australian Government temporarily suspended elective surgeries, redeployed private clinicians to the public system, and authorised cooperation between private and public hospitals and health agencies
- While COVID-19 demonstrated the flexibility to shift capacity in relation to built infrastructure (e.g., ICU beds), it also highlighted some inflexibility in sharing specialist knowledge, equipment, and personnel to support comprehensive and coordinated care

“... Inflexibility is unfortunately baked into many of our health system structures, exacerbated by our system of devolved governance, clinical and specialist siloing and separated lines of accountability in public and private health, and segregated primary care and hospital systems ...”
The Medical Journal of Australia, July 2020

- Further focus was on workforce capacity to support planned additional ICU activity. It was estimated that an additional 43,000 ICU nurses and around 4000 senior doctors would be needed

The COVID-19 pandemic also highlighted supply chain weaknesses that support the Australian health system

The COVID-19 pandemic has exposed gaps in Australia's Personal Protective Equipment (PPE) manufacturing capability

- In health, there were some changes in manufacturing capacity of PPE and needs such as ventilators and masks where organisations pivoted to build stockpiles. While this was temporary, it has highlighted some key gaps in essential manufacturing capability to produce essential medical supplies, with a number of doctors raising concerns regarding lack of access to PPE

"... The COVID-19 pandemic has exposed some gaps in our capability to produce essential medical supplies ..."
Minister for Industry, Science and Technology, 15 June 2020

- This has been a key driver of the Australian Govt's Modern Manufacturing Strategy which aims to build Australia's manufacturing sector and strengthen Australia's sovereign capability to produce medical supplies to promote self-sufficiency and export opportunities
- The Victorian government has recently provided investment towards CSL's \$800m vaccine manufacturing plant
 - the Australian Government has provided \$2m to assist businesses including Kestrel Manufacturing, Nobody Denim and Cleets Linen to manufacture materials needed to produce PPE (e.g., textiles, clothing & footwear, medical grade filter material)

"... This strategy will go a long way to addressing manufacturing gaps...This co-investment will not only develop our local manufacturing capability; it will see staff up-skilled and new opportunities created both directly and indirectly along the supply chain"
Minister for Industry, Science and Technology, 15 June 2020

Global supply chain disruptions have also highlighted exposure to medical supply shortages

- There was also significant supply chain disruptions of Medtech, medicines and pharmacy products from international sources, with medical professionals also noting that bidding wars on PPE were exacerbating this problem
 - India banned export of certain APIs and finished drug products to prioritise local supply
 - in China, disruption in manufacturing and delays in procurement / freight also created shortages of drug supplies

"... We are relying on international supply lines that are in real jeopardy at the moment. We know there are countries trying to outbid each other to get these things ..."
Vice President, Australian Medical Association

- Australia has a heavy reliance on international markets for medical supplies, importing \$16.6bn of supplies while producing only \$4.9bn domestically. While some of this supply chain uncertainty can be addressed by companies building more resilient international supply chains, the Modern Manufacturing strategy aims to ensure access to essential supplies in the future

"... We do have a heavy reliance on overseas and quite frankly that needs to change ..."
Minister for Industry, Science and Technology, 9 April 2020

Medicine delivery services grew, and may require investment in medical software

- Home medicine services including medicine delivery also increased during COVID-19 to support telehealth services
- However according to the Australian Journal of Pharmacy, a large scale roll out of medicine delivery services may require larger investments into electronic prescription software (e.g., fast tracking e-prescriptions)

Rules and restrictions on certain services, and physical distancing requirements, led to reduced healthcare service capacity

Restrictions and guidelines

Closure of services

- In the early months, Australian Government restrictions were placed on non-urgent elective surgeries to ensure medical supply availability for COVID-19. This temporarily reduced private clinic capacity, and has reportedly led to some workforce reductions, and financial pressure on some hospitals and clinics

"... Hospitals cannot simply close down entire wards and ICUs then turn them back on at the flick of a switch ..."
Pat Garcia, CEO at Catholic Health Association, March 2020

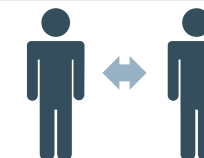
"[The cancellation of non-urgent elective surgery] has a devastating impact on private hospitals and their critical infrastructure... The availability of private hospitals is at risk..."
Healthe Care, March 2020

- A survey conducted by Continuity of Care found that around 52% of respondents had delayed or avoided a medical appointment during March – May 2020
 - of these respondents, around 30% cite that this was due to closure of the health services that they typically use
 - this is also due to the fear of COVID-19 infection, particularly amongst the elderly



Physical distancing*

- In enclosed rooms, individuals must maintain 1.5m distance from others, with chairs positioned 1.5 metres apart where possible. Individuals must also aim for 4 square metres per person
- During ward rounds, patients, staff and visitors must maintain 1.5m distance



Restrictions on number of people

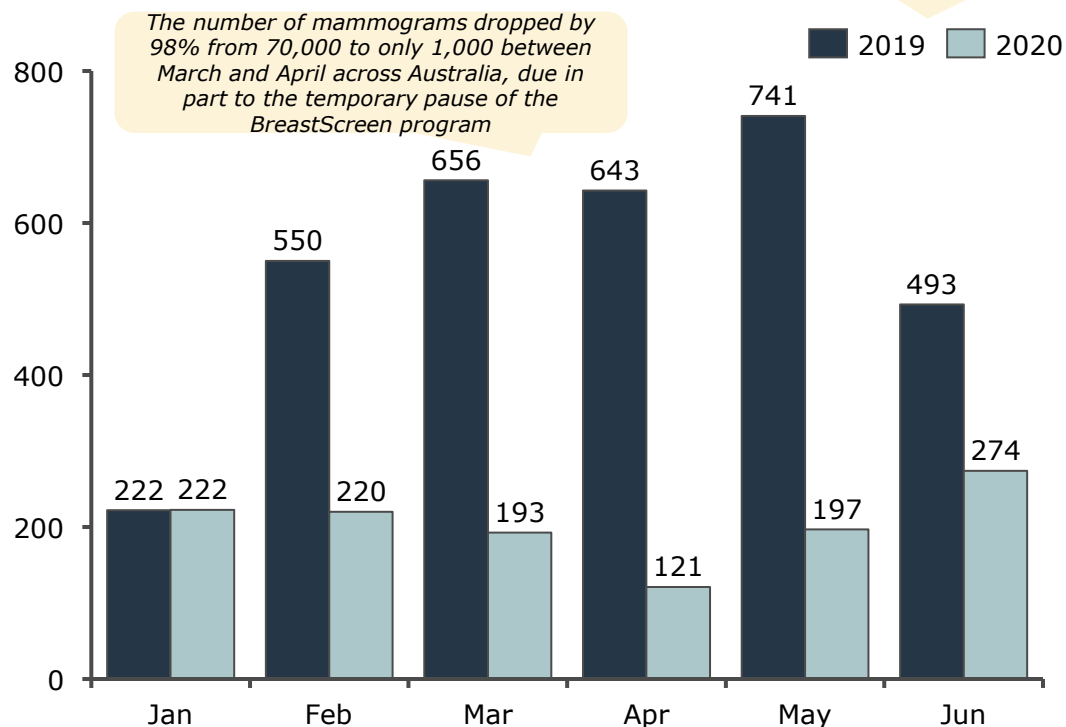
- In enclosed rooms and specialist clinics, health service organisations must limit the number of people present to maintain physical distancing guidelines
- Ward rounds should be conducted with the smallest number of staff possible, ideally with fewer than four people



Health concerns and social distancing also prompted patients to defer health appointments, with preventive screenings falling to 19% of 2019 levels

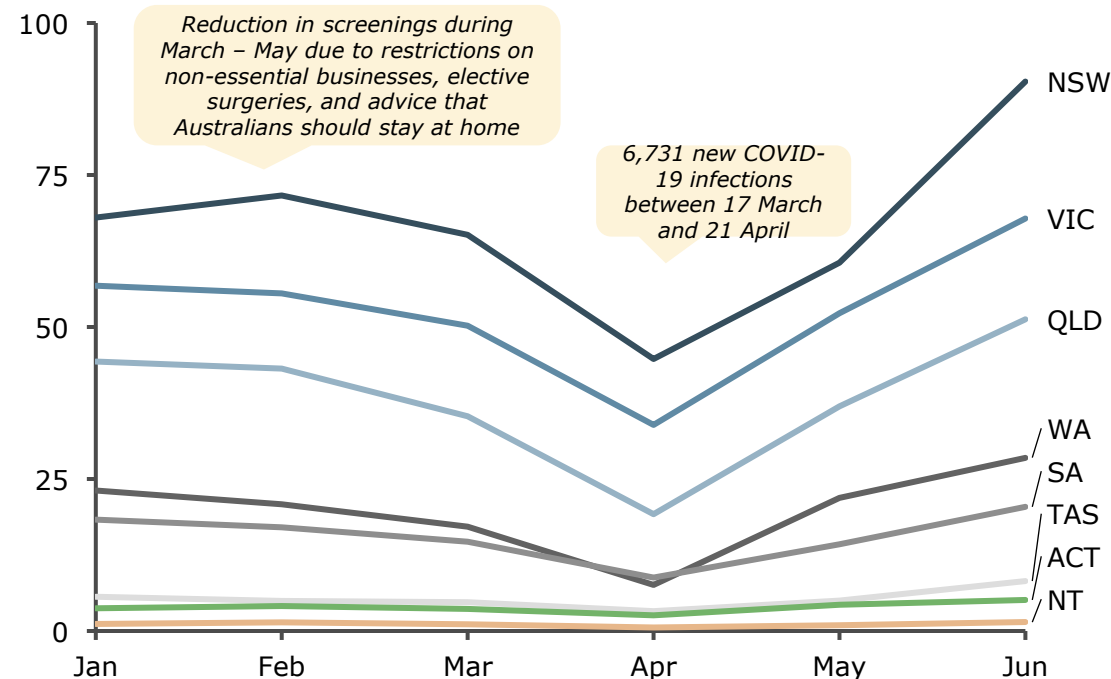
Cancer screenings in Australia* (2019 to 2020)

Thousands of screenings



Cancer screenings in Australia, by State* (2020)

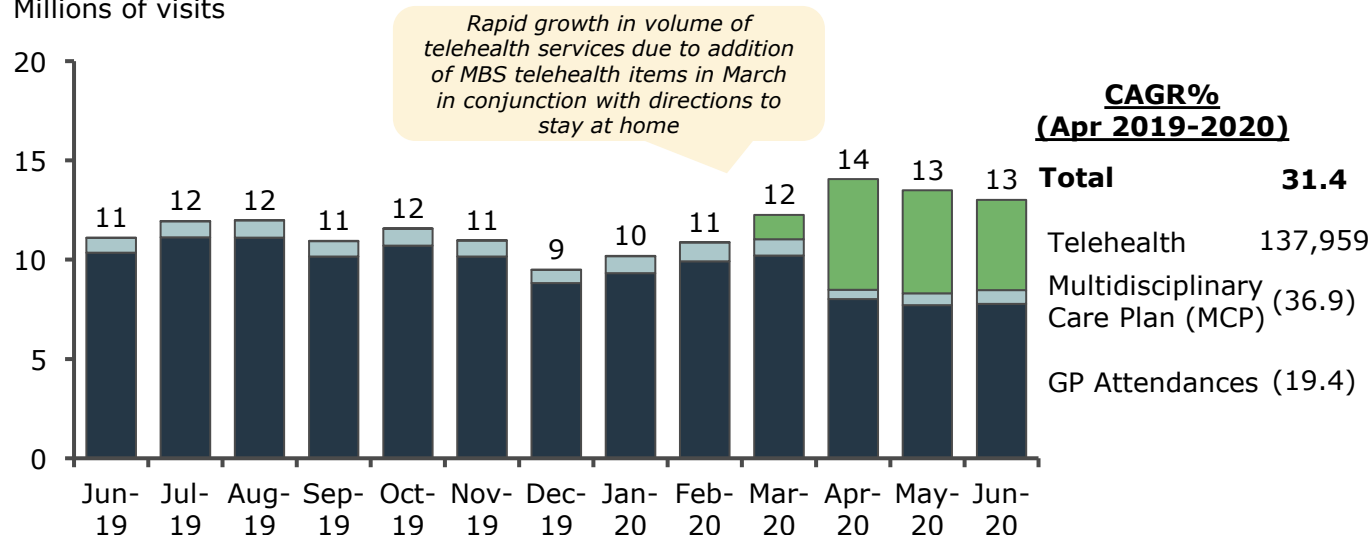
Thousands of screenings



Telehealth service usage increased significantly, enabled by the MBS extension

Monthly Volume of core MBS services* (Jun-19 to Jun-20)

Millions of visits



CAGR% (Apr 2019-2020)

Total	31.4
Telehealth	137,959
Multidisciplinary Care Plan (MCP)	(36.9)
GP Attendances	(19.4)

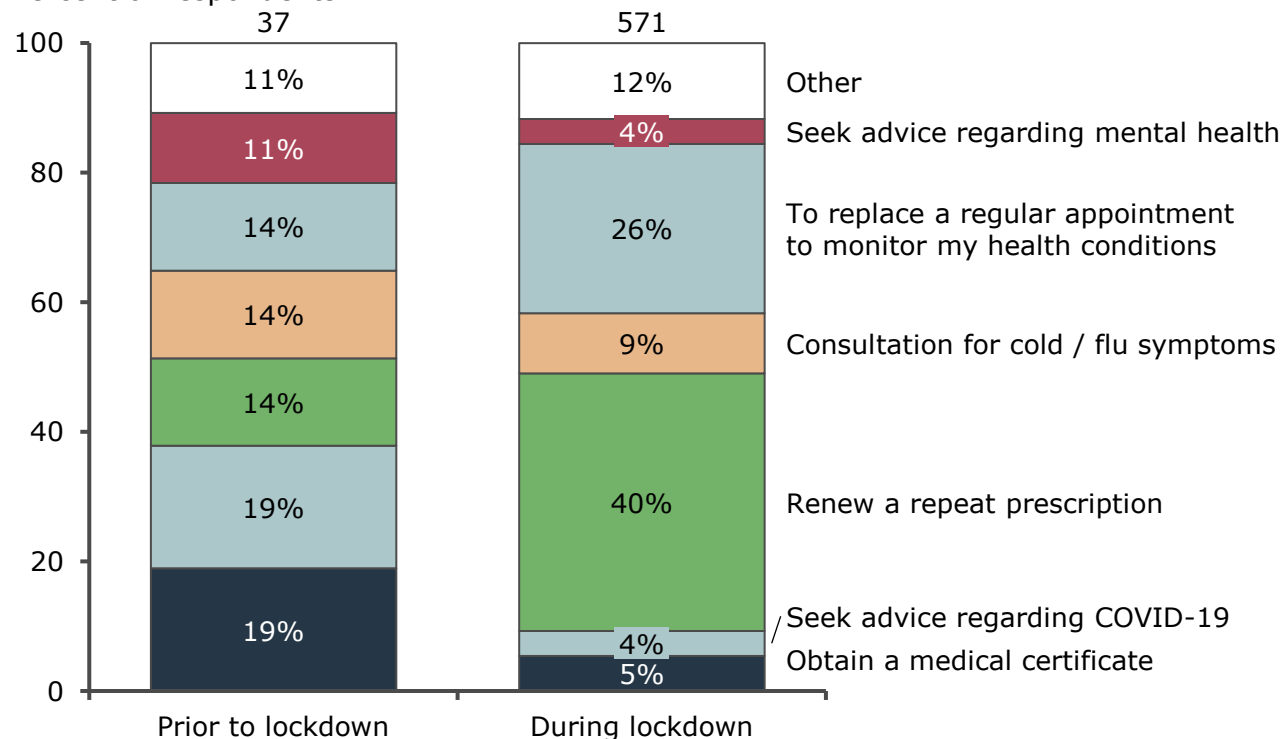
- In March 2020, in response to the COVID-19 pandemic, the Australian Government introduced temporary Medicare funding for telehealth services. This drove a rapid increase in both the use of telehealth and overall service volumes. A total of 17.2 million telehealth consultations were conducted from March-June 2020, representing around 26% of all Medicare Benefit Schedule (MBS) services
- Multidisciplinary care and general practitioner (GP) attendances shifted quickly to telehealth, from around 0.04% to around 35% of all core MBS services*. However, these figures appear to have stabilised since
 - Multi-disciplinary Care Plan (MCP) attendances suffered the largest decline of around 51% between February-April, while GP attendances fell around 19% during the same period
 - the volume of telehealth services increased rapidly from 5,110,000 to 5,570,000 between February and April, but has since stabilised at around 4,540,000
- There was a significant increase in total attendances from March till June. This was due in part to backlog and a surge in the use of telehealth GP consultations that exceeded the fall of in-person consultations
- The rapid uptake of telehealth suggests an opportunity to invest in virtual health infrastructure (e.g., at-home monitoring machines), particularly amongst non-GP specialists who are currently lagging in their adoption of such infrastructure

% change from previous month					
Telehealth		24k	356	(7)	(12)
MCP**	Pre COVID-19	(14)	(43)	28	16
GP Attend.		3	(22)	(4)	1

The majority of patients using telehealth services did so for routine attendances such as prescription renewal and monitoring for health conditions

Main purpose of telehealth usage, prior to and during lockdown (2020)

Percent of respondents

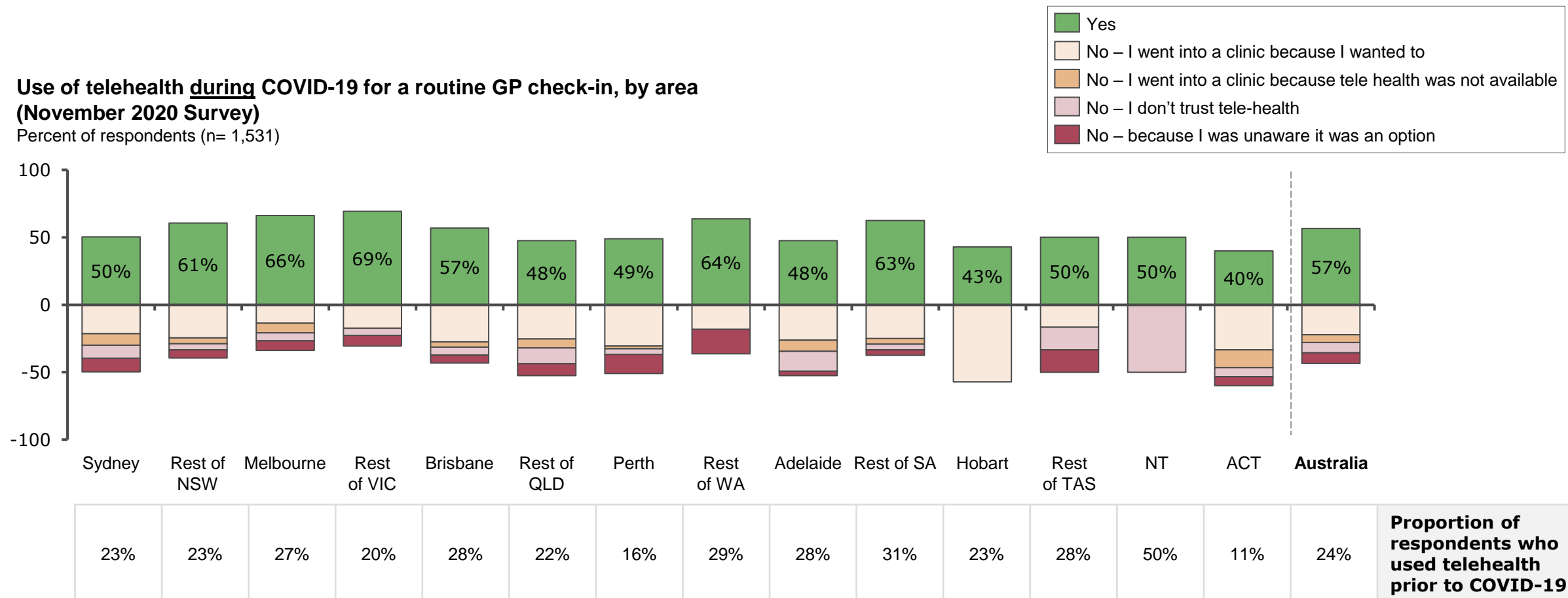


- 4.3 million telehealth services (primarily telephone consultations) were delivered to 3 million patients in March following the introduction of MBS telehealth items
- Prior to lockdown, telehealth services were used for a range of purposes, however this has become more focused during lockdown. In particular, telehealth services have primarily been used for renewing repeat prescriptions and replacing regular check-ups
- As of June 2020, mental health and GP consultations were the most commonly used as telehealth, with telehealth comprising 34% and 31% of their total services respectively
 - telehealth represented 20% and 18% of specialist and nurse consultations at 20% and 18% respectively
 - in contrast, allied health telehealth accounted for only 5% of total allied health consultations

The adoption of telehealth services boosted service accessibility in metropolitan and regional areas, with patients reporting 2-3 times increased usage

Use of telehealth during COVID-19 for a routine GP check-in, by area (November 2020 Survey)

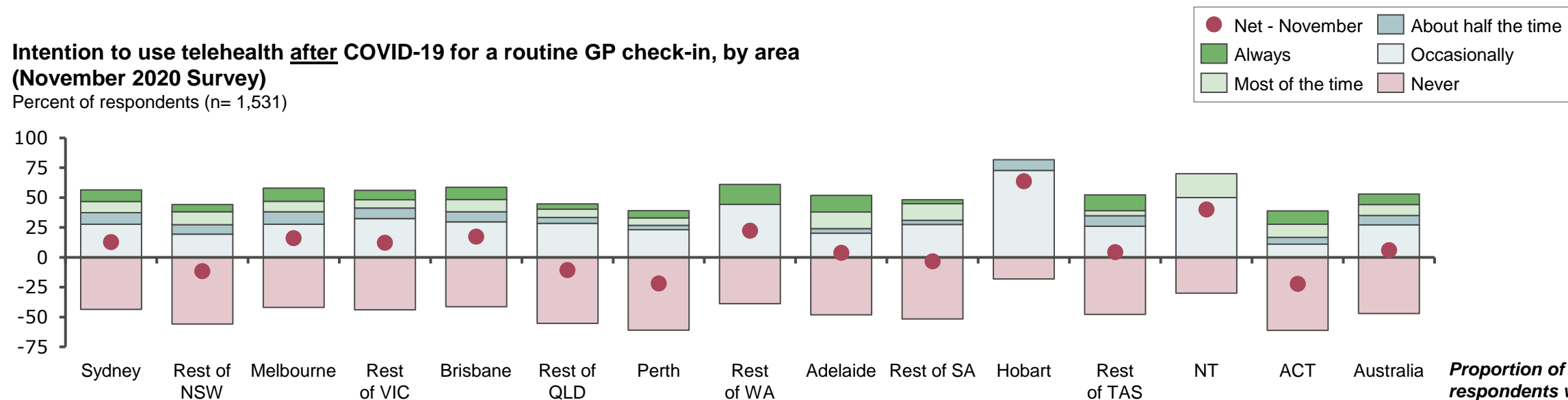
Percent of respondents (n= 1,531)



The majority of respondents intend to keep using telehealth services, however there is lower interest in Canberra, Perth and regional areas of NSW, QLD and SA

**Intention to use telehealth after COVID-19 for a routine GP check-in, by area
(November 2020 Survey)**

Percent of respondents (n= 1,531)



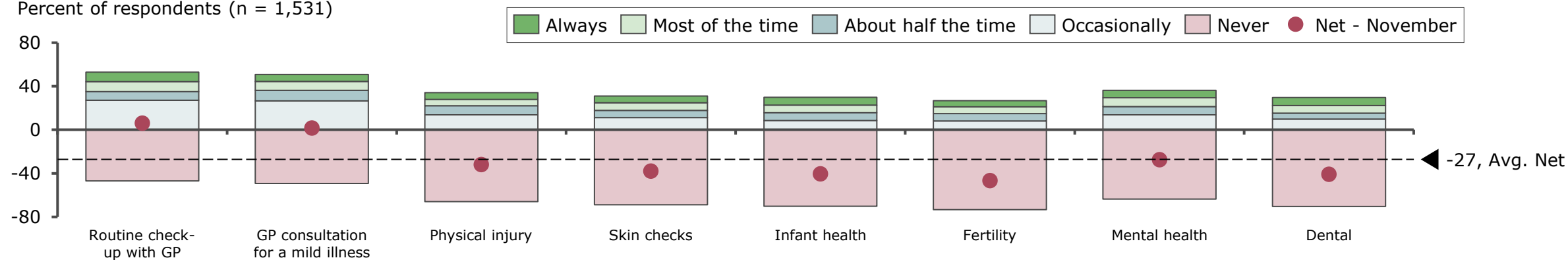
Proportion of respondents who used telehealth:

23%	23%	27%	20%	28%	22%	16%	29%	28%	31%	23%	28%	50%	11%	24%	Prior to COVID-19
50%	61%	66%	69%	57%	48%	49%	64%	48%	63%	43%	50%	50%	40%	57%	During COVID-19
56%	44%	58%	56%	59%	45%	39%	61%	52%	48%	82%	52%	70%	39%	53%	After COVID-19 (intention)

People that intend to use telehealth services beyond COVID-19 will use it for routine check ups and mild illness

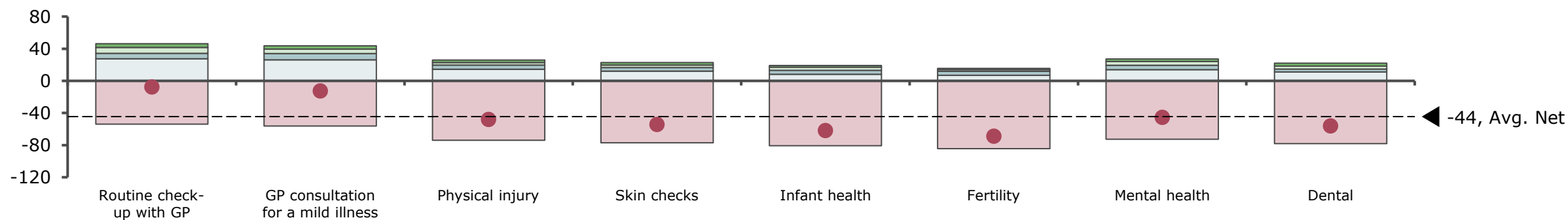
Intention to use telehealth services once COVID-19 restrictions are lifted, by type of consult (November 2020 survey)

Percent of respondents (n = 1,531)



Intention to use telehealth services once COVID-19 restrictions are lifted, by type of consult (Only those who did not use telehealth prior to COVID)

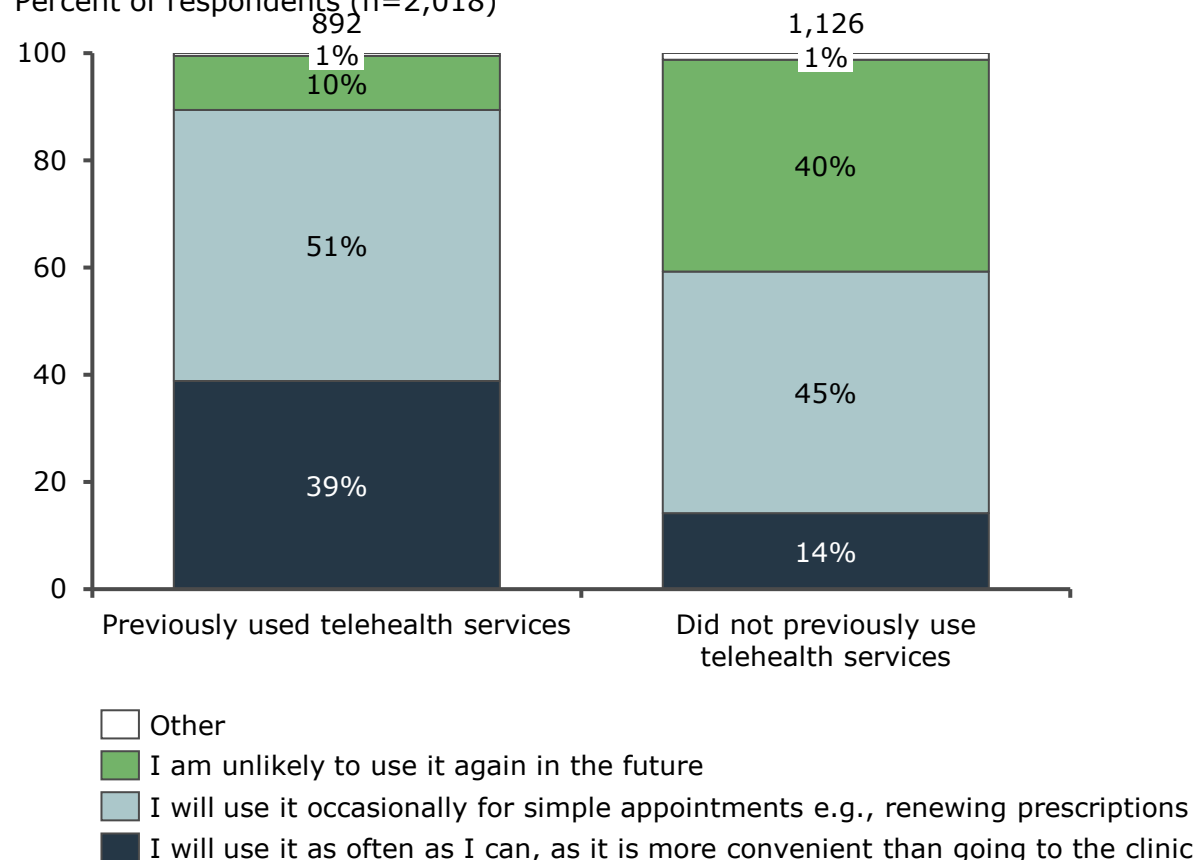
Percent of respondents (n = 1,164)



Preference for telehealth is not ubiquitous, however there is substantial interest for simple appointments and amongst existing users

Proportion likely to continue using telehealth services post COVID-19* (2020)

Percent of respondents (n=2,018)



- Survey data from the Melbourne Institute suggests a significant uptake of telehealth services by medical providers, with 99% of GPs and 76% of non-GP specialists offering telehealth
- Panellists at the Consumer Forum of Health indicate a trend towards using telehealth even after COVID-19, citing convenience (i.e., travel time) and improved accessibility

around 73% of respondents state that they will likely continue to use telehealth post COVID-19, especially for 'simple' appointments

"...I was more relaxed in my consultation. I didn't have the stress of driving to the city hospital. I saved money on fuel and parking. I didn't have to sit in a full waiting room. I didn't have to turn down work because of the travel and waiting room time blowouts. The benefits of telehealth are immense. ..."

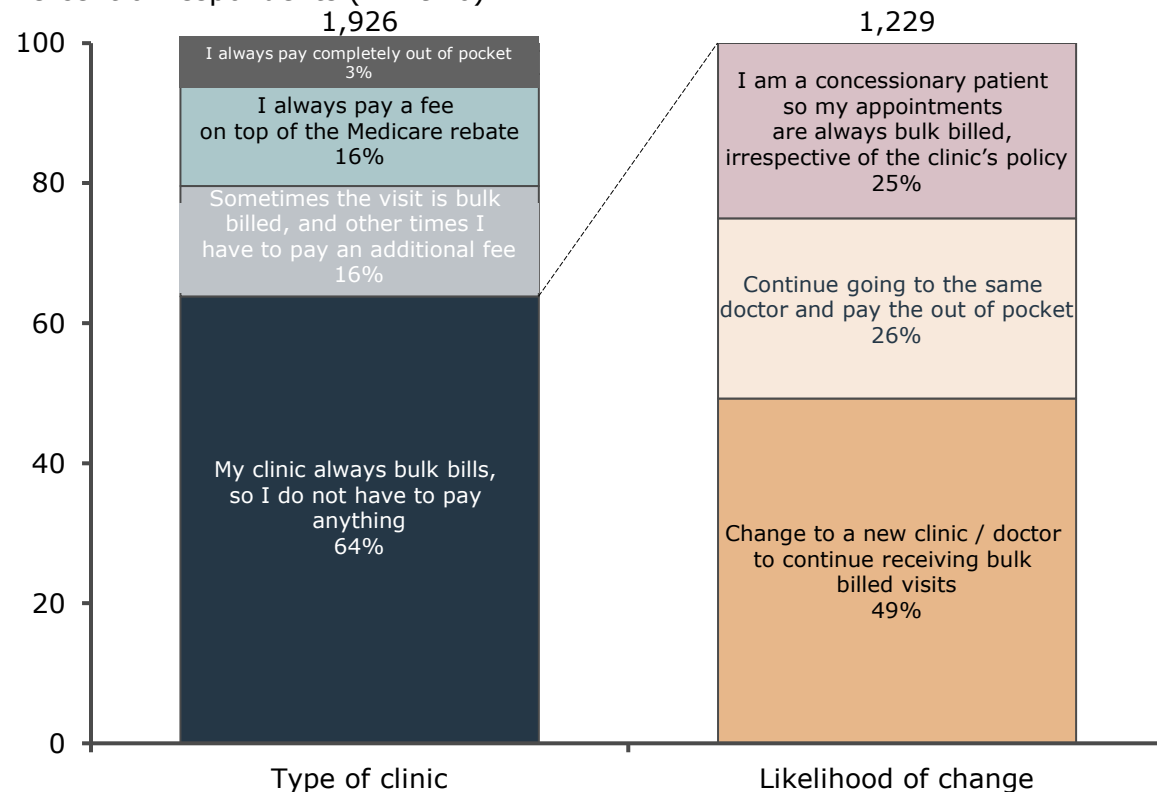
Panellist at Australia's Health Panel, April 2020

- A barrier to adoption remains internet and technology access (28% of Continuity of Care Collaboration respondents reported experiencing technological difficulties in June 2020)
- Nonetheless around 86% of respondents claimed to be 'happy' or 'very happy' with their telehealth

Nonetheless, health research points to strong patient preference for bulk billed services, with public funding key to sustained telehealth use

Type of clinic and likelihood of change* (2020)

Percent of respondents (n=1926)

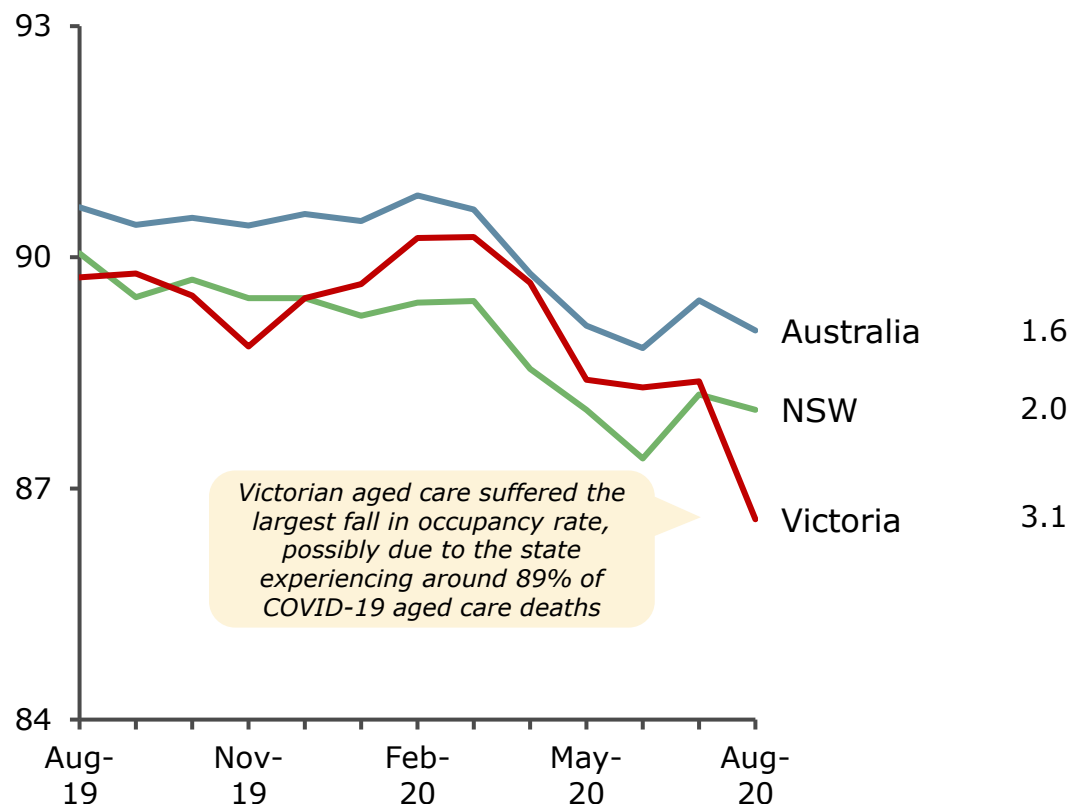


- Of the 64% of L.E.K. survey respondents who currently visit a clinic that always bulk bills, half of these respondents claim that they would switch clinics or doctors if they no longer received bulk-billed visits
- Only around 26% of patients currently visiting fully bulk-billed clinics would continue to see the same doctor and pay out of pocket if bulk billing stopped
- Hence, despite strong consumer sentiment for continuing to use telehealth, it is likely that if MBS support were removed, there would be a partial decline in the volume of telehealth demand
- However, investments made to enable the transition of medical services to telehealth models may indicate continued use of telehealth
- The Australian budget has committed \$18.6m towards the development ICT systems and infrastructure to support long-term MBS telehealth services
 - The Minister has signalled effort to ensure telehealth is a permanent transformation in the MBS in future
 - The Royal Australian College of General Practitioners (RACGP) is expected to work closely with the government on a long-term telehealth solution post March 2021

The COVID-19 pandemic triggered a decline in residential aged care admissions across Australia

Residential aged care occupancy rate, by State (Aug-19 to Aug-20)

Occupied beds as a percentage of available beds



- Aged care occupancy rates in Australia have fallen to their lowest level in over 10 years (from 91% to 89% between 2019 – 2020), with COVID-19 accelerating the decline. This fall in the occupancy rate is due to both decreasing new admissions and increasing departures
 - admissions into residential aged care decreased from 29,407 to 28,845** between 2019 – 2020
- Anecdotal evidence suggests a deterioration of sentiment within the sector, causing voluntary departures to grow as COVID-19 outbreaks occurred in residential aged care facilities. In particular, the Aged Care Quality and Safety Commission reported 2,163 COVID-19 related complaints since the beginning of the pandemic

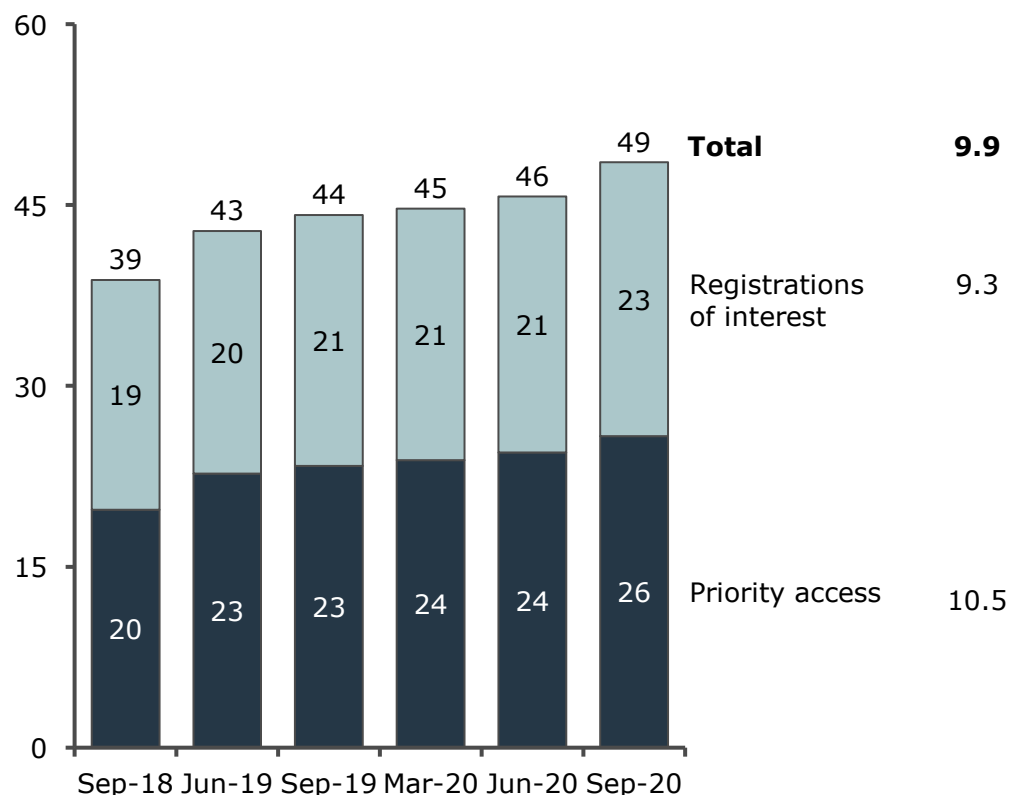
"... COVID-19 has really thrown a spotlight onto the residential aged care sector and shown it to be a broken system in desperate need of reform ..."

Director of AHSRI, October 2020
- This has resulted in the proportion of occupied beds falling from 90.5% in January to 89.1% in August, the lowest occupancy rate in over 10 years
 - Victoria was hit the hardest with occupancy falling from 89.7% to 86.6% during this time
- This decline in residential care admissions highlights a possible shift towards home care, with the number of home care recipients increasing by 38% year-on-year to around 137k in April 2020

Social housing is already constrained, with the economic downturn from COVID-19 placing further pressure on demand

Applications for social housing in Victoria (Jun-19 to Jun-20)

Thousands of households

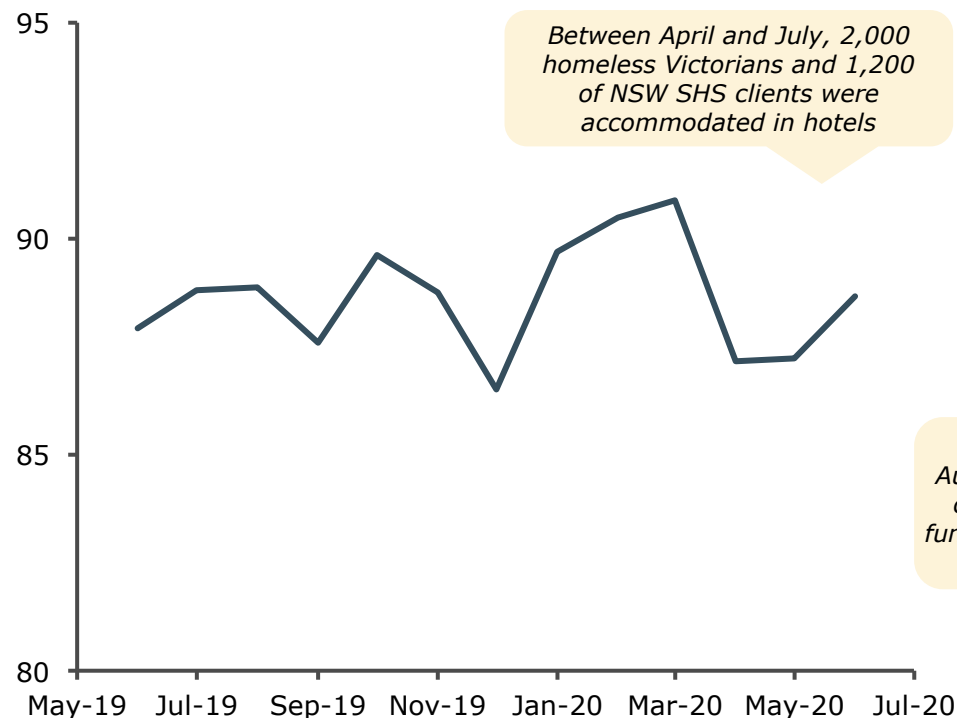


- As of 2019, there were around 797,000 occupants in social housing programs across Australia, with the majority (72%) in public housing
 - with around 435,000 social rental dwellings, social housing in Australia accounts for around 4.4% of the total housing stock and 3.2% in Victoria, lower than the OECD average
- There appears to be a shortage of fit-for-purpose social housing in Australia, particularly in Victoria and NSW, with the pandemic adding further pressure to the capacity of housing infrastructure
 - it is estimated that there are 100,000 individuals on Victoria's public housing waiting list and 50,000 in NSW, with the pandemic contributing to an additional 2200 Victorians being added between April and June
- Community groups across Australia claim that the COVID-19 pandemic has shifted the profile of social housing applicants to a greater number of people with 'regular but insecure work'
- There has been an estimated \$204m committed to crisis accommodation since the beginning of the pandemic. Furthermore, both the Victorian and NSW state governments have signalled a commitment to social housing as part of their COVID-19 recovery plans
 - in November, the Victorian 2020/21 budget announced it is spending around \$5.3bn *Big Housing Build* towards 9.3k new social housing homes
 - additionally, the 2020/21 NSW Budget committed around \$810m towards new and upgraded social housing. This takes the total NSW Government investment in social housing to \$4.4bn over four years and includes a \$400m towards a new Fast-Track Housing Construction Package to boost the State's economic recovery from COVID-19

There has been a slight increase in the number of individuals accessing homelessness services, with COVID-19 contributing to 6-7% of cases

Special homelessness services (SHS)* clients in Australia (Jun-19 to Jun-20)

Thousands of clients



CAGR%
(2019-20)

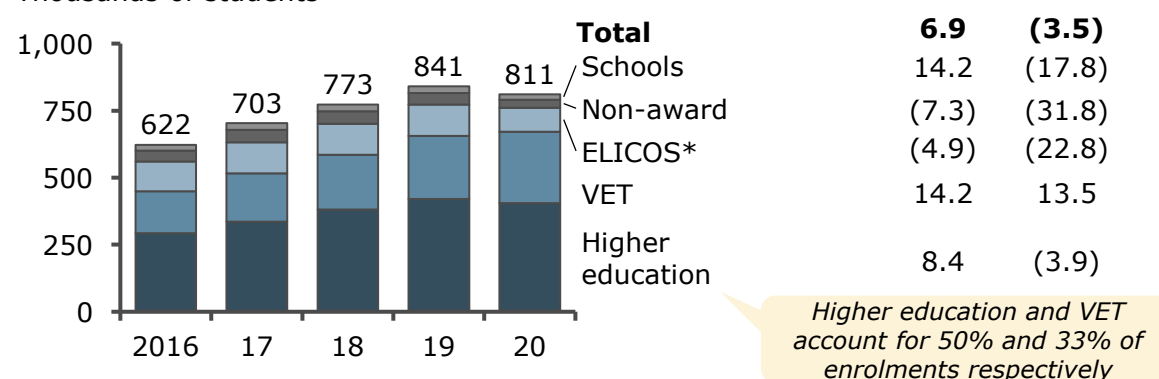
0.8

- In June 2020, there were a total of 88,665 individuals requesting SHS assistance, of which around 60% were women
 - key reasons include issues relating to financial and interpersonal relationships
 - Victoria accounted for the largest percentage of clients (around 37%) followed by NSW (26%) and QLD (14%)
- Between March and June 2020, 5,885 agencies / individuals applied for SHS assistance due to both direct and indirect impacts of COVID-19
 - these COVID-19 related cases account for around 6.6% of all SHS recipients, however it is likely that the crisis only played a contributory role
- In response to the pandemic, governments have transitioned an estimated 8,000 homeless people into hotel accommodation. However, there is uncertainty around the permanency of such accommodation after restrictions ease
 - the Victorian Government launched a \$150m package covering hotel accommodation for 2,000 homeless people until April, and a further around 9m to repurpose unused aged care centres to accommodate the homeless
 - other states including NSW, and WA have launched long-term and secure accommodation programs such as WA's 'Hotels with a heart' for the homeless

Border closures have reversed the growing trend of international students, with both enrolments and commencements falling

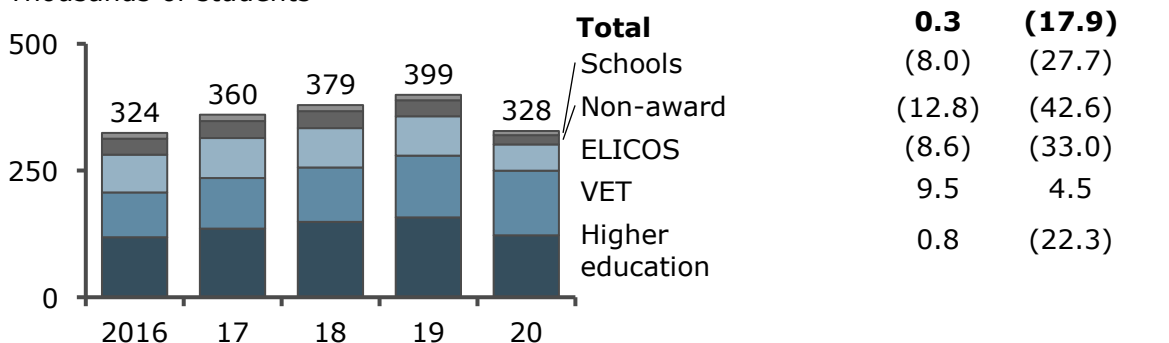
International student enrolments, by education sector (2016 to 2020)**

Thousands of students



International student commencements, by sector (2016 to 2020)

Thousands of students



- In 2019, international students accounted for around 32% of Australian higher education students, with China accounting for around 28% of this figure. This proportion is significantly higher than the OECD average of 6%
- COVID-19 related travel bans on foreign nationals have caused the number of international student arrivals to drop from 144,000 in July 2019 to just 40 in July 2020
 - there are currently 210,000 fewer international students in Australia compared to the figure expected prior to COVID-19
 - 400,000 international students are currently in Australia, while around 135,000 are still outside the country
- International student commencements fell by 18% compared to 2019, with the non-award and English Language Intensive Courses (ELICOS) sector experiencing the largest year-on-year reductions of 43% and 33% respectively
- International student enrolments have fallen by 5% compared to 2019
 - between April and October, there was a 75,000 reduction in currently enrolled international students, partly due to deferrals
- Modelling by the Mitchell Institute suggests that there will be a 50% reduction in international students by July 2021
 - if travel restrictions remain in place until July 2022, it is forecast that there will only be 165k international students in Australia, representing only around 30% of the 2019 intake

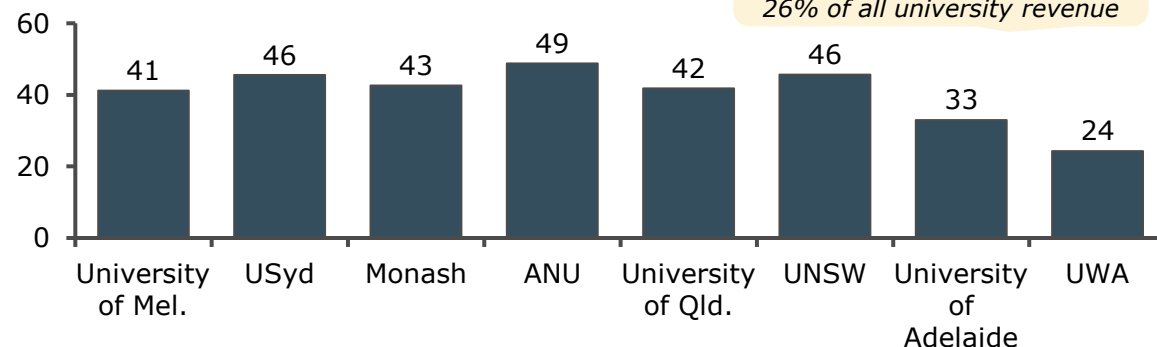
"... There might be international student pilots, possible in SA at the end of November [2020], and we hope it will return to normal by late next year but it's very hard to say..."

Executive Director, Regional Universities Network

With international students comprising a significant proportion of tertiary enrolment and revenue, universities are likely to face revenue pressures

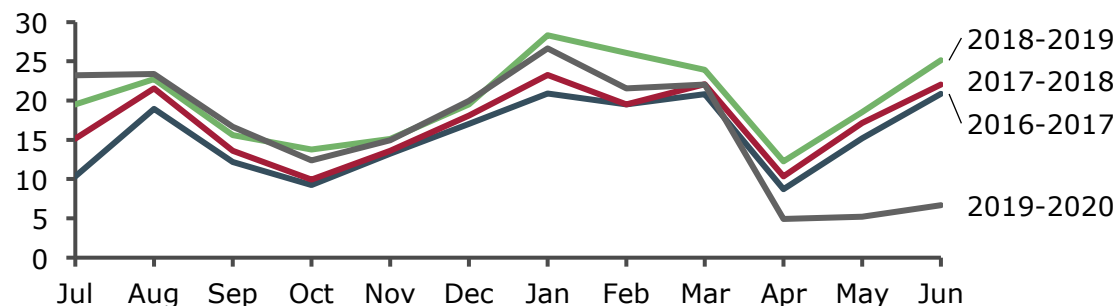
Percent share of overseas students, by Go8 university (2018)

Percent of total students



Number of student visa applications for higher education (July 2016 to June 2020)

Thousands of applications lodged



- Data from the Department of Home Affairs shows that between March and August, the number of overseas student visa applications fell by 83% from 137,000 to 23,000 due to the imposition of travel bans
- As all international students are required to obtain a student visa, this fall in student visa applications can be seen as a leading indicator for overseas student enrolments, suggesting a similar drop in international enrolments for 2021

"... Every year, Australia grants about 240,000 student visas to people overseas. Without these new international students starting courses, total numbers will start falling. ..."

Peter Hurley at Mitchell Institute, November 2020

- While visa and enrolment applications have fallen dramatically, a survey conducted by BridgeU (of 16,900 students across 83 countries) shows that 67% of international students do not intend to change their tertiary education plans.
 - of those changing their plans, 44% are picking a new university while 42% are picking a new country
 - among those switching countries, international students show a positive net switch to Australia
 - this suggests that overseas demand for tertiary education may experience a recovery after travel bans are lifted

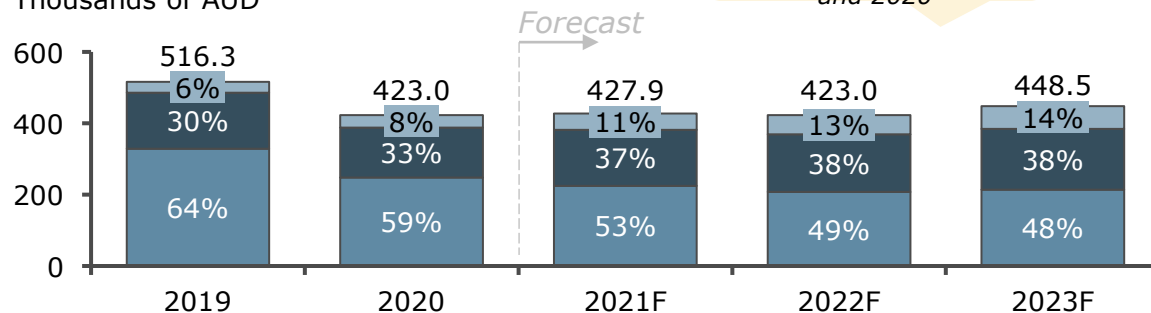
"... As travel bans continue, this loss will continue to get worse. Every six months international students cannot enrol because of travel bans, 110,000 to 140,000 international students don't start their courses..."

Peter Hurley at Mitchell Institute, November 2020

ANU is forecasting total student numbers to drop, with international student numbers expected to increase again from 2022

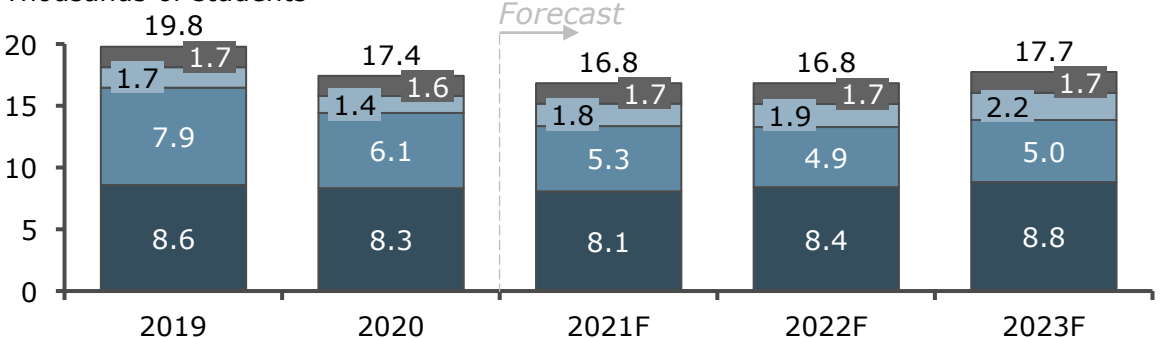
Student revenue at ANU, by type (2019 to 2023F)*

Thousands of AUD



Student load at ANU, by type (2019 to 2023F)*

Thousands of students



- Universities across the country have experienced revenue and job losses largely due to COVID-19 related travel bans. Universities Australia has forecast that COVID-19 could cost Australian universities \$3-5bn in 2020 and around \$16bn in revenue by 2023, with universities also expected to lose 21,000 full time staff
 - the University of Melbourne has forecast a revenue loss of \$1bn between 2020-2022, and reducing 250 full time staff
- As a result of these COVID-19 disruptions, universities in Australia have been reassessing their strategic and operational plan for 2021 to recover from the short and long-term impacts of COVID-19
 - many universities are planning to reduce and rationalise courses (e.g., Sydney University will cut 30% of arts units), and review capital works projects
 - lecturers also expect a shift towards online or blended teaching compared to face-to-face teaching
 - universities are also looking to consolidate smaller campuses and potentially consider mergers with other universities

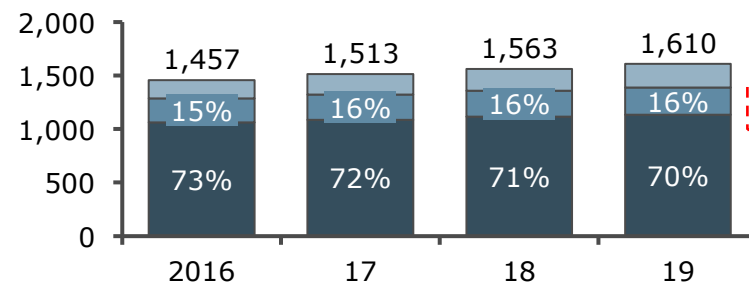
"... [there may be] possible merit in the rationalisation of the shape and number of public universities in South Australia ..."

Chancellor, University of Adelaide

There has been a gradual shift towards online learning in recent years, and this has been accelerated by compulsory online education due to COVID-19

Higher education students, by attendance mode* (2016 to 19)

Thousands of students



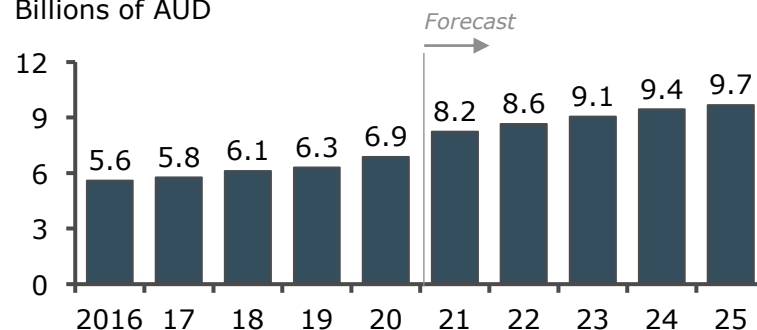
**CAGR%
(2016-19)**

Total	3.4
Multi-modal	8.9
Online	4.3
Internal	2.2

- The online education industry has been growing in recent years largely due to technological advancements and wider internet access, with over 1,000 online education providers currently in Australia
- While the multi-modal segment has been growing incrementally, COVID-19 appears to have facilitated a shift to online learning, as lockdown restrictions have forced schools and universities transition to online teaching in March
 - in response to COVID-19, TAFE NSW closed over the Easter break, and trained 8,000 to deliver its course content online
 - the NSW Department of Education signed a 90-day trial licence with Zoom and training for teachers in preparation for students return to school in May 2020
- Some forecasts indicate there will be a significant increase in online education revenue, which is predicated to grow at a similar rate after a step change increase in 2021
- There are also concerns that this transition will lead to disproportionately worse educational outcomes for lower socio-economic groups, such as households with limited access to laptops or the internet, or public schools with limited resources and technology

Estimated revenue in online education sector (2016 to 25F)

Billions of AUD



**CAGR%
(2016-25F)**

**CAGR%
(2020-25F)**

6.3

7.1

The acceleration of technology trends with COVID-19 has prompted the large universities to revisit how they use their infrastructure

Changes to infrastructural requirements for universities

Lecture theatres and classrooms

In the short-term, the TEFMA has estimated target utilisation of university spaces at around 40-60% to meet COVID-19 cleaning requirements

A study by University of Melbourne highlights that a re-appraisal of infrastructure will likely result in universities scaling back capital works due to a lack of necessity for assets built during Australia's infrastructure boom

The Australian National University (ANU) has launched a COVID-19 Recovery and Response plan outlining proposals to increase efficiency across the university, with more effective utilisation of 'space' key component of the plan. In particular, the university has expressed support for the development of relationships with commercial vendors to lease vacant commercial spaces across ANU's campus



Rationalisation of campuses and courses

Research from the University of Melbourne also suggests that COVID-19 may trigger the consolidation of campuses and courses to reduce overhead costs

Universities are also expected to evaluate costs and associated revenues of individual course and subject offerings and consolidate or eliminate those that are unprofitable. For example, the University of Newcastle has identified 500 courses to be discontinued in 2021 out of its current 2,200 offerings



"... COVID-19 provides the opportunity for institutions to confirm the break-even revenue required to sustain individual courses and subjects and to consolidate or eliminate offerings that either are non-viable ..."
The University of Melbourne

Digital infrastructure

Murdoch University has announced plans to replace face-to-face lectures with 'flexible' and 'scalable' digital learning based on student feedback stating a preference for face-to-face tutorials and labs, and virtual lecture materials that can be accessed flexibly

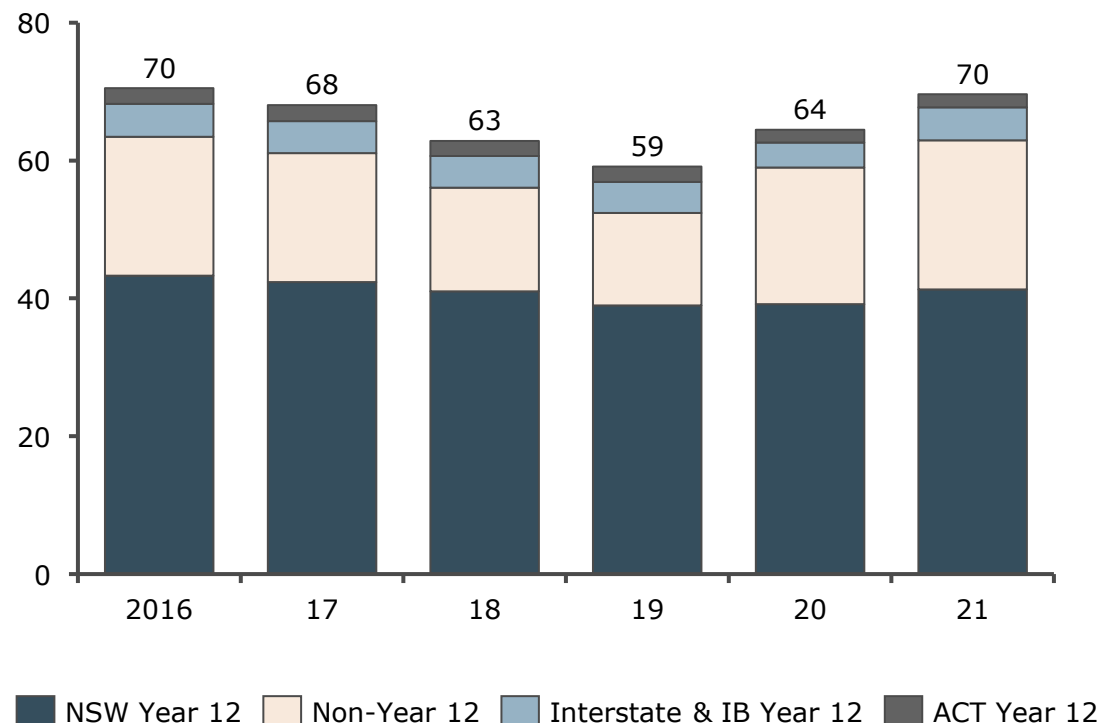
"... Even without the impact of COVID-19, this is a contemporary and pedagogically sound approach that increases students' flexible access to learning and is aligned to our Technology Enhanced Learning Strategy ..."
Professor Readman at Murdoch University, October 2020



Universities have received an increased number of early applications, particularly from mature students, due to an uncertain economic outlook

Early university undergrad. applications in NSW and ACT, by type (2016 to 2021)

Thousands of applicants



- COVID-19 appears to have accelerated the increase in domestic intake of tertiary education, with the volume of early domestic applications rising by 8% in NSW and ACT between 2020 and 2021. The majority of this increase was driven by non-year 12 students (i.e. mature aged students), as many people were not able to travel or lost employment and took the opportunity to study

“... Domestic students are up because a lot of people have lost their jobs, they’re taking it as an opportunity to retrain ...”

Executive Director at Regional Universities Network

- In order to combat revenue losses, universities across the country (UNSW, UMelb, USyd) are expected to request that the government re-introduce ‘demand-driven funding’ and the removal of caps

“... UNSW’s domestic student numbers are capped and we expect to fill all places in 2021. We would welcome relaxation of the Australian government’s [sic] cap on places as we have room to take extra students. We expect domestic demand will be up more than 10% ...”

Spokesperson at UNSW, August 2020

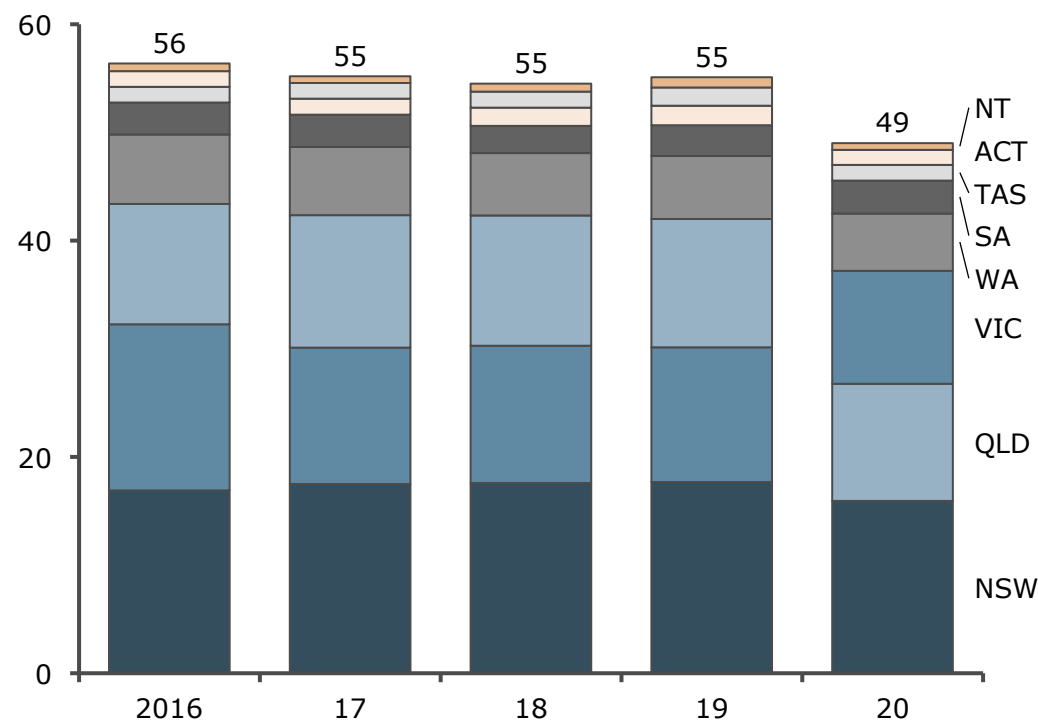
“... A lot of this increase will be due to the recession and its impact on the job market. In recessions, more people seek to upskill and build their qualifications ...”

Chief Executive of Universities Australia, August 2020

There was an 11% year-on-year reduction in the number of apprenticeships undertaken in Australia in 2020

Apprentice and trainee commencements, by State (2016 to 2020)*

Thousands of commencements

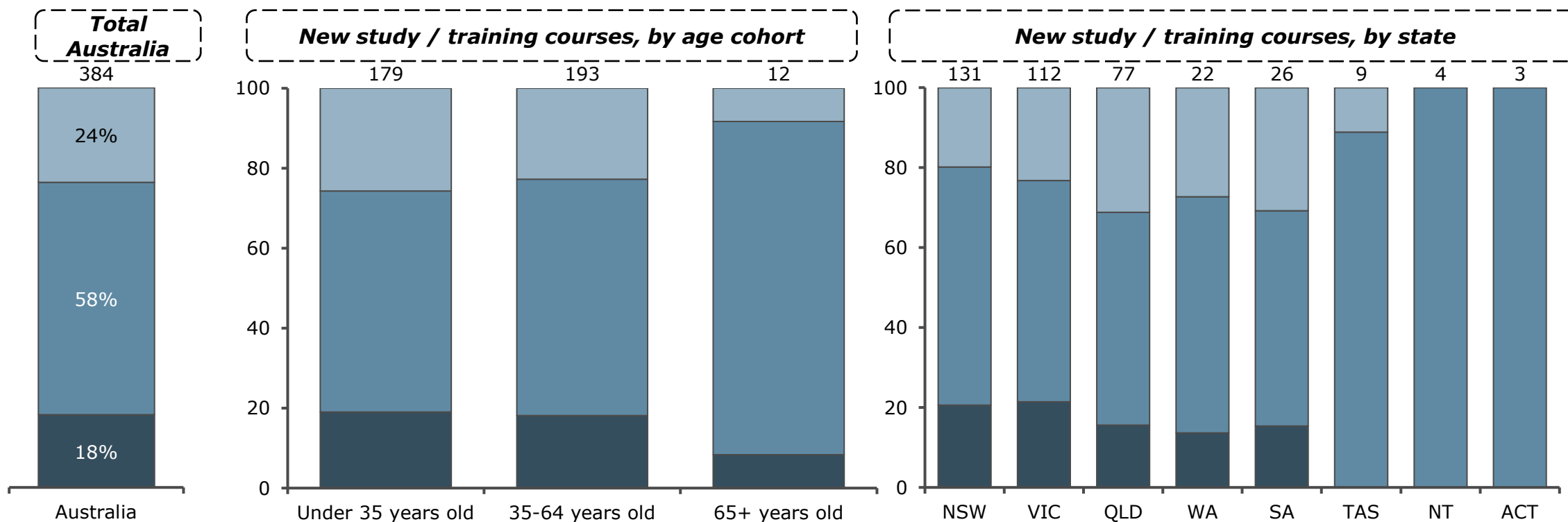
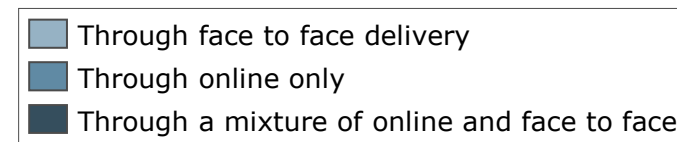


- Apprentice and trainee commencements were down by around 11% in the March 2020 quarter compared to March 2019
 - the largest declines were seen in hospitality & retail of around 68% followed by receptionists (42%) and sales (29%)
 - as at March 31, the total number of apprentices has fallen by around 2.9% across the country compared to 2019
- The Mitchell Institute forecasts a fall in commencements of around 45,000 each year during 2021 and 2022 compared to pre COVID-19 levels
- However, 2020 cancellation and withdrawal rates remain stable at around 41.8% compared to around 39.6% in 2019, and this trend is stable across all states

Over 75% of respondents who took up new study during COVID-19 used online education, especially in the ACT and NT, and among older respondents

Method of taking new study / training courses during COVID-19, by age cohort and by state (November 2020)

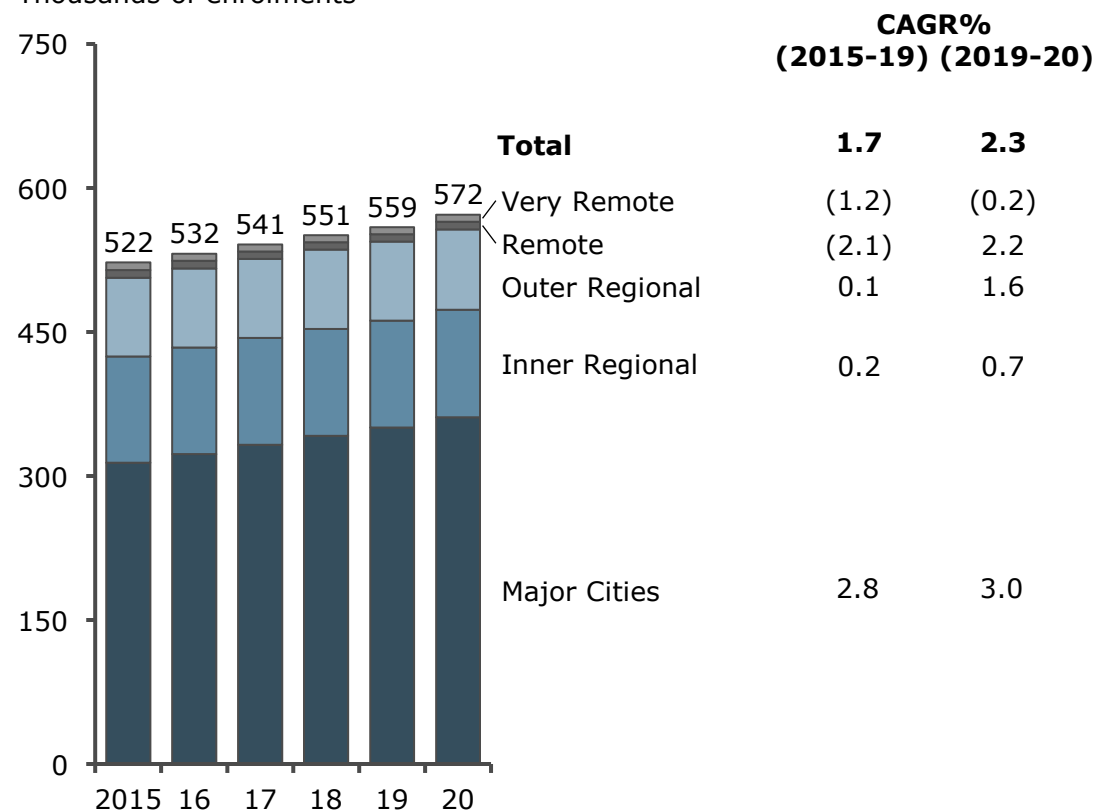
Proportion of respondents who did take up new courses, Number of respondents (that took up courses)



There has been a small increase in primary school demand in some regional and coastal areas as families moved out of cities

Primary and Secondary state school enrolments in Qld, by LGA (Aug-15 to Aug-20)

Thousands of enrolments

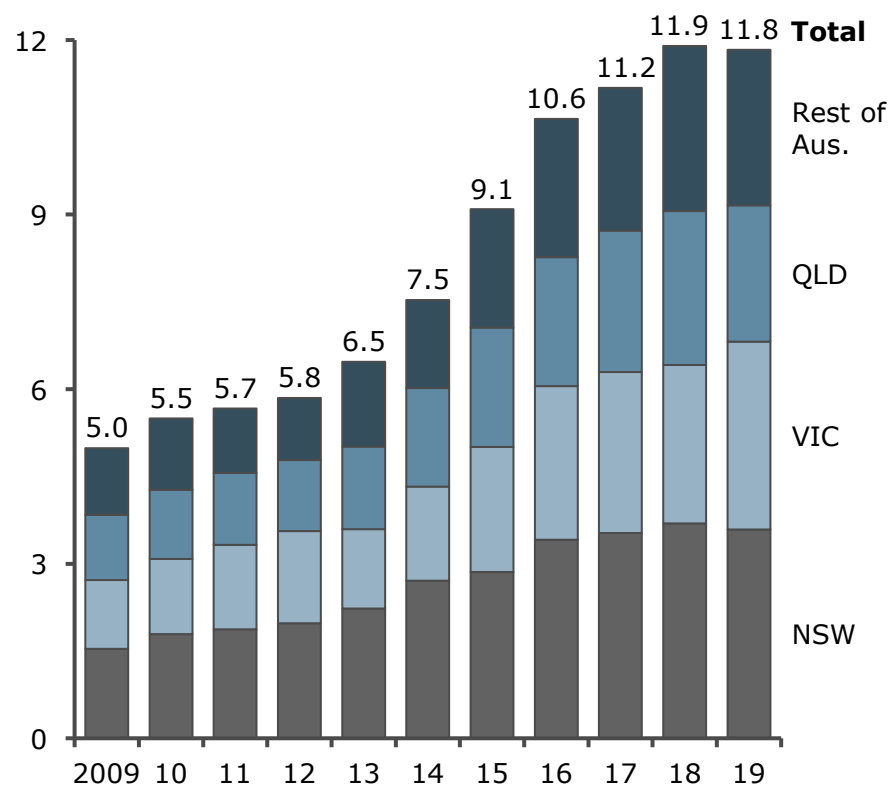


- Data released by the Australian Bureau of Statistics (ABS) revealed a trend of Australians moving from capital cities towards regional areas
 - there has been a net loss of 14,000 residents from Sydney and 10,000 from Melbourne to regional areas in the first half of 2020, with 3,000 Sydneysiders moving to regional Queensland
- This movement from the cities to the regions is confined within specific areas, with inner and outer regional enrolments growing at a slower rate than average and city enrolments
- This has led to an increase in enrolments at schools in some growing regional areas. For example, a number of local schools in the Sunshine Coast report an uptick in enrolments and enquiries, and some reportedly reaching their maximum capacity
- This small shift towards increased regional school demand can be seen by the around 1.6% and around 2.2% growth in outer regional and remote enrolments between 2019-20 which had previously stagnated prior to COVID-19. However, this is still exceeded by the growth in enrolments from students in major cities

Historically, national park usage has been increasing across all states, with some states experiencing spikes in recent months due to COVID-19

Domestic daytrip visits to national parks, by State (2009 to 2019)

Millions of visitors



CAGR% (2009-18)

10.1

10.6

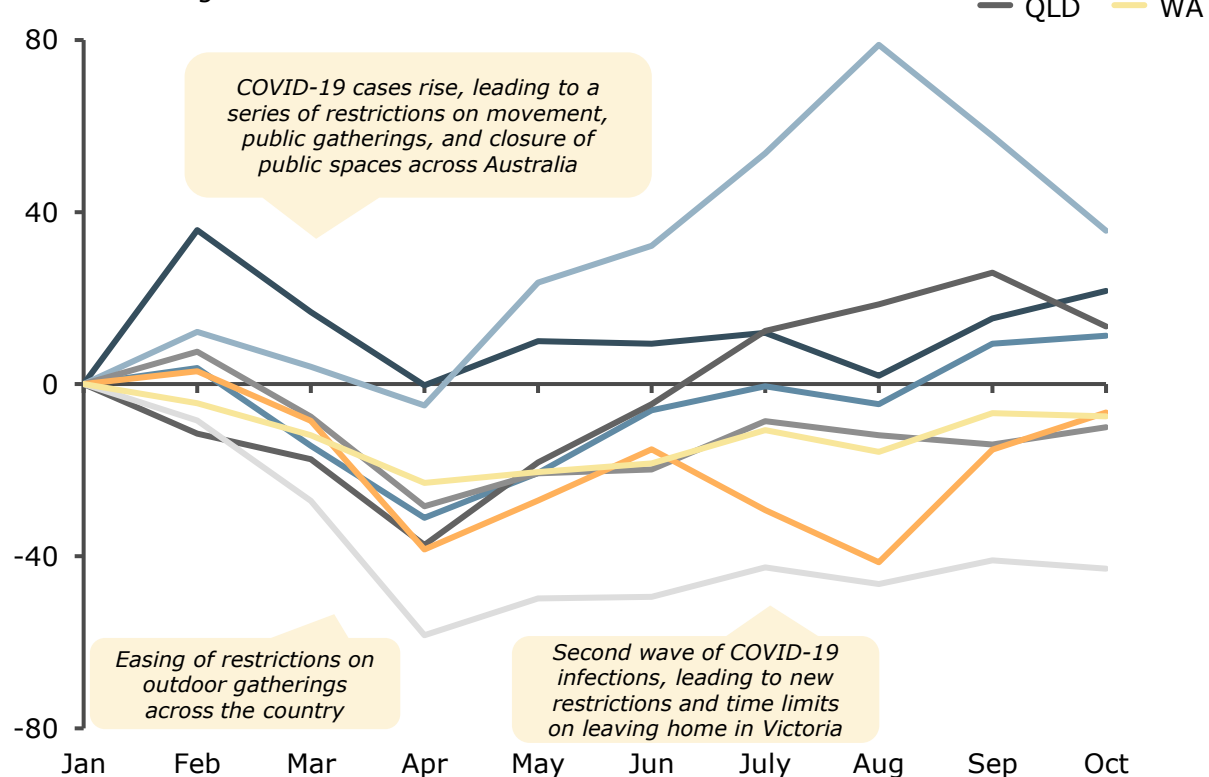
10.2

9.7

10.0

Change in the number of park visits in Australia, by State (Jan-20 to Oct-20)

Percent change from baseline*

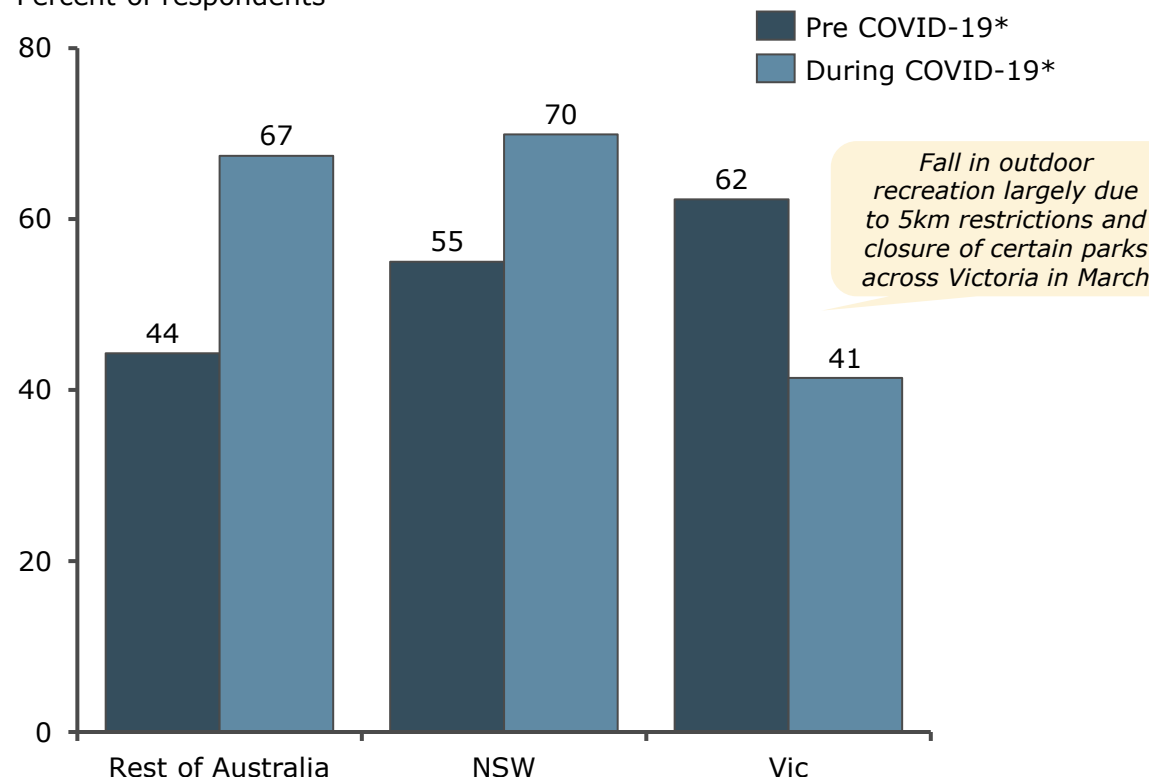


ACT SA
NSW TAS
NT VIC
QLD WA

There has been a sharp increase in the utilisation of national parks and green spaces during COVID-19, with the exception of Victoria

Visits to public park / recreation area at least once a week (Mar-20 to Oct-20)

Percent of respondents



- Visits to green spaces have increased significantly across Australia with the exception of Victoria
- Anecdotal evidence regarding Australians' realisation of positive impact of park visitation on mental health and wellbeing, suggests that there may be a degree of stickiness in this behaviour

“... More people are becoming aware that getting outside fresh air is essential for mental health and wellbeing ...”
Greener Spaces Better Places Survey

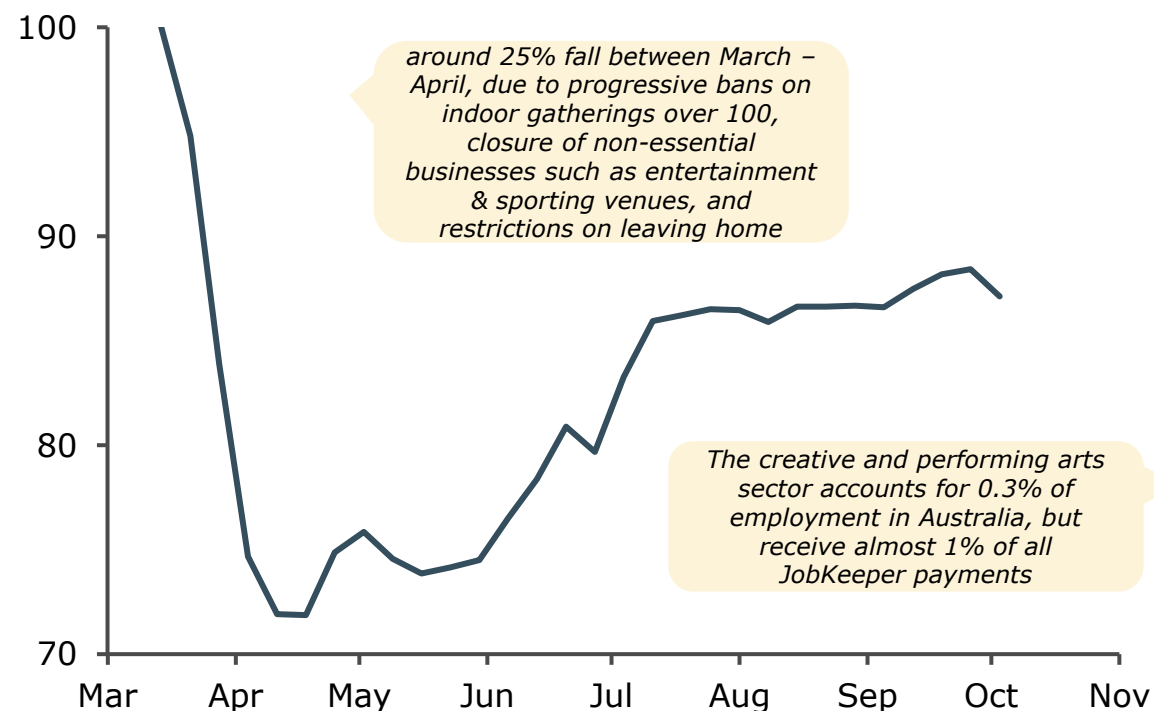
- In a survey conducted by the NSW Department of Planning, Industry & Environment, 46% of respondents** claimed to have spent more time in parklands and gardens, primarily for exercise
- Further, 72% of NSW survey respondents cited that local parks have been 'especially useful' or 'appreciated more' during COVID-19, with some parks (e.g., Centennial Park) experiencing a doubling in the volume of visits
- Research also shows that 87%^ of Australians have noticed a positive shift in community attitudes towards green space, particularly amongst those living in high density areas

“... Parks, promenades and open spaces have become vital community place. They are peoples' backyards for those living in denser suburbs with apartment blocks. Urban green space and the quality of residential spaces has never been more important ...”
Green Spaces Better Places Report

Arts and recreation were amongst the hardest hit by COVID-19 restrictions, with a fall in employment of around 12.9% across the industry

Employment in Arts and Recreation Services* in Australia (Mar-20 to Oct-20)

Percent of baseline**

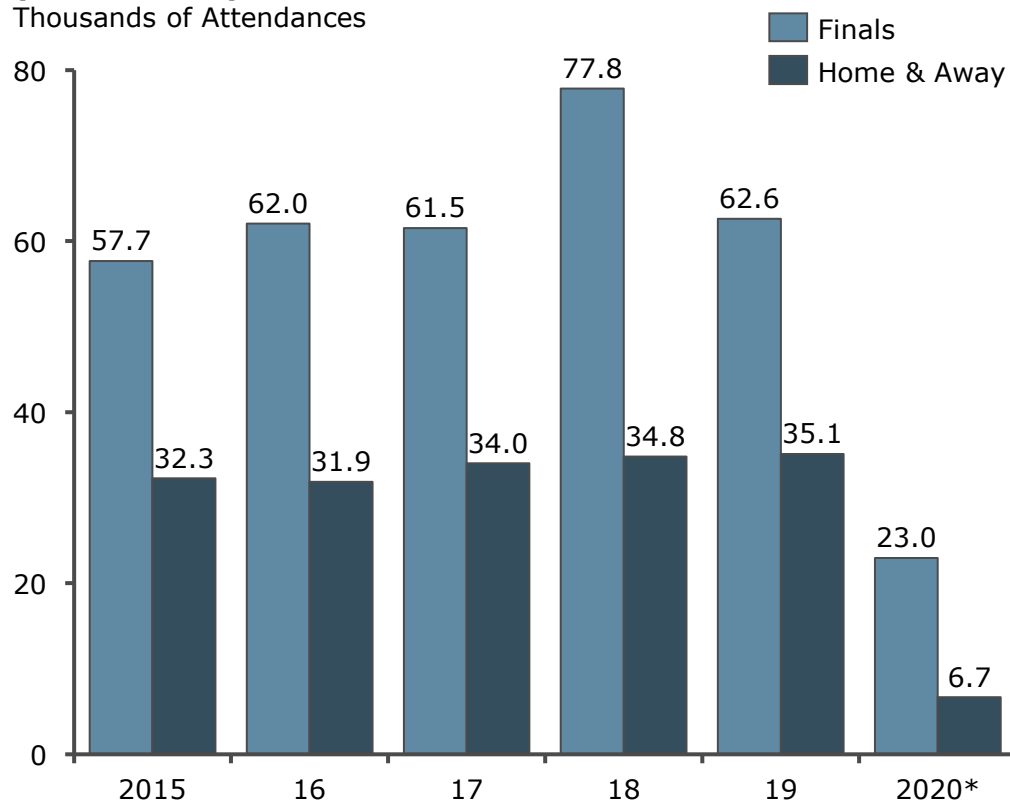


- The Arts and Recreation sector has been one of the hardest hit by COVID-19 with around 53% of businesses ceasing operations in April due to restrictions on mass gatherings across the country
- In mid-April, employment fell around 28%. While the sector has since recovered to around 87% of baseline levels, it is the second hardest hit after accommodation and food services where employment sits at around 82% of baseline levels
- The recovery since April was assisted by JobKeeper which provided over \$76m of funding to 25,000 individuals in Arts & Recreation. It is estimated that the 200 largest Australia Council-funded arts organisations will receive \$95m in JobKeeper
 - 118% of businesses have applied for JobKeeper in arts & recreation – i.e. the number of employees and number of businesses that applied for job keeper as a proportion of the number of businesses in sector is 118%^
- With around 60-70% of individuals in the sector receiving JobKeeper, there may be challenges to business viability when JobKeeper finishes in March 2021
- However, consumer survey data suggests a positive outlook for the industry, with 85% of Australians in Audience Outlook Monitor's September 2020 survey claiming that they expect to return to arts and culture events in the long term

The sports & recreation industry is expected to experience a 5-10% reduction in revenue in 2020, caused by social distancing restrictions and health concerns

AFL average attendance per game, by match type (2015 to 2020)

Thousands of Attendances



- Restrictions and bans on sporting and cultural events across Australia are expected to contribute to a 7.2% decline in industry revenue between 2019-20

- there has been an ~86% decline in total attendances at AFL matches, with fewer matches and restrictions on gatherings

- Spectator and sport participation are two key drivers of industry revenue, and as a result physical distancing requirements and cancellation of clubs events have driven a significant revenue decline

- While clubs and gyms have innovated, with spectator-less sports, online training plans and virtual workouts, organisations such as the Melbourne Cricket Club (MCC) have been forced to cancel major events, with the MCC anticipating a revenue shortfall of \$16m (around 10%)

"... Our revenue model is dramatically compromised as a result of the crisis and the revenue from managing the ground will not return in any significant form until crowds at games can return ..."
President at MCC, August 2020

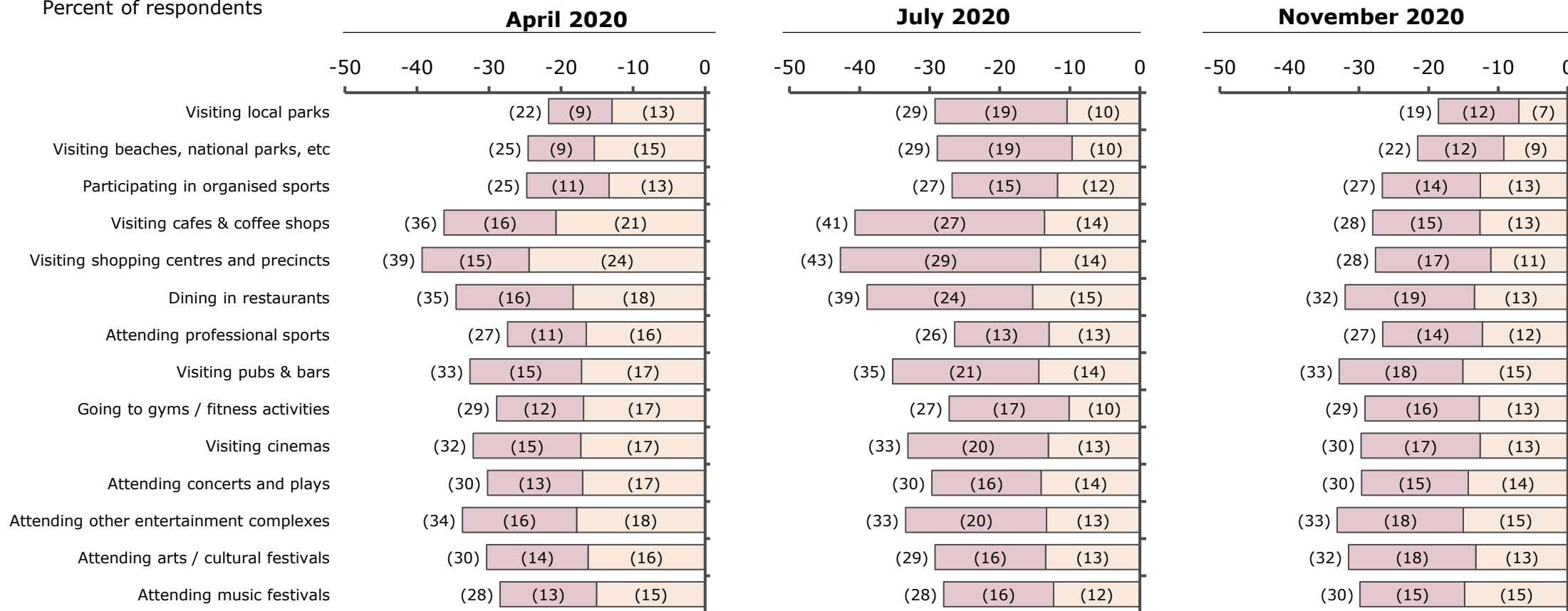
- A survey conducted by Gemba Insights in July shows that 52% of Australians would feel safe attending live sport / entertainment venues if there was social distancing in place, with distancing and temperature checks on entry seen as the most important measures
 - however 40-45% of consumers anticipate lower spend on live sports and entertainment compared to their pre-COVID-19 levels


Consumers were more confident of returning to past behaviours in November than in July, with health concerns and financial pressures easing

Likelihood of returning to past behaviours*, as restrictions are lifted

(Apr 20, Jul 20, Nov 20)

Percent of respondents



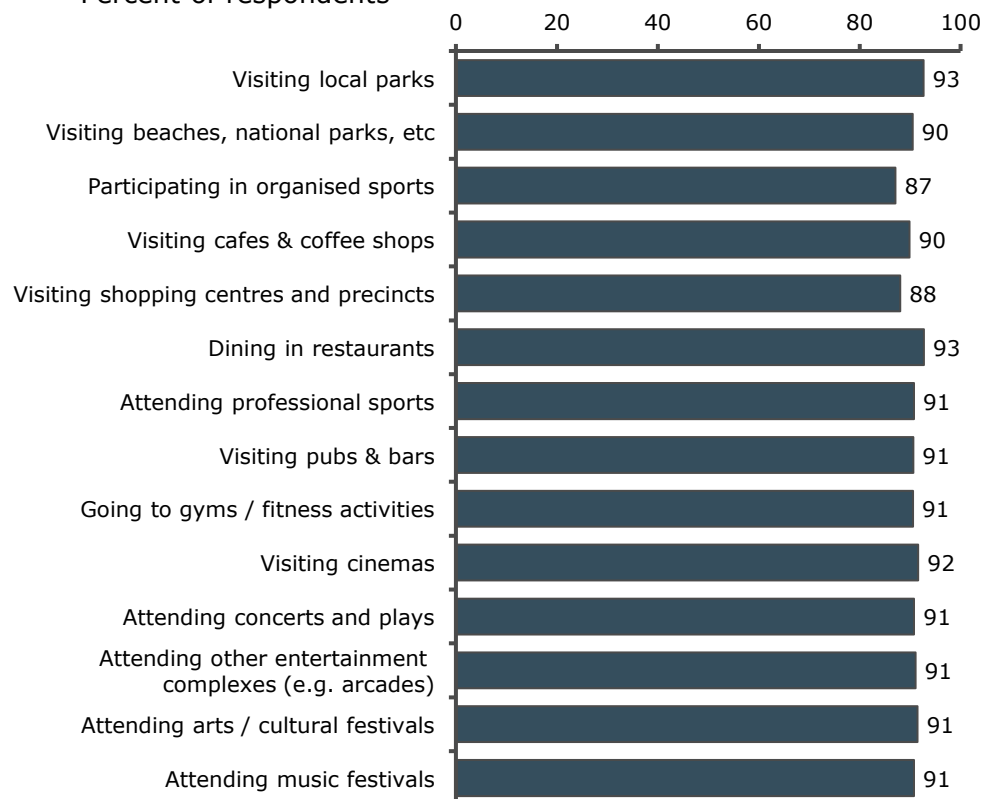
 I will do it on occasion, but not with the frequency I used to due to the lingering health risks

 I will do it on occasion, but not with the frequency I used to due to financial pressures / concerns

Most consumers reported changing their spending habits, with the majority indicating that they would return to previous spending within a year

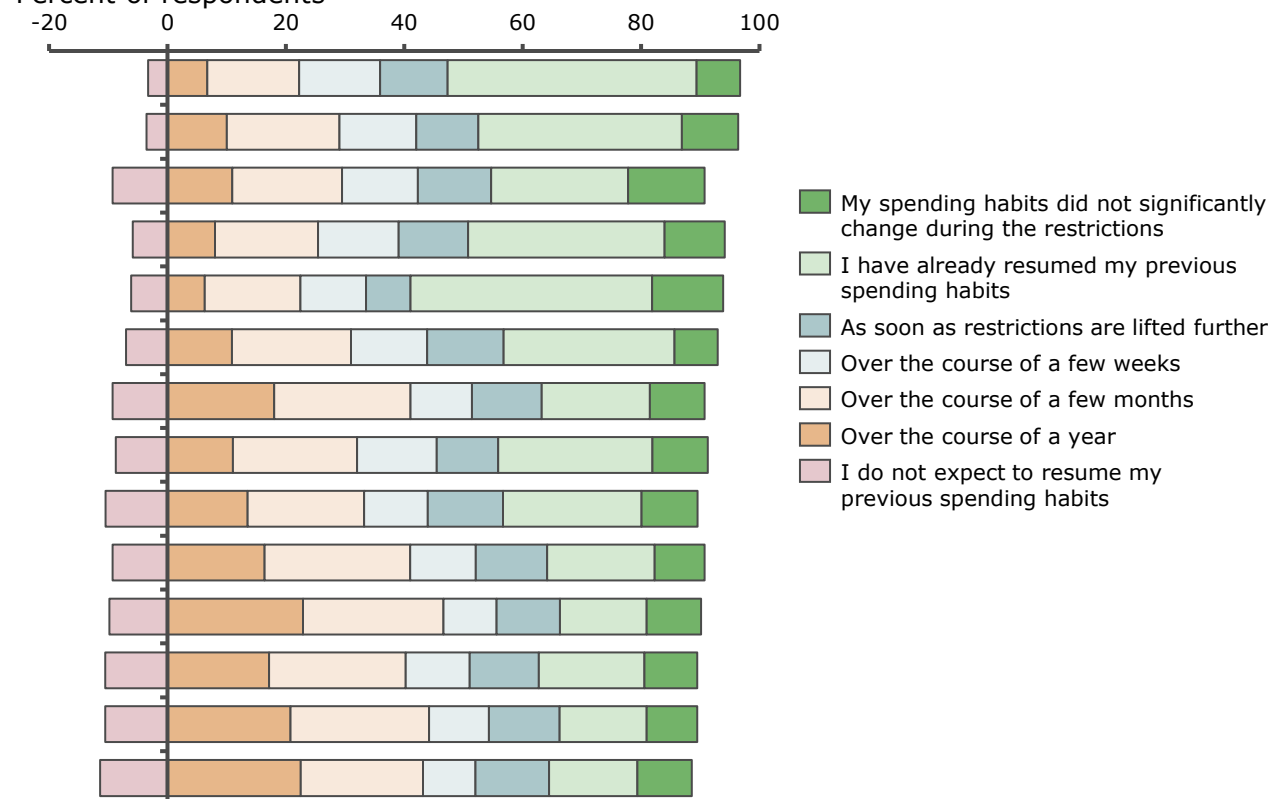
Respondents reporting changes in their spending habits due to COVID-19 (November 2020)

Percent of respondents



Expectation of returning to past spending habits, for those reporting a change in their spending habits (November 2020)

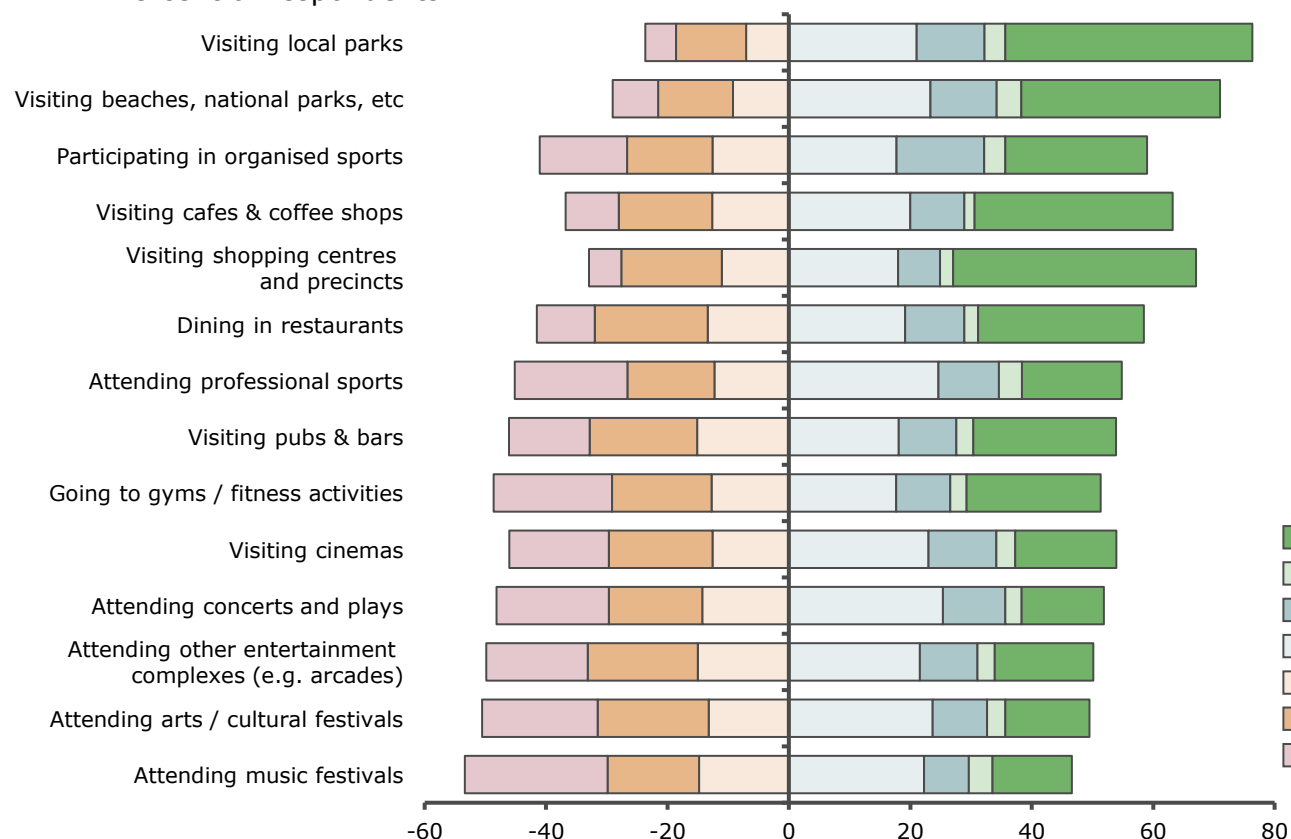
Percent of respondents



Health concerns and the risk of COVID-19 infection are still key drivers of some consumers not yet wanting to return to past Fitness and Recreation behaviour

Intention to return to past Fitness & Recreation behaviour (Nov 20)





















Percent of respondents

































- Survey data from AusPlay also shows that while some individuals may delay their return to sport due to COVID-19 related health concerns, the majority are likely to resume participation after such risks have passed
- 26% of participants (AusPlay) express concern about playing again largely due to health concerns
- 61% of adult participants (AusPlay) claimed they were 'extremely' or 'very likely' to play sport organised once it becomes available

- I have already resumed my pre-COVID behaviour
- I expect to do this activity more than I did prior to the restrictions being put in place
- I expect to return to my previous habits within a few weeks
- I expect to return to my previous habits over the course of a few months
- I will do it on occasion, but not with the frequency I used to due to financial pressures / concerns
- I will do it on occasion, but not with the frequency I used to due to the lingering health risks
- In the foreseeable future I am unlikely to because I am still worried about the risk of infection

Assessment and outlook for key trends: Social Infrastructure (1 of 2)

TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID)	Correlation of trend to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID
Health	Repurposing of existing health resources	Major – mx	 All	 New direction	 Examples of repurposing will revert	 Unlikely to be affected	 Temporary only – will return
	Rapid increase in the uptake of Telehealth	Major – mix shift and volume up	 All	 Acceleration	 Patient demand will likely be stronger, and more so during COVID-19	 Some impact driven by MBS and bulk-billing rates	 Will grow, with MBS support a key factor
	Decrease in access to other healthcare services	Major – volume down	 All	 Reversal	 Access to other services is recovering	 Unlikely to be affected	 Temporary only – will return
Social Housing	Increase in need for social housing and change	Minor – volume up	 Fast growing cities, smaller cities/regional centres	 Acceleration	 Some housing demand impacts from COVID-19	 Demand strongly linked to economic recovery	 Higher demand could endure if downturn is prolonged

Assessment and outlook for key trends: Social Infrastructure (2 of 2)

TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID)	Correlation of trend to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID-19
Education	Decrease in international student enrolments and commencement	Major – volume down	 Fast growing cities, smaller cities/ regional centres	 Reversal	 Dependent on COVID-19 recovery and easing of travel restrictions	 May be sensitive to bilateral trade and relationship issues	 Low national cases is an advantage for recapturing market share
	Increase in online education	Major – volume up	 All	 Acceleration	 Highly sensitive to social distancing requirements	 Unlikely to drive the switch to online but may increase demand	 Potential shift towards greater online learning content
	Spatial shift of school enrolments away from metropolitan areas	Minor – mix shift	 Fast growing cities, smaller cities/ regional centres	 Acceleration	 Prolonged WFH would see greater shift to regional areas	 Need for greater affordability may shift more to regional areas	 May be small but sustained rebalancing from cities to regions
Art and cultural, Green , blue, sport and recreation	Increase in park visitation	Major – volume up	 All	 Acceleration	 Sensitive to social distancing requirements	 Unlikely to be impacted by duration of downturn	 Survey data suggests strong preferences for green spaces
	Decrease in participation in arts and recreation	Major – volume down	 All	 Reversal	 Sensitive to social distancing requirements	 Participation is less influenced by economic recovery than health risks	 Will see strong return post restrictions
	Decrease in participation in sport	Major – volume down	 All	 Reversal	 Sensitive to social distancing requirements	 Participation influenced more by health risks	 Survey data suggests likely to return post COVID-19

Future directions for consideration: Social infrastructure

Opportunities and Challenges



Education Campus Capacity

- There is likely to be longer term campus capacity resulting from a major shift to online learning, and the reduced international student intake. This could be disruptive to planned campus investments



Arts and Culture

- Arts and culture has been severely impacted during COVID-19, with survey data pointing to continued strong caution around attending these events in the future
- Under a prolonged COVID-19 or economic recovery scenario, the risks of sector decline are high



New health service models

- Rapid transition to telehealth and digital medical models has occurred through COVID-19, in ways that were not considered possible prior. New models of delivery that build on this will require continued investment and support



Aged Care

- In response to the pandemic residential care admissions dropped to the lowest occupancy rate in over 10 years, in favour of home care. The number of home care recipients increased by 38% year-on-year to around 137k in April 2020. This highlights the need for significant policy and service reforms for the sector

Future Directions for Consideration

- ✓ Strategic repurposing and multi-use of campus infrastructure
- ✓ Flexible design of built infrastructure to ensure re-use
- ✓ Prioritise investment in reskilling

- ✓ Need for public support and investment to sustain cultural assets, infrastructure and institutions and to enable sector resilience
- ✓ Investment in digitisation of cultural exhibitions and integration into education programs

- ✓ Continued investment and support for new health service models
- ✓ Sustained MBS funding for telehealth
- ✓ Support for ongoing development and change management of innovative service delivery models, with policy reform where required

- ✓ Review and reform of policy and service settings for aged care, both residential and home care models
- ✓ Confidence building measures

Section 6

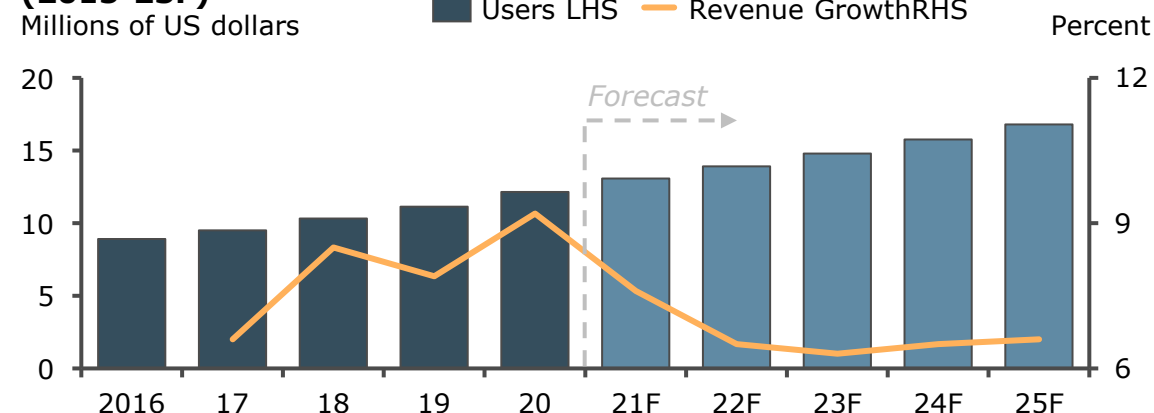
Telecommunications & Digital

Telecommunications rapidly responded to decentralisation and remote connectivity

Category	Segment	Summary of trends
Uptake of tools and technologies	Collaboration tools	<ul style="list-style-type: none"> The COVID-19 lockdown significantly increased the uptake of online collaboration tools Demand for Cloud services from Australian companies accelerated as they moved to new models of working, even as the market approaches maturity Despite the uptake of Cloud, data centre investment declined in 2020 due to restricted cash flow as a result of COVID-19, but is expected to rebound in 2021 The accelerated take up collaboration tools was seen not just in the business sector but across other areas of the economy including education and training Higher levels of remote working and Cloud usage also catalysed an increase in cyber security investment during COVID-19 lockdowns
	Demand for Cloud, data and security	
	Commercial and non-commercial implications	
Bandwidth and connectivity	Internet usage and network response	<ul style="list-style-type: none"> The impact of large-scale remote working led to a surge in usage, with telecommunication providers responding by leveraging extra capacity in the network The COVID-19 lockdown periods saw more acute bandwidth congestion, which were addressed by NBN increasing capacity for internet service providers Demand increased as a result of lockdown measures with two significant impacts on the network: <ul style="list-style-type: none"> Some suburban areas were impacted significantly with network outages Regional Australians experienced access issues during lockdown restrictions, which required in home work and schooling There has been an increase in complaints as a result of the COVID-19 pandemic with a greater proportion of complaints coming from SMEs Other countries have likewise seen increased demand and to varying degrees, have experienced issues with broadband performance Despite working from home, the rate of total connections to NBN has slowed by c.1.5% from the previous period Telecommunications providers have brought forward investments in 5G, in part due to the COVID-19 pandemic
	Accessibility and reliability	
	NBN and 5G implications	

The COVID-19 lockdowns significantly accelerated the uptake of online collaboration tools by businesses

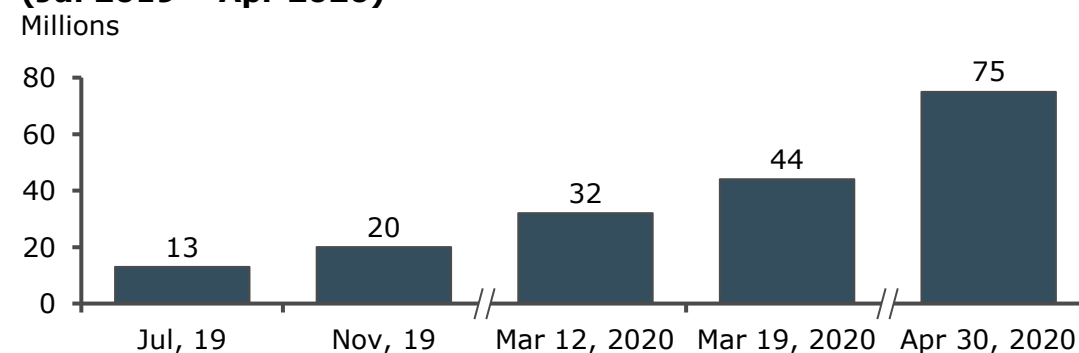
Global collaboration software market revenues (2015-23F)



CAGR%
(2016-12)(21-25F)

8.1 6.5

Daily active users of Microsoft Teams worldwide (Jul 2019 – Apr 2020)



CAGR%
(Jul-Nov 19) (Mar*-Apr 20)

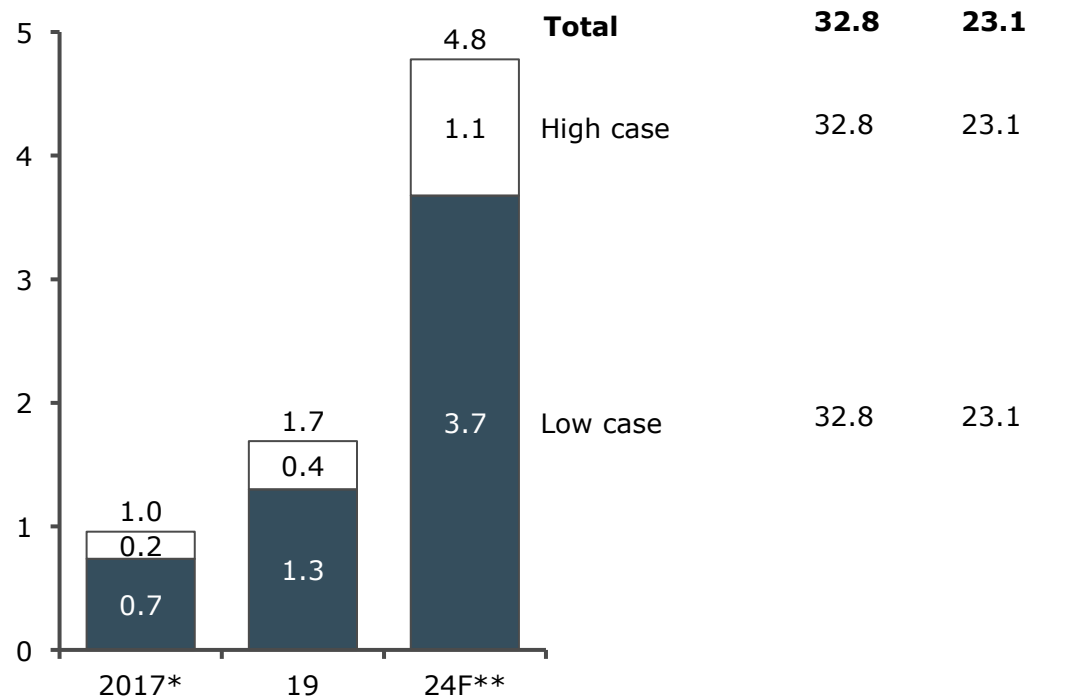
11.4 134.4

- The COVID-19 lockdown catalysed a “rush-to-remote” trend that forced Australian businesses and organisations to accelerate adoption of collaboration tools such as Zoom, Cisco Webex and Microsoft Teams
 - Microsoft Teams experienced a surge in usage as new ways of working were established globally with the number of daily active users on the app increasing from 32m in March 2020* to 75m in April 2020
 - according to research conducted by ComScore, Microsoft Teams users heavily favour desktop usage (over mobile), as 90% of desktop users are using Microsoft Teams exclusively on their desktop devices
 - Zoom noted their video conference adoption rates rose by 85% during the COVID-19 period
- Revenue of the global collaboration market grew by 9.2% from 2019 to 2020 compared to an increase of 8.1% from 2018 to 2019. Growth is expected to soften in the future at 6.5% from 2020 to 2025F
- Analysis by Microsoft and AlphaBeta indicates nearly 9 in 10 Australian firms adopted new technologies during COVID-19, supporting 3.2m workers

The demand for Cloud services from Australian companies accelerated as they moved to new models of working, even as the market approaches maturity

Forecast addressable Cloud services market, Australia* (2017-24F)

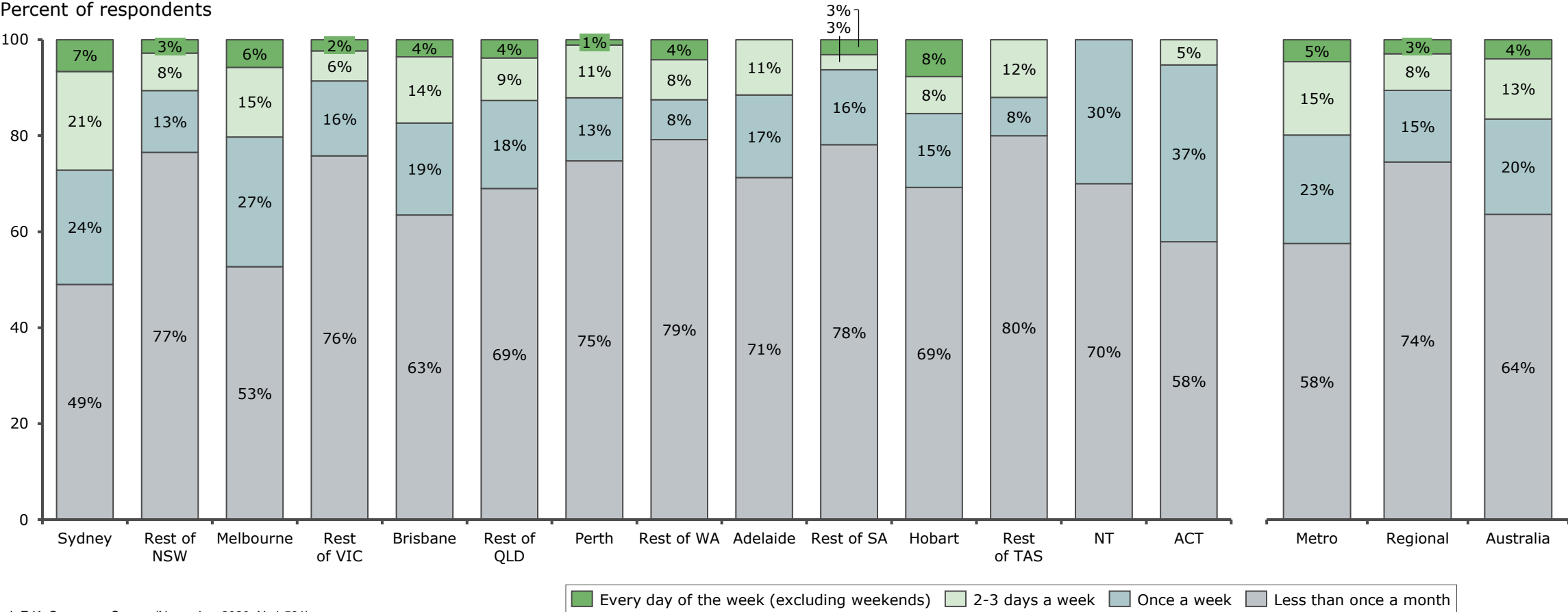
Billions of AUD



- Cloud adoption was already on the rise pre-COVID-19. According to Gartner research on COVID-19 impacts, continued digitisation and migration of legacy applications to the Cloud will drive growth in the short term
 - prior to COVID-19, 69% of enterprise organizations were migrating data for enterprise resource planning (ERP) applications to the Cloud
 - COVID-19 has accelerated this adoption as organisations accommodate employees who are working remotely
 - once migrated, the changes to the business model of these companies is fixed
- The pandemic response by businesses likely brought forward anticipated investment, as organisations adopted Cloud to support the use of VPN services – representing a faster transition than would have happened without COVID-19
 - in AGL, adoption of Cloud has been driven by solutions which necessitated the use of VPN services to allow ~4,000 employees work from home without compromising company security
 - other organisations had limited infrastructure (e.g. limited VPN capability) prior to changes in working patterns and required a faster transition to the Cloud to allow for continued work
- Nonetheless, the market is approaching maturity, hence the growth rate will slow in forward years from c.33% between 2017 to 19 to c.23% from 2019 to 24F

Around 37% expect to use online collaboration tools at least weekly in future, with metro respondents expecting to use these more than regional respondents

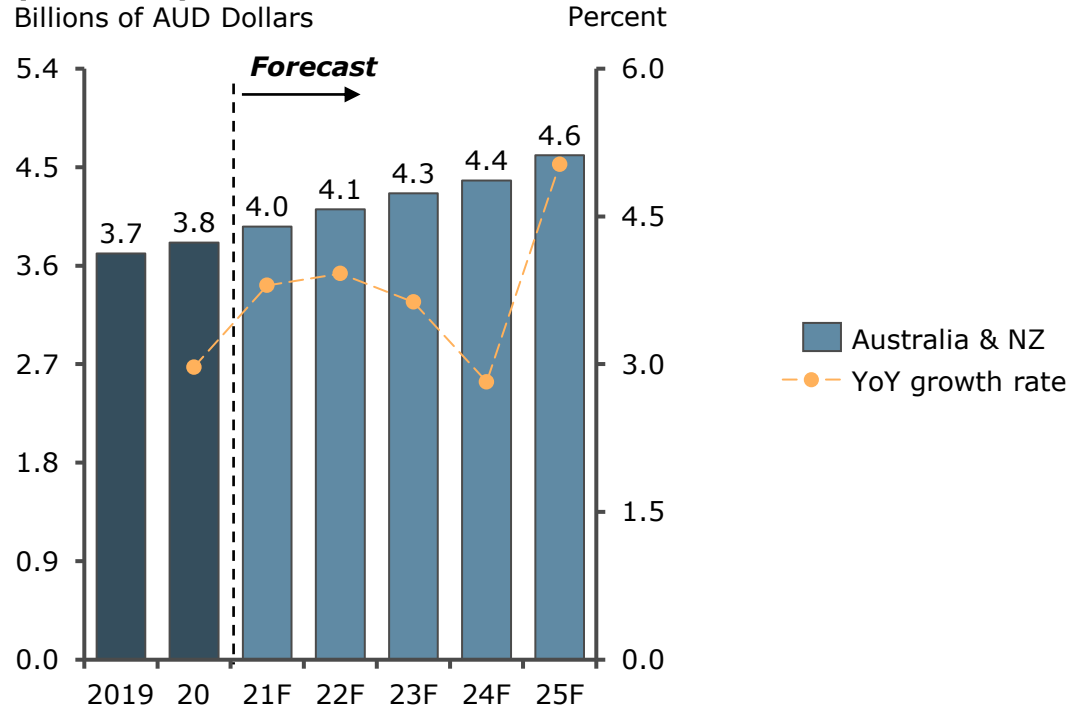
**Intention and frequency of using digital tool (e.g. Zoom) after COVID-19
(November 2020 survey)**



Source: L.E.K. Consumer Survey (November 2020; N=1,531)

Despite the uptake of Cloud, data centre investment declined in 2020 due to restricted cash flow as a result of COVID-19, but is expected to rebound in 2021

Investment in the Australian and New Zealand hyper scale data centre market (2019, 25F)

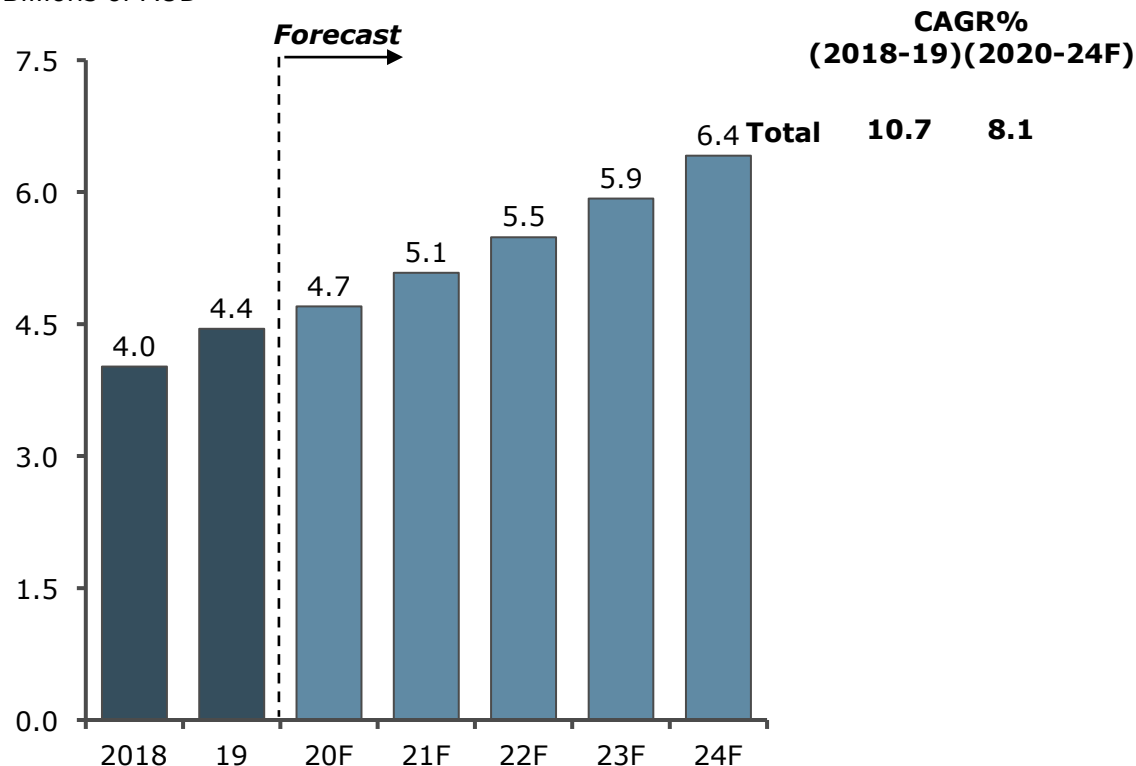


- The hyperscale data centre market in Australia is set to increase at a rate of c.4% from 2021 to 2025F as businesses move their data onto the cloud and out of internal facilities into hyper scale data centres that are operated by external companies (e.g. NextDC)
- Gartner forecasts global spending on data centre infrastructure to reach US\$200 billion in 2021, marking a 6% increase from 2020, despite a 10.3% decline in data centre spending in 2020 due to restricted cash flow and revenue pressure during the pandemic
- In Australia, organisations are forecast to spend AU\$2.7 billion on hyper scale data centre infrastructure in 2021, marking a 3.8% increase following only a 3.0% increase in 2020 from 2019
 - it is expected that larger enterprise data centres will resume expansion in late 2020 or early 2021. However 'hyperscale' data centres will continue with expansion plans due to continued investments in public cloud
 - Data centre efficiency is also increasing – with cloud storage and traffic constantly being optimised via AI. Therefore the investment is not just limited to the development of additional sites but also in improving existing data centre infrastructure
- Data centre construction projects in Australia have nonetheless been able to continue through COVID-19 under the essential service classification
 - construction during the pandemic has allowed Macquarie to work on IC3E, as well as the IC5 data centre in Canberra

Higher levels of remote working and Cloud usage also catalysed an increase in cyber security services investment during COVID-19 lockdowns

Australian Cybersecurity Professional Services Market* (2017-24F)

Billions of AUD



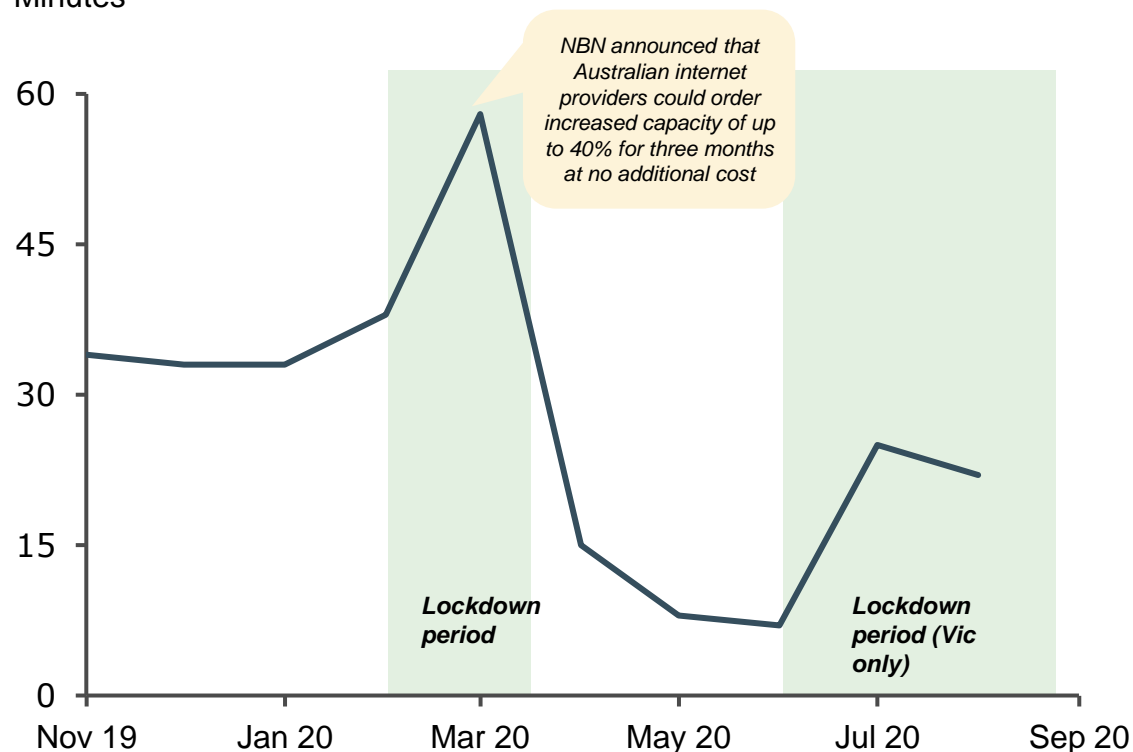
- There has been strong historical growth in the cyber security services market. According to Gartner analysis of the impacts of COVID-19, growth is expected to continue at c.8% from 2020-24F compared to c.11% from 2018 to 2019
- Globally cyber security services spending was the largest growing digital segment, increasing by 84% due to COVID-19, driven by a spike in cyberattacks and increased use of IT tools
- The permanent shift experienced by the market in the future will be driven by increased risk of security attacks and hacking activity as a result of:
 - an uptake of Cloud computing
 - an increased acceptance of a remote environment
- Companies prioritised cybersecurity needs at the expense of other projects, with spending on security initiatives slated to increase in light of new models of working (e.g. scaling VPNs, multi-factor authentication, end point protection, etc)
 - Microsoft witnessed a 700% increase in demand for VPN connections
 - according to a survey conducted by Infoblox, 56% of Australian companies have adopted multi-factor authentication technology as a result of COVID-19 (compared to UK 48%, US 48%, China 43%, Japan 35%)
- Sectors expected to see the greatest shift in cybersecurity spending in the next 12 months are large enterprises for: healthcare systems and services, banking and financial systems, technology, media, and telecommunications and public and social sectors

The COVID-19 lockdown saw acute bandwidth congestion, which was addressed by NBN increasing capacity for internet service providers

NBN average network bandwidth congestion*

(Nov 2019 – Aug 2020)

Minutes

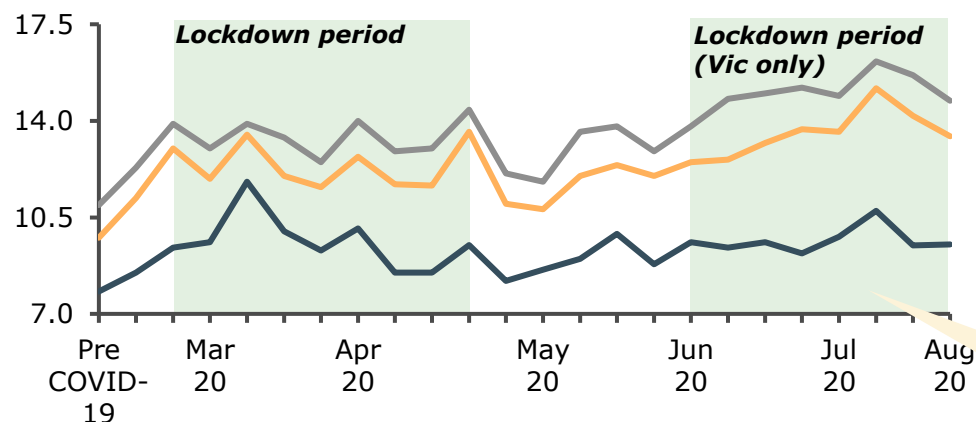


- The first lockdown saw average network congestion reach 58 minutes per week before decreasing as extra capacity was released. The second lockdown period in July saw congestion peak at 25 minutes per week as capacity was momentarily removed
- Retailers reduced congestion by taking up extra network capacity for
 - the lockdown and the move to working from home resulted in a surge of usage from March 2020 to August 2020.
 - this meant that on average, users appear to not have faced a significant problem with extra data use
- This was supported by NBN who undertook a range of actions including
 - allocated up to 40% extra capacity to retail service providers at no extra charge
 - agreed with major content service providers to reduce the bitrate of streamed content
- The NBN established a \$150m relief and assistance fund with support for:
 - households with school-aged children who do not currently have an NBN connection by creating more affordable offers
 - businesses and residential customers facing financial hardship (until 30 September 2020)

Internet use during the evening increased as Australians stayed home

NBN download demand[^] (March 2020 – August 2020) TeraBits Per Second (TBPS)

NBN saw peaks in demand by as much as 32%** of pre-COVID-19 demands



— Business hours
— Early evening hours
— Evening busy hours

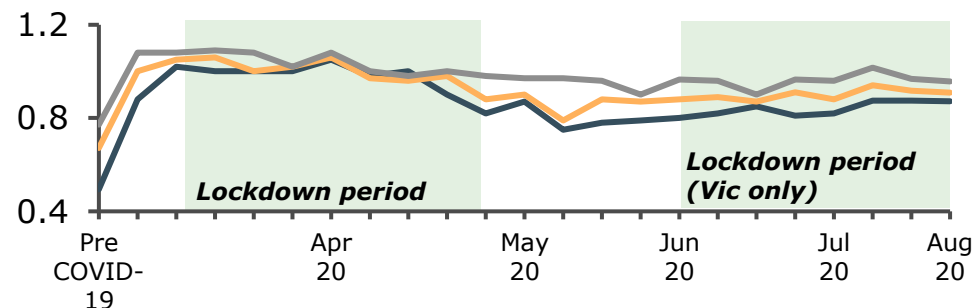
CAGR% (Feb-Mar)(Mar-Aug)

12.3	0.6
14.8	0.6
8.7	0.0

Despite initial peak during business hours, demand has returned close to pre-COVID-19 levels

NBN upload demand[^] (March 2020 – August 2020) TeraBits Per Second (TBPS)

Upload data includes emails, file uploads, video conferencing etc.



CAGR% (Feb-Mar)(Mar-Aug)

40.0	(0.8)
48.8	(0.7)
77.9	(0.6)

- Upstream and downstream data demand increased during the COVID-19 lockdowns as working patterns changed, although this is likely an acceleration of existing trends
- Download demand** increased by c.12-15% during the evening hours – indicating higher use for recreation, as more people stayed home
 - demand can be attributed to an increased use of streaming services for entertainment and increased online collaboration
 - some of the increase observed for downstream network usage may also be attributable to a decline in outdoor activity during winter (i.e. not only contributed to by lock-down)
- Upload demand** approximately doubled at the start of COVID-19 and has remained consistently high throughout (irrespective of lockdowns), especially in the early evenings. This indicates that more people were working from home at flexible times of day, videoconferencing and emailing in the early evening – even once they began returning into the office from May 2020
 - an initial ramp up for upstream network usage of c.78%** was observed between February to March 2020 as lock down restrictions increased, which levelled off as restrictions eased from July 2020 onwards
 - those on entry level plans may have experienced more acute connectivity issues

The impact of large-scale remote working led to a surge in usage with demand being redistributed from the CBD to suburban and regional areas



Demand has seen a shift from the CBD to suburban and regional areas

- Australia has seen changes in demand between the CBD and suburban areas, with some suburbs experiencing greater congestion related issues as a result of the surge in demand as individuals moved to working from home
 - for example, KASPR Datahaus has indicated that suburbs in Sydney with a higher proportion of corporate professionals have experienced greater congestion during working hours
- A survey conducted by the Regional Australia Institute indicated that the number of Australian's working from home in a regional setting had doubled following COVID-19 restrictions from March 2020 to August 2020
- Increased demand in areas which were not set up to manage business grade internet usage has resulted in higher congestion (e.g. suburban areas were designed to handle typical household usage such as personal emails, Netflix etc.)



Surges in demand have changed the telecommunications landscape

- Telecommunications providers have handled surges in demand in residential areas through optimising network settings and NBN allocated extra capacity
 - with NBN releasing capacity Australia is at a point in which levels of service can be improved within the capacity of existing infrastructure
- On average it appears Australian's have not been significantly impacted with regards to their internet speeds and congestion, however the surge in usage as individuals transitioned to remote working and learning has revealed some bottlenecks in the network (e.g. some suburbs were more impacted than others)
- Going forward, one solution is greater infrastructure investment in these areas. Additionally, putting standards in place for how providers should respond in future situations may also ease congestion caused by demand surges

- There are also considerations about affordability as an undercurrent for policy changes around infrastructure investment with telecommunications being seen as a utility (i.e. disadvantaged children who were forced to learn remotely without access to internet)
- As a result, some providers are looking to bring forward 5G investment to meet future demand and relieve some of the constraints which exist in the network

COVID-19 has exposed deficiencies in the network for suburban and regional areas as more people work remotely

Suburban network deficiencies in certain areas

- The COVID-19 pandemic has seen an increase in internet demand in suburban areas. While the impact on Australia's infrastructure was manageable, some cities and areas fared less well when demand surged
- Research by the Monash University-linked company KASPR datahaus indicated that ACT, South Australia and Victoria's internet infrastructure was showing signs of strain, as a result of the sudden demands of the new work-from-home
 - specific regions which saw decline in internet quality were Canberra, Melbourne, the Sunshine Coast, Brisbane and Adelaide
 - the best place for internet access since Australians have been working from home has been Perth
- In response to these challenges, NBN allocated additional capacity
- The changes in ways of working and living has also highlighted inequity in suburban areas within Metropolitan cities

Increasing load on regional networks

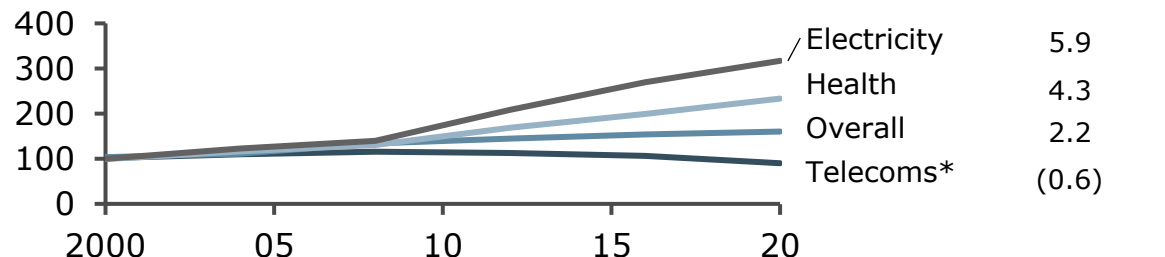
- A move towards regional areas may cause extra strain on the network which was not built for business applications and usage levels. The COVID-19 pandemic has highlighted these deficiencies
- ABC reports suggest that existing accessibility issues caused by the impact of the 2020 bushfires coupled with COVID-19 has exacerbated digital inequality for some rural communities
 - internet connectivity in towns affected such as Batlow and Tumbarumba is unreliable, making home schooling difficult
- Regional Arts Victoria has stated that artists in regional areas have increasingly been using the internet as a way of sharing their art due to lockdown restrictions that have cancelled in-person events, but have found it difficult to participate due to poor quality internet

COVID-19 has also exposed the need for affordable internet connectivity, especially for disadvantaged students who are unable to access online learning

Prices for selected Australian services

2000-2020

Percent of consumer price index baseline



Groups with low digital inclusion

2020

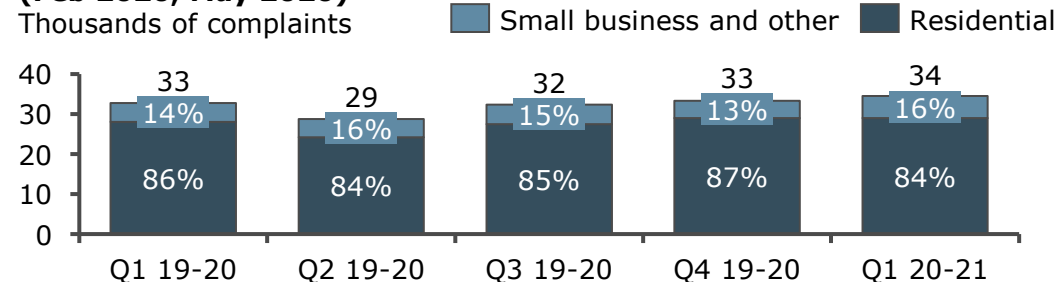
ADII Score

2020	Australia	Families with school aged children	Low income families (<35k) with school aged children
Access	76.3	81.9	74.6
Affordability	60.9	65.4	35.6
Digital Ability	52.0	57.9	48.5
ADII	63.0	68.4	52.9

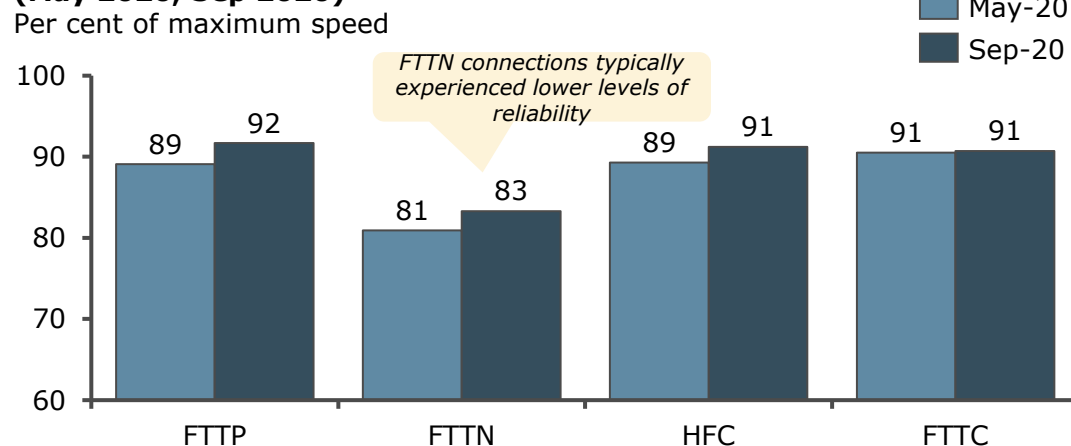
- According to NBN, 11.8 million Australian locations (i.e. homes and businesses) are able to connect to the nbn network but only 7.8 million locations (i.e. homes and businesses) are now connected to a plan as of October 2020.
- The Australian Digital Inclusion Index (ADII) measures digital inclusion
 - affordability remains the key barrier to digital inclusion and is likely to be exacerbated by COVID-19 related economic slowdown
 - approximately 800,000 (20%) of the 4 million primary and secondary students in Australia are from households with the lowest income bracket (under \$35,000). These households record an ADII score of 52.9, 10.1 points lower than the national average (63)
 - COVID-19 may have further impacted disadvantaged individuals where public services were unavailable (e.g. internet at local libraries) during lockdowns
- The National Digital Inclusion Affordability score has marginally increased since 2014
 - while the absolute cost of internet data has gone down, households are now spending more money on internet services due to greater usage
 - The ADII shows that the proportion of household income spent on internet access by those living in the lowest household income quintile has increased every year since 2014, with a widening affordability gap between the lowest-income and highest-income segments
 - The Australian Communications Consumer Action Network (ACCAN) highlights that the average household spends approximately 3.5% of disposable income on communications, compared to 10-15% of consumers in the lowest income quintile

Increased broadband usage during the pandemic appears not to have caused a spike in complaints which were growing at c.3% over the past 3 quarters

Complaints by consumer type (Feb 2020, May 2020)



NBN plan speeds delivered during busy hours by technology (May 2020, Sep 2020)



- The number of complaints submitted to the telecommunications ombudsman has increased by 3.2 % since Q3 19-20
- Press releases by the Telecommunications Industry Ombudsman indicate that existing issues such as frequent dropouts or low speeds have been exacerbated due to COVID-19 and have emerged as problems reported by residential consumers
- The ombudsman also reported that small business owners had reduced their income as a result of lockdowns and wanted to reduce or suspend telecommunication services connected to their premises due to affordability issues
- However the Ombudsman also commented that telecommunications providers coped 'extremely well' over the period of increased demand
- Fibre-to-the-Premise (FTTP), Fibre-to-the-Node (FTTN) and Hybrid-Fibre Coaxial (HFC) connections increased their percent of maximum speed by 2% from May to September 2020, while Fibre-to-the-Curb (FTTC) connections remained the same
- The ACCC noted that underperforming services* represented 8.1% of the 1,115 NBN services that were tested and that 97% of underperforming NBN services are fibre to the node connections

Nonetheless, 35% of survey respondents experienced outages, with more issues apparent in metropolitan areas, and 25% switched plans or providers

Experience of internet outages or slower service after onset of COVID-19, by area (November 2020)

Percent of respondents

Yes Yes, but then changed plans No



Changed internet plans after onset of COVID-19, by area (November 2020)

Percent of respondents

I have upgraded my plan I have changed provider I have moved to the NBN No change

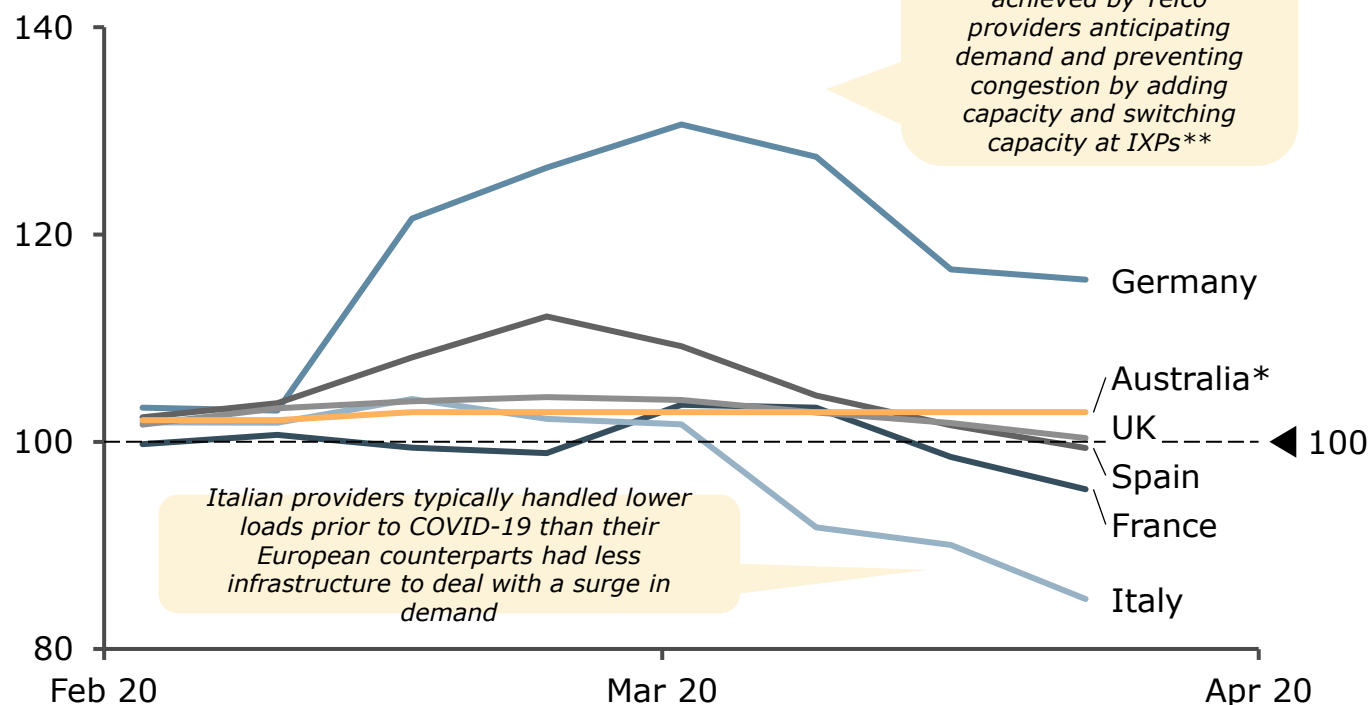


Other countries have likewise seen increased demand, with many experiencing performance issues

European broadband speed test results

(Feb 2020 – Mar 2020)

Index Jan avg = 100, per cent



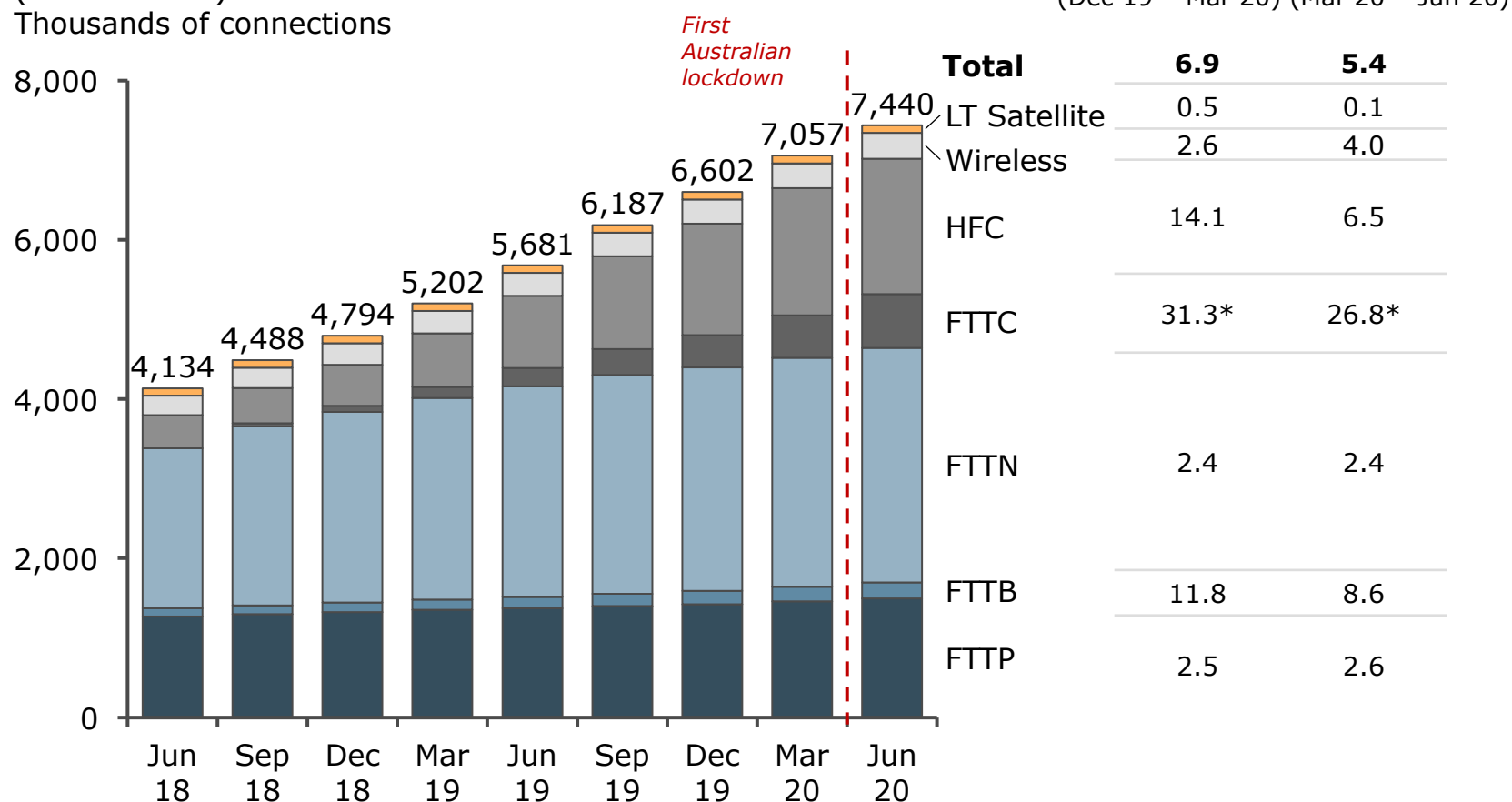
- European broadband performance was based on existing infrastructure and measures taken by network operators and content providers to maintain services by efficiently utilising pre-existing capacity, and in certain cases expanding capacity
 - countries such as Italy which experienced larger surges in bandwidth were impacted to a greater extent (e.g. Italy handled 39.9% more bandwidth between December 2019 and March 2020, compared to Germany which experienced a 16.5% increase)
- The U.K., Germany and Spain saw recent network performance at or above January levels, even as traffic volume increased substantially
 - Italy went into nationwide lockdown on March 9th 2020 and was impacted by severe lockdown measures which resulted in significantly worsened broadband speeds when compared to its European counterparts
 - it is estimated that Italian telecommunication providers had limited infrastructure (e.g. small amounts of unused capacity) as they handled about a third of the traffic compared to the U.K. pre-COVID-19 and were therefore less resilient to traffic surge

Completion of the build phase has lead to a slowing in NBN connections

Number of NBN services in operation by technology type

(2018 – 2020)

Thousands of connections



- During March to June, some 400,000 households connected to NBN, continuing moderate growth at a rate of c.5.4% compared to the previous period of Dec 19 to Mar 20 which saw connections increase at a rate of c.6.9%
- As NBN is available to premises,
- This suggests that the pace of the roll-out not COVID-19 is the biggest factor in the level of connections
- In addition to fixed broadband connections, many households use mobile broadband as an additional service option

Completion of the NBN build phase enables focus on a range of upgrades

NBN uptake moving forward will be at a reduced rate

- It is anticipated going forward that there will be a reduced rate of connections as the NBN number of connections levels off and the roll out nears completion – as of August 2020 the NBN was completed at 99% build rate – resulting in an organic slow down in gross additions
 - There are 11.8 million Australian locations (i.e. homes and businesses) able to connect to the nbn network and 7.8 million locations (i.e. homes and businesses) now connected to a plan

The increase in the demand for data during COVID-19 has increased the need for high data connections

- The NBN has worked to upgrade the network to increase the number of locations with gigabyte capable network connections to 75% of connections
- Between March and June, 100 megabit per second plans increased uptake by 12%
- Australian Broadband Advisory Council found that during COVID
 - 32% increased laptop use
 - 76% increase in upstream internet volume per user
 - 314% increase in off-peak traffic

Telecommunications companies have brought forward 5G investments, in part due to the pandemic
















While 5G has a long ROI period it is seen as being more profitable than NBN for proponents

- Construction of 5G infrastructure is capital intensive relative to 4G, with a ROI period of 10 years (compared to 5 years for 4G), and a long lag and order-to-cash tail. This is due to a large number of individual sites required for it to be set up. The roll out could therefore require a new business model to allow it to be profitable for specific use cases
- 5G roll out could increase profitability of providers and potentially draw away from NBN demand. Many providers have been unsatisfied by the EBITDA margins of around 7% they have been getting with their NBN network. It is estimated that the roll out of 5G will allow providers to reach margins as high as 20%
 - with 5G, telecommunication providers may be able to send fixed-wireless broadband directly to homes and bypass the connection fee they have to pay to the NBN
- It is important to note that these investments are being made despite downward revenue pressure in the mobile businesses of these proponents – due to the decrease in mobile roaming and pre-paid revenue that would have otherwise been generated by tourists


























Bringing forward investment in 5G to meet demand

- Prior to COVID-19, telecommunications executives had pointed out a lack of compelling use cases as the biggest barrier to 5G rollout, which created a risk of competitive stalemate. However, the onset of the pandemic has seen some providers bring forward their investments
- In Australia the three major providers are taking slightly different approaches to their investment approach regarding 5G
 - Telstra made the decision early in March to bring forward \$500 million of capital expenditure planned for the second half of FY21 into calendar year 2020 for 5G roll out
 - as a result, 75% of Australia's population will have access to 5G coverage where they live, by June 2021
 - Telstra's CEO indicated that the accelerated roll out will work to support activities such as telehealth, e-commerce, and working / studying from home
 - TPG accelerated its roll out of 5G in slightly later, in August 2020 and is set to launch a new set of 5G fixed wireless products in the first half of 2021, with the aim of covering 85% of Australians in major cities by the end of 2021
 - Optus appears to be taking a slower approach, not yet making commitments. However its parent Singtel appears to be moving at pace in its other international market
- Globally, incumbent operators with larger capital reserves and latent capacity are moving quickly (e.g. Verizon, EE, France Telecom, Deutsche Telekom, Telefonica)

Assessment and outlook for key trends: Telecommunications (1 of 2)

TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID-19)	Correlation of trend to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID-19
Uptake of tools and technologies	Significant increase in uptake of online collaboration tools	Major – volume up	 All	 Acceleration	 <i>Highly sensitive to COVID-19 related working from home despite being available prior to lock-down</i>	 <i>Partial sensitivity to improving economic conditions with individuals opting to work from home for lifestyle factors</i>	 <i>Increasing permanent uptake of online collaboration tools as WFH continues for a subset of people</i>
	Demand for Cloud services from Australian companies accelerated	Major - volume up	 All	 Acceleration	 <i>Moderately sensitive to COVID-19 related remote working, however already was a maturing trend</i>	 <i>Uptake has limited sensitivity to economic recovery. However construction of new data centres maybe accelerated</i>	 <i>Incurred investments are likely to continue however may not see same rate of adoption of new customers observed during the period</i>
	Increased cyber security investment	Minor – volume up	 All	 Acceleration	 <i>Highly sensitive to COVID-19 related working from home despite being available prior to lock-down</i>	 <i>Uptake has limited sensitivity to economic recovery. However construction of new data centres maybe accelerated</i>	 <i>Incurred investments are likely to continue however may not see same rate of adoption of new customers as observed during the period</i>

Assessment and outlook for key trends: Telecommunications (2 of 2)

TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID-19)	Correlation of trend to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID-19
Bandwidth and connectivity	Peak spreading of network usage	Major – mix shift	 All	 New direction	 <i>Highly sensitive to COVID-19 related working from home</i>	 <i>Weighted to working from home behaviour over economic recovery</i>	 <i>Trend is likely to continue due to working from home behaviour set to continue</i>
	Increased demand in suburban areas	Major - Volume	 Fast growing cities	 New direction	 <i>Driven by COVID-19 related working from home and lock down measures</i>	 <i>Partial return to the office may reduce this trend, however working from home preference is independent of economy</i>	 <i>As individuals return to work this may drop off slightly, however working from home and therefore suburban demand is likely to continue</i>
	Increased demand in regional areas	Major - Volume	 All excl. Fast growing cities	 New direction	 <i>Driven by COVID-19 related working from home and lock down measures</i>	 <i>Partial return to the office may reduce this trend, however working from home preference is independent of economy</i>	 <i>As individuals return to metro centres this may drop off slightly</i>
	Continued usage of NBN infrastructure	Major - Volume	 All	 Acceleration	 <i>Driven by COVID-19 related working from home and lock down measures</i>	 <i>Likely to continue irrespective of economic recovery scenario, instead will be impacted by saturation of NBN connectivity</i>	 <i>Driven by remote working this is likely to continue, it is likely that there will be slow down in number of new connections</i>
	Increase in the investment in 5G	Major - Volume	 All	 Acceleration	 <i>Driven by increased demand during COVID-19</i>	 <i>Investments likely to be accelerated in stronger economic conditions</i>	 <i>Investments already made are unlikely to be unwound, however pace of new investments may slow</i>

Future directions for consideration: Telecommunications

Opportunities and Challenges



Ongoing network congestion

- The NBN response to network congestion in the early shutdown period indicates that latent capacity is available to improve the level of service responsiveness. However some specific areas continue to have congestion related issues which require remediation, particularly if the use of online collaboration tools continues
- This raises the inevitable question about the future role of 5G, which may improve the level of infrastructure competition especially in areas of congestion.



Regional infrastructure and access

- While some decentralisation may have been induced through metropolitan lockdowns, there may be 'bleed out' over time of individuals moving to regional areas – this will cause demand that the existing broadband infrastructure may not be able to meet

Future Directions for Consideration

- ✓ Targeted measures to ensure providers can bring forward planned 5G investment. Some measures should be considered to support viability and efficient roll out, including shared infrastructure and coordinated planning for next generation investment
- ✓ Targeted 'pinch points' relief of identified congestion points on the network
- ✓ Connectivity and adoption measures to extend mobile coverage in underserved areas and to drive uptake in targeted sectors
- ✓ Improve regional connectivity to support the 'bleed out' from metropolitan centres as individuals increasingly work remotely / flexibly

Section 7

Energy

In energy COVID-19 led to greater decentralisation and spreading of demand

Category	Segment	Summary of trends
Network demand	Impact on electricity demand	<ul style="list-style-type: none"> COVID-19 has had a limited impact on total electricity demand, with increases in residential use offsetting decreases in commercial use
	Change in demand (e.g. residential and SME)	<ul style="list-style-type: none"> COVID-19 restrictions have decreased Commercial & Industrial demand with Cultural and Recreational Services decreasing across all states during lockdown periods
	Geographical changes in demand	<ul style="list-style-type: none"> However, energy demand has shifted from the CBD to outer suburbs and regional cities as a greater number of Australians adapt to remote working and some move away from CBDs
	Summer demand concerns	<ul style="list-style-type: none"> Changes to the distribution of demand should not pose a risk to network reliability ahead of the summer peak, however there are some concerns that the impact of COVID-19 may constrain resources that would have otherwise been used for network upgrades and maintenance
	Gas demand is similar	<ul style="list-style-type: none"> Gas demand has followed a similar trend, albeit it to a smaller extent. It is likely the lockdowns over winter increased the seasonal residential gas use. Industry usage remained unchanged – a trend similarly observed in electricity
	New products and services	<ul style="list-style-type: none"> Proponents are leveraging an increase in digital interaction with customer to launch new product and service offerings
Customer	Impact on residential and SME customers	<ul style="list-style-type: none"> Higher residential energy use and economic conditions have led to higher levels of hardship customers. Residential customers have faced short term hardship whereas SME customers have faced longer term hardship as a result of the pandemic COVID-19 has caused an increase in the financial support required for hardship customers through both government and utility provider initiatives
Evolving supply profile	Changing supply landscape	<ul style="list-style-type: none"> COVID-19 has not yet changed the long term investment planning by utilities (e.g. plant retirements, continued management of decentralisation, and major plant upgrades), although there have been some push backs in maintenance schedules Despite a slowdown in the number of installations since the start of 2020, capacity continues to grow
	Increase in DER	<ul style="list-style-type: none"> Increasing Distributed Energy Resources* impacts the future planning of market participants because they need to accommodate the expensive changes in supply needs An increased acceptance of batteries is likely to continue creating demand for localised industrial battery capability

Economic and policy uncertainty are driving a pause in investment decisions; COVID-19 specifically has delayed maintenance upgrades

Uncertain economic environment stalling investment decisions

- The Clean Energy Council states that the number of large-scale renewable energy projects committed in the second quarter of 2020 was the lowest since 2017, with just three projects representing 410 MW of new capacity reaching financial close
- Wood Mackenzie research indicates that the primary drivers for this fall in investment relate to the challenges associated with the grid connection process, unpredictable government policy interventions and underinvestment in network capacity creating congestion and constraints
 - it is believed that solar and distributed storage risk is more acute but the industry will rebound
 - a survey by the Energy Storage Association revealed that 62% of industry stakeholders report project delays
- Gas has seen a deferral of projects, as well as a slowing down of decision making as organisations focus on maintenance of existing capital structures and liquidity / balance sheet. While these decisions do not impact current demand, they may have a longer term impact on future supply

COVID-19 has created some uncertainty with regard to resource constraints

- AEMO's analysis observes an improved reliability outlook across the next few years driven by the rapid uptake of distributed and large-scale renewables, increased transmission capacity and reduced peak demand
- AEMO commented that while COVID-19 has reduced peak demand and energy consumption expectations for the coming summer, it also creates a significant new uncertainty
 - COVID-19 could cause delays in the return to service of generators on forced outages or defer maintenance required for summer readiness depending on the number of new cases
 - the pandemic is likely to have added to the capacity constraints on industry, particularly in terms of the focus of senior management and key decision makers in energy businesses and AEMO

COVID-19 impacted reform implementation to support energy market transition

- According to the ECA, the NEM will be required to undergo design changes to better cope with two sided market dynamics as greater demand side participation will help manage reliability concerns
- According to the Australian Energy Market Commission, the impacts of the lockdowns have put a strain on participant capabilities in meeting new designs, e.g. slowing or delaying their five-minute settlement (5MS) and global settlement (GS) implementation programs*
- Participants have diverted resources away from implementing reforms and towards meeting business-as usual activities and new regulatory expectations such as the support of pricing relief packages for customers impacted financially by COVID-19
- The government allowed for a 12 month delay in the commencement of 5MS and GS reforms, but a report by the AEMC has indicated that participants would only need 3 months to make up time lost due to COVID-19

Note: * 5MS decreases the settlement period for the spot price from 30 minutes to 5 minutes. Five minute settlement provides a better price signal for investment in fast response technologies, such as batteries, new generation gas peaker plants and demand response

Source: AGL; AEMO; Australian Energy Market Commission

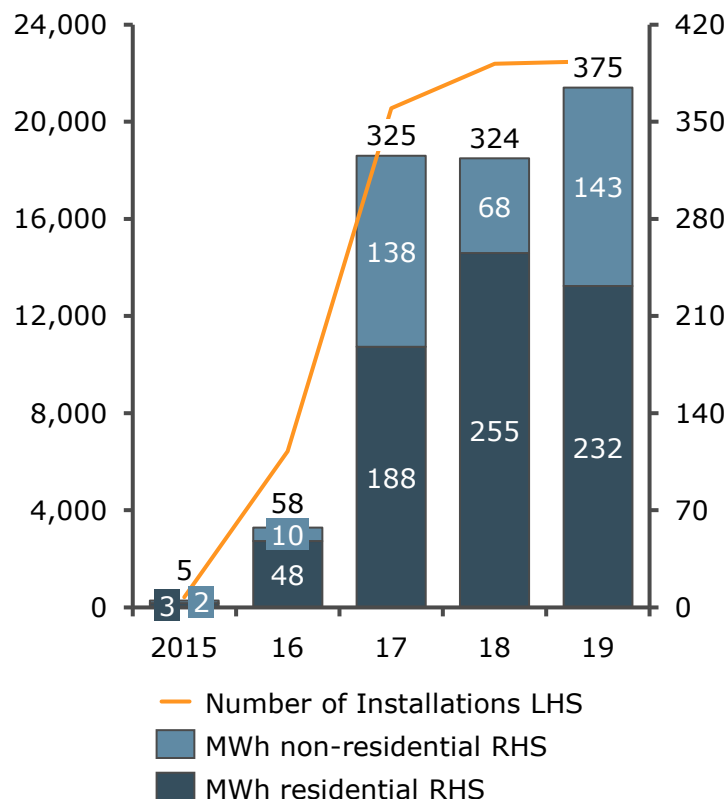
Growing demand for batteries is likely to continue creating demand for localised industrial battery capability

Energy storage system installations and type

(2015 – 20)

Number of installations

MWh installed



CAGR%
(2015-19)

Total 195

192

196

- There is a trend of continued demand for localised industrial battery capability, with notable Australian projects including:
 - the 100MW/129MWh Hornsdale Power Reserve in SA which is the largest lithium-ion battery in the world, it is also currently undergoing a 50MW/64.5MWh expansion
 - the construction of Victorian Big battery with the capacity of 300MW/450MWh, with construction expected to be completed by Tesla at the end of 2021
- Non-residential installations fell in 2018 by c.50%, following completion of major projects (e.g. Hornsdale farm battery commissioned in December 2017), and recovered in 2019 by c.110% with increased investment in firming capacity. The number of installations has also plateaued to c.0.5% growth from 2018 to 2019, indicating that larger systems are being installed
 - battery uptake increased c.465% from 2016 to 2017 as a result of rapid cost reductions due to improvements in manufacturing and technology
 - changes in market dynamics have driven battery adoption – for pricing arbitrage by taking advantage of off-peak wholesale energy pricing

There are typically two types of batteries:

- Household batteries:** typically used in private residential applications to store excess power from solar panels
 - a report by SunWiz indicates an increasing trend in battery installation, with now 1 in 13 Australian solar households having battery storage
- Large scale industrial batteries:** can store electricity oversupply to be used to stabilise the grid during frequency disruptions
 - large scale industrial batteries, such as the Victoria Big Battery, are being installed as they provide the grid with flexibility and the capability to dispatch electricity rapidly
 - the battery will also participate in NEM and support increased penetration of renewables in Victoria

Almost 30% of survey respondents either installed battery storage during COVID-19 or considered doing so, with barriers due to cost and living in a rented property

Intention or consideration to install battery storage during COVID-19, by area (November 2020 survey)

Percent of respondents (n = 1,531)

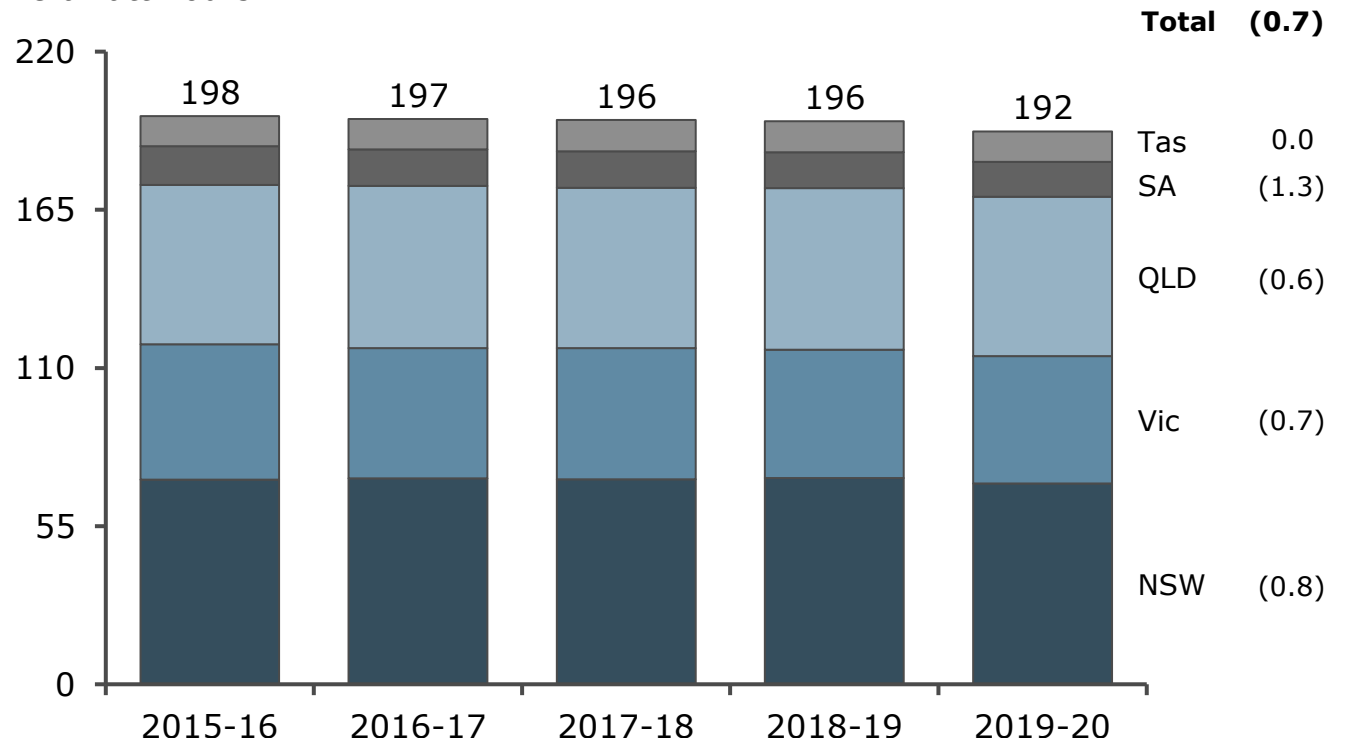


COVID-19 has had a limited impact on overall electricity demand despite its widespread economic impacts

Annual electricity consumption in the NEM

(FY2015-20)

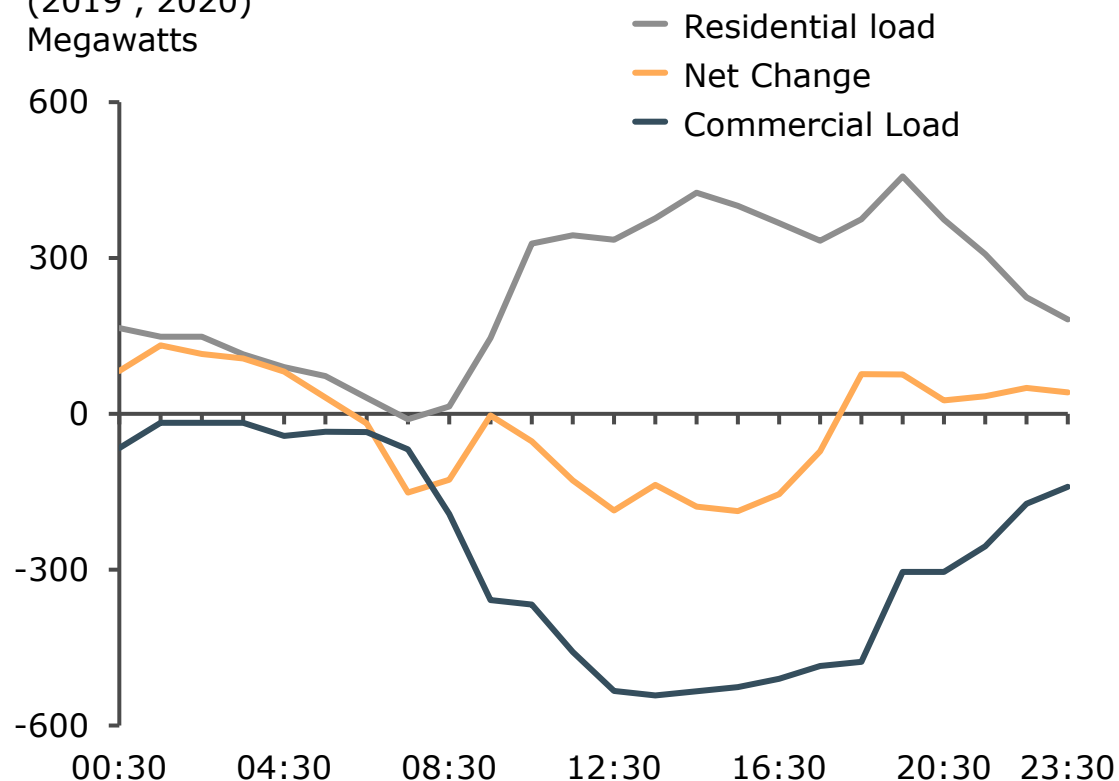
Terawatt hours



- Overall electricity demand in the National Electricity Market (NEM) has been steadily decreasing by 0.7% year on year with South Australia seeing the greatest annual decrease of 1.3% between 1999 and 2020, with increasing small scale renewable generation
- Despite the restrictions imposed due to COVID-19 and transition of a large proportion of workers and students to working and learning from home, the impact on Australia's total electricity demand in Q2 was relatively modest
- Compared to Q2 2019, NEM operational demand was down 2%. COVID-19 contributed an estimated 2.1% reduction, and increased distributed photovoltaics (PV) a further 1.2% reduction, but this was offset by increased heating requirements due to cooler weather which increased demand by 1.4%
- The reduction in demand is one element of a changing energy landscape in Australia – which involves the transition from traditional coal fired generation assets that may be nearing end of life, to renewable, gas or hydro based energy as well as managing the update of DER and its impact on supply

While the overall change in demand has been negligible, there has been a significant shift in usage between different customer types

Year on year COVID-19 commercial and residential load changes in Vic* by time of day (2019 , 2020)
Megawatts

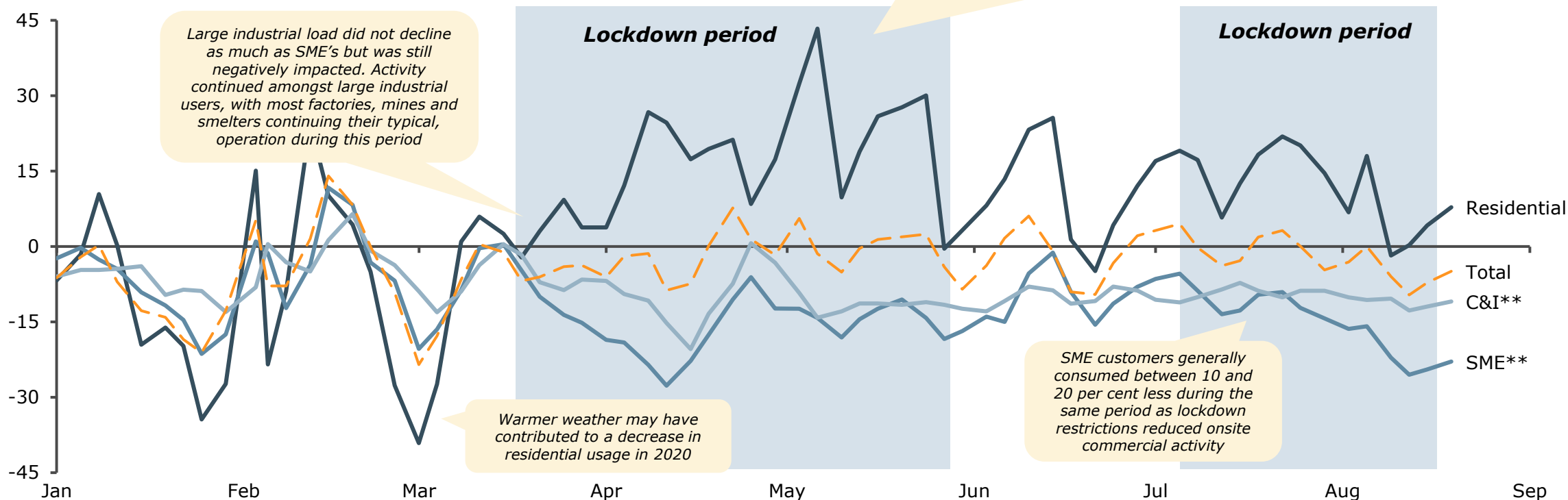


- The overall electricity load observed in Victoria did not change significantly, however there has been a notable change to the residential and commercial load patterns
 - Commercial load reduced c.20% due to lockdown restrictions limiting business activity
 - Residential load increased (c. 10-40%) due to lockdowns and working from home
- Regions such as Victoria have a lower rate of residential electrification (i.e. a high proportion of gas heating systems) and therefore recorded a lower impact on residential electricity demand compared to other regions
- The peak spreading trend was also identified in NSW and ACT. While there was a 5% reduction in peak demand, the aggregate usage did not change suggesting consumer electricity consumption outside of peak times
- Prior to COVID-19 there was typically and overlap in Residential and Commercial demand as Australians would arrive home while office buildings would still be using electricity. However, changes in working and the decreased Commercial load have resulted in a further softening of this peak

Higher residential consumption has mostly been offset by lower business consumption, resulting in a marginal overall decrease in demand for 2020

Year on year percentage change in total electricity consumption in Vic (2019, 2020)

Per cent

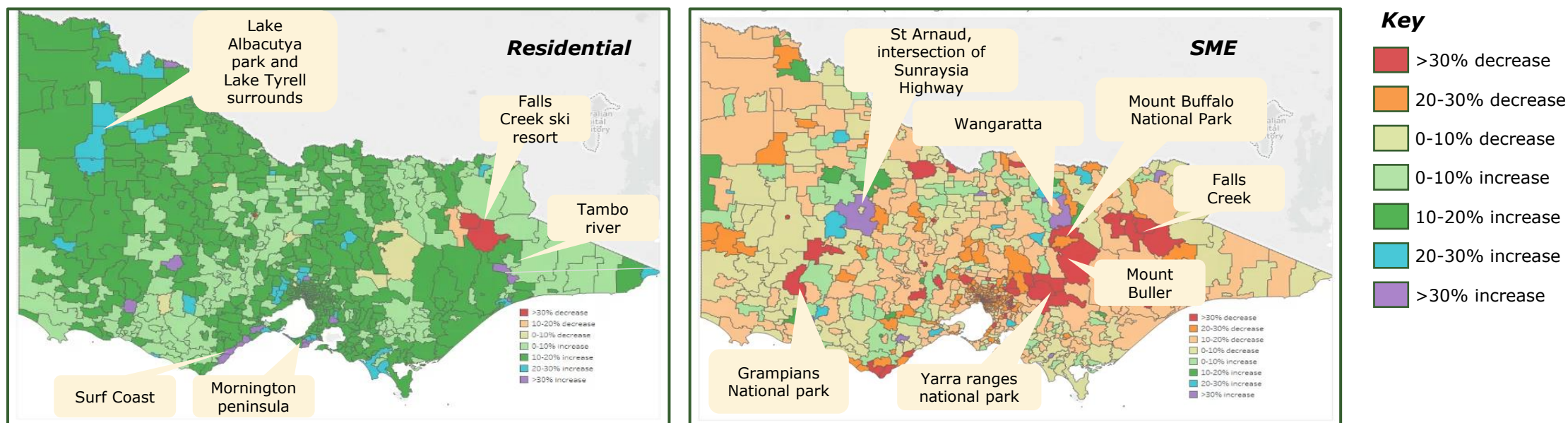


Note: * For each customer type, the 7-day moving average in total consumption for each date in 2019 is compared to the 7-day moving average in total consumption for the corresponding date in 2020 to calculate the year-on-year percentage change; ** Commercial & Industrial (C&I) customers are characterised by large electricity usage, generally more than 100 MWh per year, SME (Small and Medium Enterprise) customers tend to use smaller amounts of energy and have different electricity contracts

Source: ACCC: Inquiry into the National Electricity Market: Supplementary report: - impact of COVID-19 and ACCC monitoring and enforcement activities, September 2020; L.E.K. Research and Analysis

Energy demand has shifted from the CBD to outer suburbs and regional areas as a greater number of Victorians adapt to remote working

Residential and SME changes demand (July/August 2019 v 2020)

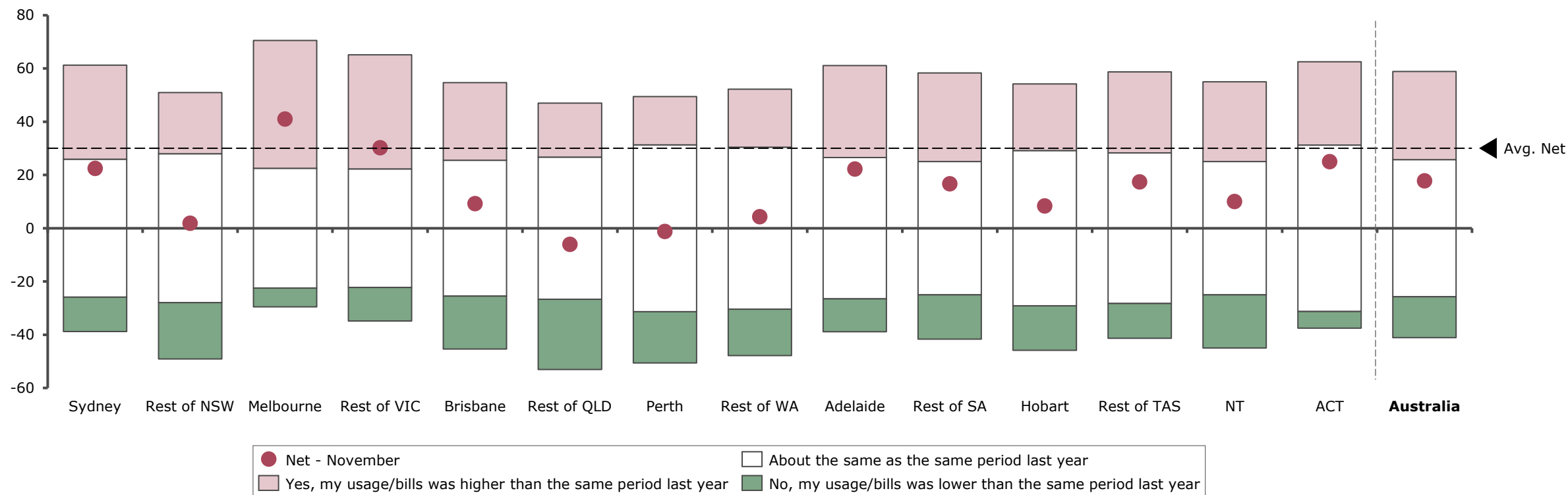


- Lockdown resulted in a change in work patterns for Victorians which resulted in increased residential demand of 10-20% and decreased SME demand of 20-30%
- Residential demand in July increased along some coastal and regional communities, including the Mornington Peninsula and Surf Coast (purple and blue), suggesting some Victorians chose to spend isolation in locations more typically used in summer. SME demand increased in some regional areas which were located on or near intersections of major arterial highways (e.g. St Arnaud and Wangaratta) which indicates increased regional movement
- The impact on the ski fields due to lock down restrictions can be seen for SMEs, where demand decreased by more than 30 per cent (Red), this decrease in demand was also noted in residential communities near the Falls Creek Ski resort
- Regions such as Victoria that have a high proportion of gas heating systems recorded a lower impact on residential electricity demand compared to other regions

Approximately 35% of respondents had higher energy bills than the prior year, with residents in Victoria reporting the most widespread effects

Higher energy / electricity bills through COVID-19, by area (November 2020 survey)

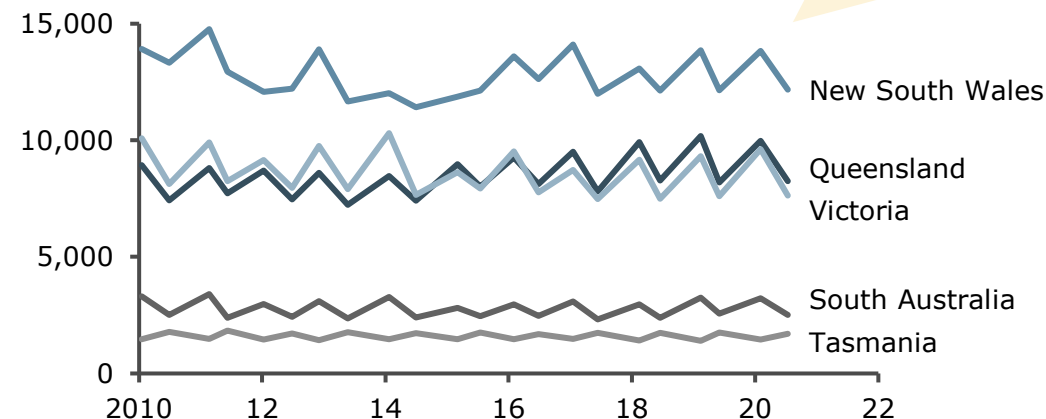
Percent of respondents (n = 1,531)



It is estimated that the NEM will be able to meet demand during the 2020-2021 summer peak

Summer and winter peak demand by region since the commencement of the NEM (1998-2020)

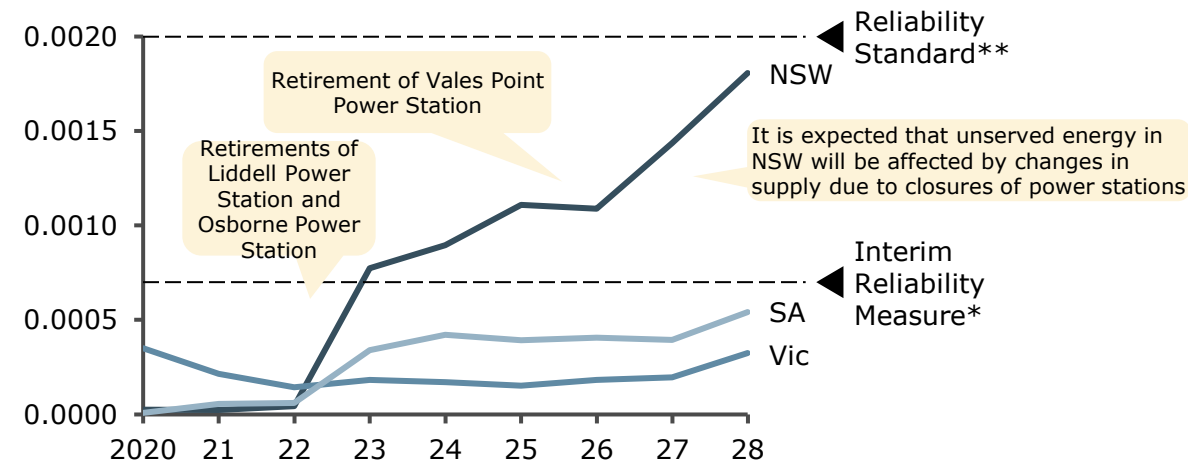
Megawatts



- In the summer of 2020-21 (generally a peak usage period), the expected unserved energy is not forecast to exceed the reliability standard, nor to exceed the interim reliability measure* in any NEM region
- COVID-19 related restriction and remote working and learning are unlikely to cause issues on the network. Instead forecast reductions in supply due to power plant closures will have the most significant impact. However this is not expected to exceed the reliability thresholds

Expected unserved energy in the NEM (2020/21 – 2029/30)

Average unserved energy, Per cent



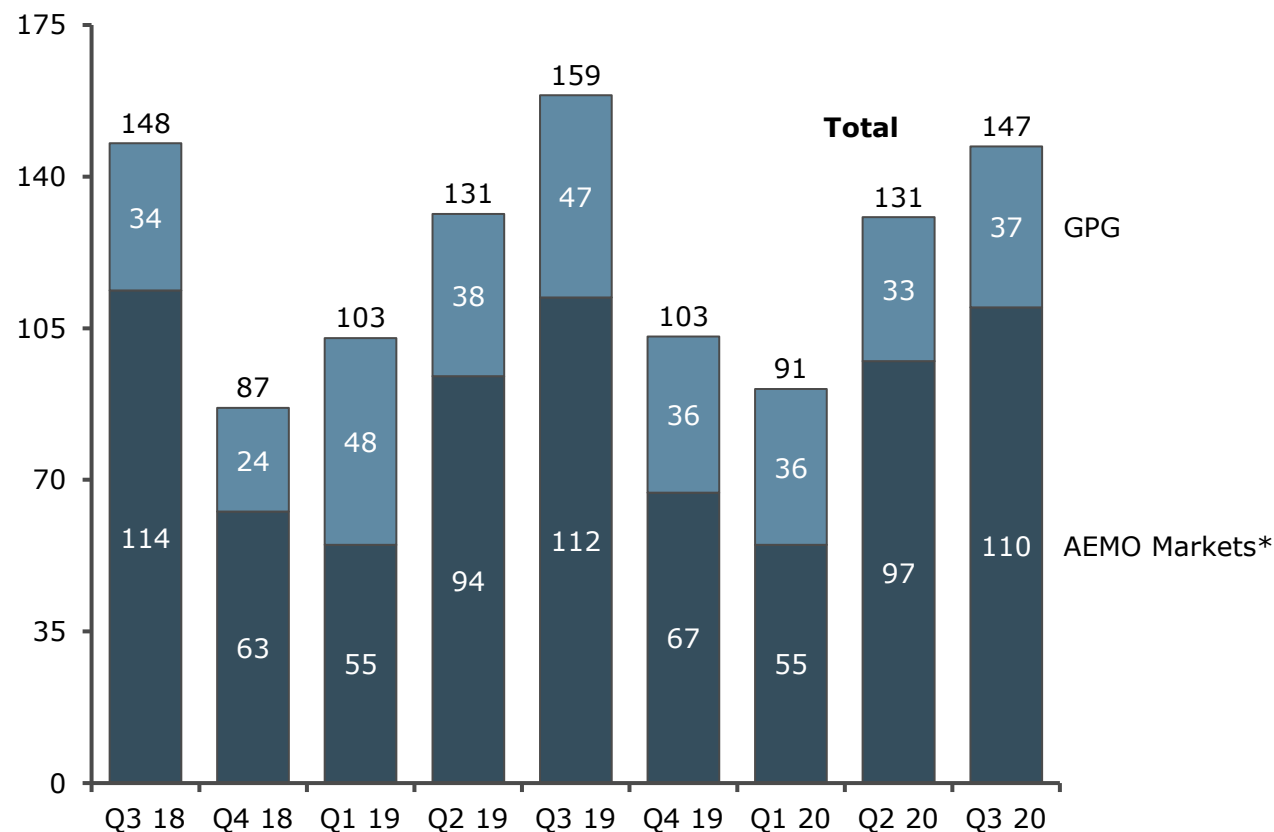
- Forecasts presented are based on a conservative approach applied by AEMO in line with the National Electricity Rules. These forecasts do not account for new generational capacity or transmission projects including those in recent government commitments across Queensland, NSW and Victoria to develop renewable energy zones as well as Commonwealth funding commitments to support delivery of the Low Emissions Technology Statement through repositioning ARENA and CEFC

Gas demand over the first three quarters of 2020 has slightly decreased from 2019

Quarterly Gas Demand

(Q3 2018 – Q3 2020)

Peta joules



- There has been a slight decrease in demand in 2020 when compared to historical seasonal periods. The demand from Q3 19 to Q3 20 decreased by 2.1%
- Gas Powered Generation (GPG) decreased by 436 MW on average compared to Q3 2019, due to reduced need to cover for coal-fired generator outages (Mt Piper and Loy Yang A), displacement by variable renewable energy output, and reduced operational demand
- In Q3 2019, total east coast gas demand was 6% higher than in Q3 2018. This was due to GPG running at elevated levels to cover coal-fired generator outages as well as a reduction in wholesale gas prices
- Gas retailers indicated that there was a slight uptick in domestic gas consumption, with specific notice of Melbourne due to winter / stay at home but otherwise there were no major changes to the demand profile

Energy companies are leveraging an increase in digital interaction with customers to launch new product and service offerings



- AGL has developed its digital capability to provide connectivity of essential services with smart technology, enabling its transition from an energy-only offering, to a multi-product proposition
- The business has also invested in new digital systems to improve customer experience including digital payment capabilities (used by 60% of customers), messaging platforms and a retail-led virtual power plant
- These investments have driven a reduction in net operating costs per customer by 8% Y.O.Y, with further cost efficiencies anticipated with continued investment into automation, optimisation and digital adoption
- Digitisation has also driven efficiencies in customer interaction, with call volumes and ombudsman complaints having fallen 20% and 37% respectively since 2017



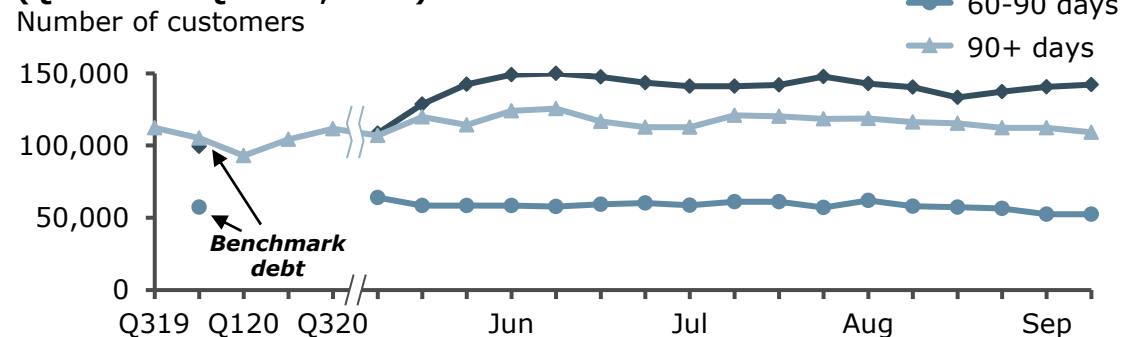
- Origin has undergone a transformation from 'traditional utility' to a high-engagement 'platform business' underpinned by four key layers:
 - Digital engagement: Origin mobile app and digital product ecosystem have driven an increase in digital engagement from 67% in FY17 to 89% in FY20. Applications include EV trials, energy usage insights, and gamified demand and battery management
 - AI Orchestration: Virtual Power Planet (VPP) which links small energy resources into a web-based network that can be controlled remotely
 - Data and analytics: Cloud analytics, AI & machine learning
 - Flexible, low cost CRM and billing: Partnership with Octopus to migrate all Origin customers to the Kraken IT platform by 2023, expected to deliver c.\$100-150m of savings from FY24
- The trend towards data and energy convergence has driven Origin's growth strategy of developing high fidelity and high frequency data flows. These solutions are aimed to address the emerging market for two-way energy flows between customers and energy providers



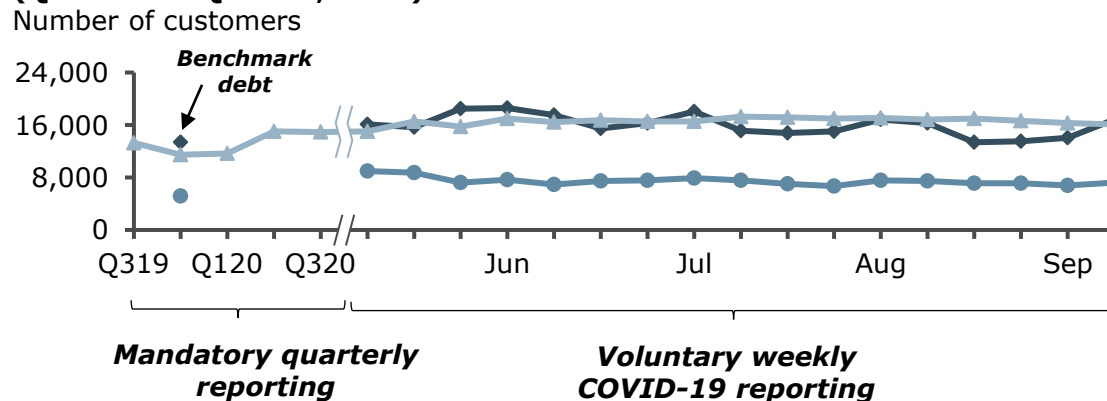
- Synergy is installing 300,000 new advanced metres in the next 3 years to enable customers to monitor their electricity use. Monitoring includes bill alerts, flexible billing, time of use tariffs and early warning fault systems
- Synergy is also developing a distributed energy resources (DER) for customers to better manage their energy use for technologies including rooftop solar systems, batteries, electric vehicles and microgrids. DER projects include a virtual power plant and smart energy for social housing

COVID-19 has resulted in an increased number of residential energy customers facing short term hardship, and record levels of SMEs on hardship

Number of residential customers paying debt to retailers (Q3 FY19 to Q3FY20, FY21)



Number of SME customers paying debt to retailers (Q3 FY19 to Q3FY20, FY21)



- There has been an increase in both residential and SME customers paying debt to retailers (i.e. customers who are behind on payments or on payment plans) as a result of the COVID-19 pandemic
- Voluntary weekly reporting by energy providers indicates an increase in the number of residential customers experiencing short term financial hardship, with a significant spike in the 30-60 day debt category for residential customers. However, the number of customers paying debt in the 60-90 and 90+ categories have remained stable
- CPRC (Consumer Policy Research Centre) estimates 34 per cent of Australians were concerned about energy costs in July, up from 27 per cent in May 2020
- Some residential customers have been reported to be experiencing increased 'bill anxiety', which involves a variety of behavioural changes. These include: refraining from using heating or appliances, using only one room and going to bed fully clothed or not having showers
- Low-income households spent an average of 6.4 per cent of their income on energy, while high-income households paid an average of 1.5 per cent
- SME customers appear to have experienced more acute financial hardship, as evidenced by the increase in the number of customers paying debt in the 60-90 and 90+ categories, suggesting a severe impact of lockdown restrictions on SME businesses

COVID-19 has caused an increase in the financial support required for hardship customers through both government and utility provider initiatives



Government subsidisation

- There has been an increase in the number of customers in financial hardship as a result of unemployment due to lockdown measures and an increase in residential energy
- In response to this there have been both State and Commonwealth programmes that have been implemented
 - households struggling to pay their energy bills during COVID-19 now have access to additional financial support directly through Service NSW and the NSW Department of Planning, Industry and Environment, through a \$30 million boost to the government's emergency support Energy Accounts Payment Assistance Scheme
 - to minimise the impact of COVID-19 on Australians, the Australian Government is extending the Coronavirus Supplement until 31 March 2020 (at a subsidised rate of \$150 per fortnight) and the JobKeeper Payment until 28 March 2021



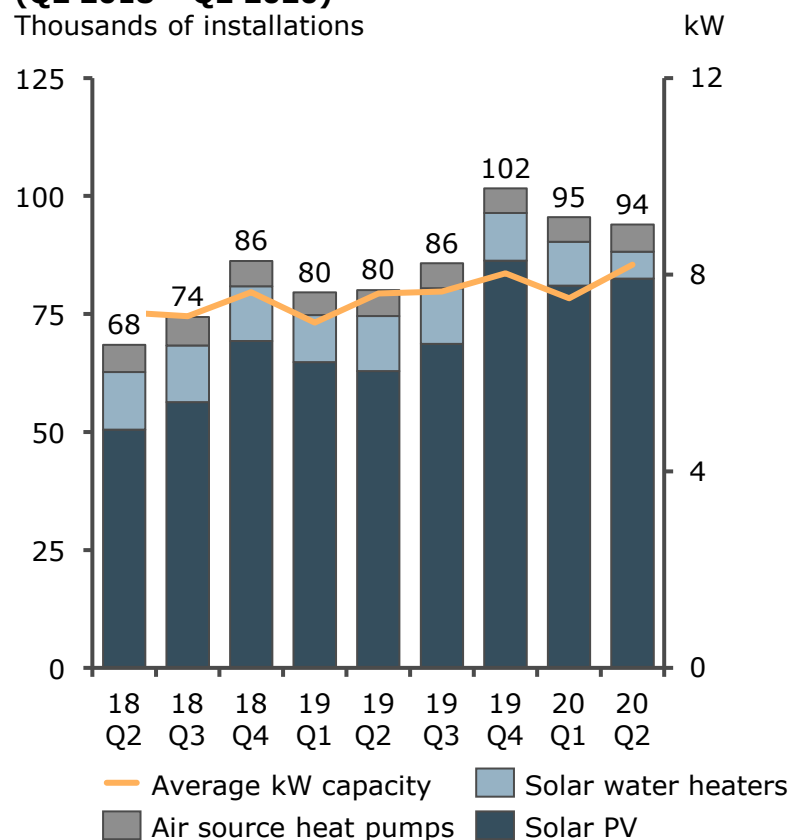
Utility subsidisation

- Many providers are also offering financial support to residential and business customers facing hardship due to COVID-19
 - the AER's statement of expectations of energy business stipulates protections for energy customers until 31 October 2020 such as provisions to stop disconnections and fee waiving for customers in hardship
 - Origin Energy said it had paused all late payment fees and was not disconnecting or default listing any customers in financial distress until at least July 31
 - Synergy has aimed to mitigate hardship as a result of COVID-19 through a \$600 rebate to customers which was announced in November and a small business package of \$2500 per business which accounted for 76,000 businesses in WA

Installed capacity of rooftop solar panels remains strong

SRES* Installations and average kW capacity (Q2 2018 – Q2 2020)

Thousands of installations



CAGR (Q2 18 – Q4 19) **(Q1 20 – Q2 20)**

Total 6.8 (1.6)

(1.6) 11.2
(3.1) (38.3)

9.3 1.8

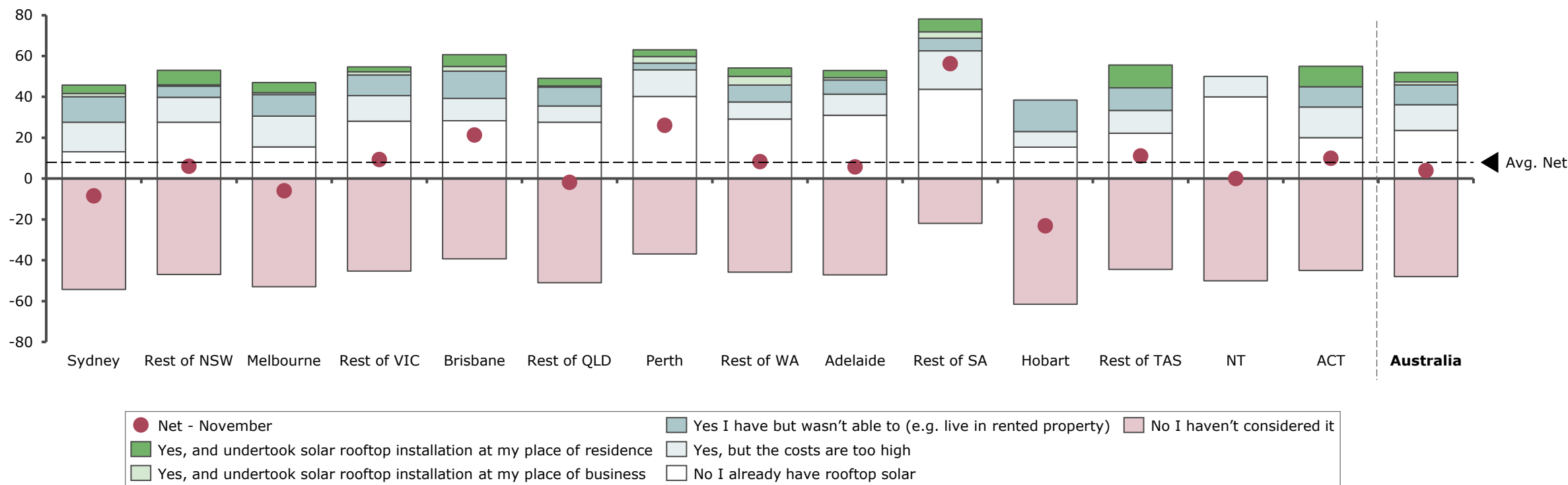
- Lockdowns have impacted the ability to undertake installations from Q1 2020 to Q2 2020, despite an increase in residential energy use and costs which might lead people to consider rooftop solar PV
 - the number of small-scale installations grew to c.83,000 in Q2 2020 up from c.81,000 in Q1 2020, coinciding with the slight easing in restrictions in all states (except Victoria). These installations resulted in a c.41% increase in installed capacity since Q2 2019
 - according to the Clean Energy Regulator renewable capacity in 2020 is set to achieve almost 6 gigawatts installed despite COVID-19 related challenges to projects
- In addition, the average added capacity is increasing despite the number of installations decreasing, as larger solar units are being installed
- Long term outlook remains positive for solar PV installation in Australia
 - in April 2020 the NT Government announced that Feed-in Tariffs on new solar installations would be cut by 66%, which will also help to encourage battery storage uptake
 - rates seen in the CEFC data are akin to those provided by the government during the GFC when there were significant incentives for solar

Almost 30% of respondents had considered installing solar panels during COVID-19, with strongest interest in metropolitan Sydney, Melbourne and Brisbane

Intention or consideration to install solar panels during COVID-19, by area

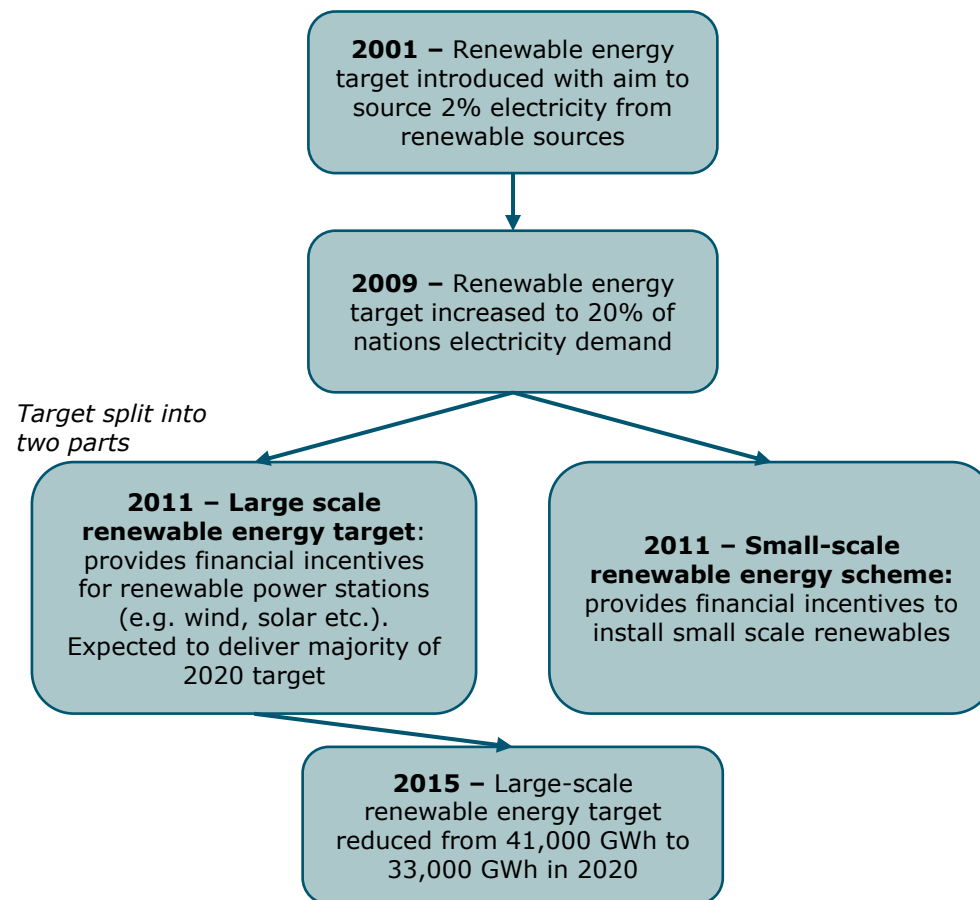
(November 2020 survey)

Percent of respondents (n = 1,531)



Government support for large- and small-scale renewable energy uptake continues a current policy focus and investment trend, less so the COVID impact

History of the renewable energy target

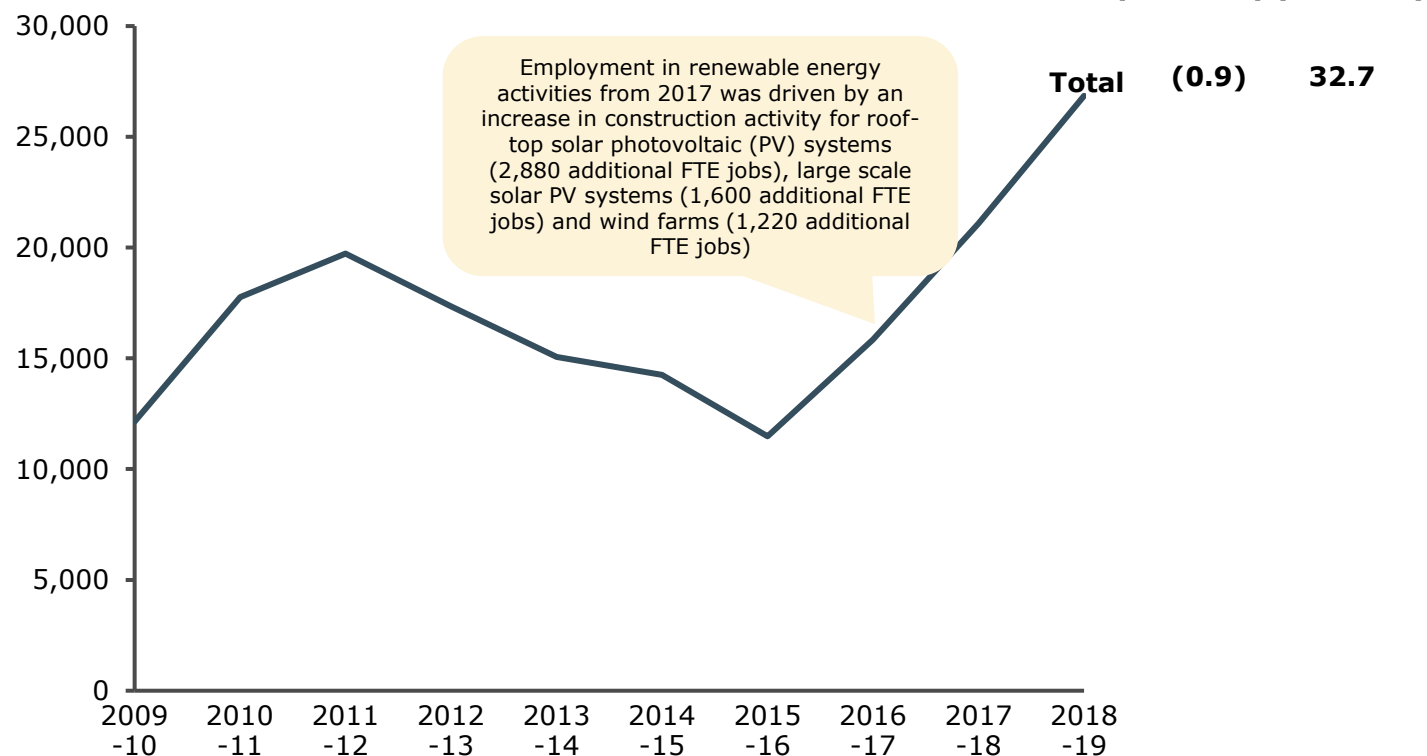


- The renewable energy target is split into a large-scale and a small-scale target to encourage the uptake of renewable energy
- According to data supplied by the Australian Government, Australia has the highest uptake of solar globally, with more than 21% of homes with rooftop solar PV
 - key drivers of the growth in solar include large numbers of people working from home, increased spending on home improvement, lower manufacturing costs and low interest rates
 - the Australian government estimates that a system without batteries typically has a payback period of 3 to 5 years. Adding batteries extends the payback period. However battery prices are also decreasing
- State Government bodies have created incentives for private owners through to large scale investment
 - for example, in July 2020, the Victorian Government announced an expansion to the state's Solar Homes Program to renters and landlords. Landlords can now apply for an interest-free loan on top of the existing rebate of up to \$1,850
 - NSW government unveiled in November 2020 a \$32b renewable energy plan with focus on pumped hydro, increasing the share of renewable energy in the state from about 16% today to more than 60% by 2030
 - WA government launched the Distributed Energy Buyback Scheme (DEBS) in August 2020, which introduces payments for energy exported to the grid from eligible home batteries and electric vehicles

Employment in the renewable energy sector has been increasing at around 30% between 2015 and 2019

Annual direct FTE employment in renewable energy activities in Australia (2009 - 2019)

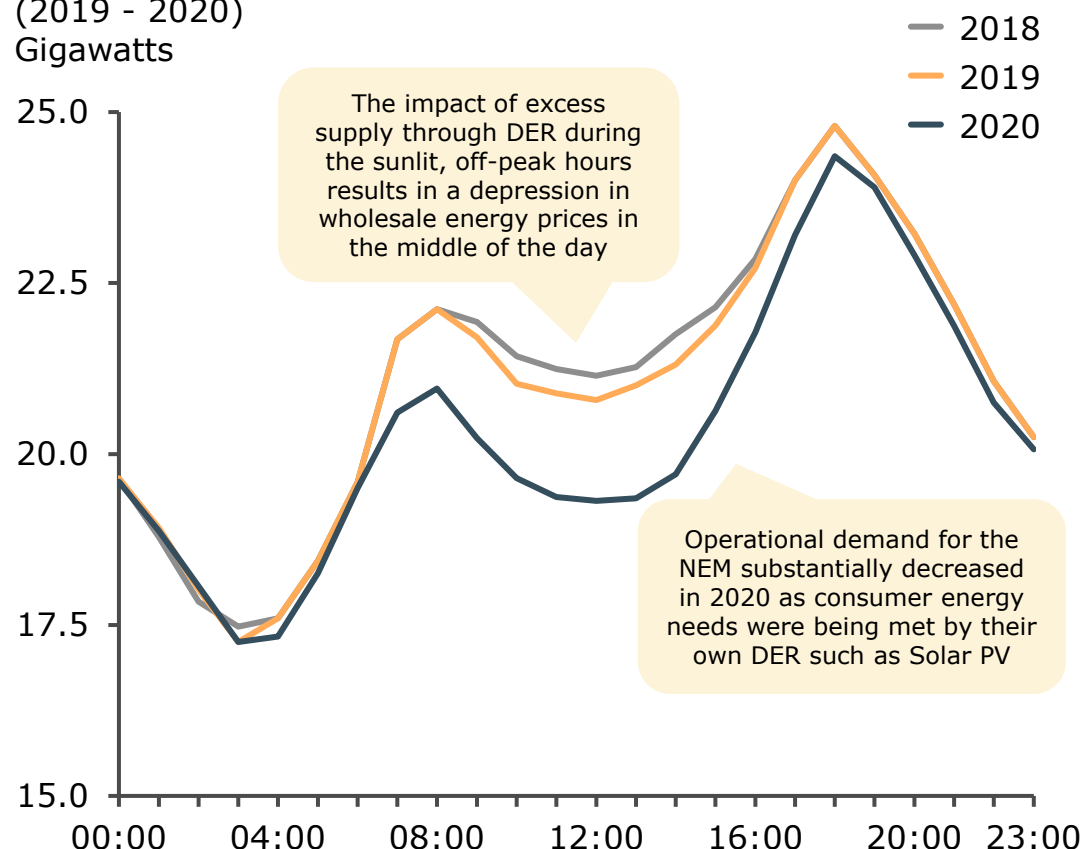
Number of Full-Time Equivalent (FTEs)



- Solar energy accounted for over 75% of the increase in employment from 2017 and the top three renewable energy types (roof-top solar, large scale solar and wind) contributed 99% of the increase in FTE employment in renewable energy
- This trajectory is expected to continue, with The Australian Government announcing \$1.9 billion to support low-emission energy projects on September 17, 2020. To facilitate these investments
- The package, aims to get the country's emission-intensive manufacturing, transport, and agriculture sectors on track to reach net-zero emissions from 2050. It also includes funding for different low-emission technologies that will secure and create jobs, lower emissions, cut energy costs for households, and improve the reliability of Australia's energy supply, including:
 - A new Carbon Capture Use and Storage Development Fund for piloting carbon capture projects (\$50m)
 - A new Technology Co-Investment Fund to support agriculture, manufacturing, industrial, and transport sector businesses that adopt technologies that increase energy productivity (\$95.4m)
 - Support for micro-grids in regional and remote communities (\$67m)
 - Investments in home and business energy productivity (\$52.2m)
 - Setting up a hydrogen export hub (\$70.2m)
















Increasing distributed energy resources impact the future planning of market participants due to its impact on peak supply requirements

Average NEM Operational Demand, Autumn
(2019 - 2020)
Gigawatts













- Average NEM operational demand between 6am to 6pm decreased in 2020 when compared to historical periods, with a c.7% decrease at midday compared to 2019
- The COVID-19 pandemic is expected to further decrease peak demand. Australia's energy ecosystem is rapidly transforming towards a decentralised, two-way power system, as increasing numbers of households and businesses invest in solar PV generation and energy storage capabilities
- Evidence of strong sales and installations in 2020 suggest the trend will continue into the future. The impact of household solar and other renewable energy generation will benefit consumers through increased affordability. However for generators this presents challenges
 - rapidly declining 'minimum operational (grid) demand' where generators may not be able to run at full capacity
 - as minimum operational demand lowers, new standards and system services are required to keep the power system secure and reliable
- Rooftop solar is not visible to AEMO in real time, and cannot currently be controlled or coordinated. However, it can be seen on the grid as the well-known "duck curve" – namely, low demand in the middle of the day, with a larger ramp to the evening peak. This change impacts the demand profile, even on average demand days
 - low utilisation and subsequent difficulty managing demand can lead to uncertainty around planned investment decisions for Operators
















Assessment and outlook for key trends: Energy (1 of 3)

TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID-19)	Correlation of trend to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID-19
Network demand	Decrease in commercial electricity and gas demand	Minor – mix shift	 Fast growing cities	 New direction	 <i>Highly sensitive to COVID-19 related lockdown measures</i>	 <i>Highly sensitive to economic recovery especially C&I sector</i>	 <i>Likely to return to pre-COVID-19 behaviours with WFH impact being minor</i>
	Decrease in SME electricity and gas demand	Minor – mix shift	 Fast growing cities	 New direction	 <i>Highly sensitive to COVID-19 related lockdown measures</i>	 <i>Highly sensitive to economic recovery and dependent on stimulus</i>	 <i>Likely to return to pre-COVID-19 behaviours potential for some drop off for businesses forced to shut down</i>
	Increase in residential energy and gas demand	Minor – mix shift	 Fast growing cities	 New direction	 <i>COVID-19 driven work from home and lock down measures directly impacting trend</i>	 <i>Demand to partially return to post COVID-19 levels as some people continue to work from home</i>	 <i>Strong influence of work from home trend moving forward may continue this demand change</i>

Assessment and outlook for key trends: Energy (2 of 3)

TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID-19)	Correlation of trend to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID-19
Network demand	Increase regional demand profile	Major	 <p>Fast growing cities, smaller cities/regional centres, small town, rural communities and remote areas</p>	 <p>New direction</p>	 <p>COVID-19 driven work from home and lock down measures directly impacting trend</p>	 <p>Economic recovery has little impact on the return of Australians to metropolitan areas, regionalisation to sustain demand</p>	 <p>Strong influence of work from home trend moving forward may continue this demand change</p>
	New solutions to meet evolving needs	Major	 <p>Fast growing cities, smaller cities/regional centres</p>	 <p>New direction</p>	 <p>COVID-19 has driven an increased awareness of energy management</p>	 <p>Economic recovery has moderate impact on demand for digital energy solutions</p>	 <p>Behavioural trend likely to continue</p>

Assessment and outlook for key trends: Energy (3 of 3)

TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID-19)	Correlation of trend to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID-19
Customer	Increase in hardship customers, in particular among SMEs	Major – volume up	 All	 New direction	 Highly sensitive to COVID-19 related lockdown measures that lead to employment and business closure	 Highly sensitive to economic recovery esp C&I sector	 Likely to return to pre-COVID-19 behaviours as long as unemployment rate improves
	Increase in DER through solar PV uptake	Major – volume up	 All	 Acceleration	 Macro policy settings more influential of uptake than WFH or lockdown	 As economy improves, growth will be sustained	 Once established, small scale generation is fixed. Strong growth was a pre-existing trend.
Evolving supply profile	Increase in local battery development capability	Minor – volume up	 All	 Acceleration	 Macro policy settings more influential of uptake than WFH or lockdown	 As economy improves, growth will be sustained	 Once established, small scale storage is fixed. Growth was a pre-existing trend.

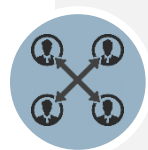
Future directions for consideration: Energy

Opportunities and Challenges



Reducing peak requirements

- Total demand has returned to normal, take up of solar PV and storage by households will have the benefit of lowering peak demand and reducing network intensity
- This could lead to substantial savings for network providers who no longer have to build capacity to sustain the peak



Evolving technology needs

- Customers have also been displaying increased demand for digital engagement (e.g., energy management / monitoring, digital billing, virtual power plants)
- Greater digital interaction provides energy providers with the ability to capture valuable customer data



Providing regulatory certainty

- Industry participants consulted for this study pointed to COVID-19 exacerbating long run policy uncertainty in energy regarding decarbonisation security and affordability



Reviewing hardship policy initiatives

- Australian Energy Regulator (AER) has imposed restrictions on energy proponents' ability to cut off supply to those customers impacted by COVID-19 lockdowns. However many proponents have noted they are not aware of how many distressed customers there really are, which may negatively impact their profitability once these restrictions are removed

Future Directions for Consideration

- ✓ Support peak and other demand management initiatives
- ✓ Prioritise program and policy reform that will enable the shift towards and integration of distributed energy sources, for example, smart meters, applications that improve visibility of generation and peer to peer trading

- ✓ Support data analytics capabilities (e.g., advanced metering) to generate customer needs solutions
- ✓ Develop energy roadmap with government / policy guidance, to facilitate investment into new energy technology

- ✓ Greater clarity on renewable energy policy to enable decision making by proponents

- ✓ Improved clarity from regulators on next steps to manage hardship customers so energy retailers are not adversely impacted

Section 8

Water

Water is focused on making the quiet recovery from drought despite COVID-19

Category	Segment	Summary of trends
Water	Water demand shift	<ul style="list-style-type: none"> The strongest driver of policy and investment in <i>both</i> regional and urban water is long-term rainfall decline, linked to climate change, and increasing scarcity There is some evidence of a small shift in housing demand from inner city areas to outer suburbs and regional areas due to COVID-19 increasing water usage in those areas But this accounts for a small portion of total water usage and water infrastructure is designed with capacity for peak periods allowing flexibility to support an increase in average use Majority of water utility providers across Australia have indicated that they won't slow capital expenditure due to COVID-19, although some indicated reductions for 2021
	Hardship	<ul style="list-style-type: none"> The most significant impact to water is likely to be an increase in hardship if COVID-19 lead to a longer period of recession

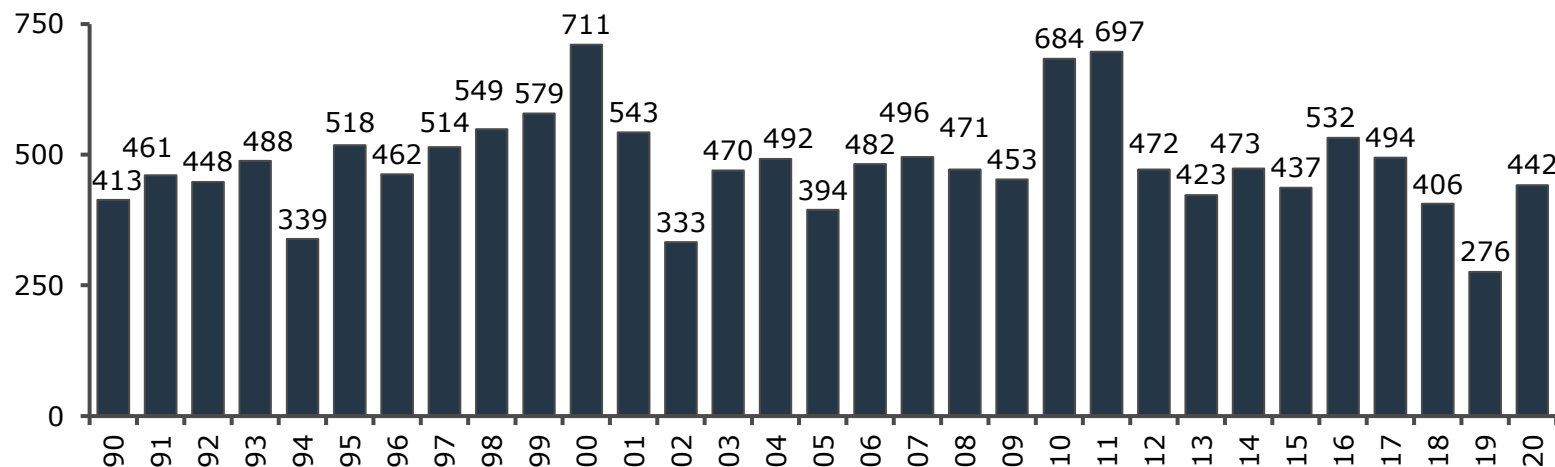
The strongest driver of policy and investment in both regional and urban water is long-term rainfall decline and increasing scarcity

Long-term decline

The climate of Australia is changing. Average rainfall across Australia has declined over the past decade and average temperatures have been steadily rising. A warming climate means Australia's water supply is becoming increasingly less secure and extreme droughts are more likely. Long-term investments to provide water security across the country, and to build resilience to drought and floodwaters, should be prioritised

Annual rainfall in Australia (1990-2020*)

Millimetres

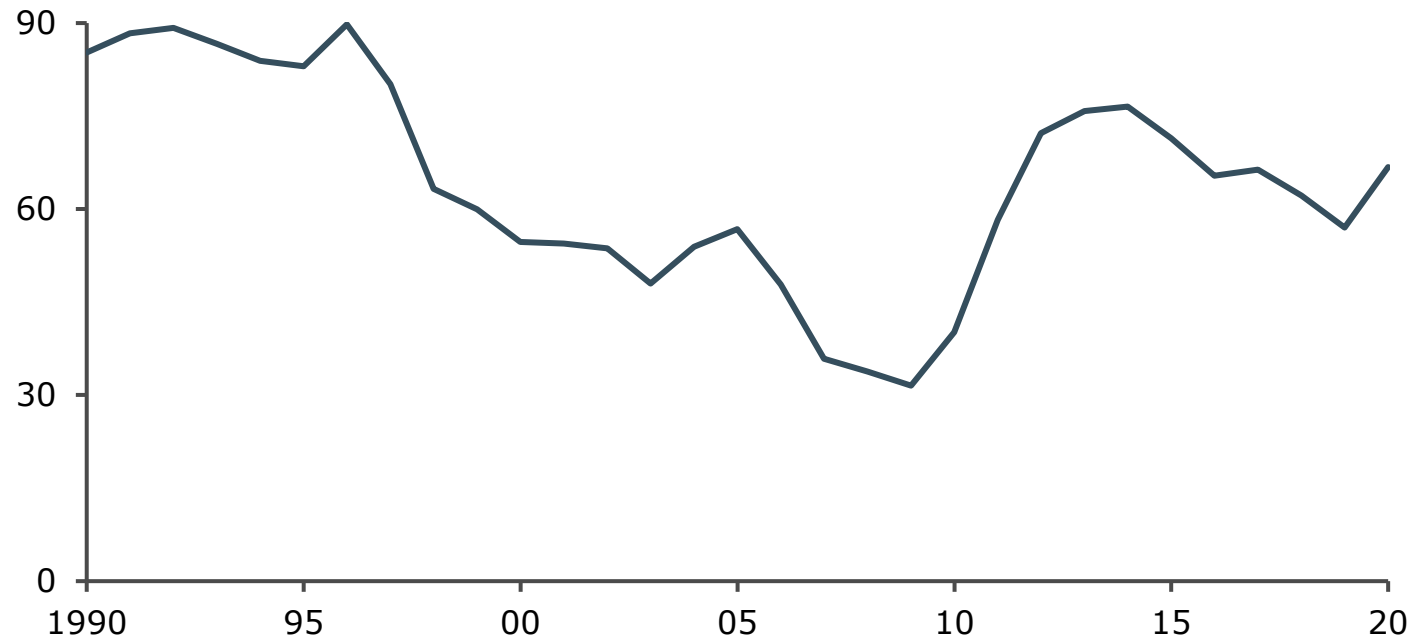


- Macro issues such as drought remain the largest challenge faced by water utility providers, with the country experiencing a 12% decline in April – October rainfall compared with the late 1990s
 - over half of Australia is currently experiencing 'severe' rainfall deficiency (April 2018 – October 2020), including south-eastern Queensland, western NSW, north-western / eastern VIC and much of SA
 - the size of this rainfall deficit has been accumulating since 2017, with persistent, above average rainfall needed to provide relief
 - this has caused low water storage levels particularly in northern parts of the Murray-Darling Basin
- The shorter term impacts of COVID-19 on water, such as increased residential demand, are less likely to drive change than pre-emptive measures to account for prolonged periods of low rainfall

Nonetheless, 2020 saw the breaking of a record drought, and metropolitan water storage levels on the east coast partially returned during the COVID-19 pandemic

**Water storage level in Melbourne*
(1990-2020)**

Per cent full

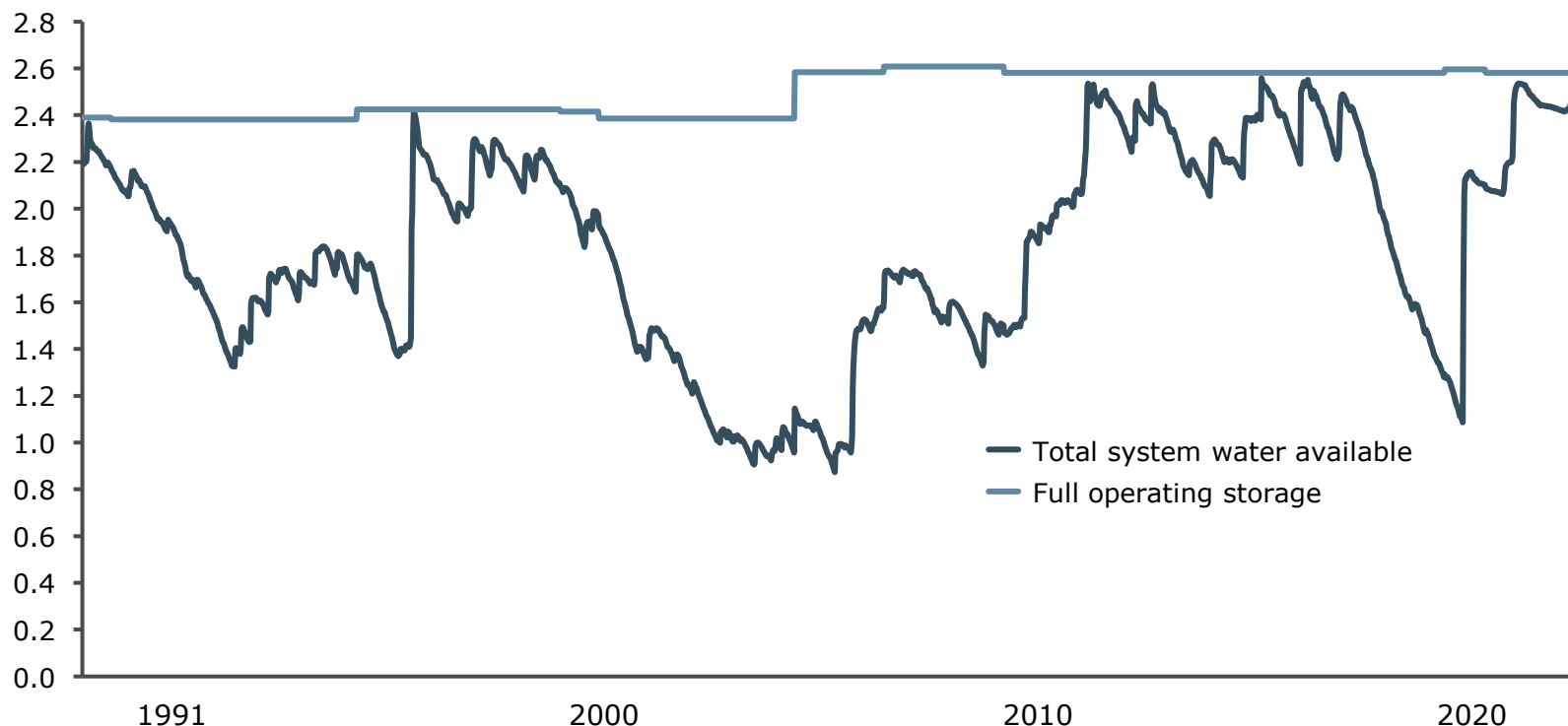


- Working from home meant a redistribution of peak demand across the day – often later in the morning as households rose later
 - COVID-19 is likely to impact on the drainage and sewerage segments of household water use
- As with other utilities, the pandemic response catalysed a redistribution of demand to municipal or household water requirements
- In South Australia, lockdowns were clearly linked to higher water usage, as Adelaide residents watered their gardens and consumed more in the home

Regional population shifts were evident, but did not risk water infrastructure capacity that is designed for very long term growth requirements

**Greater Sydney – Total System Water Availability
(1992-2020)**

Millions of litres

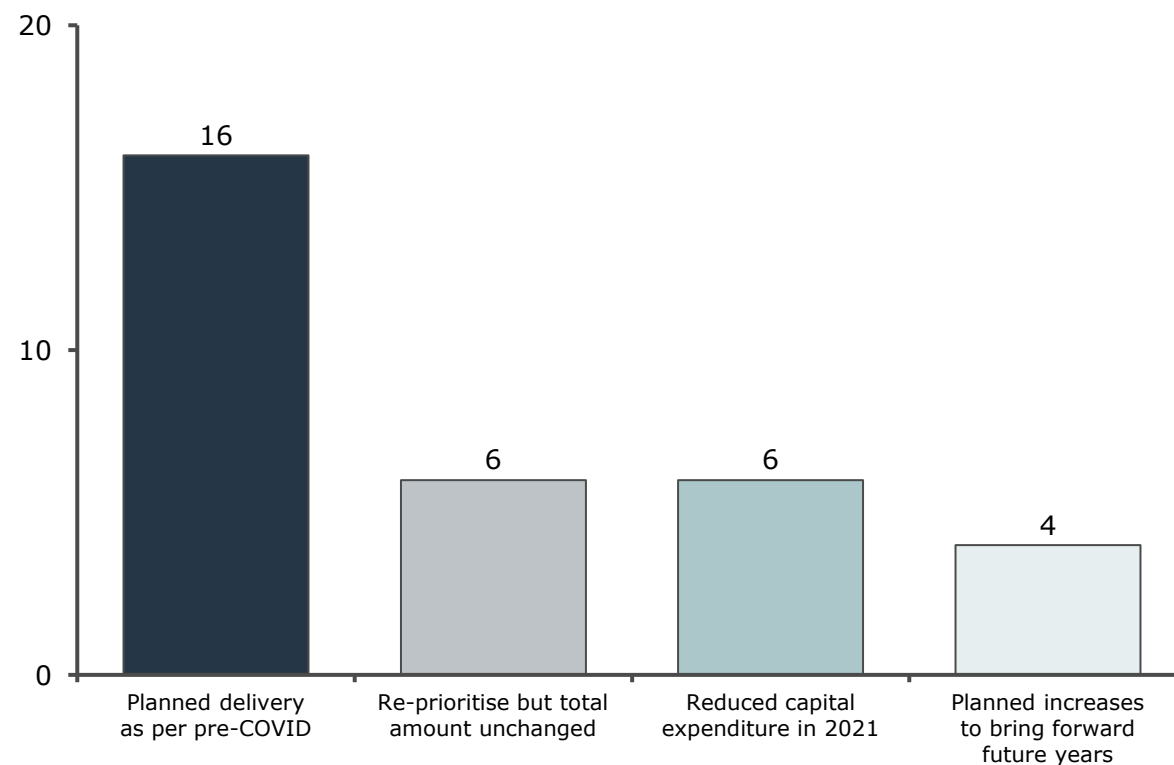


- Existing water infrastructure has been built to manage peak demand periods such as weekends and public holidays like Australia Day over long term horizons and to support long term population growth
- Hence the increase in average use in some areas generated by COVID-19 has had minimal impact on water infrastructure requirements

As essential service providers, water utilities across Australia have indicated they will maintain capex despite COVID-19

Changes to urban water capital expenditure (2020)

No. of responses

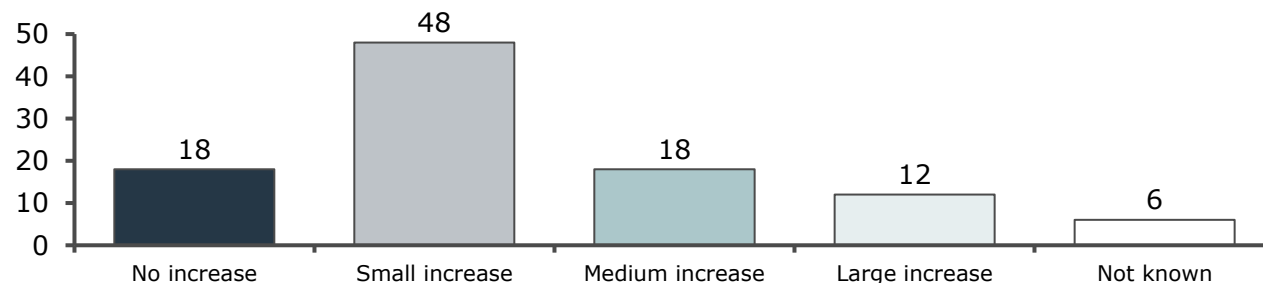


- As capital-intensive providers of essential services, water infrastructure projects attract project timeframes of 5-10 years, making quick changes to water infrastructure unlikely
- An executive level survey accounting for 80% of water utility providers across Australia reveals the majority of water utility providers will not be making material changes to their urban water capital expenditure in 2020-21, with 50% of responses stating capital expenditure will continue as planned despite COVID-19
- If future population growth decreases as a result of COVID-19, this may affect future infrastructure investment but will not be realised in the immediate future
- Regional water utilities have reported improved collaboration through the pandemic as they put in place rapid business continuity plans that often involved cross-training nearby regional teams
 - social distancing requirements led to site maintenance teams being reduced to single person operations, and increased difficulty in maintaining physically separate manufacturing processes

A slow economic recovery from COVID-19 could have a significant impact on customer hardship

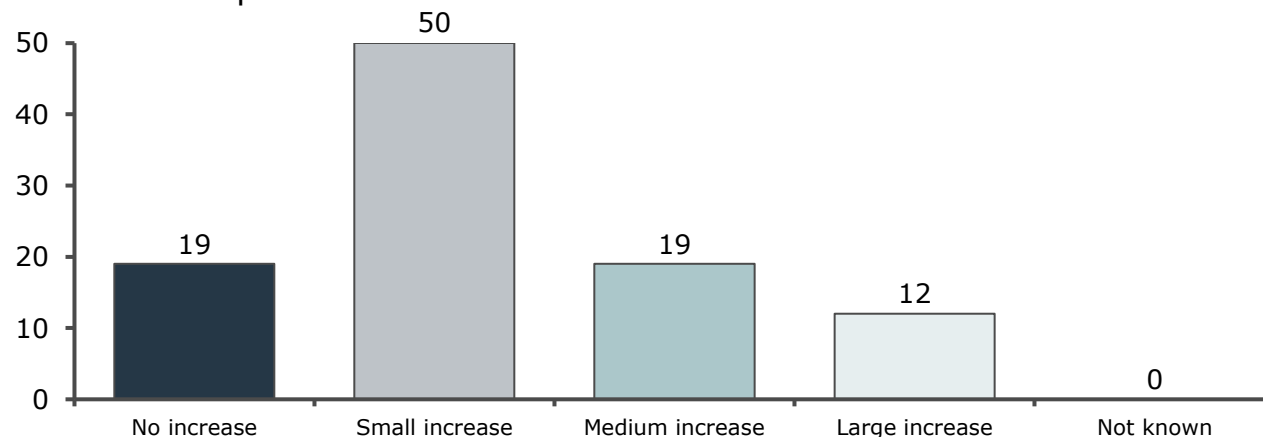
Average debtor days since COVID-19 (2020)

Percent of responses













Increase in calls/contacts for hardship since COVID-19 (2020)

Percent of responses



- The water industry is capital intensive with high fixed costs. Revenue from household and business customers covers operating and capital costs (with some contributions from developers for growth)
- Hence a reduction in revenue due to customer hardship can have a significant impact on the financial wellbeing of water providers
- A survey conducted by the Water Services Association of Australia reveals around 50% of surveyed members noted a small increase in average debtor days and calls for hardship since COVID-19
- A longer term recession as a result of COVID-19 could lead to much higher increases in hardship customer volumes and cause further financial stress on water utility providers, impacting their ability to fund planned infrastructure

Assessment of trends against scenarios: Water (1 of 1)

TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID-19)	Correlation of trend to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID-19
Water	Redistribution of water use to suburban and regional areas	Minor – volume up	 <p>Fast growing cities, smaller cities/regional centres</p>	 <p>New direction</p>	 <p>Largely driven by WFH behaviours and greater regionalisation</p>	 <p>Water infrastructure is designed for LT growth and peak demand, with increased average demand not impacting infrastructure capacity</p>	 <p>Residual WFH, regionalisation and slower population growth will all impact at the margin</p>
	Increased hardship customers across water utility providers	Minor – mix shift	 <p>Fast growing cities, smaller cities/regional centres</p>	 <p>New direction</p>	 <p>Sustained COVID-19 could lead to a longer recession which would have a greater impact</p>	 <p>Sustained COVID-19 could lead to a longer recession which would have a greater impact</p>	 <p>Full return is anticipated once economic recovery has occurred</p>

Future directions for consideration: Water

Opportunities and Challenges



Supporting sustainable, local water projects

- 2020 was a significant year of rain for many parts of Australia, in a year when the sector began rolling out drought-responsive and stimulus-oriented water projects. Efficient and sustained delivery of projects will improve local sustainability and water resilience
- Regional water utilities have identified ways to ensure greater collaboration and business continuity

Future Directions for Consideration

- ✓ Investment in local water resilience projects
- ✓ Promote household water efficiency improvements

Section 9

Waste

Shifts in waste generation put households at the centre of the circular economy

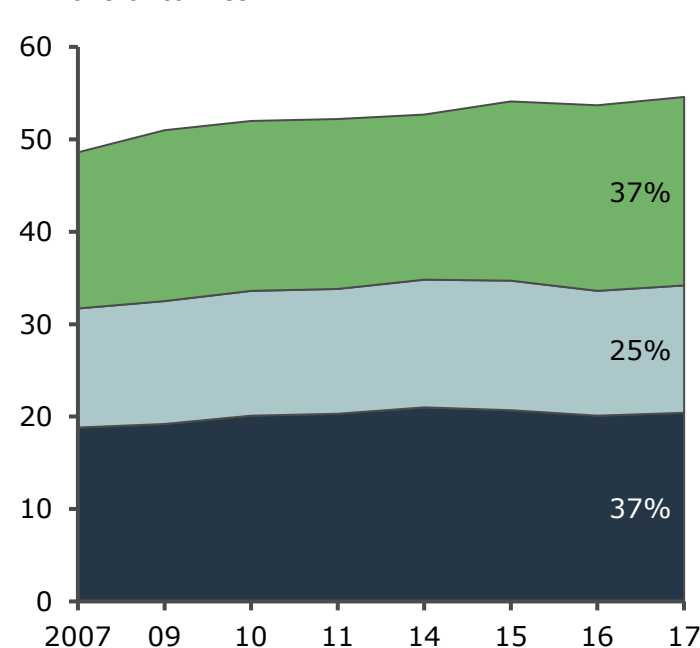
Category	Segment	Summary of trends
Municipal (household waste)	Household	<ul style="list-style-type: none"> The shift to working from home reversed a trend towards declining household waste per capita, with a around 20% spike in household waste across Australia Although there is limited data available, household recycling volume data in Victoria shows the increase in household generated waste Rapid growth in food and online shopping deliveries generated large quantities of waste such as old corrugated containers, cardboard, and single use items such as refrigerator grade cardboard Historically there has been a decline in the volume of organic waste, however COVID-19 has driven an increase in food waste across certain regions
	Household recycling	
	Green waste	
	Increased contamination	
Commercial waste	Paper & Cardboard	<ul style="list-style-type: none"> Commercial waste declined in 2020, as office working stopped and has been slow to return. This has included acceleration of the reduction in office based paper in line with a shift to online and digital based offices COVID-19 has caused a spike in the generation of clinical waste due to the increased use of PPE across medical and other facilities The COVID-19 pandemic doubled the rate of growth in medical waste services market in FY20, with increased demand from hospitals and healthcare providers and a 100 fold increased in waste across the Victorian aged care sector
	Clinical waste	
Waste Market economics	Market prices for recoverables	<ul style="list-style-type: none"> COVID-19 has led to reduction in oil and pulp prices, which has also driven down the price of recovered materials such as plastic resins The lower prices of recovered material reduces the economic viability of recovery facilities which are already tight prior to COVID-19

Note National reporting of waste data lags considerably (2-3 years). Information on pandemic impacts has been available for a few states or is anecdotal

While overall waste has been growing, per capita waste has been steadily declining over the last 15 years

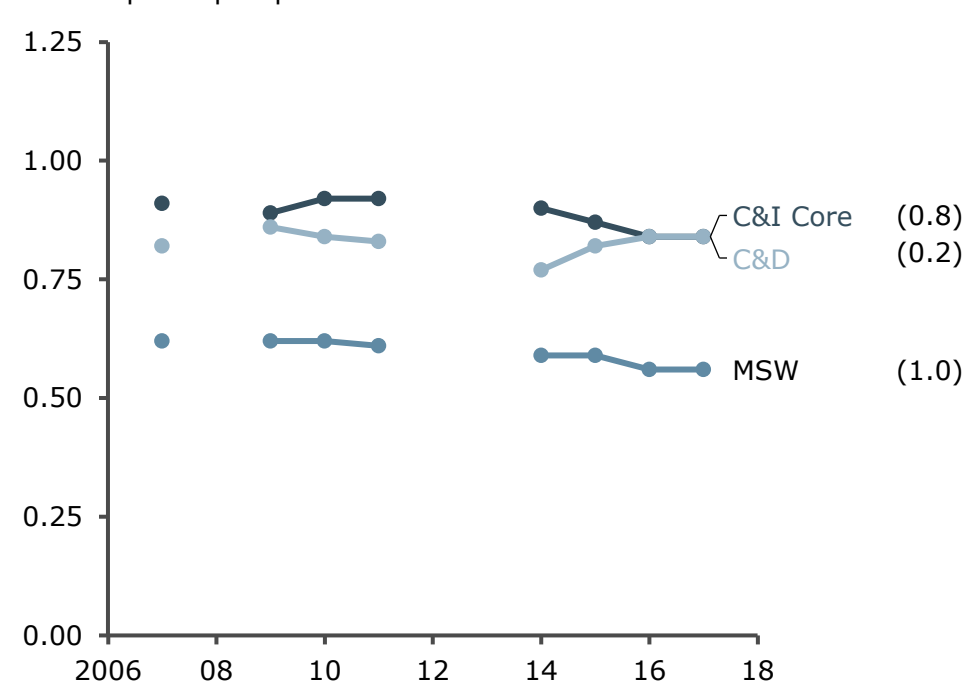
Australian Core Waste* Generation by Waste Segment^ (FY2007 to FY17)

Millions of tonnes



C&I^ Core Waste Generation per Capita (FY2007-17)

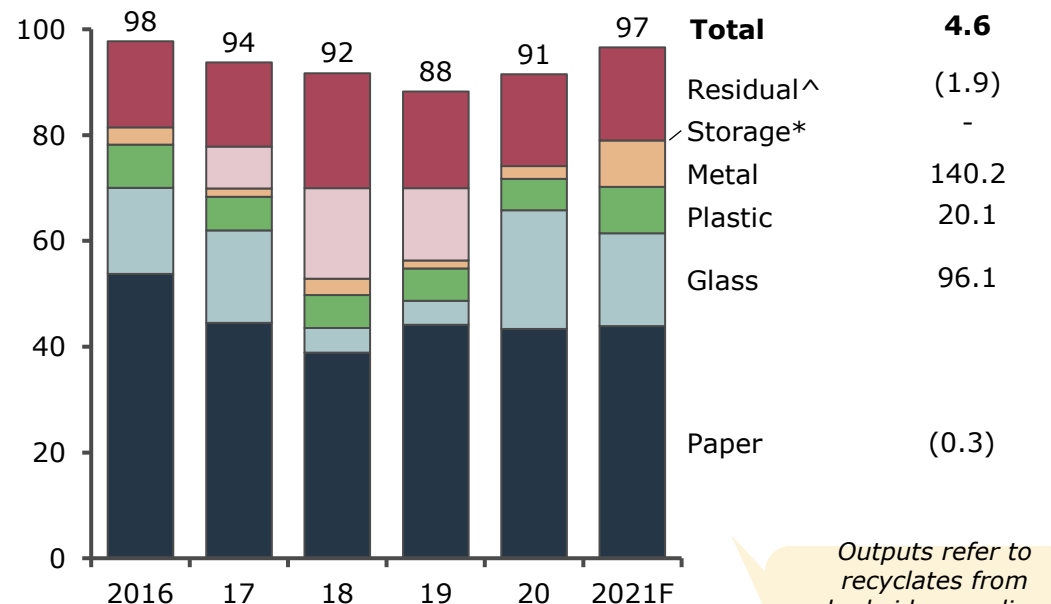
Tonnes per Capita per Year



In Victoria, per capita household waste grew by 5.5% from 2019 to 2020, while Australian household waste reportedly increased by 20% due to COVID-19

Per capita kerbside MRF*** outputs in Victoria, by type (FY16-21F)

Kilograms per capita



Outputs refer to recyclates from kerbside recycling collections only, and does not include non-recyclable plastic waste

- Historically, household waste generation per capita has been gradually declining, but COVID-19 has reversed this trend
- According to the Australian Council of Recycling (ACOR) the COVID-19 pandemic has seen household waste and recycling rise by 20% across Australia, particularly across inner-city areas
 - in Victoria, household waste has increased by 5.5% between 2019 and 2020 due in part to the increased time spent at home through COVID-19
 - in Brisbane, household general waste and recycling increased by 13%

"... As people stay at home more, exceptionally high levels of soft plastics like fresh food packaging, biscuit wrappers, pasta and bread bags, some ready-to-eat meal packaging is going through the system"
CEO at ACOR, May 2020

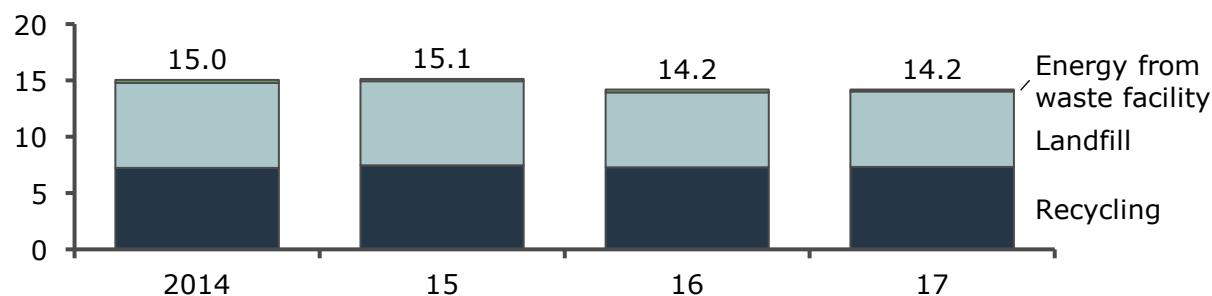
- This increase is largely due to the increase in working from home arrangements, online shopping, time spent 'decluttering', and the use of single-use items
- A rapid increase in plastic waste is likely to challenge Australia's ability to meet their 70% target for the recycling of plastic packaging and phase-out unnecessary single-use plastics packaging

"With these new and unexpected [COVID-19 plastic usage] trends, these targets will be even harder to hit by 2025 ... We need to send a signal to packaging manufacturers and to brand companies that they need to be really conscientious about their decisions and how it impacts consumer choice ..."
CEO at ACOR, August 2020

Historically there has been a decline in the volume of organic waste, however COVID-19 has driven an increase in food waste across certain regions

Generation of organic waste, by management method (2014 to 2017)

Millions of tonnes



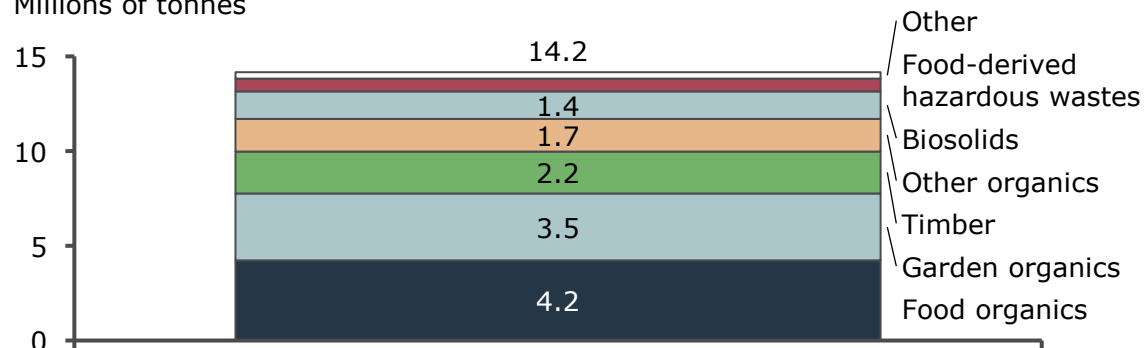
- COVID-19 appears to have driven a trend of increased organic waste in certain areas across the country
 - in Brisbane household organic waste rose by 33% between April and June 2020, compared to 2019 figures
- Reports suggest that the increase in organic waste is partly caused by a surge in food wastage during the pandemic, which saw consumers panic buying groceries and perishable food items

"... the level of vegetable waste has increased significantly, particularly leafy green materials...it just about doubled for a two-week period"

Organic farmer, May 2020

Organic waste, by type (2017)

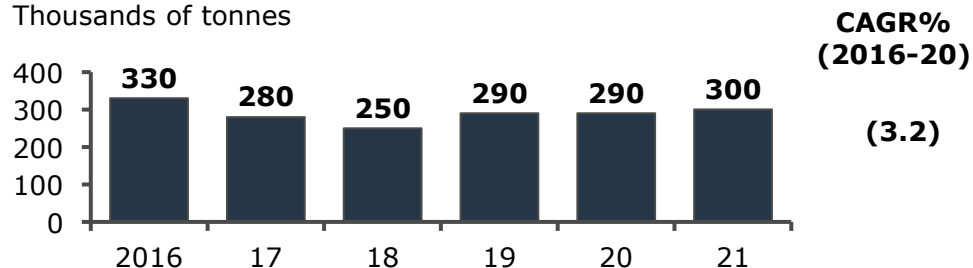
Millions of tonnes



Paper and cardboard waste increases during the pandemic are challenging due to higher rates of contamination in household recycling bins

Generation of kerbside MRF paper and paperboard waste* in Victoria (FY16 to 21)

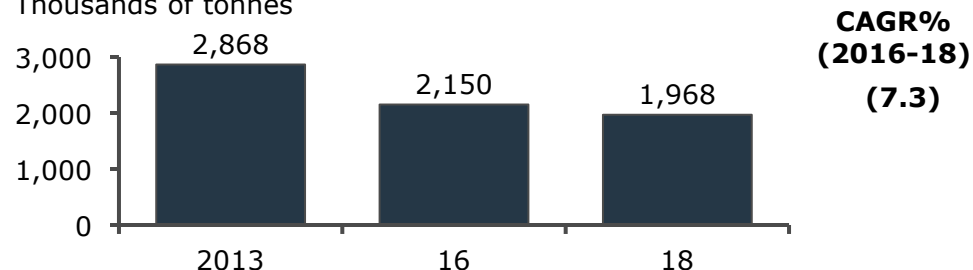
Thousands of tonnes



Paper and paperboard waste per capita						
Output (kg)	53.76	44.50	38.86	44.12	43.35	43.89

Generation of Household paper and cardboard waste in Australia (2013 to 2018)

Thousands of tonnes



Paper and paperboard waste per capita			
Output (kg)	124.5	89.2	79.0

- Historically, the volume of paper and cardboard waste per capita has been gradually decreasing. However, COVID-19 has caused an uptick in paper waste generation due to increased online shopping and working from home behaviours

“... The real increase in waste is packaging for online purchasing. Bubble wrap, polystyrene, cardboard, paper. ...”

Respondent of ABC Brisbane survey, August 2020

- During the COVID-19 pandemic, there has been an increase in demand in the home for paper and packaging materials measured through outputs from materials recovery facilities
 - in particular, corrugated box demand has grown by 4% in FY20
 - according to Sustainability Victoria, these increases are likely to continue as retail patterns shift online

“... Industry reports state that almost all of the increase [in demand for recovered paper] was recorded in the first half of 2020 and is directly related to the pandemic. ...”

Sustainability Victoria, October 2020

- While paper and paperboard had the highest recovery rate of 63% in 2018, ACOR fears that COVID-19 behaviours that increase contamination and worsen recycling behaviours could diminish these rates

“... The kerbside paper volume is becoming more contaminated than the commercial and industrial sector...”

Sustainability Victoria, October 2020

Contamination of municipal waste is an ongoing issue in Australia and the increasing volume through COVID-19 will accelerate the issue

Existing contamination issue

- Contamination of recycling collections in Australia is high, which increases the cost of processing these materials
 - there is a lack of unified recycling standards across the country
 - there is an education gap with Australian consumers on what can and can't be recycled in kerbside recycling bins

Accelerated by increased COVID-19 volume

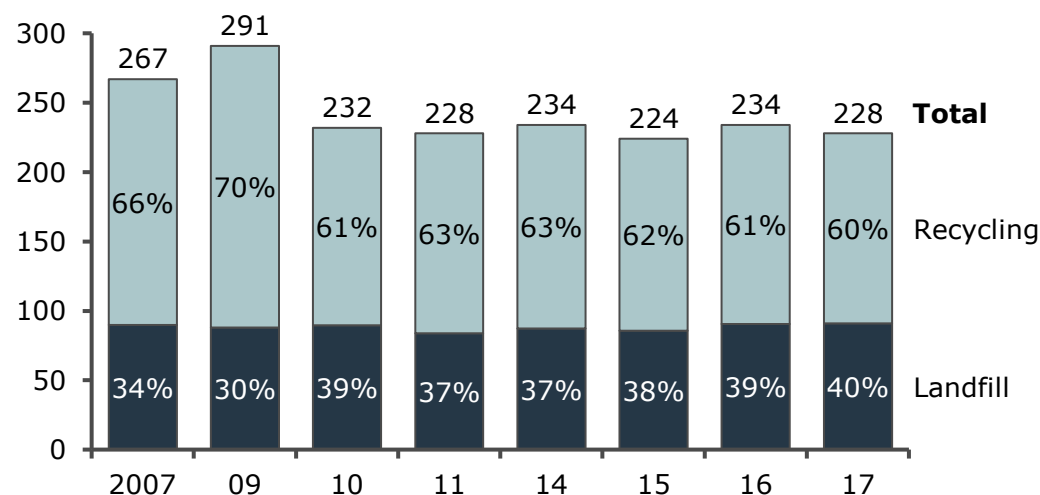
- Kerbside collections of recyclables are historically highly contaminated, and the trend of increased household waste has been exacerbating these contamination issues
 - according to ACOR, kerbside contamination rates have gone as high as 20%, primarily caused by soft plastics and food scraps from home deliveries'

"... Contaminating material has been finding its way into kerbside recycling bins like prepared meal trays, plastic bags, shipping packaging, bubble wrap ..."
CEO, ACOR

Generation of office paper waste is expected to decline with increasing digitalisation and reduced office activity, accelerated by COVID-19

Generation of paper / cardboard waste* per capita, by management method (2007 to 2017)

Kg per capita



**CAGR%
(2007-17)**

Total (1.6)

Recycling (2.5)

Landfill 0.1

- Historically, there has been a decline in per capita paper and cardboard waste generation, and this is partly due to digitisation trends including a 10% reduction in newspaper circulation
- Per capita paper generation has decreased by around 15% over the 2007-17 period
- COVID-19 is likely to have accelerated this trend, with business and office closures and working from home arrangements supporting a behavioural shift away from printing
 - office paper collectors have reported a large drop in supply due to a reduction in paper and print consumption

"... offices and manufacturing facilities are operating at less-than-full capacity, so primary paper products like office paper and cardboard boxes are being generated and disposed of less..."

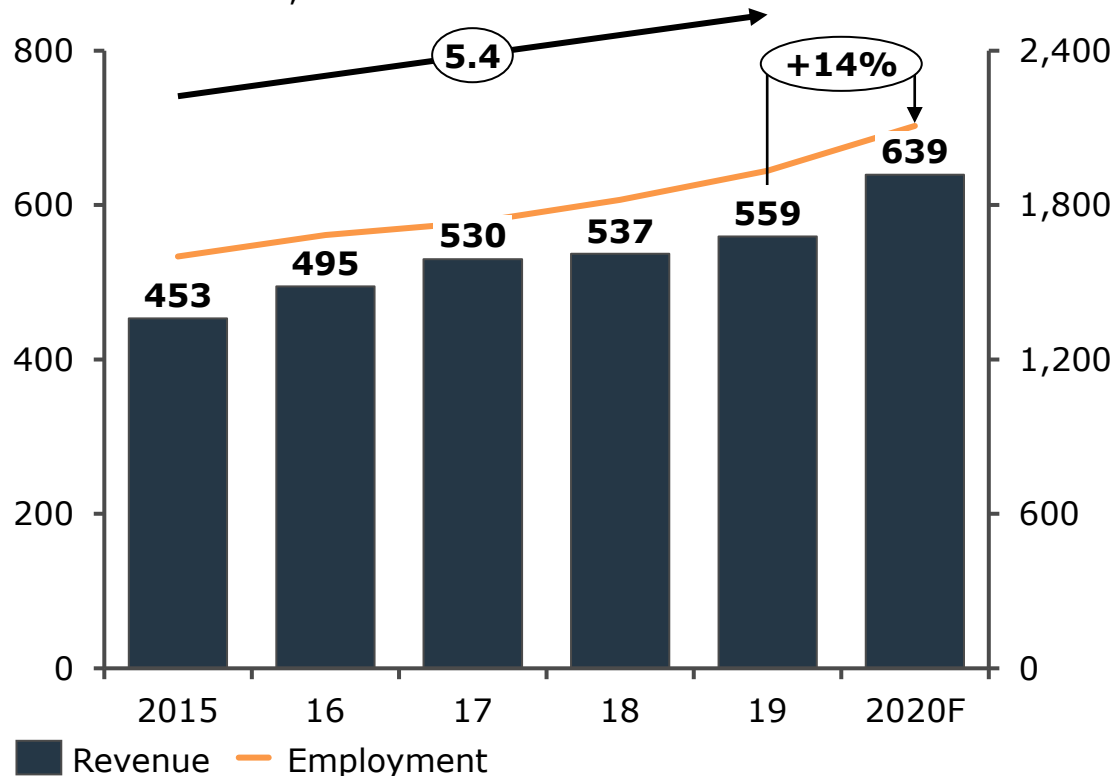
U.S. PIRG

Total paper and cardboard waste								
Waste (Mt)	5,546	6,279	5,105	5,078	5,481	5,325	5,646	5,591

There has been a large spike in clinical waste generation due to the increased use of medical equipment, which poses significant health risks if not managed

Medical Waste Services revenue and employment (2015-20F)

Millions of dollars, number of workers



- COVID-19 has caused a 14% increase in Medical Waste Services revenue from 2019-20, significantly up from the 5.4% growth rate prior to COVID-19
- There has been a 100 fold increase in clinical waste generation across the Victorian aged care sector, with this spike in waste largely caused by the increased volume of PPE required by staff for infection control

“... Many of these centres usually generate enough medical waste to fill one 240-litre wheelie bin per week. Those with active cases of coronavirus are now filling as many as 12 240-litre bins per day ...”

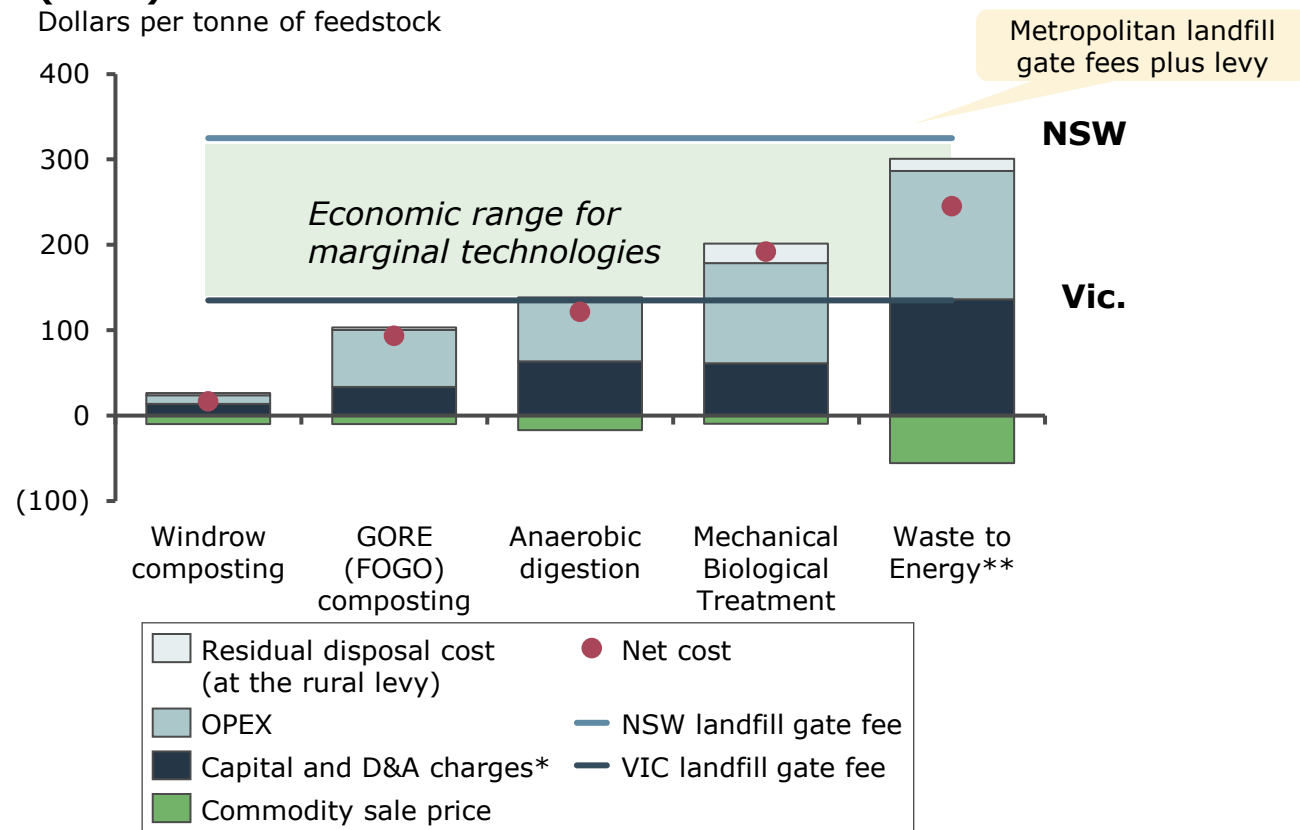
CEO at Victorian Aged Care Response Centre, August 2020

- The pandemic is expected to continue driving an increase in demand for clinical waste disposal between 2020-21 due to increased testing, treatment and use of PPE
- Major waste contractor Cleanaway Waste Management is seeking to expand their storage facilities to handle the increase in medical waste

During 2020, the market prices for recoverable materials was low, making the economics of resource recovery technology and infrastructure more challenging





















Cost comparison resource recovery methods vs landfill gate fee (2018)

Dollars per tonne of feedstock



- Historically the economics in Australia of resource recovery technologies have made investment in more advanced technologies challenging
- Australia does not currently have the onshore capability to process the growing volume of recyclable material
- Virgin plastic prices dropped in line with oil prices due to COVID-19. This then dropped the price of materials for making recycled plastics
- The value of resins from plastic recovery has dropped to the lowest price in several years
- The global market for paper exports has also reduced, with virgin pulp prices remain at historic lows due in part to lower wood fibre prices across Brazil and Russia, and weakening pulp demand in China
- These lower prices for recovered materials make the economics of investment in recovery infrastructure more challenging, although the impact is likely to be short term and recover with COVID-19 recovery

Assessment and outlook for key trends: Waste (1 of 1)

TRENDS		CURRENT ASSESSMENT			FUTURE SENSITIVITY		
Segment	Trend	Volume / Mix	Distribution	Trend Type (vs. pre-COVID-19)	Correlation of trend to COVID-19 duration	Sensitivity to Economic Recovery	Indicative trend post COVID-19
Municipal waste	Increase in municipal waste generation	Major – volume up	 Fast growing cities, smaller cities/ regional centres	 Reversal	 Highly sensitive to WFH and online shopping	 Discretionary spending would be impacted by prolonged recovery only	 WFH continuation will result in partial return.
	Decrease in paper usage within commercial offices	Minor – volume down	 Fast growing cities, Smaller cities / regional centres	 Acceleration	 Highly sensitive to WFH	 Impacted by slower return to work in CBDs	 Some continuing WFH and new behaviours in the office will soften full reversion
Commercial waste	Increase in the amount of clinical waste produced	Major – volume up	 All	 Acceleration	 Highly sensitive to COVID-19 pandemic infection risks	 Not impacted	 Higher PPE use likely to be sustained as precaution
	Decrease in market value of recycled material products	Major – mix shift	 All	 Acceleration	 Not directly influenced by pandemic but by decreasing oil and pulp prices	 Prolonged downturn will impact prices	 Tends to be cyclical, likely to return to pre-COVID-19 dynamics
Waste market and infrastructure							

Future directions for consideration: Waste

Opportunities and Challenges



Municipal waste policy reform

- Per capita waste has steadily declined over the past 15 years – however COVID-19 has reversed trend to drive a 20% increase in household waste
- High levels of food delivery and online shopping have generated sizeable increases in paper and plastic packaging waste and single use waste e.g. refrigerator grade cardboard



Waste processing and recycling

- The shift in volumes from commercial to municipal waste has placed additional pressure on the sector adapting to Chinese import bans, and may bring forward the horizon for policy reform
- Suppressed commodity prices (reducing the value of recycled materials) and contamination from household waste have made recycling facility economics more marginal, risking the achievement of national targets

Future Directions for Consideration

- ✓ Promote waste reduction / sustainable product packaging
- ✓ Improved and scaled collection and sorting

- ✓ Plan future infrastructure
- ✓ Pricing reform for landfill
- ✓ Implement reforms to support resource recovery technology investment
- ✓ Support R&D and technology demonstration

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