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CHAIRMAN'S MESSAGE



I am delighted to welcome you to *Partnerships* – Australia’s most senior annual gathering of infrastructure leaders. This year marks IPA’s first decade serving Australian infrastructure – and so it is pleasing that today’s speakers reflect the central importance of infrastructure to the national interest – and IPA’s positive role in the national debate.

‘Change’ will be a constant theme across today’s proceedings, reflecting the reality that substantial national progress on infrastructure and public administration are each unlikely, without equally substantial enabling changes to both.

Of course, Australia is well equipped to address its infrastructure and related fiscal and productivity challenges – but only if we can successfully conceive good reforms – and have them implemented.

Australia has been here before; and so I am very pleased that leaders like Fred Hilmer, David Gonski and other eminent Australians will share their views on how past precedent might guide contemporary change; and in so doing, provide a context for the rest of the days discussions.

I look forward to today’s programme because it will provide a mixture of new practices and historic precedent – and because each year, *Partnerships* provides a platform to distil new thinking about perennial challenges.

Also, like you I hope that today’s programme will continue to provide momentum and new thinking into the national debate.

As a senior leader in the sector I thank you for your ongoing support and engagement with Infrastructure Partnerships Australia – and for your active participation today.

Yours faithfully,
ADRIAN KLOEDEN
Chairman

RECALIBRATING THE PPP MODEL: DELIVERING SERVICES, NOT ASSETS

Trevor Tsui | Analyst – Macquarie Capital

Chris Voyce | Co Head of Infrastructure, Utilities & Renewables Australia New Zealand – Macquarie Capital

The population of Australia’s major capital cities is projected to almost double to 27 million by 2060, creating an unprecedented need for infrastructure of all types to support urban growth, amenity and productivity in our cities. Public Private Partnerships (PPPs) will play an increasingly crucial role in delivering not only much-needed assets, but more importantly the services that those assets enable.

We’re already seeing PPPs moving from a traditional focus on building infrastructure towards an emphasis on service provision, as governments seek to achieve value for money by paying for outcomes and solutions rather than inputs. Frameworks such as ‘outcomes based contracting’ and ‘contestability’ have now become common language and core features of the ‘services’ PPP model, which has resulted in greater alignment between delivery outcomes and government funding.

PPP PROJECTS ARE BECOMING LARGER AND MORE COMPLEX

As governments respond to the growing infrastructure task, both the number and size of PPP transactions has grown, with projects valued over \$1 billion comprising 43.4 per cent of total transaction value over the last five years, up from 29.4 per cent in the preceding five year period. This has primarily been driven by an influx of large

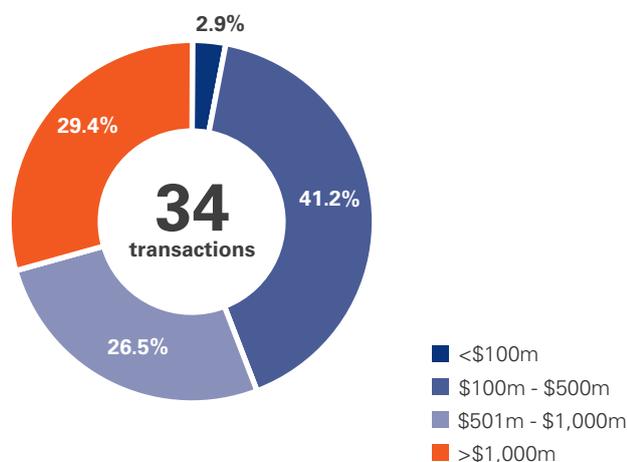
and complex integrated transport projects to address the challenge of congestion in major capital cities. Notable examples include the Sydney Metro Northwest and Melbourne Metro projects.

These projects illustrate the increased size and complexity of PPP projects today. Retrofitting major transport infrastructure in established city environments requires substantial planning and alterations to the inner city design to cater for increases in street level activity and minimise disruption to traffic flows.

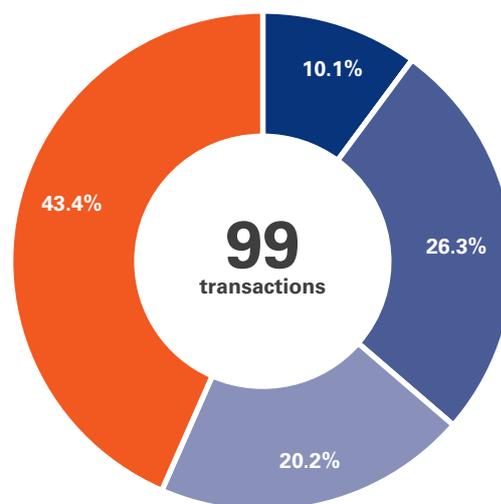
With the majority of the infrastructure task located in well-developed capital cities, there has also been a notable increase in projects focused on expanding existing infrastructure capacity, rather than providing new builds. Examples include the \$1.3 billion widening of the CityLink Tullamarine and West Gate Freeway in Victoria and the refurbishment and expansion of the ACT Law Courts.

THE GROWING SHARE OF LARGE PPPS

PPP deal size by transaction value 2006 – 2011



PPP deal size by transaction value 2012 – YTD2016



Source: InfraDeals – PPP transactions announced in Australia

1. Prequin estimates US\$144 billion of dry powder available for infrastructure investment, Prequin 2016

PRIVATE SECTOR APPETITE ENABLES SHIFT TO SERVICE DELIVERY MODEL

Robust private sector involvement has been underpinned by unprecedented low interest rates and significant 'dry powder' for infrastructure investments, creating aggressive competition for core infrastructure assets which has compressed returns to historic lows. Consequently, many investors have sought higher risk adjusted returns by moving up the risk spectrum to invest in hybrid infrastructure assets.

Increased private sector risk appetite has been beneficial for governments seeking to achieve greater value for money, facilitating a recalibration of the PPP model whereby infrastructure projects are defined by the outcomes that they enable, rather than the assets they create. For example, transport projects are defined by the ultimate objective of providing safe and reliable transit journeys with limited congestion, rather than pure-play asset finance and construction projects defined by design specifications.

This allows governments to pay only for solutions and outcomes rather than inputs, reflected in increased outcomes-based contracting in PPPs, where service payments are linked to Key Performance Indicators and well-designed abatement regimes are applied to unsatisfactory performances. This is in contrast to traditional procurement models, where service payments are made to operators based on the availability of an asset, irrespective of the outcomes achieved.

The development of this 'services' PPP model has, over time, led to more diverse applications beyond traditional sectors. The past decade has seen an increase in health, prison and social housing projects, enabled by increased private sector risk appetite and a more sophisticated PPP model that's now better suited to service-based sectors. For example, the NSW Government recently committed \$1 billion to a Social and Affordable Housing Fund to deliver 3,000 social and affordable dwellings across NSW. Additionally, numerous jurisdictions have recently procured prisons under operational PPP frameworks.

CONTESTABILITY AND EFFICIENCY

'Services' PPPs have also enabled greater contestability, with projects in sectors such as prisons incorporating reviewable services mid-points during the concession, that may require the project company to retender relevant operational services. This allows PPP concessions of meaningful durations to be awarded while preserving the government's ability to maintain more frequent services contestability across a broader estate.

A focus on efficient delivery has also led to innovative PPP contracts which aggregate several smaller scale assets on an attractive economic scale. This portfolio approach to infrastructure procurement has enabled governments to deliver multiple projects in a single contract, driving enhanced standardisation as well as corresponding quality and value for money benefits. A recent example includes the Western Australian Schools Project, where the Macquarie Capital-led EduWest consortium was awarded a contract to finance, construct and maintain eight new primary and secondary schools over a 25-year period.

GOOD FOR GOVERNMENTS AND INVESTORS

In an era of high urban population growth, the PPP model will continue to play an indispensable role in project and service delivery, particularly as governments continue to operate in a fiscally constrained environment. The renewed focus on services, rather than asset construction, will ensure that public funds are used to pay for 'value-for-money' solutions rather than inputs that may not ultimately deliver on intended outcomes. For investors capable of rising to the challenge, the growing size, complexity and diversity of PPP transactions signifies an abundance of new and exciting opportunities on the horizon.

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FIXING TRANSPORT INFRASTRUCTURE MEANS MEASURED IMPROVEMENT

Brendan Lyon | Chief Executive Officer – Infrastructure Partnerships Australia

Infrastructure is the new black – every politician wants to promise it - every voter wants to use it - and every economic indicator says we need it. But behind that highest-level of agreement, the infrastructure debate is increasingly discordant and deeply balkanised.

The heavy political pall over state infrastructure projects and privatisations has been further complicated by the Turnbull Government's surprise (and very last minute) rejection of both bidders for the NSW electricity grid.

This state and now national political uncertainty reflects the absence of community consensus about the way forward, in part because we do not clearly understand many of the infrastructure problems that need to be fixed – or the fiscal and regulatory reforms needed to enable them.

In transport infrastructure, while easy references to "evidence-based decision making" remain strong, beyond unsophisticated discussions about project BCRs, we do not actually measure much, instead relying on our historical approach of "decision-based evidence making," to a very large degree.

WHAT CAN BE MEASURED, CAN BE FIXED

Australia invests many tens of billions in transport infrastructure each year – but we don't routinely measure the effectiveness of either the capital programme, or the overall function of the transport system.

Rather, we focus the debate squarely on whether a BCR on an individual project, rather than a series of projects across the network, is above or below one. While this debate is healthy, only measuring the value of inputs neglects a more meaningful process of measuring whether journey quality, costs and time is improving, or falling.

WE'RE ALL FROGS, AND THE WATER'S GETTING PRETTY WARM

The words 'productivity' and 'competitiveness' have been mentioned tens of thousands of times in the press in recent times – but there is no regular measurement of the cost and performance of the transport network underpinning the economy.

While our measurement of transport network performance is non-existent, we do know from some external measures that infrastructure performance has been declining in Australia.

Across the past two decades, Australia has fallen from the fifth most competitive economy in the world to the 21st, with the decay in enabling economic infrastructure singled out by the World Economic Forum as a key factor in Australia's decline.

The ABS has already shown that Australia's productivity spike through the 1990s and early 2000s has slowed, stalled and now reversed.

There was a 0.7 per cent annual decline in productivity between 2005 and 2011, as compared with a 2.4 per cent increase between 1993 and 1999.

For transport specifically, the recent BITRE update found avoidable congestion costs nationwide will be between \$27 billion and \$37 billion by 2030. IA published an even higher estimate of \$53 billion by 2031 in its 2015 Australian Infrastructure Audit.

With national economic performance in freefall, congestion stripping up to \$53 billion a year and with governments funding circa \$55 billion of investment this year, it seems illogical that we don't measure performance of the transport network – or analyse the value of the new investments we make, ex post.

Better informing the debate about budget and regulatory reform could only be helped by routine measures that show the community that we are all frogs, and the water is getting pretty warm. Good information and good evidence are the best way to force public policy back to the fundamentals.

If you were being unkind, one could almost suspect we don't produce this information, because the answer is bad and getting worse.

WHAT CAN CANBERRA ADD TO A CITIES AGENDA?

For its part, the Turnbull Government has correctly identified cities as a policy focus this term. Capital cities drive 80 per cent of GDP and 70 per cent of employment, so it's logical that any national economic agenda will necessarily focus on making cities work.

But this is a hard issue for a national government to address well.

The Federal Government is, both by deliberate constitutional design and by practical effect, far removed from the realities of urban infrastructure.

Indeed, it is unlikely that Canberra will have much value to add on areas like land use planning or infrastructure delivery, beyond high level principles.

CANBERRA SHOULD FOCUS ON A MEASURED RESPONSE

Beyond 'City Deal' grants for regional sports stadiums and the wider narrative about Commonwealth leadership on cities, finding a useful and meaningful role for Canberra in urban infrastructure – beyond providing cash to states - remains an elusive outcome.

Perhaps, given the obvious national impact of struggling cities, Canberra might be well placed to develop a national measurement system that can benchmark the performance of urban infrastructure between Australia's cities – and between Australian cities and our global competitors.

Better information would also allow better assessment of how new infrastructure performs – and make states more accountable for network performance, rather than signature projects.

It is very hard to treat a disease without a diagnosis – and it's time we began to develop the metrics that will allow us to track actual performance over time.

Federal, state and local governments already harvest a wealth of statistics concerning water, waste, energy, transport and health infrastructure services - but it often remains uncollated data, rather than useful information.

With a Federal Government keen to talk 'cities', but without any practical power or experience in urban policy, the Federal Treasurer should task the Productivity Commission to develop a 'dashboard' of measures that tracks the performance of infrastructure networks in Australia's major cities.

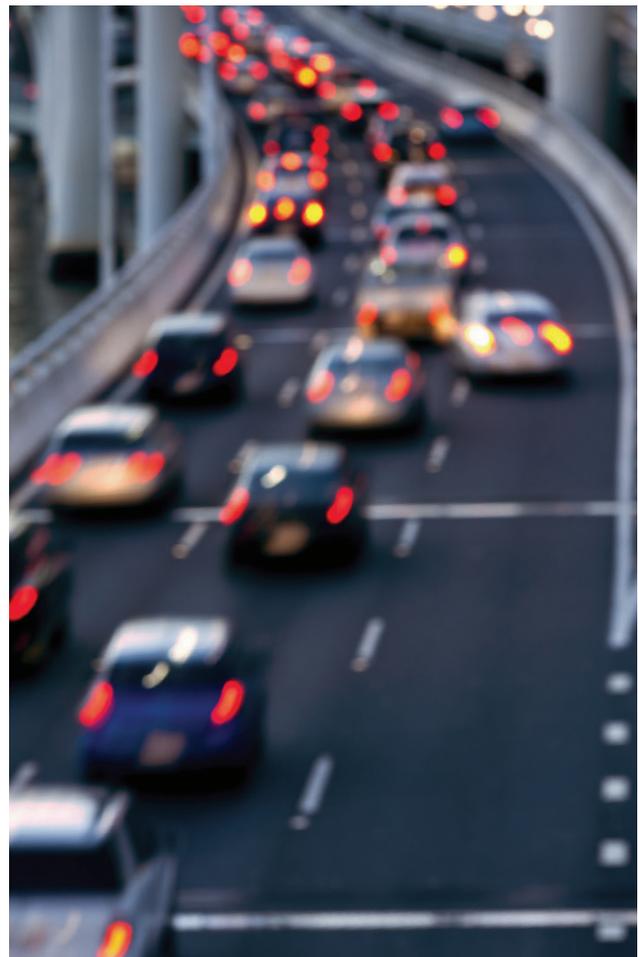
A dashboard that measures city-wide economic and social indicators – as well as sector-specific indicators such as congestion on road networks, or the efficiency of waste and water systems - would allow governments and the public to consistently track the performance of cities - and the success or otherwise of policymakers in addressing these challenges over time.

If these independently developed benchmarks were routinely published, it would make visible where infrastructure is performing well, and where it is not.

Tracking the efficiency of cities would also allow for a much more reasoned discussion around integration between and across asset types and jurisdictions.

And it would make the problems much more obvious to the public – and could well serve to force infrastructure policy back to real discussions about the hard changes needed – like privatisations and structural reform to infrastructure markets.

Measuring the decline will allow the community to focus on the reality that things cannot get better, if they stay exactly the same.



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TRANSFORMING MELBOURNE'S RAIL NETWORK



Major investments in transport infrastructure, such as the Metro Tunnel, level crossing removals and high capacity rolling stock, lay the foundation for a highly liveable and well-connected city.

New and upgraded infrastructure will provide a significant passenger capacity uplift across the network. As a result of the Metro Tunnel investment, 39,000 more passengers will be able to use the rail network during each peak period.

METRO TUNNEL

The \$10.9 billion Metro Tunnel, funded by the Victorian Government, will transform the way people move around Melbourne, with 'turn up and go' rail services and improved access to key economic precincts.

The Metro Tunnel will create a new end-to-end rail line from Sunbury in the west to Cranbourne/Pakenham in the south-east, with high capacity trains and five new underground stations. Twin nine kilometre tunnels will deliver a new dedicated pathway through the heart of the city for two of Melbourne's busiest rail lines, allowing more train services to run in and out of the CBD.

Two CBD station connections at Melbourne Central and Flinders Street Station will allow passengers to seamlessly interchange with Metro Tunnel services, while key medical, educational and employment hubs at Parkville and Domain will be connected to rail for the first time. The investment in a new station at Arden will also be a catalyst for significant urban renewal in the Arden-Macaulay precinct.

The economic case for the investment in public transport is strong with a Metro Tunnel Benefit to Cost Ratio of 1.1, which increases to 1.5 when wider economic benefits are included.

The project will be delivered as an integrated program of works. The Tunnel and Stations package has been released to market as an availability Public Private Partnership (PPP) and will be financed through a combination of state capital contributions and private sector debt and equity. An Alliance procurement approach is underway for the Rail Systems package for signalling, communications and related systems, and the Rail Infrastructure Alliance package for portal and corridor works will go to market in 2017.

Subject to the necessary planning approvals, early works will begin in 2017 with major works commencing in 2018. The Metro Tunnel is expected to be operational in 2026.

HIGH CAPACITY ROLLING STOCK AND SIGNALLING

Victoria is moving ahead with Australia's first roll-out of advanced high capacity signalling on an existing network. High capacity signalling will be installed on the Sunbury and Cranbourne/Pakenham line and the new cross-city tunnel created by the Metro Tunnel project, meaning more services can run closer together.

Victoria's *Rolling Stock Strategy: Trains, Trams, Jobs: 2015-2025* is delivering 65 High Capacity Metro Trains, freeing up more trains across the network.

Together with the removal of nine level crossings on the Cranbourne/Pakenham line, the rebuilding of five stations, and new power and signalling infrastructure, the new trains will boost capacity on the rail corridor by more than 40 per cent. More trains means fewer cars on the roads, helping to tackle congestion.

Passenger safety will be improved with international-style platform screen doors built in the Metro Tunnel's five new underground stations, enabled by the new signalling and dedicated fleet of next generation trains.

The rolling stock is being procured as an availability PPP and includes long-term maintenance in a new dedicated train maintenance facility and stabling yard. The contract structure incorporates flexibility for future rolling stock and maintenance requirements.

The 455 carriages will have a minimum of 50 per cent local content to enable local companies to invest in facilities, new technology and sustain local high-skill manufacturing.

LEVEL CROSSING REMOVALS

Over the next eight years the Level Crossing Removal Authority will oversee the removal of 50 dangerous and congested level crossings across Melbourne.

The Victorian Government allocated \$2.4 billion in its 2015-16 budget to remove at least 20 level crossings by 2018. These sites form the basis of a long-term strategic plan being developed to remove all 50 level crossings by 2022.

Some of these removals are already complete on several sites, and construction has commenced on many others, with planning and early consultation underway for the delivery of the entire project.

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SERVICING AUSTRALIA'S LEADING ECONOMY



The Hon Gladys Berejiklian MP | NSW Treasurer and Minister for Industrial Relations

The NSW Government is the nation's leader when it comes to finding new and innovative ways of providing quality services to its customers.

Our citizens rightly expect high quality services from Government where and when needed.

We have always worked hard to improve government delivery models and worked closely with the non-government sector to find innovative ways of delivering better services to our citizens and customers, whether that be through Public Private Partnerships (PPP), social impact investment, service provider contracts or infrastructure contracts.

The latest chapter in improving service quality is the Government's new Commissioning and Contestability Unit (CCU). Delivering on the NSW Government's State Priority to improve services, the unit will put government service delivery under the microscope to identify innovative opportunities to improve quality, efficiency and value for citizens.

The CCU will improve government services by exploring delivery models within government, NGO and private sector providers.

The CCU will work with government agencies to test the efficiency and effectiveness of current service delivery, and identify opportunities for improvement.

The CCU will then partner with agencies to design, source and deliver services that are better and more accessible for customers. Best practice learnings and principles will be applied consistently by the CCU across government to ensure outcomes are positive and that service delivery is of the highest quality.

The CCU will offer expertise for government agencies to draw on at each stage of the programme – from scoping to execution. Similar programmes overseas, such as in the UK, have been highly successful in improving the delivery of a range of government services.

The NSW Government's Data Analytics Centre (DAC) is another ground breaking initiative set up to drive better decision-making and policy outcomes.

The DAC will provide a central platform for information sharing and data analytics across multiple government

agencies. This will ensure greater strategic, timely and evidence-based decision-making leading to better policy outcomes.

We have also delivered better social outcomes through social impact investment. The most recent social impact investment will be used to target parolees with the aim of reducing the rate of reoffending and re-incarceration.

The investment will support a new programme, OnTRACC (Transition Reintegration and Community Connection), which will work with up to 3,900 parolees over five years to prevent reoffending and re-incarceration. This is the third social impact investment in NSW, following the Newpin Social Benefit Bond (SBB) and The Benevolent Society SBB implemented in 2013.

The Social and Affordable Housing Fund (SAHF) is another innovative service delivery approach, which is designed to deliver a more diversified, flexible, innovative and contestable social housing system. The dedicated fund will facilitate new social and affordable homes to support vulnerable households.

This outcomes-focused model has been developed in consultation with Infrastructure Partnerships Australia (IPA) and the NSW Council of Social Service (NCOSS) and aims to foster partnerships between NGOs, landholders and the private sector.

I was pleased to recently announce that nine parties were shortlisted to develop proposals to tap into the SAHF, which will deliver an additional 3,000 social and affordable homes in its first phase and slash waiting lists for vulnerable families.

The NSW Government is committed to ensuring our citizens have access to high quality services and infrastructure. Building on our strong track record of successfully engaging with the non-government and private sectors, we will continue exploring and implementing best practice partnerships to deliver on this commitment.

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THE AUSTRALIAN RENEWABLE ENERGY SECTOR: A TAIL WIND WITH THE SUN SHINING

Mark Clover | Head of Renewable Energy, Project and Export Finance – ANZ

Katharine Tapley | Head of Sustainable Finance Solutions (Acting) – ANZ

The development of the Australian renewable sector has been shaped by government policies in response to concerns about climate change, energy independence and economic stimulus. Most significantly, the introduction of the Renewable Energy Target (RET) by the Federal Government in 2001 mandated obligations for large energy users to draw from renewable sources of energy generation and ultimately created a market for tradeable Large Scale Generation Certificates (LGCs).

One notable example of renewable energy project development is the Macarthur Wind Farm in Victoria, at 420MW, it is Australia's largest operating windfarm. Developed as a joint venture between AGL and Meridian, Macarthur was completed in January 2013. ANZ led and underwrote the financing of Meridian's 50 per cent, with participation by the Danish Export Credit Agency. Since then both joint venture partners have sold their equity and the debt has been successfully refinanced.

The renewable energy development pipeline slowed in 2014 as the Federal Government conducted a lengthy review into the RET. The subsequent bipartisan political support for the revised RET has reinvigorated investor confidence in the sector. The revised RET target is forecast to require at least A\$10 billion of new renewable investments¹, equating to an estimated 6,000MW of new renewable generation by 2020.

State governments have also positively influenced the development of the sector by setting their own renewable energy targets and initiatives. Most notably, the ACT Government has increased its legislated renewable target from 90 per cent to 100 per cent of total energy production by 2020. The ACT's recent solar and wind reverse auctions provided some certainty for investors during the Federal Government's extended RET review process. The offtake provided from these auctions has supported the development of up to 720MW in new capacity across several new wind farms.

The ACT reverse auction process also supported the development of the Royalla Solar Farm, which at 20MW was Australia's first non-recourse financing of a large-scale solar plant. With Spain's Fotowatio Renewable Ventures (FRV) as developer and ANZ acting as co-lender, Royalla utilises 81,600 photovoltaic modules and has paved the way for further large-scale solar projects.

Recently, the Victorian Government announced its own state-based renewable energy target of 25 per cent by 2020, moving to 40 per cent by 2025. These targets are

to be achieved via an auction scheme (wind and solar) to be released later in 2016. This is estimated to require up to 5,400MW of new capacity over the next nine years, providing a further significant future pipeline of development opportunities.

Renewable energy represented eight per cent² of total Australian energy generation in 2003-04, increasing to almost 15 per cent³ in 2013-14. Under released Federal and State Government policies, it is estimated that renewables will represent 37 per cent of electricity generation capacity by 2030.⁴

Given the long-term investment horizon of large-scale renewables of 20-30 years, projects have been underpinned by long-term offtake arrangements with strong counterparties – Macarthur was supported by a 25-year offtake agreement with AGL, Royalla a 20-year feed-in-tariff with the ACT Government via ActewAGL. Such arrangements have become less available given oversupply of electricity in the market, out-of-the-money positions of historical contracts, and the mismatch of tenor with shorter dated consumer contracts. This, along with the current RET end date in 2030, is requiring energy retailers, developers, equity and debt financiers to consider new and innovative ways to facilitate investment in the growing renewables pipeline.

One such innovation is green bonds. Green bonds have emerged as an alternative form of debt capital to transition towards a low-carbon economy and satisfy institutional investor demand for a competitive return whilst meeting Environmental and Social Governance (ESG) mandates. A green bond is essentially a 'normal' bond with a specific 'use of proceeds' clause which earmarks proceeds for projects with positive environmental and/or climate benefits.

Globally, the green bond market has demonstrated strong and consistent growth and is emerging as a credible means to raise capital for, and invest in, new or existing projects with positive climate benefits. The green bond

1. 2015 Clean Energy Australia Report 2015.

2. 2011 Australian Energy Update

3. 2015 Australian Energy Update

4. Bloomberg New Energy Finance, New Energy Outlook 2015: Asia-Pacific

5. Bonds and Climate Change: the State of the Market in 2016

6. <http://www.cleanenergyfinancecorp.com.au/media/feature-articles/files/australias-budding-green-bond-market.aspx>

7. <http://www.cleanenergyfinancecorp.com.au/media/feature-articles/files/australias-budding-green-bond-market.aspx>

8. <https://www.environmental-finance.com/>

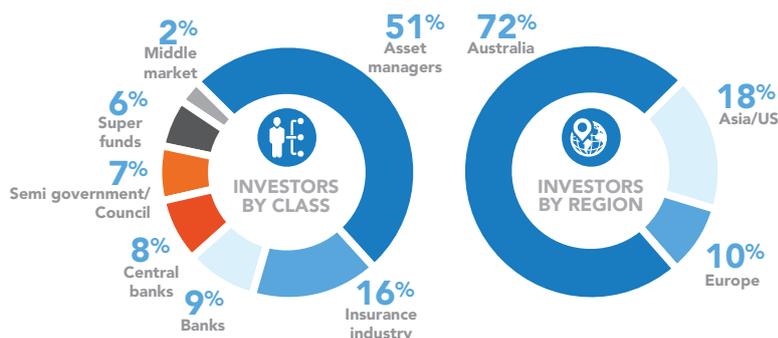
STATE OF THE AUSTRALIAN GREEN BOND MARKET

Which institutions are issuing bonds?

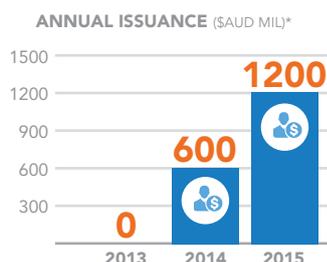
50%
OF BONDS ARE ISSUED BY INTERNATIONAL DEVELOPMENT BANKS

50%
OF BONDS ARE ISSUED BY DOMESTIC COMMERCIAL BANKS

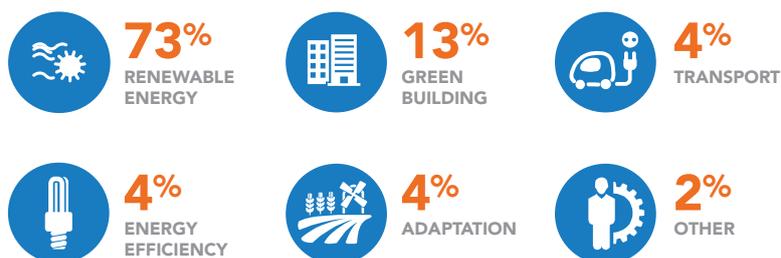
Who is buying Australian green bonds?



What is the size of the market?



What is the Australian green bond market financing?†



* AUD denominated bonds targeted at Australian investors, † Estimated breakdown of which sectors issuers have allocated funds to.

This information is based on data from the issuance of the KfW Kangaroo Green Bond; ANZ Green Bond; NAB Climate Bond and World Bank Kangaroo Green Bond. Clean Energy Finance Corporation, June 2015

market has grown exponentially from US\$3.1 billion (A\$4 billion) in 2012 to US\$118 billion⁵ (A\$155 billion). In Australia, the green bond market is still in its infancy with A\$1.2 billion issuance to date, primarily in the renewable energy, green buildings and transport sectors.⁶ To date, issuance in the Australian market has been dominated by domestic commercial banks and international development banks with a recent issuance by the Treasury Corporation of Victoria which marks the inaugural green bond from any Australian state government.⁷ This issuer base is expected to continue to diversify with growing interest across the public sector and amongst corporates looking to issue green bonds to finance low-carbon projects. ANZ has been a leading issuer within the Australian green bond market, launching its inaugural

green bond for A\$600 million in May 2015, then still the largest climate-related bond by an Australian issuer. Of note, ANZ's green bonds have outperformed similarly rated five year bonds issued on the same day, reflecting recent research indicating a premium on green bonds in the secondary market.⁸

Currently, over 70 per cent of Australian green bonds are earmarked to fund renewable energy projects, with 18 potential wind and solar projects across Australia benefitting from green bond finance. Given the growing renewable energy pipeline, the rapidly emerging Australian green bond market will be integral in providing an alternative source of capital and an enhanced investor base.

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FUTURE TRANSPORT NETWORKS

Michele Huey | Group General Manager, Strategy – Transurban

Globally the transport sector is experiencing the largest revolution since the invention of cars. Disruptions such as driverless and electric vehicles and technologies that integrate transport modes are accelerating the digitalisation of the sector and fundamentally changing the way we move around our cities.

These disruptions and the opportunities they bring are not five or 10 years away, they are happening now and have been building for some time.

Just 17 years ago, CityLink opened in Melbourne and at the time was one of the most technologically advanced roads in the world. Today, CityLink may look more or less the same as any other road to most drivers but the technology underpinning the infrastructure has been constantly developing and expanding to optimise traffic flow and create a better and safer experience for drivers.

Transurban's road networks in Australia and the United States now have more than 500 kilometres of optic fibres connected to 100,000 pieces of technology and safety systems. These intelligent transport systems incorporate coordinated ramp metering, lane use management systems, variable speed limit signs, CCTV cameras and travel time information; and have improved safety and efficiency across our road networks.

By introducing these kinds of systems on CityLink, we have seen average speeds at peak times increase and this in turn has allowed 20 per cent more cars to travel in each lane, which is equivalent to adding more than half a lane to the motorway through technology alone. In addition, the installation of automated incident detection systems has allowed us to improve the time it takes to clear an incident by more than 30 per cent.

Roadside systems are also generating significant amounts of information about travelling conditions and road operators are using increasingly sophisticated data analytics capabilities to help inform traffic operations and customer service. It is about smart data in, smart data out, and presents a host of new opportunities in the way road operators interact with vehicles, roadside systems and customers.

Transurban recently completed a proof of concept that showed by using data from traffic and control systems as well as other sources such as weather information we were able to predict the likelihood of accidents occurring with a high level of accuracy.

We are now applying this information to our real-world traffic management practices and the proactive use of real-time messaging to ensure drivers stay alert.

In the near term, road operators will be able to better connect and integrate communications, control, and information processing across all aspects of transportation systems. This will extend to the vehicle, infrastructure and driver or user with applications in inter and intra vehicular communication, smart traffic control, smart parking, electronic toll collection systems, logistic and fleet management, vehicle control, and safety and road assistance.

We need smart infrastructure to support the smart vehicles that are emerging and will soon be widespread on Australian roads. The automotive industry is confident that we are just five to 10 years away from driverless vehicles being on the market with mass adoption predicted to occur in the 2030s.

Once humans are taken out of the driving equation, the impacts will be far-reaching. The number of crashes is predicted to drop by 90 per cent once autonomous vehicles reach critical mass, which will have a considerable impact on addressing the 1.3 million fatalities and 50 million serious injuries worldwide each year.

Autonomous vehicles also offer significant potential to improve the efficiency of road networks through vehicle platooning, which allows them to travel closely together in a slipstream using sensors and vehicle-to-vehicle communications to accelerate and brake simultaneously.

Advances in autonomous vehicles and the technologies underpinning ride and car sharing, electric vehicles and integrated transport platforms are not simply the outcome of ambitious technology companies. Global trends such as growing population and increasing urbanisation have led to unprecedented levels of traffic congestion in many cities.

At the same time we are facing a worldwide backlog in infrastructure that the OECD estimates runs into the trillions and a traditional funding source for many

jurisdictions – fuel excise – is rapidly diminishing as we move to more fuel efficient cars. The need to find better, smarter and more efficient ways to move around our cities is critical. Technology plays a vital role in the solution but so does policy reform.

With demand projected to far exceed supply when it comes to road network capacity, we will need to consider the potential for pricing signals to help manage demand. Additionally, with the increasing take-up of fuel efficient

and electric vehicles, moving to a funding system that is not so reliant on fuel excise is a challenge governments will need to quickly address.

Australia must move to a fair and sustainable funding system that is based on a principle of those who benefit pay. This will allow us to manage and use transport infrastructure more efficiently and make the most of the opportunities the transport revolution will bring.



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DEALING WITH THE BANANAS

Tony Shepherd | IPA Patron

A democratically elected government with an overwhelming majority has included a project as a priority in its election campaign. The project is supported by the opposition and surveys show the project enjoys wide community support. The Government proceeds with the project in accordance with stringent planning laws. Following extensive investigations, including traffic studies, the government publicly releases a detailed business case for the project that demonstrates a significant benefit to society. This business case is reviewed by two respected and independent bodies, Infrastructure NSW and Infrastructure Australia.

Welcome to WestConnex – Australia’s largest ever infrastructure project.

Then war breaks out. After months of abuse, misinformation and vandalism from the self-righteous few, the Council Administrator appoints a Senior Council, at ratepayer expense, to frustrate the Government in the legitimate pursuit of its policy objectives. It would be Monty Pythonesque if it were not such a serious affront to democracy and commonsense. Welcome to modern Australia, or should I say modern western democracy, which is increasingly showing signs of decay as it turns on itself and throws rationality out the window.

Everybody wants infrastructure but nobody wants it built near them. The ‘Not In My Back Yard’ (NIMBY) has morphed into the BANANA – ‘Build Absolutely Nothing Anywhere Near Anything or Anyone’.

Thank heavens our resources sector is located mainly in remote parts of Australia otherwise this stalwart of our economy would be much smaller and we would be in deep economic trouble.

Governments have two options. They can back off, build nothing and kick the can down the road. This is increasingly the stance of modern western governments on contentious issues such as economic and budget reform. It gets them elected but when the chickens come home to roost it is the poor and the dispossessed who inevitably suffer.

In the case of WestConnex it is the people and businesses, small and large, who will suffer directly.

Of course we will all suffer if the economy of NSW and the nation is strangled by inadequate transport.

The alternative for government is to stand by its principles, invest more upfront in community consultation and use modern communication techniques to engage with

affected communities and more broadly, the wider community, which will benefit from the investment. The Government must also remain resolute in the pursuit of its goals. Even if they disagree, the community will respect a Government which has a clear and well-articulated picture of what it is seeking to achieve and sticks to its guns. Any sign of weakness or vacillation by government merely encourages the vocal minority.

Modern propaganda techniques which were developed last century and rely on flooding all media and the fact that if you tell an untruth often enough and with great conviction you will eventually convince the majority. The anti- groups have learnt this lesson well using the megaphone of inexpensive and ubiquitous social media.

Social media and the internet have revolutionised modern campaigning and have provided legitimate, convenient and cheap national platforms to proselytise and to organise. The naysayers have been far better at adapting to the new technology. Governments and business need to lift their game in this facet of community engagement and consultation. Social media needs to be monitored as it is an early warning of emerging community concerns and issues. It can also be used to rapidly disseminate information.

The first rule in project communications is to ensure the community has timely and early advice on what you are planning and why. The “why” is vital because it encapsulates the benefits to the community and to the economy. The local impacts, both short and long-term, must be honestly disclosed together with explanations of how any adverse effects will be attenuated. I cannot overstate the need for a website which is easy to use, interactive and up-to-date at all times. You need to build a database of interested and impacted parties.

Of course, traditional media, advertising, mail outs and good old fashioned face to face door knocking cannot be

ignored. Television and radio in particular remain vital to any communications strategy. We live in a time-poor world with most parents working. News and information usually comes with our entertainment. In some cases like The Project and Q&A, it is entertainment.

Another tried and proven technique is face to face engagement with community groups. The problem with some modern community groups and public forums is you may need a thick hide and a loud voice to cope with the abuse and invective. However engagement will always win you points because most Australians still cringe at bad manners. Progress Associations, Lions and Rotary Clubs, Parents and Citizens Associations and volunteer groups are a great way to communicate and get feedback from community minded people.

The buzz word is "consultation". Unfortunately some take that to mean "informing". The true meaning also includes "listening". Some of us have a strong transmitting diode but a weak receiving diode. For a big project it is impossible to take into account the objections of every single person but you can quickly build a list of the major issues concerning the community and seek to deal with each of them. There may not be a lot of flexibility in an already optimised design, but there can be more flexibility in construction and operation.



I have worked on projects where we have cut the height of buildings and put in parks and community facilities while community leaders have given us support on other less contentious parts of the project. Hours of construction work can be an issue for the locals, and in modern civil engineering a lot is done to reduce the impact. On one project the locals agreed to extended working hours on the basis that the period of excavating would be reduced by three months. This grassroots consultation from construction contractors and principals is vital. Consultation must be readily accessible, friendly and constructive.

Like me, some people love the smell of wet cement and asphalt in the morning. Once work is underway local communities and schools in small groups should be given organised access to the site when it is safe to do so and not disruptive to the work. People are fascinated by large projects and there is a lot to learn on a well-organised site visit. A tunnel breakthrough is pure theatre.

Property acquisition is a very sensitive issue. Your home is your castle until somebody knocks on your door and says sorry we are taking it. Government cannot be too generous and too caring in compulsorily acquiring property. Not only should fair compensation be paid for the property but also for the disruption, cost of moving and social dislocation. We should recognise that on all projects, property acquisition is kept to a minimum and is a last resort. It is the main driver for using far more expensive tunnels. However one must feel for the people who lose their home and the government should be compassionate and generous in compensation and assistance.

Another truism is the need for a whole of government approach. Coordination within and across government is vital. Inter-agency jealousies must be avoided as they invariably impact negatively on public perception. Ministers and Members must show leadership and use every opportunity to promote a project and its benefits. Failure to do so indicates to the community that the Government is not fully committed.

Major projects in the modern era are increasingly difficult to deliver. However this should not dissuade government. Rather government should invest more in up front community consultation and take full advantage of modern communication techniques. There is light at the end of the tunnel. Once infrastructure is delivered the community as a whole invariably enjoys and supports it.

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RENEWABLE ENERGY MOVES INTO THE MAINSTREAM

Mark McDermott | Associate – Macquarie Capital

John Pickhaver | Co Head of Infrastructure, Utilities & Renewables Australia New Zealand – Macquarie Capital

Australia is experiencing a resurgence in renewable development activity. New opportunities for investors and lenders in the sector are being facilitated by government policy and rapid technological change, amid an environment of new risk allocations and significant investor appetite.

The industry reached a significant watershed in 2015, when global investment in renewable generation exceeded investment in traditional thermal and hydro generation for the first time. This has been driven by landmark multilateral agreements and global policy developments on climate change, coupled with technological advancements and cost reductions.

A RENEWED COMMITMENT TO EMISSIONS REDUCTION IN AUSTRALIA

For several years, uncertainty surrounding government energy policy has constrained renewable energy investment in Australia. That changed in June 2015 with the Federal Government's announcement of a revised Renewable Energy Target (RET) of 33TWh of generation by 2020, or approximately 23.5 per cent¹ of total generation. State governments and other bodies have also implemented their own initiatives to complement the RET and further boost renewables investment. This assurance has caught the attention of conventional infrastructure investors, driving an increased focus on the Australian renewable energy market.

Given Australia's flat energy demand growth², meeting this target will require almost all new investment in energy generation to be in the form of renewables. Factoring in time for construction and commissioning, approximately 6GW of capacity – roughly the equivalent of 25 new wind farms – needs to be built in the next 18 months³, at an estimated cost of over \$12.5 billion⁴. Put another way, Macquarie estimates that most of the prospective wind farms with existing development approval will need to be built in order to meet the RET.

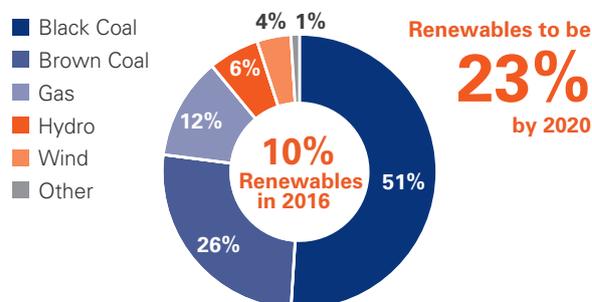
To satisfy their renewable obligations, energy retailers are once again entering into Power Purchase Agreements (PPAs), providing the necessary long-term certainty to create mainstream investment opportunities for infrastructure investors and project financiers. However, as retailers seek to offset increased competition by operating less capital-intensive business models, traditional PPAs for the life of the project – which are accounted for as a liability on the off-taker's balance sheet – are increasingly

being replaced by shorter duration contracts, requiring investors to take on merchant risk. The 240MW Ararat wind farm, the first to be project financed in Australia under this risk allocation model, reached financial close in June 2015 with Macquarie acting as sole financial adviser.

EMERGENCE OF LARGE-SCALE SOLAR

Of course, wind is not the only option for meeting the RET. However, with the exception of Tasmania, where abundant water resources are harnessed through hydroelectric power, almost all of Australia's large scale renewable energy investment to date has been in the form of wind. Moving forward, large scale solar is expected to play a growing role in Australia's energy mix.

With one of the world's highest levels of solar irradiance, **GENERATION BY FUEL TYPE: AUSTRALIA NATIONAL ELECTRICITY MARKET**



Source: AEMO: NEM Historical Market Information Report 2015

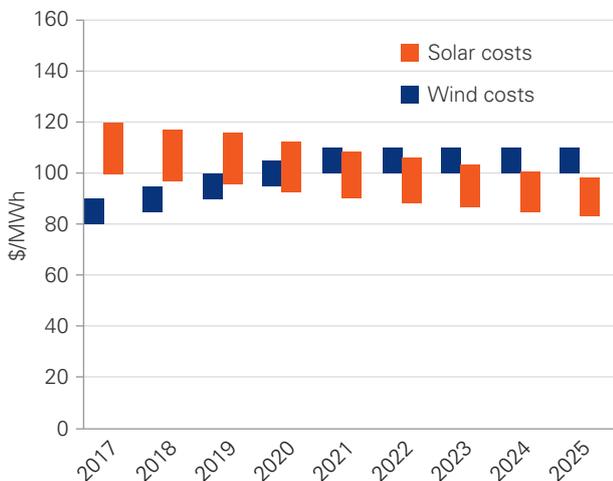
Australia also has the world's highest uptake rate of residential rooftop solar installations⁵. This deployment was driven by government incentives and the lure of 'off grid' energy generated behind the meter, eliminating grid and distribution costs. However the relatively high cost of large scale solar installations compared to other forms of wholesale generation has led to slow uptake to date, with only a handful of large scale (>1MW) solar developments, all of which have benefited from some form of government assistance in addition to the RET.

1. Renewable Energy Target (RET) Scheme, Australian Government, June 2015
2. National Electricity Forecasting Report (NEFR) 2016, Australian Energy Market Operator
3. Assuming an average project size of 200MW
4. Estimating \$2.1m/MW in capital costs and a capacity factor of 34%

5. Renewable Energy in Australia: How do we really compare?, Australia Energy Council, June 2016
6. Ten big trends in solar, wind and storage to watch out for in 2016, reneweconomy.com.au, December 2015
7. Renewable Energy Integration in Power Grids, IRENA Technology Brief, 2015
8. Australia's options for emissions abatement, Bain, April 2016
9. Australian Power Generation Technology Report, CO2CRC, April 2016

As technological advances and increasing production efficiencies drive down the cost of panels, this cost imbalance is forecast to change. Solar's 'Levelised Cost of Energy' (LCOE, a measure that seeks to compare energy sources over the whole life of the project), is expected to become cheaper than wind by 2020, with significant implications for the industry.

COST CONVERGENCE: LEVELISED COSTS OF WIND AND SOLAR



Source: Origin Energy FY2015 Financial results presentation

Compared to wind, solar's relatively straightforward installation, flexibility of location, elimination of complex transmission connections (by locating close to the transmission network) and reduced environmental impact should see a rapid uptake of large scale solar once the cost inflection point is reached. Developers are readying themselves for this event, with several GW⁶ of potential sites with development approval.

Solar proponents are typically less well capitalised than wind farm developers due to the reduced barriers to entry for solar development, and will likely require substantial third party long-term equity capital to bring these projects to fruition.

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IN SEARCH OF A STORAGE SOLUTION

Renewable energy sources such as wind and solar are by their very nature intermittent. An interim solution to this intermittency is the use of supplementary gas fired power plants that can achieve peak load in a very short space of time. In the medium to long term, energy storage is expected to provide a more sustainable solution. Examples of energy storage technologies include pumped-storage hydro, compressed air energy storage, electric batteries, flywheels, chemical storage and thermal storage⁷.

Although battery storage has seen rapid cost decreases and capacity improvements in recent years, reliable grid-scale batteries are not expected to be commercially viable until 2030⁸. In the US, Macquarie has invested \$US200 million (A\$267 million) in Advanced Microgrid Solutions, a battery based energy storage solution aimed at improving grid-solar integration and voltage management. Investments like this, together with competition from the manufacturing powerhouses in China, will accelerate the commercial viability of storage technologies.

COST CONVERGENCE BETWEEN RENEWABLE AND TRADITIONAL ENERGY SOURCES

CO2 Commonwealth Research Centre (CO2CRC) research has forecast that LCOE for renewable energy sources such as solar and wind will converge with the cost of traditional thermal generation such as coal and gas by 2030⁹, thereby eliminating the need for government policy to drive investment. Cost reductions will be driven by increasing economies of scale, more competitive supply chains, technology improvements that will raise capacity factors (a measure of efficiency) and reduced installation costs.

This combination of technological advances, an increasingly favourable policy climate and cost convergence between renewable and traditional energy resources will continue to create opportunities in Australia and globally, cementing renewables as a mainstream infrastructure investment allocation.

NORTHCONNEX: CONNECTING SYDNEY MOTORWAYS

Tim Orpen | Project Director – NorthConnex

The NorthConnex project is the construction of twin nine-kilometre tunnels under Pennant Hills Road, linking the M1 Pacific Motorway at Wahroonga to the Hills M2 Motorway at West Pennant Hills.

The nine-kilometre tunnel motorway is Australia's longest road tunnel and includes interchanges to the north and south to accommodate connections at either end of the tunnels.

The NSW and Federal governments, Transurban and the M7 Westlink shareholders will build, operate and maintain the tolled motorway. A Lendlease Bouygues Joint Venture (LLBJV) won the competitive tender to design and construct the project in 2014. This team has introduced a range of innovative safety and construction measures that establish NorthConnex as one of Australia's leading infrastructure projects.

SHAFT EXCAVATION

Four main compounds have been established along the tunnel alignment to provide access for machinery, equipment and personnel below ground. These entrance sites – the Northern Interchange, Trelawney Street, Wilson Road and Southern Interchange compounds contain portals and vertical shafts at various depths.

The shafts are being excavated through a combination of controlled blasting and traditional excavation. The deepest part of the NorthConnex tunnel is at Wilson Road, where the tunnel will be around 90 metres deep in order to pass under the Sydney Metro Northwest tunnel at Beecroft. Over half the tunnel is more than 60 metres deep – about the height of the Sydney Opera House.

TUNNELLING

A total of 19 roadheaders will be used to excavate the 22 kilometres of tunnel and cross passages. The first roadheader arrived on site in April 2016 and a new roadheader will be deployed every few weeks until February 2017.

Excavation by roadheader rather than Tunnel Boring Machine (TBM) is considered the most suitable option due to the profile of the tunnel, as well as the geological attributes of Sydney sandstone and shale. The roadheaders selected for the project also work better in confined spaces and create less spoil for evacuation.

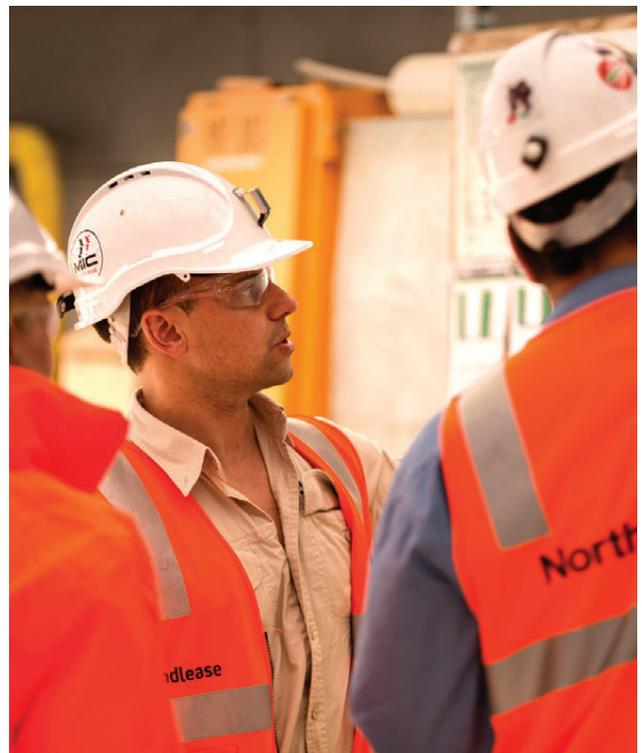
The roadheaders have been procured from Sandvik in Austria and Mitsui in Japan and are easily assembled.

Tunnelling with the first two roadheaders commenced at the Southern Compound on the mainline tunnel and the ramp onto Pennant Hills Road in April 2016, with further roadheaders continuing the excavation towards Wilson Road.

The first roadheader to start tunnelling at the Northern Compound began in June 2016 once the 45 metre deep vertical shaft was completed. The Northern Interchange will provide direct connection with the M1 Pacific Motorway and the tunnel for both north and southbound motorists.

It is expected all roadheaders will be fully operational by February 2017 and once they have all commenced on site, NorthConnex will have the most roadheaders used on one road project in Australia.

Underground work (including fit out and mechanical and electrical installation) will continue until the project reaches the anticipated completion date in December 2019.





INNOVATION IN SAFETY

The project is employing state-of-the-art technology for on-site management and safety systems including the introduction of a full Wi-Fi system underground, which will be the first employed on an underground road project in Australia. The Wi-Fi system will allow engineers and specialists to gather information and complete inspections of the tunnel via tablets and smartphones, significantly minimising the amount of time they need to spend underground and improving safety, data flow and productivity.

As an example, the Wi-Fi system will be used by geologists to complete geo-mapping of the underground environment. Cameras fitted out at various locations in the tunnel will capture video footage of ground conditions for use by the team above ground.

Another new innovation on site is the Plant Proximity System which eliminates the risk of a worker coming into contact with a moving machine. Sensor-based braking technology will be employed to either stop or slow machinery to avoid any unnecessary contact with ground personnel.

The same technology will also be used to run the 3D Safety System, developed to track onboarding and management

of personnel and plant via staff access cards, complete with QR reader. This smartcard system will also be used to ensure workers can only access areas that match their level of skill and training. This system will also be used to locate personnel in the case of emergencies.

The challenge of the confined space has also spurred another first for an Australian infrastructure project with the introduction of a high-angle conveyor system to move the spoil from deep below the ground to the surface. Instead of using the traditional method of gantry crane and kibble, three high capacity conveyor systems will move most approximately 2.3 million cubic metres of excavated spoil up the shafts, some of them only 12 metres by 15 metres wide. This is the first time this technology will be used in an infrastructure project in Australia and is crucial in ensuring the muck away of the spoil is timely and efficient.

FIND OUT MORE

When complete in 2019, NorthConnex will link Sydney's north to the Orbital network and form part of the National Highway route. NorthConnex will also boost the state and national economies by provide more reliable journeys and short travel times for the movement of freight.

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A NEW ERA OF PUBLIC TRANSPORT IN THE NATION'S CAPITAL

Emma Thomas | Director-General, Transport Canberra and City Services

We all know investing in infrastructure is essential to stimulate the economy. Stepping forward into our second century, we are on the cusp of building great things; revitalising the city; attracting investment and generating local jobs in the ACT. With the recent investment in light rail, the ACT is all set to meet the demands of a growing city which is estimated to house almost 500,000 people in Canberra by 2032.

Although an original part of Walter Burley Griffin's plan, attempts throughout the decades to build a light rail network in Canberra have always been halted, until now.

Since the creation of the Capital Metro Agency in 2012 (now part of Transport Canberra), the light rail project has achieved a number of significant milestones, from the release of the Business Case and a call for Expressions of Interest from international and national consortia, to appointing the successful consortium and facilitating financial close. At the time of writing this article we are on the brink of starting major construction work to bring the first stage of a potential city-wide light rail network to life. The 12-kilometre light rail line, connecting Canberra's CBD to Gungahlin, which is one of the fastest growing regions in Canberra, will commence operations in late 2018.

This is an exciting time for Canberra. We are building one of the largest infrastructure projects in the ACT's history and changing the way we use public transport forever. To do this we are partnering with a world class consortium, Canberra Metro, under a Public Private Partnership (PPP). As one of the first PPP projects for Canberra, and with no existing light rail system, our partnership with Canberra Metro will allow us to draw upon the expertise and technical infrastructure knowledge of a high-class consortium. Delivering the project through a PPP also allows us to spread the cost of the project over a 20-year period.

Delivery of a light rail network in Canberra has been as much about informing the community of its merits as it has been preparing for the start of construction. In order to demystify and increase awareness around the project and the PPP delivery model, we have been transparent throughout the process by engaging with the community.

In line with this commitment, the Capital Metro Stage One Business Case was released in October 2014 outlining the full costs and benefits of the project in both the short and more importantly long term. Much of the community information involves educating the community

about how a PPP model works and how it will deliver the benefits outlined in the Business Case. Our community and stakeholder outreach programmes have allowed us to engage with people to promote the project and combat misunderstanding or concerns on an individual level.

In the 2015-16 financial year, we connected with more than 2,630 people. Also in 2015, we implemented a Place Manager Program to provide residents, businesses and community groups with greater access to the project team. This programme has now been superseded by the Canberra Metro consortium's own community liaison programme to continue the great work. While outreach activities are not unusual in a project like ours, it has been a learning curve for local residents who have not seen as much face-to-face consultation for other projects in the ACT. As the project continues we are also constantly learning and adapting to new ways of communicating to meet the needs of our stakeholders and the community.

Unfortunately, the sentiment of local media reporting remains conflicted; however this isn't unusual in a major and, in Canberra's case, city-changing project such as this. Those who worked on or followed the progress of the first stage of light rail on the Gold Coast would have seen the shift in the local media from negative to positive once operations began, and we are confident we will see this shift once light rail is part of Canberra's landscape and residents and tourists can see the benefit for themselves.

Despite being a tested method of transportation in other parts of the globe, light rail is an innovation for Canberra and will eventually form the spine of an integrated public transport network, working in conjunction with the existing city-wide bus service. The benefit of starting a light rail project from scratch is the ability to immediately introduce new technologies into the service. Where other light rail and tram systems are required to retrofit digital developments and upgrade safety initiatives, there is the opportunity to make these modern features the standard as soon as the system is operational.



One of the innovations of the Canberra light rail project is that the system will run on 100 per cent renewable energy. Earlier this year, the ACT Government legislated new targets for utilising renewable energy sources in a bid to lower emissions by 2020 under the Climate Change Action Plan. The light rail project is already committed to this legislation, and it was part of our requirements that the bidding consortium would conform to this initiative. The Canberra Metro consortium is encouraged to bring innovation to the table to assist in meeting this target over the life of the project. Also, in effect immediately from the start of operations in 2018, there will be a single ticketing system across the light rail and bus networks, real time information, and smart phone apps. We are also developing design details for proposed 'dynamic lighting' at major stops, where various lighting effects may be used for special events or may be linked to the departure or arrival of light rail vehicles.

Through incorporation of local industry participation plan requirements in the contract, the delivery of this project has allowed us to assist the local businesses to create local jobs and study opportunities. Our team created a pathway for civilian students to study Engineering at the Australian Defence Force Academy for the first time, with a view to these skills being more in demand in Canberra's future. The Canberra Metro consortium has already started creating hundreds of jobs during the construction phase, and we have partnered with the Canberra Business Chamber who are assisting businesses make the most of opportunities that the first stage of light rail will provide.

It is such a unique prospect to work on a light rail system from the ground up. As the project continues, I look forward to leading my team to implement emerging technology and other innovative solutions to provide a world class light rail network for Canberra.

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CONTINUING TO DELIVER RECORD INFRASTRUCTURE PROJECTS

Peter Duncan | Chief Executive – Roads and Maritime Services

In the past five years Roads and Maritime Services has delivered record investment in major road infrastructure projects, which have been completed on time and on budget.

NSW is leading infrastructure activity across the country with mega road and rail projects being delivered across the State, with \$27.5 billion allocated to the roads, maritime and freight portfolio alone in the past five years.

This year a record \$9.7 billion budget will continue to drive the ambitious infrastructure delivery task, with more than 4,000 projects to build, manage and maintain the State's road and maritime networks already under way.

Roads and Maritime has delivered on the NSW Government's mandate to deliver multi-billion dollar projects while driving efficiencies, introducing innovative technologies and leveraging off private and public sector partnerships.

We have engaged private sector infrastructure partners and introduced new models and approaches to delivery.

Developing partnerships based on trust and respect, and leveraging off the private sector's capabilities and expertise will continue to play a part in our road infrastructure delivery.

Roads and Maritime Services' 2020 Strategy defines our purpose, values and priorities to meet the NSW Government's goals of delivering quality infrastructure and services to make NSW a better place to live, work and visit.

Safety is paramount for everyone on the network, especially our customers and is embedded in everything we do. It is a value we share with our industry partners as we build and operate the road network.

Partnerships and a focus on safety are visible across major projects such as WestConnex, NorthConnex and the Pacific Highway, as well as other significant freight and regional projects.

For example, the Pacific Complete consortium comprising Laing O'Rourke and Parsons Brinckerhoff will complete the final stages of the Pacific Highway Upgrade by 2020, delivering the final 155 kilometres of 'life saving' dual carriageway between Woolgoolga to Ballina as part of a \$4 billion project.



This new delivery partner model is based on the approach used to oversee construction of infrastructure for the London Olympics and supports collaboration and innovation by bringing businesses, workers, consumers and suppliers together.

It encourages the best ideas and solutions from the private sector while also drawing on knowledge to ensure better engineering and design, customer outcomes and public value.

In addition, Roads and Maritime Services has established five programme offices throughout the State to deliver the largest infrastructure programme in NSW history, including one focused on easing Sydney's congestion.

Investing in new technologies also helps us to meet future demand, tackle congestion and improve journey time reliability.

A great example is the M4 Smart Motorways programme.

This programme will deliver real-time monitoring and management of traffic flows through variable message signs and speed limits, ramp signals and lane use signs.

This technology and approach has been designed to boost performance on a key section of the existing Sydney motorway to deliver safer, more reliable journeys, in advance of future innovations such as autonomous vehicles.

In September, I will be stepping down from my role after more than 40 years in the public sector.

I am proud to have led the Roads and Maritime Services team for the past five years, during a time of great delivery and reform.

I have been fortunate to be part of the team during completion of projects including the Hume Highway duplication, key milestones in the Pacific Highway upgrade, the start of work on the WestConnex and NorthConnex projects, the widening of the M2 and M5 – as well as a host of projects important to local communities across the State.

The introduction of stewardship road maintenance contracts in Sydney also stands out as a key highlight, with joint venture partners delivering better outcomes, safety and efficiencies. Over the next eight years, our partners are set to deliver projects valued at \$2 billion across the Sydney network.

The 2016-17 NSW Budget includes a \$73 billion investment in infrastructure over four years. Roads and Maritime Services is privileged to have a large share of this record investment to deliver 'once in a generation' improvements to the State's road network.

Roads and Maritime will continue to focus on delivering our infrastructure projects on time and on budget, while driving greater performance from the management and operation of the NSW road network, through partnerships, technology and innovation.



For more information please contact:

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TECHNOLOGY: TIME TO DISRUPT OUR INFRASTRUCTURE THINKING



Stan Stavros | National Head, Infrastructure & Projects Group – KPMG Australia

Paul Foxlee | National Sector Leader, Transport & Infrastructure – KPMG Australia

As technology starts to play an increasingly valuable and highly disruptive role in markets, government and society, it has become a powerful source of innovation and renewal for the infrastructure industry.

The problem is, whilst governments and communities can usually identify what infrastructure should be developed and where, the impact of technology on our future infrastructure requirements is often missing from the conversation.

DISRUPTION IS HERE

Five trends reshaping infrastructure planning:

- **Embedding technology:** Embedding technology into infrastructure assets can improve performance, and allow owners to be continually informed of their asset's condition and use;
- **System integration and management:** Optimising infrastructure networks through system integration and management within and across asset classes results in optimal utilisation of existing and new assets;
- **Disruptive technology innovation:** This has the potential to alter both demand and supply dynamics by driving efficiencies and in some cases make existing infrastructure obsolete;
- **Technology impacting how people use infrastructure:** This will drastically impact how people use infrastructure and therefore what infrastructure is needed; and
- **Technology impacting how businesses use infrastructure:** Technology innovation is and will continue to impact how businesses use infrastructure and therefore what infrastructure is required.

PLANNING FOR A NEW WORLD

While the specific impacts of these trends may not be immediately apparent, it is entirely likely that future infrastructure requirements will be dramatically different than they are today.

Two potential visions of tomorrow's world might include:

- the combination of driverless vehicles and the establishment of secondary employment hubs to significantly improve the efficiency of traffic movement and increase capacity of existing roads; and
- advances in eHealthcare combined with innovative

service delivery models that may reduce the requirement for expanding traditional hospital infrastructure.

Unless we carefully consider the impact technology will have on our communities, businesses and society, we run the risk of planning and building infrastructure that is outdated or unnecessary even before it is operational.

RETHINKING REGULATION

Governments increasingly recognise that new technologies have the potential to disrupt the entire business and regulatory model of monopoly services. The transmission and distribution of electricity using 'poles and wires' is a typical example. Solar generation, improved battery storage and the need to charge large volumes of electric vehicles is creating unprecedented uncertainty in the electricity supply sector.

However, to date, regulatory frameworks for infrastructure services have not been designed to address either planned or unexpected service or infrastructure obsolescence. New technologies have the potential to disrupt regulatory paradigms, something that regulatory policy makers have yet to tackle.

SEIZING THE OPPORTUNITY

While there remains uncertainty as to what the future will bring, what is immediately clear is the need to take action to harness the power of technology and recalibrate infrastructure plans and strategies as the world evolves.

Without a commitment to understanding how our infrastructure needs have and will change and a willingness to invest in innovative thinking, we will find ourselves pedalling backwards and investing in projects that will be underutilised in the long term.

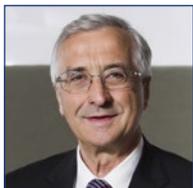
The winners will be those able to adapt and lead improvements and innovation throughout the infrastructure asset lifecycle and drive better outcomes for their communities. Above all, early adoption of technology in infrastructure planning, development and operation will drive the productivity benefits Australia's economy needs.

For more information please contact:

Paul Foxlee E: pfoxlee@kpmg.com.au P: 02 9335 7438 W: www.kpmg.com.au

KPMG partnered with the Chartered Accountants Australia and New Zealand to explore how new technologies will change the way we plan, fund, deliver and operate infrastructure around the world. This article is a summary of the partnership's findings.

SPEAKER PROFILES



ADRIAN KLOEDEN

Chairman | Infrastructure Partnerships Australia

Adrian Kloeden is a non-executive director of Infrastructure Partnerships Australia. He is currently Chairman of Infrastructure Partnerships Australia, Aquasure, Hancock Victorian Plantations and the Serco Asia Pacific Advisory board. He is a director of the Victorian Chamber of Commerce and Industry and The Smith Family. Adrian's management experience covers a wide variety of industries, including forestry, agribusiness, manufacturing, distribution, retail, research and development, brand management, technology, e-commerce, defence and tourism and transport. He has held leadership positions in large and small public and private companies and government related organisation and has operated in many regions of the world. His early education was in Australia where he graduated in science from the Australian National University. He followed this a few years later with a master's degree in business from the London Business School. He also has an Honorary Doctorate from Deakin University.



BRENDAN LYON

Chief Executive Officer | Infrastructure Partnerships Australia

Brendan Lyon is the Chief Executive of Infrastructure Partnerships Australia, the peak infrastructure policy partnership between Australia's Commonwealth & state governments, and the business sector. Joining IPA on its formation a decade ago, Brendan initially led the policy and research team, before being appointed CEO in early 2008. In his role, Brendan also serves on a range of boards, committees and inquiries, currently serving on the Board of Transport for NSW and on the NSW Government's Expert Advisory Panel on social housing reform. Brendan has previously served on major national reviews including COAG's Infrastructure Finance Working Group and the Commonwealth Government's study into High Speed Rail. Brendan is a Member of the Australian Institute of Company Directors and holds a Masters of Business Administration with Distinction. In 2013, Brendan was appointed an Honorary Associate Professor at the Sydney Business School.



THE HON DARREN CHESTER MP

Minister for Infrastructure and Transport

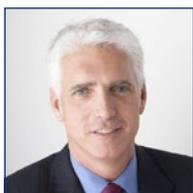
Darren Chester was elected to Federal Parliament as the Member for Gippsland on June 26, 2008, in a by-election following the retirement of the Hon Peter McGauran. He was re-elected in 2010 and served as the Opposition's Shadow Parliamentary Secretary for Roads and Regional Transport as well as being an active member of various Parliamentary Committees until the most recent Federal election. Following a successful campaign in 2013 and the introduction of the Abbott-Truss Government, he was appointed the Parliamentary Secretary to the Minister for Defence. Darren continued as the Assistant Minister for Defence under the new Turnbull Government and in February 2016, was appointed to Cabinet as the Federal Minister for Infrastructure and Transport. Prior to entering Federal Parliament, he worked as a newspaper and television journalist throughout Gippsland and then became Chief of Staff to the Leader of The Nationals in Victoria, Peter Ryan.



THE HON TIM PALLAS MP

Treasurer of Victoria

Treasurer Pallas was elected to the Victorian Parliament in 2006 and is the state member for Werribee. Following the election of the Andrews Labor Government in November 2014, he was appointed Treasurer. Previously Treasurer Pallas served in the Bracks and Brumby Governments as Minister for Roads and Ports, and later added Major Projects to his responsibilities. As Minister for Roads he oversaw the M1 Upgrade, the construction of the Deer Park Bypass and Geelong Ring Road, completed the upgrade of the Calder Freeway to improve links to Bendigo, and was responsible for commencing the Peninsula Link project on the Mornington Peninsula. In the Major Projects portfolio, he was responsible for big ticket items like the development of AAMI Stadium, the Melbourne Convention and Exhibition Centre, as well as the Melbourne Recital Centre and Melbourne Theatre Company's theatre.



SCOTT CHARLTON

Chief Executive Officer | Transurban

Scott Charlton joined Transurban Group as Chief Executive Office in 2012. Mr Charlton has more than 25 years' experience in developing, funding, constructing, and operating infrastructure assets, working with some of the sector's leading corporations including Lend Lease, where he was Chief Operating Officer for global operations (2010 to 2012). Prior to this he was Chief Financial Officer at Leighton Holdings and a Managing Director of Deutsche Bank. Mr Charlton is an engineer by training. He is deputy chairman of Infrastructure Partnerships Australia, a board member of Roads Australia and a member of Monash Industry Council of Advisers and the Business Council of Australia.

SPEAKER PROFILES



PHILIP DAVIES

Chief Executive Officer | Infrastructure Australia

Philip Davies is the Chief Executive Officer of Infrastructure Australia, with a mandate to provide independent expert advice to all levels of government on infrastructure policy and planning. Mr Davies is an experienced infrastructure executive who has had over 25 years shaping policy, delivering nationally significant infrastructure projects, and leading reform within the infrastructure sector. Before joining Infrastructure Australia, Philip led AECOM's Infrastructure Advisory business in Asia Pacific providing government and private sector clients with infrastructure advisory services. He is a Chartered Engineer and a Fellow of Engineers Australia.



KEVIN DEVLIN

Chief Executive Officer | Level Crossing Removal Authority

Kevin is the Chief Executive Officer of the Level Crossing Removal Authority and is responsible for overseeing the planning and delivery of Victoria's Level Crossing Removal Project, the Mernda Rail Extension and the Hurstbridge Rail upgrade. Kevin has extensive experience delivering engineering projects in both the public and private sector. Working on a broad range of contractual models and across the full lifecycle of projects. Prior to his current role, Kevin has held a number of senior positions including Executive Project Director for the East West Link, and Project Director for the Middleborough Road Rail Grade Separation and the West Gate Bridge Strengthening projects which received Victorian Engineering Excellence Awards in 2007 and 2011 respectively. The West Gate Bridge Strengthening was also awarded the Engineers Australia, 2011 Australian Engineering Excellence Award.



CHRIS ECCLES

Secretary | Victorian Department of Premier and Cabinet

Chris Eccles was appointed Secretary of the Victorian Department of Premier and Cabinet (DPC) in December 2014. As Secretary, Mr Eccles leads the Department and the Victorian Public Service in advising the Premier and the Government of Victoria. Chris was previously Director-General of the New South Wales Department of Premier and Cabinet from 2011 to 2014, and Chief Executive of the South Australian Department of Premier and Cabinet from 2009 to 2011. Chris also has previous experience in Victoria's DPC, having held the positions of Deputy Secretary, Sector Improvement Group and later Deputy Secretary, National Reform and Climate Change Group from 2007 to 2009. Prior to joining Victoria's DPC, Mr Eccles worked in a variety of government and private sector senior management positions.



DAVID GONSKI AC

Chairman | ANZ

David Gonski is Chairman of the Australia and New Zealand Banking Group (ANZ) and Coca-Cola Amatil. Mr Gonski is also Chancellor of the University of New South Wales, President of the Art Gallery of NSW Trust, and Chairman of the UNSW Foundation. He is also a member of the ASIC External Advisory Panel and the board of the Lowy Institute for International Policy, a Patron of the Australian Indigenous Education Foundation and Raise Foundation, and a Founding Panel Member of Adara Partners. He was previously a member of the Takeovers Panel, Director of Singapore Airlines, the Westfield Group and Singapore Telecommunications, Chairman of the Australian Securities Exchange, the Guardians of the Future Fund, the Australia Council for the Arts, the Board of Trustees of Sydney Grammar School and Investec Bank (Australia).



FREDERICK G HILMER AO

Emeritus Professor | AGSM, UNSW

Professor Fred Hilmer has held a number of leadership roles in industry and academia, including heading McKinsey's Australian practice, Chief Executive of Fairfax, Dean of the Australian Graduate School of Management and most recently President and Vice Chancellor of UNSW. He has also served as Chair, Deputy Chair and Director of major public companies. Professor Hilmer also chaired the National Competition Policy Inquiry, which reported in 1993, and provided the framework and approach to competition policy in Australia, as well as in a number of other jurisdictions. Since that time he has been an active writer and commentator on competition policy. His contributions in these fields were recognized by the award of Officer of the Order of Australia in 1998. Professor Hilmer is currently based at the Australian Graduate School of Management at UNSW.



MARGARET JACKSON AC

Chairman | Spotless Group

Margaret Jackson is Chairman of Spotless Group Holdings Limited and Ansett Aviation Training Limited. She is also a Director of the Prince's Charities Australia, The Melbourne Symphony Orchestra and a member of Monash University's Industry Council of Advisors. Margaret has also served as Chairman of Qantas, FlexiGroup Ltd, the Victorian Transport Accident Commission, and a Director of The Broken Hill Proprietary Company Ltd, The Australia and New Zealand Banking Group Limited, Pacific Dunlop Limited, John Fairfax Holdings Ltd, Billabong International Ltd, Telecom Australia and former partner KPMG in Peat Marwick's Management Consulting Division and BDO Nelson Parkhill. Awarded Companion of the Order of Australia in the General Division (AC) in June 2003 for service to business in diverse and leading Australian corporations and to the community in the area of support for medical research, the arts and education. Awarded the Centenary Medal in 2001 for service to Australian society in Business. Margaret holds an Honorary Doctorate of Laws from Monash University.



CRAIG MICHAELS

Director, Sovereign and Public Finance | Standard & Poor's Rating Services

Craig Michaels is a Director in the Sovereign and Public Finance Ratings group at Standard & Poor's Ratings Services. Based in Melbourne, Mr Michaels is the lead analyst for sovereign credit ratings for Australia, New Zealand and other Pacific countries, as well as ratings on a number of Australian and New Zealand sub-sovereign governments. Prior to joining Standard & Poor's, Mr Michaels was a Senior Economist at ANZ Banking Group, with a focus on the Australian economy and financial markets. Before this, he was a Senior Economist at the Victorian Treasury in Melbourne, responsible for economic and revenue forecasting, economic modelling, and providing microeconomic policy advice.



TERRY MORAN AC

Former Secretary of the Department of Prime Minister and Cabinet

Terence Francis Moran AC was Australia's most senior public servant, from 2008 to 2011, as the Secretary of the Department of the Prime Minister and Cabinet. His current roles include: Chair, Barangaroo Delivery Authority in NSW; Senior Adviser, Boston Consulting Group; CEDA Governor; Chair, Cranlana Program; Chair, Melbourne Theatre Company; and Chair Centre for Policy Development. Mr Moran spent his early career as a public servant in the Commonwealth and Victorian Public Services, with roles including Chief Executive Officer of the Office of the State Training Board in Victoria, Chief Executive Officer of the Australian National Training Authority in Brisbane. In August 1998 he became Queensland's Director-General of Education. Mr Moran was appointed Secretary of the Department of Premier and Cabinet for the State of Victoria in July 2000 and held this position until his appointment as Secretary of the Department of the Prime Minister and Cabinet in 2008. On 26 January 2012, Mr Moran was named a Companion of the Order of Australia (AC) for his contributions as a public sector leader.



BRIAN NEGUS

General Manager Public Policy | RACV

Brian Negus is General Manager Public Policy for RACV where he is accountable for market and technical research to formulate policies and initiatives addressing a broad range of safety, mobility and community needs across the transport sector. The Department advocates for and is the public face for these issues on behalf of the RACV's 2 million members. Mr Negus was formerly the Deputy Director of Public Transport with the Victorian Department of Transport for three years and previously held the position of Metropolitan Regional Director with VicRoads, Victoria's state road authority for eight years. Prior to this, Brian worked across many areas of the transport sector, including ITS implementation, transport project delivery and policy formulation. Mr Negus is the President of Intelligent Transport Systems Australia (ITSA) and represents ITSA on the ITS World Congress Board.



PETER REGAN

Chief Financial Officer and Deputy Secretary, Finance and Investment | Transport for NSW

Peter is the Chief Financial Officer and Deputy Secretary, Finance and Investment at Transport for New South Wales. He is responsible for ensuring strong financial management across the cluster of NSW Government agencies involved in the provision of road and public transport assets and services, as well as identifying and acting on commercial and financing opportunities to support the significant investment in Transport infrastructure currently underway in NSW. Peter has over 20 years of experience in infrastructure and project financing in both Australia and the UK, with a particular focus on the transport industry. He has a strong track record of delivering innovative outcomes through efficient use of public and private sector capital and expertise, and in the effective delivery of strategic priorities. Prior to joining Transport for NSW, Peter has performed senior roles at NSW Treasury, Sydney Motorway Corporation, Transport for London and Deutsche Bank.

SPEAKER PROFILES



RODD STAPLES

Program Director, Sydney Metro | Transport for NSW

Rodd Staples leads the team which is delivering Sydney's new, fully automated rapid transit network. The first stage of the programme is the \$8.3 billion Sydney Metro Northwest from Rouse Hill to Chatswood which is on schedule and due to open in 2019. Work is also well underway on the next stage, Sydney Metro City & Southwest, which will extend the network beyond Chatswood under the harbour and through the CBD to Sydney's south west. This second stage will provide much needed additional stations in the CBD and relieve congestion across the broader rail network. Rodd has worked in the fields of transport and infrastructure planning for nearly two decades – across Australia and in both the public and private sectors. His qualifications in engineering and finance provide the strong foundations required to deliver a program of works on this scale.



TONY SHEPHERD AO

Patron | Infrastructure Partnerships Australia

Tony is Chairman of Macquarie Specialised Management Limited (a global infrastructure fund), the Sydney Cricket Ground Trust and ASTRA (the subscription TV Association). He is also a Director of Virgin Australia International Holdings Limited, and an advisor to Lendlease and the Bank of Tokyo Mitsubishi UFJ. Tony has had an extensive career in Australia and overseas in the private and public sectors. He pioneered private infrastructure with projects such as the Sydney Harbour Tunnel, Melbourne City Link and East Link and a range of power stations, water treatment plants, railways and light rail. He was the inaugural Chairman of WestConnex. He oversaw the listing of Transurban, Transfield Services and Connect East. Tony was President of the Business Council of Australia and Chairman of the National Commission of Audit.



EMMA THOMAS

Director-General | Transport Canberra and City Services

Emma Thomas is the Director-General for Transport Canberra and City Services (TCCS) and brings extensive experience in both the commercial and public sectors, including major infrastructure projects, particularly transport infrastructure. Prior to leading TCCS, Ms Thomas was the Director-General of the Capital Metro Agency, delivering Canberra's first stage of light rail. Prior to this, she was the State Rail Commissioner for South Australia and Deputy Chief Executive of Public Transport. Previous experience also includes senior executive roles at Transport and Main Roads Queensland and Boeing.



CHRISTOPHER VOYCE

Executive Director, Co-Head Infrastructure, Utilities & Renewables, ANZ | Macquarie Capital

Christopher Voyce is the Co-Head Infrastructure, Utilities & Renewables, ANZ for Macquarie Capital and was previously a Senior Managing Director for the New York infrastructure team, heading the Transport and PPP practice for North America. Christopher has over 18 years of experience in infrastructure and PPPs. Mr Voyce has closed over \$50 billion in infrastructure financings, fund raisings and acquisitions for a range of clients in the utilities, airports and road and rail transportation sectors in Australia, Asia, Europe and North America.



BENJAMIN WYATT MLA

Shadow Treasurer of Western Australia

Ben Wyatt MLA is the current Western Australian Shadow Treasurer, as well as the Shadow Minister for Indigenous Affairs, Native Title and Cost of Living. He was elected to the Legislative Assembly in a by-election held in March 2006. Mr Wyatt previously worked as a Barrister and Solicitor, and served as Counsel for the Director of Public Prosecutions in Western Australia. He has also served on the National Board of Indigenous Business Australia, and as an officer in the Australian Army graduating from the Royal Military College, Duntroon, in 1996. Mr Wyatt was awarded the Australian Defence Medal in 2008 and was the Town of Victoria Park's Young Australian of the Year in 2001.



Creating pathways to productivity

Macquarie Capital is helping governments build
the foundation for Australia's future prosperity

Investing in essential infrastructure is crucial to Australia's continuing competitiveness. Macquarie Capital is working with governments across the region to address the challenges of financing, delivering and managing new infrastructure and infra-like services. From the WA Schools PPP to the ACT Law Courts project, our recent roles reflect the diverse strengths of Macquarie's advisory team and the evolving infrastructure market.

From innovative transaction structures and strategies to maximize returns from asset securitisations, to financing solutions for new projects, Macquarie is committed to providing innovative and comprehensive solutions for governments. As adviser, developer or financier, we're helping to forge Australia's future.

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