

Modelling of potential policy reforms

*Infrastructure
Australia*

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Our report has been limited to estimating the economic impacts of several policy reforms proposed by IA. The direct impacts applied in the modelling for each of the reforms have been collaboratively developed by PwC and IA and are based on findings of literature reviews, publicly available material and discussions with industry experts. The broad nature of the modelling is such that the results are intended to be indicative only.

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Executive summary

Infrastructure Australia (IA) is recommending reforms to the energy, telecommunications, transport and water sectors that will enhance Australia's productivity over the next 15 years and beyond. A group of significant market reform recommendations, which form part of the 2016 Australian Infrastructure Plan prepared by IA, has been modelled by PwC in order to estimate the increase in economic activity associated with the reforms.

The reforms considered in this analysis were:

In the energy sector:

Recommendation 6.4: All governments should transfer their remaining publicly-owned electricity generation, network and retail businesses to private ownership. Public ownership of commercial businesses, including monopolies in well-regulated markets, distorts outcomes, stifles competition and harms consumers. Priorities include:

- All remaining retail and generation businesses in public ownership should be prepared for sale, including Snowy Hydro
- Queensland, Western Australia, Tasmania and Northern Territory should begin the process of explaining the need for reform to the community, with a view to divesting all electricity network assets. New South Wales should articulate a pathway to a full sale as soon as practically achievable following the partial lease process currently underway.

Recommendation 6.5: Governments, through the COAG Energy Council and the Australian Energy Market Commission, should introduce more flexible network tariffs in the near term.

Governments should publicly renew their commitment to this reform and work with relevant bodies to communicate the consumer benefits of a more flexible tariff arrangement.

Recommendation 6.7: Australia's electricity and gas market should move to full retail price deregulation as soon as practically possible. To support this:

- Where price deregulation has not occurred in the retail electricity market, the Australian Energy Market Commission should provide advice and a pathway for removing price regulation
 - The Australian Government should undertake a review to identify ways to increase competition in the retail gas market (consistent with the *Harper Review*).
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In the telecommunications sector:

Recommendation 6.9: NBN Co should be privatised into an appropriately regulated market in the medium term. In the near term, the Australian Government should commission a scoping study to assess the most appropriate approach, structure and timing to deliver a privatised NBN model. The scoping study to assess the most appropriate approach and structure for a privatised NBN should include options to efficiently support delivery of NBN services in regional and remote areas that are non-commercial.

In the water sector:

Recommendation 6.10: Governments should define a pathway to transfer state-owned metropolitan water utility businesses to private ownership to deliver more cost-effective, customer-responsive services. That pathway will:

- Implement policy and institutional reforms to promote competitive neutrality in advance of privatisation, including full cost recovery pricing and commercial rates of return on capital
- Introduce independent economic regulation, with the potential for the regulatory framework to be set nationally to avoid perceived conflicts of interest
- Apply uniform drinking water quality and environmental regulation.

These reforms should be delivered within five years.

In the transport sector:

Recommendation 6.13: Australia should seek to transition the revenue and funding framework for roads to be consistent with other utility networks by establishing a corporatised delivery model. A regulated asset base approach provides a strong framework to achieve this outcome. As part of the broader public inquiry into road funding reform (see Recommendation 5.3 below), the Australian Government should direct a body like Infrastructure Australia or the Productivity Commission to:

- Research the merits of a corporatised model for Australia’s road network(s) to establish a reform pathway over the medium term
- Evaluate and define the pathway to establish the corporatised road fund model in jurisdictions, including provisions for hypothecation of existing taxes and charges to support the delivery of transport infrastructure in advance of the introduction of user charging.

This work should be delivered in tandem with heavy vehicle charging and investment reform.

Recommendation 5.3: The Australian Government should initiate a public inquiry, to be led by a body like the Productivity Commission or Infrastructure Australia, into the existing funding framework for roads and development of a road user charging reform pathway. The public inquiry should consider:

- Flaws in the existing charging framework – including fairness, financial sustainability and economic efficiency
- The optimal approach for road user charging and transport infrastructure funding in Australia
- The social implications of charging reform, including transitional and distributional impacts of replacing current taxation with direct user charges
- A detailed reform pathway for transition to a full user pays model for roads covering the whole network and all users.

A public inquiry into road user charging reform should be supported by large-scale voluntary trials of road user charging options, funded by the Australian Government.

Recommendation 5.4: Federal, state and territory governments should commit to the full implementation of a heavy vehicle road charging structure in the next five years. This reform should include the removal of all existing registration and usage charges under the PayGo model and the introduction of supporting regulatory and investment frameworks.

Recommendation 5.5: Federal, state and territory governments should also commit to the full implementation of a light vehicle road charging structure in the next 10 years. This reform must include the removal of all existing inefficient taxes – including fuel excise and registration charges – and the development of supporting regulatory and investment frameworks.

Recommendation 6.14: Governments should adopt a default option of exposing public transport services to contestable supply through franchising. The focus of reform should be to improve customers’ experience by exposing delivery to contestable supply and selecting the best operator to provide services. Private operation of public transport through time limited, exclusive franchises – where providers compete to deliver services – is a proven model both in Australia and overseas in raising service quality and value for money for customers. It should be the default option for public transport provision, with capital city bus and rail services as immediate candidates for franchising.

After reviewing local and overseas experience to understand the potential direct impacts on the sectors subject to these reforms PwC and IA agreed the following ‘shocks’ would be applied in an economy-wide modelling of the impacts. The shocks applied are an indicative estimate of the possible impacts that might be achieved under such reforms. In some cases, the details of the reforms are yet to be specified (e.g. congestion pricing) and so the assumptions applied are necessarily broad. For this reason, the cost of reform has not been explicitly included in the modelling; however the benefits of reform that have been modelled are intentionally conservative.

In regard to IA’s recommendations on privatisation, it is not the change in ownership *per se* that results in benefits but the change in incentives and practices that markets apply to businesses that enable more efficient allocation of resources. Assumptions were also made about the timing of the impacts; more difficult reforms were generally assumed to occur later. Where relevant, assumptions have been aligned with previously published IA analyses.

Table 1: Summary of direct impacts applied by sector

Sector	Sub-sector	Estimated Direct Impact	Comments
Energy	Generation	Between 1.5% and 1.8% capital productivity improvement for the coal, hydro and gas generation sectors	From 2017, build up over 5 years. Applied to government-owned generators in QLD, NSW, VIC, SA and TAS.
	Networks	15% operating cost saving to the electricity supply sector	From 2017, productivity gains build up over 5 years. Applied to government-owned networks in QLD, NSW, WA, TAS and ACT.
	Retail	5% reduction in NSW gas prices, 5% for QLD electricity prices and 10.5% for WA electricity prices	From 2017, gains build up over 5 years. Applied to larger markets that are not deregulated: NSW for gas, and WA and QLD for electricity.
Telecommunications	National Broadband Network	5% total factor productivity gain	From 2024, productivity gains build up over 5 years.
Water	Metropolitan water utilities	10% total factor productivity gain	From 2017, builds up over 10 years and staggered by state/territory starting with NSW to allow for a slower path of improvement due to the sector being relatively less reformed than other sectors.
Energy, Water and Telecommunications	Government owners	0.15% borrowing cost saving leading to a capital productivity gain for new government investments	Starting from the first year assets are sold, the relevant government gains a capital productivity equivalent to 0.15% of the value of assets sold.
Transport	Heavy vehicles	10% productivity improvement to road transport sector	From 2021, productivity gains build up over 5 years.
	Rest of fleet	15% reduction in the cost of congestion delays to various service sectors using roads	From 2028, productivity gains build up over 2 years.
	Public transport	35% productivity improvement to passenger rail and bus sectors	Shock applied to government-operated rail is 20% in the first round of franchise and 15% in the second round. Each franchise contract is 12 years. Rollout is staggered so it commences in NSW in 2018; QLD in 2019; and WA in 2020. Shock applied to government-operated bus is 20% in the first round, 10% in second round and 5% in third round. Each franchise contract is 7 years. Rollout is staggered so it commences in NSW in 2017; QLD in 2018; and VIC in 2019.

Note: An explanation of the reasons for the choice of these direct impact and timing assumptions is provided in Chapter 3 and 4.

Source: Infrastructure Australia, PwC.

Applying these assumptions results in a gross domestic product (GDP) increase above baseline of \$27.2 billion in 2031, and \$39.0 billion in 2040 (see Table 2). On average, the package of reforms equates to increased GDP per capita of \$1,151 or increased GDP per household of \$2,936 in 2040. These are one-off impacts. GDP is higher every year as a result of the reforms.

Table 2: Impact of reforms on GDP in 2031 and 2040

Indicator	2031	2040
GDP in baseline	\$2,766,837m	\$3,485,144m
Increase in GDP above baseline	\$27,169m	\$38,956m
Projected population	30.438m	33.854m
Increase in GDP per capita above baseline	\$893	\$1,151
Projected number of households	11.752m	13.267m
Increase in GDP per household above baseline	\$2,312	\$2,936

Note: Values are in 2015-16 dollars.

Source: Australian Bureau of Statistics, 3236.0 - Household and Family Projections, Australia, 2011 to 2036, Released 19 March 2015, Series III; Australian Bureau of Statistics, 3222.0 - Population projections, Australia, 2012 to 2101, Released November 2013; PwC IFEM, November 2015; PwC analysis.

The results presented in Table 2 are preliminary estimates of the gross benefits of the broad reforms identified by IA and will need to be refined as more precise plans for reform are developed over time. Any actual changes would need to go through a formal assessment process that should involve a cost-benefit analysis expanding on this report's analysis by considering net economic benefits of specific reform proposals in detail.

Abbreviations

Acronym	Description
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AER	Australian Energy Regulator
BITRE	Bureau of Infrastructure, Transport and Regional Economics
CAPEX	Capital expenditure
CBD	Central Business District
CGE	Computable General Equilibrium
COAG	Council of Australian Governments
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CWW	City West Water
DNISP	Distribution network service provider
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortisation
FY	Financial Year
GDP	Gross Domestic Product
GSP	Gross State Product
GST	Goods and Services Tax
IA	Infrastructure Australia
IFEM	Intergenerational Fiscal and Economic Model
IPART	Independent Pricing and Regulatory Tribunal
MW	Melbourne Water
NBN	National Broadband Network
NPV	Net Present Value
NSW	New South Wales
NT	Northern Territory
NTC	National Transport Commission
OPEX	Operating expenditure
PAYGO	Pay-as-you-go
PPP	Public Private Partnerships
PC	Productivity Commission
PV	Present Value

Acronym	Description
PwC	PricewaterhouseCoopers Australia
QLD	Queensland
RAB	Regulated Asset Base
SA	South Australia
SEW	South East Water
TAS	Tasmania
TfL	Transport for London
TNSP	Transmission network service provider
UK	United Kingdom
VIC	Victoria
VURM	Victoria University Regional Model
WA	Western Australia
YVW	Yarra Valley Water

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1 Introduction

Infrastructure Australia (IA) is preparing to present an Australian Infrastructure Plan (the Plan) to the Australian Government in early 2016. The Plan covers four economic infrastructure sectors – energy, telecommunications, water and transport. Although the Plan has a 15 year outlook, it is necessarily being framed with regard to potential developments over the longer term.

The Plan builds upon and responds to the Australian Infrastructure Audit (the Audit), published in May 2015. The Audit identified a number of areas where policy reform will be required, if Australia's infrastructure is to meet the challenges facing the nation. In this regard, raising productivity is a key focus of the Plan.

Accordingly, the Plan includes a series of 'policy reform recommendations'. If implemented, the reforms are expected to raise productivity and increase national economic output.

Hence IA is interested in understanding the:

- economic impact of prospective policy reforms (i.e. the impact on gross domestic product at a national level and on gross state product at a state and territory level)
- economic impacts on Australian households.

PricewaterhouseCoopers Australia (PwC) was engaged to undertake this analysis using economy-wide economic modelling. This analysis has been undertaken by employing assumptions that are necessarily high-level and so the results of the analysis should be viewed as indicative of the possible scale of impact on the Australian economy. The assumptions are therefore conservative. This is an initial assessment of the gross economic benefits of reform intended to identify the broad scale of impacts; it is not a cost-benefit analysis. Further modelling following the development of more specific policy proposals (notably in the transport sector) will be useful to refine the estimates presented here.

PwC's modelling relies on assumptions PwC and IA have made about the direct impacts of the reforms; for example, by how much the costs of congestion can be reduced by the suggested transport sector reform. We have assisted IA by researching possible direct impacts of the reforms and then agreed with IA as to the scale of impacts.

Our modelling approach uses a Computable General Equilibrium (CGE) model, specifically the Victoria University's Centre of Policy Studies dynamic CGE model – the Victoria University Regional Model (VURM). The CGE model is based on Australian Bureau of Statistics input-output data which details the various income and expenditure components that comprise Australia's gross domestic product (GDP). Using this model and PwC's forecast of economic growth out to 2040, we can estimate the deviation in economic output from a baseline as a result of the proposed policy reforms.

This report sets out the findings of this analysis.

The remainder of this report is structured as follows:

- Chapter 2 – describes the proposed reforms that are the subject of the analysis undertaken in this report
- Chapter 3 – summarises the research undertaken into the direct economic impacts that are likely to be experienced in the sectors affected by the reforms
- Chapter 4 – sets out the assumptions applied in the baseline of the model to which the reform scenarios are compared and the assumptions applied in the policy scenarios
- Chapter 5 – documents and discusses the results of the analysis for each of the sectors and in total
- Appendices are included which set out some supporting information relevant to the analysis.

2 Proposed reforms

In order to meet Australia's infrastructure needs, infrastructure policy and governance needs to be reformed. Investment in new projects, while important and necessary, will not be sufficient to support the nation's development. The Australian Infrastructure Plan therefore sets out a number of recommendations aimed at reforming the infrastructure sector. These recommendations are aimed at improving productivity in the Australian economy.

This chapter provides some context to the reforms proposed by IA in order to understand the potential scale of direct economic impacts the reforms may have on each sector.

2.1 Energy

There are two main elements relevant to the energy sector that IA is considering in its proposed reforms: privatisation and deregulation. Each of these are described below.

2.1.1 Privatisation of electricity assets

Some of the electricity generators, transmission, distribution and retail operators in Australia have been privatised:

- Victoria, South Australia and New South Wales have privatised some or all of their electricity generation assets.¹ The remaining generators that are partially or fully government-owned include Stanwell Corporation, CS Energy, Delta Electricity,² Snowy Hydro, Hydro Tasmania and Synergy.
- Victoria and South Australia have sold their networks. These are now run as: Ausnet Services, Powercor, CitiPower, United Energy and Jemena in Victoria, and as ElectraNet and SA Power Networks in South Australia. New South Wales is currently in the process of leasing out 50.4 per cent of AusGrid and 50.4 per cent of Endeavour Energy, while a private consortium that successfully bid for 100 per cent of TransGrid will operate that business under a lease.³ Apart from these examples, many of the electricity networks businesses are government-owned.

IA proposes that those electricity assets remaining in public ownership be sold:

Recommendation 6.4: All governments should transfer their remaining publicly-owned electricity generation, network and retail businesses to private ownership. Public ownership of commercial businesses, including monopolies in well-regulated markets, distorts outcomes, stifles competition and harms consumers. Priorities include:

- All remaining retail and generation businesses in public ownership should be prepared for sale, including Snowy Hydro
 - Queensland, Western Australia, Tasmania and Northern Territory should begin the process of explaining the need for reform to the community, with a view to divesting all electricity network assets. New South Wales should articulate a pathway to a full sale as soon as practically achievable following the partial lease process currently underway.
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¹ Australian Energy Regulator, Industry information, available at www.aer.gov.au/industry-information. Accessed 20 December 2015.

² We note that since undertaking the analysis, Delta Electricity has subsequently been sold by the NSW Government to Sunset Power International.

³ http://www.treasury.nsw.gov.au/electricity_network_transactions Accessed 20 December 2015.

2.1.2 Deregulation of energy retail markets

Most Australian households are able to choose the company supplying their gas or electricity – households that choose their electricity supplier have prices set by a ‘market contract’ whereas, those that choose to remain on a ‘standard contract’ have their electricity prices set by the relevant State or Territory regulator or by the electricity supplier. Markets where regulated electricity prices have been phased out for households include Victoria since January 2009, South Australia since February 2013 and New South Wales since July 2014.⁴

IA’s recommendations are:

Recommendation 6.5: Governments, through the COAG Energy Council and the Australian Energy Market Commission, should introduce more flexible network tariffs in the near term.

Governments should publicly renew their commitment to this reform and work with relevant bodies to communicate the consumer benefits of a more flexible tariff arrangement.

Recommendation 6.7: Australia’s electricity and gas market should move to full retail price deregulation as soon as practically possible. To support this:

- Where price deregulation has not occurred in the retail electricity market, the Australian Energy Market Commission should provide advice and a pathway for removing price regulation
 - The Australian Government should undertake a review to identify ways to increase competition in the retail gas market (consistent with the *Harper Review*).
-

2.2 Telecommunications

NBN Co is a government-owned company with an aim to provide high quality broadband to homes and businesses throughout the country (although different technologies will be used, so some regional areas will have access by satellite rather than fibre optic cable for example). Since its inception in 2009 it was envisaged that government would fund the roll out (through borrowing) and then once NBN Co was operational it would be privatised at some point.⁵

The Vertigan review of the NBN in 2014 recommended promoting competition in the market for telecommunications by:

- ‘breaking up parts of NBN Co to foster long-term competition
- relaxing the rules around how new broadband networks compete with NBN Co and promoting competition in new developments by requiring developers and consumers to meet infrastructure costs
- creating a new regulator for managing access to telecommunications networks across Australia.’⁶

⁴ Australian Energy Regulator, ‘State of the Energy Market 2015’, 2015, p. 131.

⁵ For example, the 2010 Implementation Study recommended that privatisation be done after roll out is complete with flexibility over the timing of the privatisation. Source: The Treasury, NBN – Privatisation, 12 November 2010. Available at: http://www.treasury.gov.au/~media/Treasury/Access%20to%20Information/Disclosure%20Log/2011/Competition%20policy%20and%20market%20structure%20aspects%20of%20the%20NBN/Downloads/R_48_101112_QTB_NBN_Privatisation.ashx Accessed 19 January 2016.

⁶ Department of Communication and the Arts, NBN Market and Regulation Report, October 2014, available at <https://www.communications.gov.au/departmental-news/nbn-market-and-regulation-report> Accessed 20 January 2016.

IA's proposed policy reform responds to the review and is:

Recommendation 6.9: NBN Co should be privatised into an appropriately regulated market in the medium term. In the near term, the Australian Government should commission a scoping study to assess the most appropriate approach, structure and timing to deliver a privatised NBN model. The scoping study to assess the most appropriate approach and structure for a privatised NBN should include options to efficiently support delivery of NBN services in regional and remote areas that are non-commercial.

2.3 Water

Overseas experience suggests that private operation of water utilities can provide a range of cost-saving capital and operational efficiencies, while maintaining or improving service quality. The Plan's recommendation is aimed at securing such efficiencies in the Australian metropolitan water environment.

IA's proposed policy reform is:

Recommendation 6.10: Governments should define a pathway to transfer state-owned metropolitan water utility businesses to private ownership to deliver more cost-effective, customer-responsive services. That pathway will:

- Implement policy and institutional reforms to promote competitive neutrality in advance of privatisation, including full cost recovery pricing and commercial rates of return on capital
- Introduce independent economic regulation, with the potential for the regulatory framework to be set nationally to avoid perceived conflicts of interest
- Apply uniform drinking water quality and environmental regulation.

These reforms should be delivered within five years.

2.4 Transport

IA has developed five reform proposals for road transport, and for public transport. These include two general and two sector specific recommendations for road transport. The fifth recommendation is for public transport and is designed to improve service quality and value for money.

In the road transport sector, IA's principal reforms are aimed at:

- facilitating the development of a transport market through greater application of user charging in the road sector
- providing a more durable funding stream for maintaining and developing the road network
- reducing the cost of congestion, by sending a pricing signal to manage demand on the road network.

In combination, these road transport reforms provide a direct link between usage and supply. This could allow for infrastructure investment that is efficient, responsive to consumer demands and financially sustainable. These market structures provide price signals to users that reflect the cost of supply, and communicate the demand profile back to infrastructure providers.

To support the effectiveness of these reforms, IA recommends changes to the framework for road funding:

Recommendation 6.13: Australia should seek to transition the revenue and funding framework for roads to be consistent with other utility networks by establishing a corporatised delivery model. A regulated asset base approach provides a strong framework to achieve this outcome. As part of the broader public inquiry into road funding reform (see Recommendation 5.3 below), the Australian Government should direct a body like Infrastructure Australia or the Productivity Commission to:

- Research the merits of a corporatised model for Australia’s road network(s) to establish a reform pathway over the medium term
- Evaluate and define the pathway to establish the corporatised road fund model in jurisdictions, including provisions for hypothecation of existing taxes and charges to support the delivery of transport infrastructure in advance of the introduction of user charging.

This work should be delivered in tandem with heavy vehicle charging and investment reform.

To deliver these reforms, IA has identified a need to further develop the policy context for road use charging and funding. This is in line with recommendations made by the Productivity Commission (PC) and other bodies. IA recommends that:

Recommendation 5.3: The Australian Government should initiate a public inquiry, to be led by a body like the Productivity Commission or Infrastructure Australia, into the existing funding framework for roads and development of a road user charging reform pathway. The public inquiry should consider:

- Flaws in the existing charging framework – including fairness, financial sustainability and economic efficiency
- The optimal approach for road user charging and transport infrastructure funding in Australia
- The social implications of charging reform, including transitional and distributional impacts of replacing current taxation with direct user charges
- A detailed reform pathway for transition to a full user pays model for roads covering the whole network and all users.

A public inquiry into road user charging reform should be supported by large-scale voluntary trials of road user charging options, funded by the Australian Government.

2.4.1 Heavy vehicles

Heavy vehicles are charged in two ways through what is known as a pay-as-you-go (PAYGO) model, a system that has been in place since 1995:

- The first is through registration charges, administered and collected by state and territory governments. These account for approximately 40 per cent of charges⁷
- The second is through fuel-based road user charges, administered and collected by the Australian Government, accounting for the remaining 60 per cent. These are calculated by the National Transport Commission (NTC), using the average of the preceding seven years’ road expenditure and vehicle numbers.

This PAYGO system has been criticised as inefficient in a number of reports and studies, including by the PC in 2006 and 2014.⁸ The PC in 2006 summarised the main drawbacks of the existing system:

- ‘Under current institutional arrangements, heavy vehicle road-user charges are set to recover current road spending allocated to heavy vehicles, rather than to fund efficient future levels of road expenditure.’

⁷ National Transport Commission, Heavy vehicles/Charges, available at: <http://ntc.gov.au/heavy-vehicles/charges/>. Accessed 20 December 2015

⁸ Productivity Commission, Road and Rail Freight Infrastructure Pricing, Productivity Commission Inquiry Report No. 41, 22 December 2006; Productivity Commission, Public Infrastructure, Productivity Commission Inquiry Report No. 71, 27 May 2014

- ‘There is no systematic linkage between how charges are set and the revenues they generate, on the one hand, and decisions about desirable future levels of road funding on the other.’⁹

Governments combine revenue from direct road use charges, such as licensing or fuel excise, in consolidated revenue. This weakens the link between demand for roads by heavy vehicles and funding of roads.

Additional concerns with these funding arrangements raised by the PC¹⁰ and IA are:

- Governments may show bias towards projects for passenger rather than freight vehicles, or make non-commercial allocations of funding for political reasons
- Funding for roads is variable year-to-year. Road providers are currently funded through yearly or annual budget processes from state and federal governments. Road providers compete with other government spending priorities, limiting the ability of agencies to consistently plan and respond to changes in demand and technology
- Local governments do not directly receive funding from heavy vehicle registration or fuel excise, but bear the maintenance costs from heavy vehicle use of local roads. Local councils may restrict access to heavy vehicles as a consequence (e.g. in order to protect the condition of individual road assets).

Following on from the PC’s 2006 recommendations, COAG committed to reforming heavy vehicle pricing. Progress with these reforms has been relatively slow, although there has been some movement in the area such as performance-based regulations and the creation of a National Heavy Vehicle Regulator. The Intelligent Access Program has been operational for several years, although take-up by truck operators of the opportunities available under the Program remains modest.

Investment decision-making is probably still not as transparent and consultative as expected by the PC in 2006. In 2014, the PC identified further areas for reform¹¹ and regulators, governments and their stakeholders continue to engage with these issues; the ministerial Transport and Infrastructure Council (TIC) agreed in November 2015 to publish the first editions of heavy vehicle asset registers and the expenditure plans for key road freight routes.¹² The National Transport Commission is also undertaking work in relation to a ‘forward cost base’ that could be used in a future iteration of the PAYGO system (as opposed to the current focus on recovering past expenditures).

Progress on the charging front has been slow, as reflected in the winding up of the Heavy Vehicle Charging Initiative in June 2014¹³ and in the November 2015 decision of transport ministers at the Transport and Infrastructure Council to freeze heavy vehicle charges revenue at 2015-16 levels for an initial period of two years¹⁴. In its response to the Competition Policy Review (the Harper Review), the Australian Government argues that governments are expected to work through the TIC and report to COAG, including on steps to transition to independent heavy vehicle price regulation by 2017-18.¹⁵

In light of these issues, IA’s proposed recommendation is that the system is reformed so that the principle of user pays is more embedded within the road transport sector.

⁹ Productivity Commission, Road and Rail Freight Infrastructure Pricing, Productivity Commission Inquiry Report No. 41, 22 December 2006

¹⁰ Productivity Commission, Public Infrastructure, Productivity Commission Inquiry Report No. 71, 27 May 2014.

¹¹ Productivity Commission, Public Infrastructure, Productivity Commission Inquiry Report No. 71, 27 May 2014

¹² Most of the asset registers and expenditure plans were published in late January 2016.

¹³ Queensland Department of Transport and Main Roads (2015) National heavy vehicle charges, Available at <http://www.tmr.qld.gov.au/business-industry/Heavy-vehicles/National-heavy-vehicle-charges.aspx>, Accessed 19 January 2016

¹⁴ Transport and Infrastructure Council (2015) Communique, Adelaide, 6 November 2015, Available at <http://transportinfrastructurecouncil.gov.au/communique/index.aspx>, Accessed 19 January 2016

¹⁵ Australian Government, Australian Government Response to the Competition Policy Review, November 2015, available at <http://treasury.gov.au/harperreview>. Accessed 11 February 2016

Recommendation 5.4: Federal, state and territory governments should commit to the full implementation of a heavy vehicle road charging structure in the next five years. This reform should include the removal of all existing registration and usage charges under the PayGo model and the introduction of supporting regulatory and investment frameworks.

IA's view of heavy vehicle pricing reform also extends to productivity-enhancing reforms to heavy vehicle institutions and regulation. These reforms support and align with the 'more fundamental reforms'¹⁶ discussed in the PC's 2006 report, including the potential for mass–distance location-based charges for national highways, amongst other options. This reform would apply to heavy vehicles over 4.5 mass tonnes.

2.4.2 Rest of fleet

Currently, owners and users of cars and light vehicles pay fuel excise taxes and road registration fees. The revenue gathered through these sources is not directly linked to the cost of road use. As such, investment in roads is funded through general government taxes, which is the same in the case of heavy vehicles. In addition, congestion is a significant and growing problem in metropolitan areas. IA is recommending that these issues be addressed by the following reform:

Recommendation 5.5: Federal, state and territory governments should also commit to the full implementation of a light vehicle road charging structure in the next 10 years. This reform must include the removal of all existing inefficient taxes – including fuel excise and registration charges – and the development of supporting regulatory and investment frameworks.

There are two components to this impact and that of recommendation 5.3:

- Firstly, a user charge would be introduced. This would enable better allocation of revenues from road users to expenditure on roads. This will allow road expenditure that is currently funded from consolidated revenues to be allocated for other general purposes. In effect, this is a change in the tax collection mix.
- Secondly, some form of congestion charge would be introduced. This would be a comprehensive national plan, addressing congestion in capital cities across Australia. This is expected to reduce congestion, enabling business users to reduce their travel time and hence increase productivity.

The Australian Infrastructure Plan does not specify a particular type of congestion charging, instead recommending that a public inquiry process be used to develop '... a detailed reform pathway for transition to a full user pays model for roads covering the whole network and all users' (see recommendation 5.3). A congestion charge could take the form of an area charge (such as that applied in London) or in another manner, for example by introducing a time of day and location element to a broader network-wide charging regime.

For the purpose of this analysis, it has been assumed that a change in light vehicle charging would commence in 2025. In the case of larger cities, this would evolve to a form of time of day and location charging. For the purposes of the modelling, it has been assumed such charging would commence in 2028.

2.4.3 Public transport

Currently a mixture of private sector and public sector operators run bus, train, tram and ferry services across Australia. Where the private sector has been involved in franchise contracts to operate public transport, there have been efficiency gains and improved customer services, alongside some incidences of failure in first round franchising.¹⁷ IA's proposed policy reform is to continue the historical trend towards franchising (i.e. to encourage governments to franchise all remaining public transport services that are publicly operated).

¹⁶ Productivity Commission, Road and Rail Freight Infrastructure Pricing, Productivity Commission Inquiry Report No. 41, 22 December 2006

¹⁷ For example, British rail company National Express participated in the first round of rail and tram franchising in Victoria in 1999, successfully bidding to operate three of the five passenger rail franchises offered. The franchises were structured with progressively decreasing subsidies to account for forecast fare revenue growth, with forecasts of increasing patronage due to service quality improvements. The franchise operators were able to achieve initial service quality and cost reduction targets, but were unable to meet their patronage growth forecasts. In 2002 franchise operators began re-negotiating contracts

Recommendation 6.14: Governments should adopt a default option of exposing public transport services to contestable supply through franchising. The focus of reform should be to improve customers' experience by exposing delivery to contestable supply and selecting the best operator to provide services. Private operation of public transport through time limited, exclusive franchises – where providers compete to deliver services – is a proven model both in Australia and overseas in raising service quality and value for money for customers. It should be the default option for public transport provision, with capital city bus and rail services as immediate candidates for franchising.

with the Victorian State Government. During this process, National Express exited the Victorian market, returning control of the franchises it had operated to the Victorian State Government, ahead of the notional franchise end date of 2014. See LEK Consulting, *Public transport, private operators: Delivering better services through franchising*, Tourism & Transport Forum, July 2012; Railway Gazette, National Express takes root in Melbourne, October 2000, available at <http://www.railwaygazette.com/news/single-view/view/national-express-takes-root-in-melbourne.html> Accessed 19 January 2016.

3 *Impact assumptions*

This chapter summarises findings from the available literature on the potential direct economic impacts that may result from the proposed reforms. The assumptions applied in the modelling for each of the reforms have been agreed to by IA and PwC after giving consideration to findings of the literature review and discussions with industry experts as to what a reasonable and conservative estimate of possible direct impacts might be. This section presents these findings and the corresponding assumptions applied in the economy-wide modelling.

3.1 *Energy*

3.1.1 *Privatisation of electricity assets*

We have focussed on the impact on government-owned generation and network businesses and these are analysed in turn below. We note that some of the generation businesses are also retailers (e.g. Hydro Tasmania, Synergy and Snowy Hydro).

Government-owned electricity generation businesses

Victoria, South Australia and New South Wales have privatised some or all of their electricity generation assets.¹⁸ The remaining generators that are partially or fully government-owned include:

- Stanwell Corporation and CS Energy in Queensland
- Delta Electricity in New South Wales¹⁹
- Snowy Hydro in New South Wales, Victoria and South Australia
- Hydro Tasmania in Tasmania
- Synergy in Western Australia.

For details of the ownership structure, capacity and fuel type, see Table 36 in Appendix A.

In order to estimate the possible direct impacts from the privatisation of these electricity assets as per the Plan's recommendation 6.4 in section 2.1.1, we undertook a high level literature review.

The review indicated that the privatisation of generators may change businesses' incentives and should lead to productivity benefits resulting in cost savings for consumers. The PC's 2006 analysis of national economic reforms investigated issues in the electricity generation sector.²⁰ This included a perceived lack of competitiveness in the National Electricity Market due to a range of factors, some of which included that government ownership lead to governance issues and a low number of market players. The report cites a 2002 study by ACIL Tasman which found that in a perfectly competitive environment there would be price reductions and improvements in capital productivity as a result of the structural reform of generation.²¹ Specifically, they cite a 1.5 per cent improvement in capital productivity in New South Wales, and 1.8 per cent in Victoria.²²

¹⁸ Australian Energy Regulator, Industry Information, available at www.aer.gov.au/industry-information. Accessed 20 December 2015.

¹⁹ We note that since undertaking the analysis, Delta Electricity has subsequently been sold by the NSW Government to Sunset Power International. As Delta Energy's expenditure was less than five per cent of total generator expenditure, the consequence of the sale for the estimate of the overall productivity impact of selling publicly owned generators is quite small. When set against the impact of the overall package of reforms, the affect is even smaller.

²⁰ Productivity Commission, *Potential Benefits of the National Reform Agenda*, Report to the Council of Australian Governments, Canberra, 2006.

²¹ ACIL Tasman, COAG Energy Market Reforms, Report commissioned by COAG Energy Market Review Panel, December, as referenced in Productivity Commission, *Potential Benefits of the National Reform Agenda*, Report to the Council of Australian Governments, Canberra, 2006.

²² Productivity Commission, *Potential Benefits of the National Reform Agenda*, Report to the Council of Australian Governments, Canberra, 2006.

The ACIL Tasman report noted inter-connector transmission constraints between states as a reason for modest productivity improvements. With the addition of Tasmania to the National Electricity Market since the report was released and other reforms in the sector since then, these constraints may be less prominent. The wholesale market is also facing some headwinds with demand falling in recent years while capacity has increased, causing wholesale prices to decline.²³ This might indicate there is less scope for privatisation to result in greater efficiency and cost savings to customers. However the Australian Energy Regulator (AER) has noted that in recent years the competitiveness of the Queensland market has deteriorated with increased concentration of government generation assets.²⁴ For these reasons and due to the lack of information specific to the potential impacts of generation privatisation, we have conservatively applied the same impacts as reported by the PC as an indicative assumption of the possible level of capital productivity gains were government-owned generation assets to be privatised.

Table 3: Possible direct impact assumptions for electricity generation privatisation

Indicator	Value	Description	Reference
Capital productivity	1.5%-1.8%	PC report references ACIL Tasman (2002) simulations which indicated that in a perfectly competitive market of generation, electricity prices would fall in the eastern States range from 1.5% in New South Wales, to 1.8% in Victoria. Government ownership of assets was one factor attributed to the lack of competition	Productivity Commission, <i>Potential Benefits of the National Reform Agenda</i> , Report to the Council of Australian Governments, Canberra, 2006.

In assessing the direct impacts of privatisation of the remaining government-owned generators, we have broken up the government-owned generators by state and by type of electricity generation. This allows for a detailed analysis of the potential benefits that will be generated in each area and in each subsector. For an indication of the size of each business and therefore the potential scale of productivity benefits see Table 37 in Appendix A.

Government-owned electricity network businesses

Many of the electricity network businesses are government-owned. Victoria and South Australia have sold their networks. The remaining partially or fully government-owned networks considered particularly relevant to this analysis include:

- Powerlink, Energex and Ergon Energy in Queensland
- Essential Energy in New South Wales ²⁵
- TasNetworks in Tasmania
- ActewAGL in the ACT
- Western Power in Western Australia.

For details of the ownership structure of these networks, Table 38 in Appendix A. Table 39 provides an overview of the operating expenditure of these networks.

In order to estimate the possible direct economic impacts from the privatisation of the government-owned electricity network businesses, a high level literature review was undertaken. Based on this literature review, we have concluded that the privatisation of networks is likely to result in productivity gains through operating cost savings. The findings included:

²³ Australian Energy Regulator, State of the Energy Market 2015, 18 December 2015, page 45.

²⁴ Australian Energy Regulator, State of the Energy Market 2015, 18 December 2015, page 59.

²⁵ AusGrid and Endeavour Energy have been excluded from the analysis as they will be both majority privately leased.

- The PC in 2013 found that ‘state-owned network businesses appear to be less efficient than their private sector peers’.²⁶
- The AER recently noted in its annual benchmarking report that Ergon Energy and Essential Energy have the highest cost per customer and that they spent approximately double the cost per customer than many Distribution Network Service Providers (DNSPs), including SA Power Networks and Powercor, who also provide rural networks.²⁷ We note, however, that the findings of AER’s benchmarking have not been accepted by all parties.²⁸
- A 2012 study suggested that government-owned companies have a larger regulated asset base per customer, and spend more on capital and operations relative to privately owned companies.²⁹ The study estimated savings of up to \$640 million per year in capital expenditure, and \$500 million per year for operating expenditure. It is important to note that the study was based on 2010 data, and as such capital and ownership structures have since changed.
- A more recent study compared price trends in South Australia and Victoria (privatised networks) with all other states.³⁰ It found that network prices for typical residential customers in Victoria and South Australia fell following privatisation. By comparison, government-owned network providers, specifically those in NSW and Queensland, have exhibited a network price increase of over 100 per cent in the same period. Moreover, another recent study suggests that privatisation of networks could result in a reduction of capital and operating expenditure by 25 per cent for each business.³¹

²⁶ Productivity Commission, Electricity network regulator frameworks, Inquiry Report no. 64, vol. 1, 26 June 2013, p. 287.

²⁷ Australian Energy Regulator, Annual Benchmarking Report - Distribution and Transmission 2015, 30 November 2015, p. 14.

²⁸ For example, see: PwC, Independent Expert Advice on appropriateness of RIN data for benchmarking comparisons, Ausgrid, January 2015. Available at: <http://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/ausgrid-determination-2014-19/revised-proposal> Accessed 19 January 2016

²⁹ Tony Wood, Putting the customer back in front: How to make electricity prices cheaper, Grattan Institute, 2012, p.30

³⁰ Ernst & Young, Electricity network services, NSW Treasury, 2014

³¹ Deloitte Access Economics, Economic Impact of State Infrastructure Strategy – Rebuilding NSW, November 2014, p.13

Table 4: Possible direct impact assumptions from reform

Indicator	Value	Description	Reference
Capital and operating costs	\$500m (opex) \$640m (capital)	A 2012 Grattan Institute paper detailing a \$640m per year saving in capital expenditure of networks, and \$0.5b saving per year in operating expenditure, if government-owned companies were to privatise. Note that the capital savings might not be as relevant, now that demand growth is flat and technological changes since 2010.	Tony Wood, 'Putting the customer back in front: How to make electricity prices cheaper', 2012, p.30
Capital and operating costs	CAPEX and OPEX savings in the order of 25% for each NSW business.	Deloitte's 2014 analysis of the economic benefits of leasing electricity assets assumed there would be a 25% saving on capex and opex. Their analysis suggested the range of capex and opex savings was 15% to 30%. ACIL Allen's recent review of Deloitte's modelling agreed that the 25% gain is a 'reasonably representative assumption'.	Deloitte Access Economics, Economic impact of State Infrastructure Strategy – Rebuilding NSW, November 2014, Appendix: Modelling the partial lease of electricity assets. ACIL Allen Consulting, Rebuilding NSW: Review of DAE report – Economic impact of SIS – Rebuilding NSW (Final), 8 February 2016, p. 1.
Operating costs	+96% in QLD vs – 23% in VIC and – 3% in SA	The privately owned businesses in Victoria and South Australia reduced their real operating costs over the period and they were able to keep their spending within the regulatory allowances. Government-owned businesses did not reduce their real operating costs over the period and they were not often able to keep their spending within the regulatory allowances.	Ernst and Young, Electricity network services long-term trends in prices and costs, 2014.
Operating costs	50%	The AER noted that some government-owned businesses in Queensland have more than double the operating expenditure of comparable privately owned businesses in Victoria.	Australian Energy Regulator, Annual Benchmarking Report – Distribution and Transmission 2015, 30 November 2015
Cost savings	50%	Crouch (2006) concluded that privatisation in the UK resulted in distribution charges to domestic customers reducing by 50% in real terms.	Productivity Commission, Electricity Network Regulatory Frameworks – Productivity Commission Inquiry Report, vol 1, No. 62, 9 April 2013
Operating cost saving	15%	Utilising the Grattan Institute study, the \$500 m saving in operating costs equates to a 15% saving. This is more conservative than some of the higher impacts, but as an average impact the percentage reflects the fact that some businesses may be relatively efficient while others may not.	Assumption

To calculate the direct impacts of privatisation of the remaining government-owned networks, the 2012 Grattan Institute study was utilised. Specifically, the study found that the privatisation of networks is likely to result in

\$640 million capital savings and \$500 million operating cost savings. As the study was based on 2010 data, several assumptions were made to apply the savings to current data:

- Capital expenditure is not likely to change. This is because there has been decreased demand for electricity in recent years. Therefore, it is less likely that there will be as high a requirement for capital expenditure in the near future.
- The operating cost saving, which equated to a 15 per cent saving, was scaled to reflect the current size and ownership structure of networks.

The estimates of possible cost savings are shown in Table 5.

We have applied the indicative cost savings estimated here in the economy-wide modelling as a productivity gain (refer to Chapter 4 for more detail of the modelling assumptions). We have not included explicit assumptions in the modelling about how this productivity gain flows through to electricity prices and in that regard we have not made assumptions about how the economic regulator, the AER, would make any future determinations about electricity prices or revenues as a result of such productivity gains.³² That said, as the AER has a responsibility for applying the National Electricity Objective, it is likely that the AER would take account of cost savings in any future determinations.³³

Table 5: Estimated cost savings by state

State	Annual savings (\$m, 2014-15 dollars)
NSW	29
QLD	159
WA	118
TAS	22
ACT	4
Total savings (\$m)	333

Note: Ausgrid and Endeavour Energy are assumed to have efficiency gains achieved through the partial lease process as they will be majority controlled by a private operator and hence are not included in the NSW total. *ACT is 50 per cent of total operating expenditure due to the ACT Government's 50 per cent ownership of ACTEW Corporation.

Source: PwC analysis.

3.1.2 Deregulation of energy retail markets

Recognising that there are various opportunities for improving competition through increasing the number of customers on market contracts, this analysis focuses on the Queensland and Western Australian electricity markets, and the New South Wales gas market. These markets have been chosen as price deregulation has not yet occurred. For simplicity, Tasmania, Northern Territory and the Australian Capital Territory electricity markets have been excluded from the analysis. However, it should be noted that there will also be benefits of price deregulation in these jurisdictions. The proportion of households on market contracts and standing offers varies across Australia – as is shown in Table 6

³² As the economic regulator, the AER reviews and sets the prices or revenues for electricity networks based on the forecast expenditure required to meet customer demand and certain safety and reliability standards. In its last round of reviews, the AER utilised its benchmarking analysis to reduce the allowable network operating expenditure and hence the allowable revenues it deemed prudent for the NSW networks. For example, see: Australian Energy Regulator, AER - Final decision Ausgrid distribution determination – Fact sheet, 30 April 2015.

³³ The National Electricity Objective, set out in the National Electricity Law, is to "promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to -
(a) price, quality, safety, reliability and security of supply of electricity; and
(b) the reliability, safety and security of the national electricity system"

Available at: <http://www.aemo.com.au/About-the-Industry/Legislation/National-Electricity-Law> accessed 12 February 2016.

Table 6: State of electricity and gas retail price deregulation

	NSW	QLD	VIC	WA	SA	TAS	NT	ACT*
Electricity retail price deregulation	✓	✗	✓	✗	✓	✗	✗	✗
Households with electricity market contracts	60%	70% SEQ 0% regional QLD	75%	0%	83%	Limited	N/A	19%
Gas retail price deregulation	✗	✓	✓	✗	✓	✓	✓	✓
Households with gas market contracts	70%	75%	75%	N/A	81%	Limited	N/A	20%

Note: ✓ Deregulated ✗ Regulated. *Data for Western Australian households were not available in the Australian Energy Market Commission source but as residential customers are on regulated tariffs it is represented as 0 per cent on market contracts for the purpose of this analysis (see Public Utilities Office, Electricity market review: Options paper, Department of Finance, Government of Western Australia, December 2014, page 22).

Source: Infrastructure Australia, Australian Infrastructure Plan, 2016, page 107; Australian Energy Market Commission, Final Report: 2014 Retail Competition Review, 22 August 2014

Table 7: Possible direct impact assumptions from reform

Indicator	Value	Description	Reference
Cost savings	Electricity: 5%; 16%-19% Gas: 5%	The AER State of the Energy Market finds that on average electricity market contracts were lower than standing contracts (regulated prices, retailers may charge less but not more than the standing contract price to consumers), by between 5% in QLD and 16-19% in Victoria. Gas discounts are at 5% in most jurisdictions.	Australian Energy Regulator, State of the Energy Market 2014, Australian Competition and Consumer Commission, 2014, p. 135

Our analysis focused on three main areas: Queensland (electricity), Western Australia (electricity) and New South Wales (gas). The cost savings generated through price deregulation were calculated based on the assumption that all remaining standing offer contracts will move to market offer contracts. Applying the cost savings shown in Table 7, the estimated cost savings will be five per cent for Queensland contracts, five per cent for New South Wales gas contracts and 10.5 per cent for Western Australian contracts.³⁴ Using this in conjunction with average annual electricity and gas prices of market contracts,³⁵ the number of households according to the ABS as a proxy for the number of residential electricity and gas customers³⁶ and the proportion of customers on market offer contracts³⁷ provided the estimated cost savings shown in Table 8.

³⁴ This is based on the midpoint of the Queensland estimate and the lower bound of the Victorian estimate.

³⁵ As reported in Australian Energy Market Commission, '2014 Residential Electricity Price Trends report', 5 December 2014 and the Independent Pricing and Regulatory Tribunal, 'Fact sheet – Change in regulated retail gas prices from 1 July 2015', June 2015, p. 8.

³⁶ Australian Bureau of Statistics, '3236.0 – Household and Family Projections, Australia, 2011 to 2036', 2015.

³⁷ Australian Energy Market Commission, 'Final Report: 2014 Retail Competition Review', 22 August 2014.

Table 8: Cost savings of price deregulation by state

Market	QLD (electricity)	WA (electricity)	NSW (gas)
Total number of residential customers# (A)	1,789,912	964,140	2,805,579
Percentage of standing contracts (B)	65%^	100%	30%
Number of users who will gain from market contract (A*B)	1,163,443	964,140	841,674
Savings per customer (\$)~	65.10	166.48	50.45
Savings (\$m)	75.74	160.51	42.46

Note: The figures above are based on 2013-14 data, with the exception of Western Australia's average cost of market offer contracts, which utilises 2014-15 figures. # Residential customers are estimated based upon number of households. ^ An average of the number of market contracts in South-east Queensland and Regional Queensland has been used. This is consistent with the total number of residential customers used in the analysis. ~ We note that there are likely to be differences in the number of market offer contracts among retailers. This may affect the value of market contracts used to calculate the level of savings per customer.

Source: Australian Bureau of Statistics, 3236.0 – Household and Family Projections, Australia, 2011 to 2036, 2015; Australian Energy Market Commission, '2014 Residential Electricity Price Trends report', 5 December 2014; Independent Pricing and Regulatory Tribunal, 'Fact sheet – Change in regulated retail gas prices from 1 July 2015', June 2015, p. 8; PwC analysis.

3.2 Telecommunications

This section sets out our analysis to estimate the potential economy-wide impact of privatising the NBN. To estimate the possible direct impacts, we have undertaken a high level review of academic literature on telecommunications privatisations.

The findings of this high level literature review included:

- A World Bank analysis of country-level panel data from 1981-1998 that found privatisation resulted in significant labour savings, output growth, network expansion and both labour and total factor productivity improvements.³⁸
- An examination of the records of 31 national telecommunications carriers from 14 industrialised and 11 non-industrialised economies that have been fully or partially divested by IPOs between October 1981 and November 1998 found that employment fell but not dramatically, from 67,000 to 63,000.³⁹

The World Bank study in particular showed that there was a statistically significant effect through privatisation of telecommunications companies of 10 per cent improvement in total factor productivity (even when exclusivity is allowed⁴⁰). To allow for possible differences in technologies used in the telecommunication sector in the 1990s and that used today, we assume a 5 per cent improvement in total factor productivity could be achieved.

³⁸ Xu (2002) cited in John Ure, Telecommunications privatization: Evidence and some lessons, October 2003, p.8

³⁹ Bortolotti et al. (2002) cited in John Ure, Telecommunications privatization: Evidence and some lessons, October 2003, p.8

⁴⁰ In Xu (2002), 'exclusivity' refers to where a country grants private operator(s) a period of exclusive access to certain market segments.

Table 9: Possible direct impact assumptions from reform

Indicator	Value	Description	Reference
Labour productivity	6%	Studies have shown that privatised telecommunications companies have a 6% improvement in labour efficiency relative to government-owned telecommunications companies.	Bortolotti et al. (2002) cited in John Ure, Telecommunications privatization: Evidence and some lessons, October 2003, p.8
Total factor productivity	10%	An examination of the impact of privatisation and competition in the telecommunications sector around the world found that even with exclusivity provisions, total factor productivity was boosted by about 10 percentage points	Li, W and Xu, L, 'The impact of privatization and competition in the telecommunications sector around the World', Darden Business School Working Paper No. 02-13, October 2002, p. 22.
Total factor productivity assumption applied	5%	To allow for possible differences in technologies used in the telecommunication sector in the 1990s and that used today, a conservative 5% improvement in productivity is assumed.	Assumption

Drawing on information contained in NBN-related reports, we are able to estimate the size of this impact. The following documents were reviewed to inform this:

- the 2013 strategic review
- the 2010 implementation study
- the 2014 cost-benefit analysis volumes 1 and 2
- NBN corporate plans
- NBN annual reports.

The 2014 cost-benefit analysis of the NBN Co includes forecast operating and capital expenditure from 2015 out to 2030. Presented in Table 40 in Appendix A, this information is used to scale the five per cent direct impact relative to the communications sector. In summary, annual capital and operating expenditure was projected to average \$4.3 billion between 2015 and 2019, and \$1.3 billion between 2020 and 2030.

3.3 Water

Recommendation 6.10 in the Plan includes three proposed policy reforms for governments to consider which aim to bring the performance of metropolitan water utility businesses in line with what could be achieved under private sector ownership. To investigate the potential direct economic impacts from aligning performance of urban water utilities with the private sector, we undertook a high level review of a number of resources such as:

- the Industry Commission report on the economic benefits of national competition policy reforms
- the Productivity Commission report on urban water sector reform
- Infrastructure Partnerships Australia reports on urban water reform and public-private partnerships
- Office of Water Services reports on the development of the water industry in the United Kingdom
- a PwC United Kingdom report on the recent experience of efficiency gains in the UK water sector
- a Partnerships Victoria report on the Victorian Desalination project
- National Water Commission reports on the urban water sector
- Academic literature on privatisation.

The findings of this review are described below. In the literature review undertaken, some attention was focussed on the UK experience, where the water sector has been privatised since 1989. Appendix B describes the UK experience and achievements, which included that water bills were an estimated 30 per cent lower than would have occurred otherwise.⁴¹ Appendix B also notes that, because privatisation, competition and regulatory oversight were introduced around the same time in the UK, it is unlikely that gains similar to those experienced in the UK could be expected in Australia.

Other research has noted the following:

- Although there is minimal private ownership of urban water utilities in Australia, there is some experience in outsourcing parts of operations or whole assets to the private sector. Efficiencies can be achieved under the following types of measures:
 - Outsourcing – Studies suggest outsourcing delivers, on average, five to ten per cent savings.⁴² For example, Hunter Water expected a 7.6 per cent efficiency gain from outsourcing some water and wastewater treatment plant operations.⁴³
 - Public-private partnerships (PPPs) – PPPs can deliver, typically, 10-15 per cent whole of life savings when compared to traditional delivery. Infrastructure Partnerships Australia's report noted PPPs demonstrate superior cost efficiency over traditional procurement, which can range from 11.4 per cent when measured from contractual commitment to the final outcome to 30.8 per cent when measured from project inception.⁴⁴
- In other sectors (i.e. non-water areas), savings of 20 per cent and more are being readily identified and delivered as organisations (utilities in particular) seek to optimise physical infrastructure investments and migrate customers into more cost-effective digital solutions for billing and customer care.⁴⁵
- In 1995, the Industry Commission modelled the indicative economic gains for the urban water sector that could be expected from national competition policy reforms. This analysis identified improvements in labour productivity and capital productivity in the order of 25 per cent and 10 per cent respectively as well as a need to raise the return on capital by 1.07 per cent.⁴⁶ The reforms, some of which are still relevant, related to:
 - eliminating cross-subsidies and restructuring pricing on a pay for use basis
 - achieving positive economic rates of return on investment
 - improving service delivery by separating service provision and regulatory functions, identifying and paying for community service obligations and adopting international best practice.

These factors are summarised in Table 10. This table indicates there is a range of possible assumptions that could be applied. None of these are bottom-up estimates of the actual efficiency gains that could be expected at an Australian water utility. For such an estimate to be prepared, detailed analysis of a water company's existing operations would be required. As this is not possible given the nature of this report, a top-down assumption needs to be made. This assumption needs to be reflective of the extent of reform undertaken already in Australian water utilities and be prudent, given the lack of experience of privatisation in the Australian urban

⁴¹ Ofwat's response to the Independent Review of Charging Household Water and Sewerage Services, 2011. Cited in Peter Martin, *24 Years Later: A Look at Water Privatisation in England and Wales*, 2013.

⁴² PwC industry experts.

⁴³ Hunter Water estimated savings of \$23 million from awarding a \$279 million contract to Veolia. Sources: Veolia, Hunter Water awards Veolia with major contract, June 26 2014. ABC, Private operator to take control of Hunter Water treatment plants, June 27 2014.

⁴⁴ Infrastructure Partnerships Australia, *Performance of PPPs and Traditional Procurement in Australia*, January 2007, p.1

⁴⁵ PwC industry experts.

⁴⁶ Industry Commission, *The growth and revenue implications of Hilmer and related reforms: Final report*, Commonwealth of Australia, Canberra, March 1995, p.337

water sector. We assume that an average direct impact will account for the differences across the sector where some utilities will be more efficient than others. Considering the range of quantified impacts summarised in Table 10, a total productivity saving of 10 per cent seems a prudent representation of the minimum level of savings that could be expected.

Table 10: Summary of possible direct impact assumptions from water reform

Indicator	Value	Description	Reference
Total productivity	30%	Assuming that the reduction in customer water bills experienced in the UK between 1989 and 2010 is comparable to a productivity saving of the same magnitude (i.e. productivity gains are passed on in full) then the UK experience could be summarised as resulting in a productivity gain of 30%. However it should be noted that this impact includes the effects of a range of reforms in addition to privatisation. Also, as noted in Appendix B, it seems unlikely that the magnitude of gains achieved in the UK would be repeated in Australia following privatisation.	Martin, P, <i>24 Years Later: A Look at Water Privatisation in England and Wales</i> , 2013.
Total productivity	10%-30%	Depending on how it is measured, PPPs can achieve savings of between 10% and 30%.	Industry experts/ Infrastructure Partnerships Australia, <i>Performance of PPPs and Traditional Procurement in Australia</i> , January 2007.
Labour productivity	15% – 25%	A 1995 Industry Commission report on the growth and revenue implications of Hilmer suggested that eliminating cross subsidies, achieving positive rates of return and adopting best practice in urban water as well as recouping operating and maintenance costs in rural water could increase labour productivity by 15% across the entire water industry or 25% for urban water providers.	Industry Commission, <i>The growth and revenue implications of Hilmer and related reforms: Final report</i> , Commonwealth of Australia, Canberra, March 1995.
Capital productivity	7%-10%	The same report said this would also increase capital productivity by 7% across the entire water industry or 10% for urban water providers.	Ibid.
Rate of return on assets	1.07%	The same report also expected that by earning a positive rate of return, the real economic rate of return would increase from 2.01% to 3.08%.	Ibid.
Operational expenditure	5-10%	Outsourcing can achieve savings of 5-10%.	Industry experts/ Veolia, <i>Hunter Water awards Veolia with major contract</i> , June 26 2014.
Operational expenditure	20%+	Implementing innovative and cost-effective solutions for infrastructure, billing and customer service can achieve savings of 20%.	Industry experts
Assumed total productivity saving	10%	Based on the above savings, 10% is a conservative representation of the level of savings that could be expected.	Assumption

If we apply the assumed 10 per cent productivity gain to the annual expenditure by provider, we can estimate the impact to the water supply sector. The capital and operating expenditure allowed by the regulator for each of the metropolitan urban water operators in Australia's capital cities (except for Darwin where information was not available) is set out in Table 42 in Appendix A.

Applying the indicative productivity saving to the metropolitan urban water utilities results in savings as summarised in the following table. The total estimated saving across Australia each year would be over one billion dollars.

Table 11: Indicative annual productivity savings

State/Territory	Annual saving (\$m 2014-15)
VIC	400
NSW	224
QLD	244
WA	172
SA	78
TAS	25
ACT	26
Total	1,169

Note: See Appendix A for capital and operating expenditure by utility.

Source: PwC analysis.

3.4 Impact of privatisation – energy, telecommunications, water

In addition to the direct impacts set out above for energy, telecommunications and water, there will also be another first round impact of privatisation driven by government borrowing costs. A common approach has been undertaken to estimate this impact across the reforms, as described in the following.

We take an approach where we are considering the net economic impacts from an asset sale. This means that the proceeds of the sale are not considered as this represents a transfer from one party to another. However, in an environment where governments are constrained by borrowing capacity yet there is a need for investment, the sale of assets may provide a net economic impact relative to the second best alternative; that is, if asset sales were not to occur and governments needed to borrow additional funds to fund investments, the cost of borrowing would be higher than if they had sold assets and were subsequently in a better net debt position. This argument is supported in analysis of the NSW Government's ability to either fund its \$20 billion Restart NSW investments through asset leases or through borrowing. A 2015 UBS report⁴⁷ estimated that, while the NSW Government could borrow to fund its \$20 billion infrastructure spend without leasing the electricity assets, this would likely result in the downgrading of its AAA credit rating for debt and so NSW would pay more interest on any new debt raised.

Following this argument, by selling the remaining energy, telecommunication and water assets, governments will be able to undertake new investments without incurring additional interest costs.

⁴⁷ UBS, Bad for the budget, good for the State, 17 March 2015.

We model this as a lower cost to government of investing. The parameter we have used in the model is increased productivity of government investment (i.e. governments can get more investment for the same cost).

To develop the direct impact for this, we first estimate the asset values of the relevant energy, telecommunication and water assets. We then make some broad assumptions about the difference in interest costs for each state (e.g. UBS stated NSW's interest costs would rise by 0.1 per cent if it borrowed to fund its capital investment plan of \$20 billion rather than funding that through leasing its electricity assets). We then convert this into an estimated impact on governments' investment productivity.

Table 12 sets out the estimated values of assets, whereby a multiple that the market would typically use to value the asset is applied to the EBITDA or RAB of the relevant entity. We considered a number of different multipliers in order to estimate the values set out in Table 12. These were as follows:

- In the case of electricity generation businesses, Infrastructure Australia applied a range of 12 to 14 times EBITDA.⁴⁸ Taking the midpoint of this range is 13.
- In the case of the network electricity businesses, a range of multipliers was considered. Although at the lower end of the range considered, the market currently prices listed network businesses at about 1.3 times RAB. This is the chosen multiplier for DNSPs. A higher rate of 1.4 was applied to transmission network service providers (TNSPs) given the recent valuation placed on Transgrid being higher than 1.3. The range of multipliers considered were:
 - 1.3, which represents the value at which listed regulated businesses (such as Spark Infrastructure, AusNet Services and DUET Group) are trading⁴⁹
 - 1.35, which was the value that Infrastructure Partnerships Australia thought would be placed on TransGrid by bidders⁵⁰
 - 1.30 to 1.45 which was the range that RBC Capital Markets expected would be placed on TransGrid by bidders prior to the winning bid being announced⁵¹
 - 1.6 which represents the actual valuation at which TransGrid was leased in 2015.⁵²
- In the case of the NBN Co, the NBN 2013 Strategic Review uses an EBITDA multiple of 6.0.⁵³ This results in a valuation of \$27 billion. Recent articles have suggested the NBN could be privatised at a valuation 'as low as \$20 billion', indicating the value may be higher than that and hence \$27 billion seems plausible in this context.⁵⁴
- In the case of water, Infrastructure Australia has previously applied a range of 1.10 to 1.20.⁵⁵ We have applied the upper end of this range (1.2), as the current lower borrowing cost environment is leading to higher valuations as has been seen in the energy sector for example.

⁴⁸ Ibid.

⁴⁹ Australian Financial Review, 'Ausgrid, Endeavour Energy to put asset valuation theories to the test', 26 November 2015.

⁵⁰ Infrastructure Partnerships Australia, 'NSW poles & wires to deliver \$3.5b more than estimated, says new analysis', 18 May 2015.

⁵¹ Australian Financial Review, 'Ausgrid, Endeavour Energy to put asset valuation theories to the test', 26 November 2015.

⁵² Ibid.

⁵³ NBN Co, Strategic review, December 2013, p.107.

⁵⁴ Australian Financial Review, 'Malcolm Turnbull in talks to sell NBN to large telcos', 4 December 2015.

⁵⁵ Infrastructure Australia, Australia's public infrastructure: Part of the answer to removing the infrastructure deficit, October 2012, p. 34

Table 12: Estimated valuation of selected publicly owned assets

Owner	Entity	RAB/EBITDA (\$m)	Multiple	Estimated value (\$m)	Notes
Electricity generation ^					
QLD	Stanwell Corporation	419	EBITDA * 13	5,451	
QLD	CS Energy	155	EBITDA * 13	2,011	
NSW/VIC/Cwth	Snowy Hydro	368#	EBITDA * 13	4,788	29% VIC, 58% NSW, 13% Cwth
NSW	Delta Electricity	-380	EBITDA * 13	n/a	
TAS	Hydro Tasmania	62#	EBITDA * 13	810	
WA	Synergy	361#	EBITDA * 13	4,693	
Electricity networks					
QLD	Energex, Ergon	19,034	RAB *1.30	24,744	
QLD	Powerlink	6,035	RAB *1.40	8,449	
NSW	AusGrid	13,613	RAB *1.30	8,778	49.6% ownership in baseline
NSW	Endeavour Energy	5,344	RAB *1.30	3,446	49.6% ownership in baseline
NSW	Essential Energy	6,518	RAB *1.30	8,473	
ACT	ActewAGL	790	RAB *1.30	514	50% ownership
TAS	TasNetworks	2,691	DNSP RAB *1.30 TNSP RAB *1.40	3,622	
WA	Western Power	8,800	RAB *1.35 ~	11,880	
Telecommunications					
Cwth	NBN Co	4,500	EBITDA * 6	27,000	This is for 2024-25
Water*					
VIC	MW, CWW, YVW, SEW	18,458	RAB *1.2	22,150	
NSW	Sydney Water, Hunter Water	17,879	RAB *1.2	21,455	
QLD	SEQwater	8,230	RAB *1.2	9,876	
WA	Water Corporation	9,600	RAB *1.2	11,520	
SA	SA Water	11,862	RAB *1.2	14,234	
ACT	Icon Water	2,205	RAB*1.2	2,646	
Total				196,540	

Sources: AER, State of the Energy Market 2014 Report; Stanwell Corporation, 2015 Annual Report; CS Energy, 2015 Annual Report; Snowy Hydro, 2015 Annual Report; Delta Electricity, 2015 Annual Report; Hydro Tasmania 2015 annual report; Synergy 2015 annual report;

Essential Services Commission, Independent Pricing and Regulatory Tribunal, Queensland Competition Authority, Economic Regulation Authority Western Australia, Essential Services Commission of South Australia, Office of the Tasmanian Economic Regulator, ACT Treasury, and Australian Bureau of Statistics; NBN Co, Strategic Review, December 2013.

Notes: *Five water distribution businesses in QLD and TasWater are owned by local government and so are not included here. ^Ergon Energy in QLD and Essential Energy in NSW have some generation assets but are not included here due to their small size. ~ The source used for Western Power's RAB did not provide a separation of the TNSP RAB from the DNSP RAB so we have used an average of 1.30 and 1.40. #Values are for the consolidated group and so will include retail activities for example.

The total estimated value of the assets listed in the above table is \$197 billion. While this analysis is not able to undertake a detailed examination of each government's fiscal position and the implications of the sales of each of the individual assets, we can make some assumptions about the potential impact on higher borrowing costs.

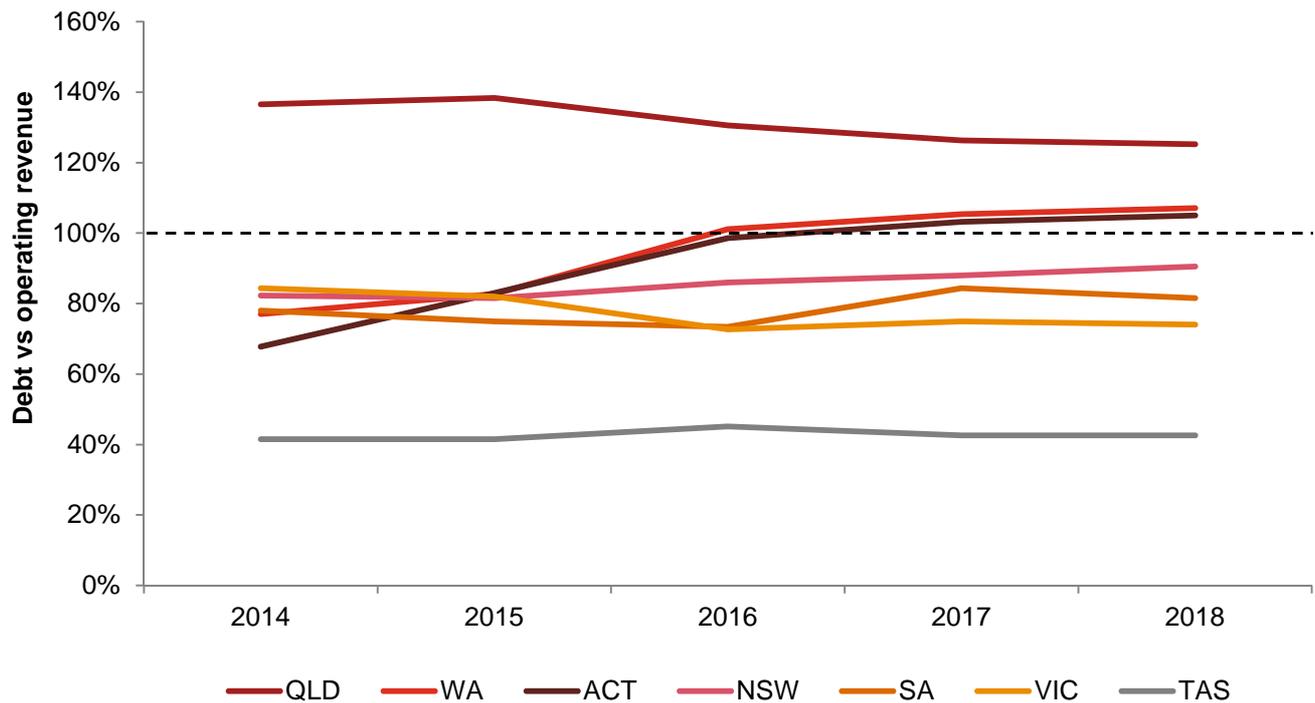
Table 13 shows the impacts if the interest costs on borrowings equivalent to the estimated value of the assets were to rise by 0.10 per cent, 0.15 per cent and 0.20 per cent. UBS analysis suggested that if the NSW Government had to borrow \$20 billion, its borrowing costs on new debt might rise by approximately 0.10 per cent. As Figure 1 shows, NSW as one of three state/territory governments on an AAA credit rating is one of the better-positioned states. This figure shows that Queensland has the least borrowing capacity, with relatively higher debt levels. Western Australia and the ACT are also tracking upwards in their debt positions. So it would seem not unreasonable that these governments may face a borrowing cost higher than 0.10 per cent. South Australia and Tasmania have a lower credit rating than NSW, so it is possible that they may face borrowing costs that would be 0.20 per cent higher.

Considering these points, analysis of an interest cost saving on new debt of 0.15 per cent – a midpoint between 0.10 per cent and 0.20 per cent – is a reasonable assumption.

Table 13: Possible annual savings from privatisation versus government borrowing

Government owning assets	Estimated value (\$m)	Annual saving if interest costs would rise by		
		0.10%	0.15%	0.20%
VIC	23,539	24	35	47
NSW	44,928	45	67	90
QLD	50,531	51	76	101
WA	28,093	28	42	56
SA	14,234	14	21	28
ACT	3,159	3	5	6
TAS	4,432	4	7	9
Cwth	27,622	28	41	55
Total	196,540	197	295	393

Source: PwC analysis

Figure 1: Projected fiscal position by State/Territory

Note: The Northern Territory has not been included here due to information on the Northern Territory Power and Water Corporation's RAB not being available. As noted in the UBS report, the dashed line represents an indicator of rating stress.

Source: Standards & Poor's, Supplementary analysis: New South Wales (State of), October 13 2015; Standards & Poor's, Supplementary analysis: Victoria (State of), September 1 2015; Standards & Poor's, Queensland (State of), November 17 2015; Standards & Poor's, Supplementary analysis: Western Australia (State of), November 3 2015; Standards & Poor's, Supplementary analysis: South Australia (State of), September 28 2015; Standards & Poor's, Tasmania (State of), November 30 2015; Standards & Poor's, Supplementary analysis: Australian Capital Territory (Government of), September 30 2015; UBS, Bad for the budget, good for the State, 17 March 2015. PwC analysis.

3.5 Transport

3.5.1 Heavy vehicles

This section discusses the productivity implications of the Plan's recommendation 5.4 concerning heavy vehicle pricing and recommendation 6.13 concerning changes to the road funding framework. It considers potential reform benefits and costs, and details assumptions used in modelling these reforms.

There are two components to this impact.

First, there are capital spending efficiencies:

- Institutional and regulatory reform allowing greater involvement of users in influencing where capital spending occurs. This is expected to lead to greater allocative efficiency, with a greater likelihood that investments will enable journey time savings and reliability improvements of value to truck operators and their customers, less wear and tear on vehicles, and, more generally, spending on the 'right' roads.
- Potentially, an increase in overall productivity enhancing investment on the road network. This would occur if road user charge revenue was directed towards investment in roads instead of to consolidated revenue, through a road fund mechanism or similar structure. In other words trucking operators could be more willing to pay for additional targeted infrastructure if they are confident that the user charges are directed to specific upgrades offering clear benefits for their operations.

Secondly, there are also capital and labour efficiencies from greater road network access:

- Enabling greater use of high productivity vehicles (e.g. greater overall mass) on the key freight routes agreed by COAG's Transport and Infrastructure Council in 2014 to increase labour productivity
- Enabling greater use of high productivity vehicles on a wider network of local roads, allowing for:
 - Travel time savings: road freight operators would have access to a greater proportion of the total road network and would be able to choose more efficient routes. This implies reduced labour costs, reduced operating costs, and, potentially, greater utilisation of the existing fleet.
 - Increased trip reliability: operators could take alternate routes in the event of accidents or other disruptions on the principal freight routes.
- Providing larger trucks with access to a wider network of 'first mile' and 'last mile' roads would reduce double handling of freight (e.g. the assembly and disassembly of truckloads).

From the literature review (summarised below), it appears that the productivity gains relate to better use of labour and capital employed in the road freight industry, as well as enabling better targeted investment in roads.

A number of studies have addressed heavy vehicle reform, notably those from the Heavy Vehicle Infrastructure Reform process, and the PC.

In 2006, the PC conducted an inquiry into road and rail infrastructure pricing, including modelling of potential reforms.⁵⁶ The PC's 2006 modelling quantified the effect of institutional reform and more efficient investment in road infrastructure. The PC modelled two scenarios:

- a five per cent improvement in road freight sector productivity associated with (primarily) regulatory reform and improved funding and investment decision-making
- a 10 per cent improvement in road freight sector productivity associated with commercialisation of road provision and pricing, including mass distance location-based charges on the national highways.

The reform contemplated in the Plan is for a general system of mass-distance-location charging across all roads (i.e. beyond a scheme potentially applying to national highways referred to in the Commission's 2006 report).

Another estimate of the impact of reforms is provided in a Heavy Vehicle Charging and Investment Reform submission to the 2014 PC Inquiry into Public Infrastructure where it was estimated that the net benefits from heavy vehicle pricing (as a result of stronger financial incentives leading to lower costs of road provision and better access for the heavy vehicle fleet) could be \$22 billion.⁵⁷ It is unclear how the assumptions of this estimate compares to those of the PC.⁵⁸

Meanwhile the PC recommended (in 2014) an enquiry be undertaken on road pricing and project selection, as has IA in the Plan's recommendation 5.3.

In considering the benefits of the reform, it is also important to consider the costs. There will be system costs to government and the private sector from implementation. The cost of 'in vehicle units' used for assessing vehicle distance, time and location presently varies between \$300 and \$1,000 per unit. It appears that road freight operators are installing such units for other compliance management and business improvement reasons.⁵⁹ In

⁵⁶ Productivity Commission, Road and Rail Freight Infrastructure Pricing, Productivity Commission Inquiry Report No. 41, 22 December 2006.

⁵⁷ Heavy Vehicle Charging and Investment Reform submission to the Productivity Commission Inquiry into Public Infrastructure Source: www.pc.gov.au/data/assets/pdf_file/0020/131744/sub077-infrastructure.pdf, Accessed 20 December 2015.

⁵⁸ It is thought that this estimate relates to a 2013 regulatory impact statement that the Heavy Vehicle Charging and Investment Reform commissioned, which is not public. The final report from the process, issued for consultation, is public and includes three options. Of these, the preferred option involves a vehicle mass, distance and location (MDL)-based charging system, based on forward-looking cost estimates. This would allow for jurisdiction-specific charges, and provide better information to road network planners. See: Frontier Economics, Heavy vehicle infrastructure funding and investment reforms: Draft for consultation, 2013.

⁵⁹ For example, advice to IA from staff of Transport Certification Australia indicates that approximately 25,000-30,000 prime movers (around a third of the total number of prime movers in Australia) have already installed in vehicle units that could be used for monitoring the location, time and distance travelled by such vehicles.

short, the capital cost of these units is modest and is unlikely to be a ‘standalone’ cost associated with the establishment of a MDL charging system.⁶⁰ The ongoing costs are also likely to be offset somewhat by replacing many of the costs associated with the current PAYGO system.

Summary and reform assumptions

As IA’s proposed heavy vehicle pricing reforms align with the ‘more fundamental reforms’⁶¹ discussed in the PC’s 2006 report, including the potential step-based charges for national highways, amongst other options, we modelled the same impact as modelled by the PC. That is a 10 per cent productivity gain in 2006 for the road transport sector. With only modest progress to enacting the reforms contemplated in the Commission’s 2006 report, and the more extensive application of mass-distance location charging contemplated in the Plan, this 10 per cent productivity gain is assumed to be a reasonable estimate.

Table 14: Possible direct impact assumptions from reform

Indicator	Value	Description	Reference
Labour, capital and materials productivity	2.9%	Efficiency gain due to improved labour, capital and materials productivity associated with the National Competition Policy reforms related to heavy vehicles. These related to adoption of proposals dealing with heavy vehicle charges, transportation of dangerous goods by road, mass limits, and other measures that could be expected to lead to improved labour, capital and materials productivity. The PC in 2006 observed that the 1999 forecasts had proved too conservative for other transport industries (rail).	Productivity Commission, Modelling the Regional Impacts of National Competition Policy Reforms, Supplement to Impact of Competition Policy on Rural and Regional Australia, 1999, p.43 Productivity Commission, Road and Rail Freight Infrastructure Pricing, Productivity Commission Inquiry Report, 2006, Appendix F.
Labour, capital productivity	2%-16%	The PC in 2006 discussed a number of Australian and International studies that have modelled productivity gains to labour and capital in transport. The PC found the range of productivity gains applied to be within 2%-16%. The PC further observed that experience or expert judgement was the main source of the estimates, rather than empirical approaches.	Productivity Commission, Road and Rail Freight Infrastructure Pricing, Productivity Commission Inquiry Report, 2006, Appendix F.
Materials, capital and labour productivity	5%	In order to capture all aspects of potential efficiency gains for both road and rail, the Commission applied a 5% productivity increase on all inputs to the production of the freight task: that is, a 5% increase in the productivity of materials, capital and labour inputs, for both road and rail.	Productivity Commission, Road and Rail Freight Infrastructure Pricing, Productivity Commission Inquiry Report, 2006, Appendix G, G.27. This was the base case (essentially low reform) scenario.
Materials, capital and labour productivity	10% +	The PC also considers that under a high reform scenario, +10% productivity gain to road is possible	Productivity Commission, Road and Rail Freight Infrastructure Pricing, Productivity Commission Inquiry Report, 2006, Appendix G, p.27.

⁶⁰ Advice to IA from staff at Transport Certification Australia is that the cost of on-board mass measurement is also falling, as advances in vehicle technology are introduced. The air suspension systems used on many larger vehicles (eg B-doubles and above) already provide a mass detection capability. Industry estimates suggest 30-40 per cent of the fleet has air suspension. The cost of other mass measurement technologies, such as ‘load cells’, is also falling. There would be some modest operational costs associated with periodic calibration of the on-board mass measuring system against a certified weighbridge.

⁶¹ Productivity Commission, Road and Rail Freight Infrastructure Pricing, Productivity Commission Inquiry Report No. 41, 22 December 2006.

Assumed total productivity saving	10%	Considering the above range of estimates, we assume 10% is a reasonable impact for total productivity in line with the scenario modelled by the PC in its modelling of gains from heavy vehicle reform (which align to IA reform recommendations 5.3, 5.4 and 6.13).	Assumption
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3.5.2 Rest of fleet

This section assesses the impacts of the Plan's recommendations 5.3 and 5.5. Consistent with the reforms, there are two components to this impact: a user charge consistent with current levels of funding; and a congestion charge that will reduce the cost of congestion in urban areas. The context to each of these issues is described in turn below.

User charging

The principal charges or taxes associated specifically with the use of roads are fuel excise and vehicle registration. The other charges or taxes relating to road transport take the form of:

- general forms of taxation applied to other goods, e.g. the goods and services tax (GST), or fringe benefits tax and stamp duty applied to aspects of road use (i.e. they can be reasonably considered part of the general tax base, rather than related specifically to road usage)
- taxation on certain but not all types of vehicles, e.g. the luxury car tax (again, part of the general tax base)
- charges related to the cost of securing other public policy outcomes, e.g. maintaining road safety through driver licensing.

Over the past decade, direct road-related charges have covered a decreasing share of expenditure on roads, with the remainder of road-related expenditure funded from general revenue streams such as income tax and the GST.

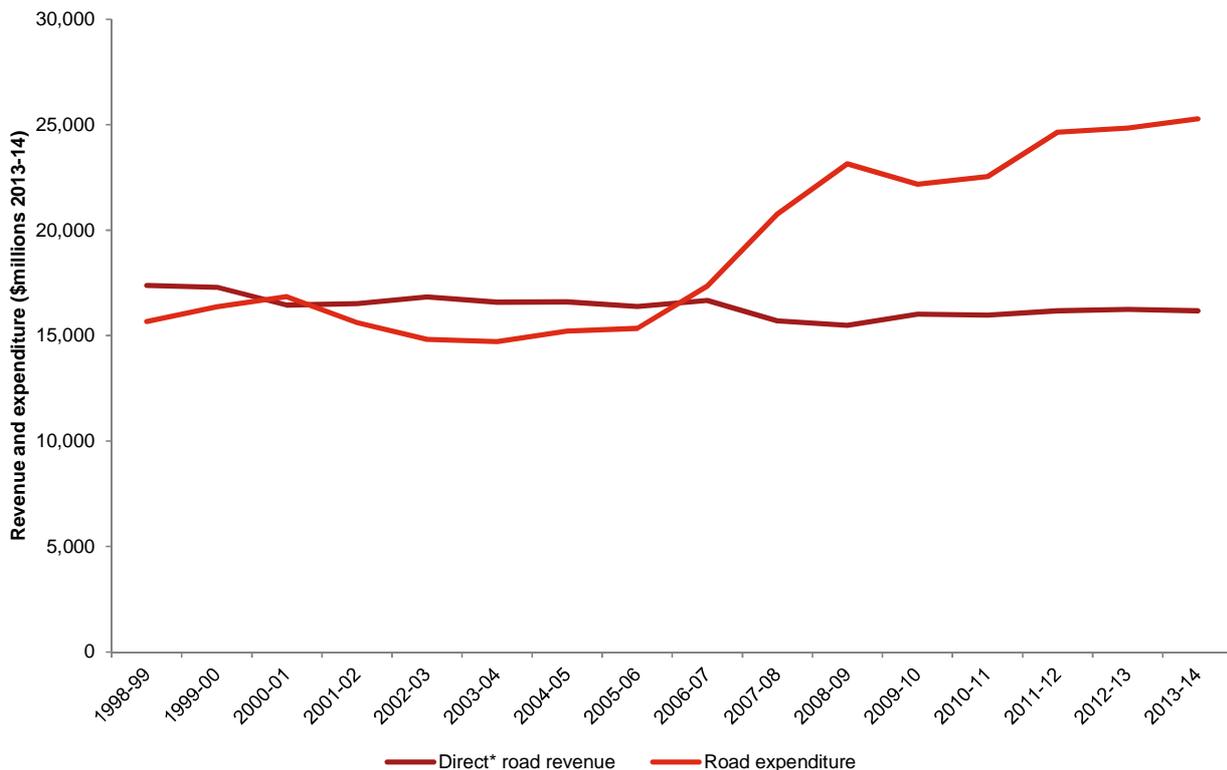
One way of estimating the gap is to consider that only direct road-related charges, that is, registration fees and fuel excise, are relevant to road funding. Bureau of Infrastructure, Transport and Regional Economics (BITRE) data shows that in 2013-14, the gap between road outlays and these two road-related revenue sources was over \$9 billion.⁶² This is illustrated in Figure 2.

The reform proposed by IA would remove fuel tax and registration fees, replacing these charges with usage charges, potentially based on distance and other criteria such as vehicle type. A trial of a similar scheme has commenced in Oregon in the United States⁶³ and the Californian Government is presently seeking participants for a similar trial.⁶⁴ As in the case of heavy vehicles, these are assumed to initially be revenue neutral. The effect of this reform can be considered to be analogous to a change in the tax mix (i.e. a change in the combination of taxes used by government to collect revenue). Establishment and transition costs for the reform have not been captured in this analysis.

⁶² Even if all potential road-related revenue categories are included except for road related GST and road related fringe benefits tax (ie fuel excise, registration, luxury car tax, customs duty on vehicles, drivers licence fees, stamp duty and tolls are included) the gap in 2013-14 was still \$2.7 billion. Source: Bureau of Infrastructure, Transport and Regional Economics, Yearbook 2015: Australian Infrastructure Statistical Report, Dec 2015.

⁶³ In July 2015, Oregon in the United States commenced a trial of a distance-based charging regime. The trial involves 5,000 cars and light commercial vehicles. Participants will be charged 1.5 cents per mile to use the road network, and receive a rebate on the \$US0.30 per gallon state fuel tax that they would otherwise pay. The trial has been introduced in the context of concern about declining fuel tax revenues, rather than congestion. Source: Oregon Department of Transportation, *Road Usage Charge Pilot Program 2013 & Per-Mile Charge Policy in Oregon*, May 2014; <http://www.myorego.org/frequently-asked-questions/> Accessed 21 January 2016.

⁶⁴ See Traffic Technology Today, *California seeking 5,000 volunteers for road charge pilot program*, 21 January 2016, Available at <http://www.traffictechnologytoday.com/news.php?NewsID=76779> Accessed 11 February 2016.

Figure 2: Historical road spending and direct road-related charges

Notes: For the purpose of this figure *direct road revenue is defined as fuel excise tax and registration fees. Source: Bureau of Infrastructure, Transport and Regional Economics, Yearbook 2015: Australian Infrastructure Statistical Report, Dec 2015; PwC analysis.

Typically the economic impact of changes in tax mix is considered by examining the change in the deadweight loss of the taxation burden. The deadweight loss of tax can be thought of as the welfare loss associated with levels of production and consumption that are lower than would be the case if prices for goods or services were at market clearing prices without a tax. Another way changes in tax mix are considered is the administration cost (i.e. the cost of collection and the cost of compliance).

To analyse the change in this way, we considered the deadweight loss and administration cost of the taxes that would be removed relative to a user charge. While estimates of the deadweight loss on taxes exist in the Australian context, there is limited information on the deadweight loss of a user charge. We know that taxes that have larger deadweight loss are typically those where the demand curve is more flexible (or more 'elastic'), such as the company tax, while those where the demand curve is less flexible, such as land tax, have a lower deadweight loss. A charge on road use is likely to have some deadweight loss effect as it will deter some road use. Considering the taxes that would be replaced by a user charge may have a similar level of deadweight loss as a user charge, such as fuel tax and registration charge (which also relate to road use) and the GST (which has one of lowest deadweight losses) it is possible that the difference in deadweight loss is not large. It is likely that if there were an economic gain, it would be smaller than the congestion impacts, which are described below. For this reason, and considering the lack of available information on the possible deadweight loss, this change is not included in the economy-wide modelling.

Separate to the impact of this change in tax mix in reform, there are likely to be productivity gains from this reform. These benefits are expected to be:

- greater involvement of users in influencing where capital and maintenance spending occurs is likely to lead to greater allocative efficiency, with benefits of a greater likelihood that investments will enable speed increases, reliability increases, less wear and tear on vehicles, and, more generally, spending on the 'right roads'
- some shift in travel patterns; for example, as:

- some users elect to use telecommunications as a means of meeting their needs that would otherwise be met by using the transport network
- other users take up opportunities to shift transport modes or combine/share trips in a way that minimises transport costs.

Data and evidence which could be used to quantify the value of these benefits is not presently available. Accordingly, the productivity benefits of a shift from current direct road-related charges (i.e. fuel excise and registration fees) to a light vehicle road charging structure has not been modelled as part of this study. Again, this represents a conservative approach to the modelling.⁶⁵

Congestion

Congestion has been identified as a growing cost associated with the use of Australian road networks in a number of studies, including those commissioned by IA⁶⁶ and by the BITRE.⁶⁷ As mentioned in section 2.4.2, a time-of-day and location road user charge could be introduced in Australian cities, as part of a broader package of user charging reforms, to address the economic burden of congestion.

This section considers the potential impact of congestion charging in two stages.

- The first stage considers the economic cost of congestion in Australia using modelling work undertaken by ACIL Allen Consulting for IA's Australian Infrastructure Audit. Based on this analysis, an estimate of the current (and projected) costs of congestion to the Australian economy is established.
- The second stage reviews the impacts on congestion in other jurisdictions where direct road user charging has been introduced. It explores the potential benefits from congestion charging, acknowledging that a specific charging proposal has not been developed at this time. Based on this analysis, some high level assumptions for the value of achievable congestion reduction used in modelling the proposal are developed.

Congestion costs in Australia

Four main elements contribute to the cost of congestion:

- travel time delays
- reduced travel time reliability
- increased vehicle operating costs
- increased environmental costs.

Most of the costs of congestion are experienced as travel time delays; for instance, 80 per cent of the costs avoided in London through the introduction of congestion charging were travel time delay costs.⁶⁸ As a result, the estimates of congestion costs presented here focus on travel time delays. In 2014, IA commissioned ACIL Allen Consulting to model the direct economic contribution of urban transport infrastructure, using a network based approach informed by transport modelling undertaken by Veitch Lister Consulting.⁶⁹ As part of this work, ACIL Allen Consulting used the outputs of the network analysis to estimate the cost of congestion

⁶⁵ Originally, it was thought that the modelling would proceed on the assumption that such a shift would occur in 2025.

⁶⁶ ACIL Allen Consulting, *Urban transport infrastructure: National economic analysis for Infrastructure Australia*, December 2014.

⁶⁷ Bureau of Infrastructure, Transport and Regional Economics, *Estimating urban traffic and congestion cost trends for Australian cities*, Working Paper 71, 2007 and Bureau of Infrastructure, Transport and Regional Economics, *Traffic and congestion cost trends for Australian capital cities*, Information sheet 74, November 2015.

⁶⁸ An *ex post* economic appraisal of the London scheme in 2007 found that most benefits from the scheme were from travel time savings: £163 million of business travellers' benefits relate to travel time savings out of a total £208 million in benefits to business travellers. Non-business travellers' travel time delay costs were of a similar proportion. Transport for London, *Central London congestion charging: Impacts monitoring fifth annual report*, July 2007, p. 136.

⁶⁹ ACIL Allen Consulting, *Urban transport infrastructure: National economic analysis for Infrastructure Australia*, December 2014.

(measured as the travel time delays for car users).⁷⁰ These estimates were \$13.7 billion in 2011 and \$53.3 billion in 2031 (measured in 2010-11 dollars). Interpolated estimates for additional years are presented in Table 15.

Table 15: Congestion delay cost estimates

Year	2011	2015	2028	2031
Cost of congestion (\$m 2010-11)	13,740	17,724	42,881	53,318

Note: Figures for 2015 and 2028 are interpolated from the 2011 and 2031 estimates by ACIL Allen Consulting.

Source: ACIL Allen Consulting, *Urban transport infrastructure: National economic analysis for Infrastructure Australia*, December 2014, page xiv and xviii; PwC analysis.

For consistency with IA's Australian Infrastructure Audit we have used the ACIL Allen Consulting estimate as the basis of the cost of congestion in Australia. While there are limitations with this approach,⁷¹ it has been applied in the context of an indicative analysis where the specification of precise policies to target congestion is not yet established.

Congestion reduction measures: international experiences

To understand the potential economic impacts of a reform that might reduce the cost of congestion, a survey of the literature was undertaken on the following international schemes:

- London (charge introduced in February 2003)
- Stockholm, Sweden (charge introduced in January 2006)
- Gothenburg, Sweden (charge introduced in January 2013).

A few other cities have also introduced a charge (e.g. Milan). However, for the moment, it appears the most extensive evaluations of experience have been conducted on the three cities above.

The three cities all introduced area or cordon charges, one of the four main forms of congestion charging.⁷² A cordon charge is a levy applied for driving into a certain area, typically the CBD of a major city during certain hours of the day. The experience in London, Stockholm and Gothenburg, shows that:

- there are both material travel time and reliability benefits from cordon charging (other benefits included reductions in air pollution and improvements in safety and amenity)

⁷⁰ ACIL Allen Consulting's approach drew upon transport modelling by Veitch Lister Consulting, which estimated traffic flows at different times of the day, by passenger, light commercial and heavy vehicles. In the case of the larger cities, ACIL Allen Consulting's modelling is of an urban conurbation. These are extended urban areas, which might consist of several centres within a larger urban area. For example, the conurbation for New South Wales includes Sydney and the Illawarra and Hunter regions.

To forecast traffic flows out to 2031 the modelling made assumptions about future infrastructure projects. As experience shows that planned infrastructure projects do not always proceed (and to avoid pre-judging the outputs of the Australian Infrastructure Plan and the associated Infrastructure Priority List), the only road and public transport projects included in the modelling for 2031 were projects under construction at the time of the modelling and projects where a budget commitment had been made by the respective government(s).

From this data, ACIL Allen Consulting isolated delay costs to passenger vehicles (both passenger and business journeys) due to congestion, measured as excess journey time. To quantify these delay costs they were evaluated by the value of travel time. The estimates, detailed in Table 15, exclude other costs associated with congestion, specifically, reduced travel time reliability, increased vehicle operating costs and all congestion costs to commercial vehicles such as delivery vans and trucks.

⁷¹ These include that some elements of congestion are not included in the base estimate (which would raise the cost of congestion) and that assumptions have been made about which planned infrastructure projects will proceed. Further analysis could consider these in more detail.

⁷² There are four broad forms of user pricing for roads:

- Area/cordon charging: charging for access to specific areas.
- Distance based schemes: charge users based on the distance they travel on a defined network, which could be a section of a city, a city or a nationwide network. This approach can be expanded to include different prices according to vehicle characteristics, eg mass.
- Link tolling: Charging for access to specific parts of the network, for example, freeways, bridges or tunnels.
- Lane based pricing: differential pricing for different lanes on a road network, for example, express lanes, or lanes reserved for carpooling.

Source: Austroads, *Research Report: Understanding the Impacts of Road Pricing Factors on Future Road Use and Network Wide Effects*, 2011.

- charging can offer travel time and reliability benefits in smaller cities and cities that do not have a large public transport mode share (factors relevant to the application of charging in cities such as Adelaide and Canberra)⁷³
- the effects are enduring, although it becomes harder to assess these effects over time,⁷⁴ both as a result of changing circumstances after the introduction of a charge, and the difficulty in assessing a counterfactual case.

At present, there is little experience in using broader network charging to manage congestion. Until 2010, the Dutch Government was considering introducing a broad mass/distance/location/time of day charging mechanism – ‘Paying Differently for Mobility’ - to replace existing vehicle-related taxes and charges. As yet, such a scheme has not been pursued. However, trials of the technology to be used suggested that drivers would in fact change their driving practices. Findings of the trials included:

- 70 per cent of trial drivers in Eindhoven changed their driving patterns, e.g. by avoiding peak hour traffic and using highways instead of local roads (due to a pricing structure encouraging users onto highways).
- On average, drivers in the trial reduced their travel cost per kilometre by 16 per cent.⁷⁵
- Immediate feedback on the price of the road chosen and total charges for the trip (via information from an ‘on-board unit’ within the vehicle) was found to be essential to maximizing the change in behaviour.
- A trial in Arnhem reduced peak hour trips by 40 per cent and 60 per cent of participants drove less frequently. In a trial in a part of Rotterdam, the figures were 56 per cent and 80 per cent. Flexible working hours were a major factor in allowing participants to benefit from the trial.⁷⁶

The measurable impacts on congestion from some of the above studies are summarised in Table 16.

Table 16: Possible direct impact assumptions from reform

Indicator	Value	Description	Reference
Traffic volume reduction	16%	London traffic volumes in 2007 were 16% below levels before the charge was introduced	Transport for London, Central London congestion charging: Impacts monitoring fifth annual report, July 2007.
Traffic volume reduction	20-22%	Stockholm cordon traffic levels have remained about 20-22% lower than those before the charge was introduced	Eliasson, J., ‘The Stockholm congestion charges: an overview, CTE Working Paper 2014:7’, Centre for Transport Studies, 2014.

⁷³ Gothenburg has a population of approximately 500,000. The density of the city is lower than in Stockholm, and the pre-charging public transport mode share was somewhat smaller than in Stockholm. See Maria Borjesson and Ida Kristoffersson, ‘The Gothenburg congestion charge. Effects, design and politics’, *Transport and Research Part A*, Vol. 75, 2015, pp.134-146.

⁷⁴ This is shown by the experience of congestion charging in London. Measured strictly against baseline (pre-charging) travel times, the level of congestion relief in London has fallen, from about 30 per cent in the first year of the charge (2003) to about 10 per cent in 2013.

The decline appears to be due to a variety of factors, including: ‘background’ increases in traffic; road space in central London being subsequently re-allocated from general traffic to other uses (eg a focus on public transport, cycling and pedestrians), as well as disruption from construction activity.

Transport for London argues that, although travel speeds have been slowly moving back towards those in 2002, compared with a situation where the congestion charge had not been introduced, the congestion reduction benefits of the London charge have persisted – in other words, the charge has continued to offer a 30 per cent reduction in congestion compared to what might have been. On the other hand, the experience in Stockholm suggests that the reduction in traffic levels can be long-lasting. Therefore, the congestion-reduction effect is arguably larger over time, ie although the city’s population has grown, the traffic levels have remained lower, and not increased as they have in London.

Source: Transport for London, Central London congestion charging: Impacts monitoring fifth annual report’, July 2007.

⁷⁵ The number of people and vehicles involved in the trial was relatively limited, although it did cover around 200,000 kilometres of travel during the trial period. IBM, *NXP and IBM Announce Results of Landmark Road Pricing Trial*, 2010. Available at <http://www-03.ibm.com/press/us/en/pressrelease/29507.wss> Accessed 20 January 2016.

⁷⁶ M. Lay, *Road Pricing at Amsterdam - comments of the proposed scheme in Holland and the operating schemes in Stockholm and London*, 2010. Available at <http://www.roadsaustralia.com.au/document/send/361> Accessed 20 January 2016.

Indicator	Value	Description	Reference
Traffic volume reduction	12-13%	Traffic levels in the Gothenburg cordon area are about 12-13% lower during peak periods	Borjesson, M. and Kristoffersson, I., 'The Gothenburg congestion charge. Effects, design and politics', Transport and Research Part A, Vol. 75, 2015, pp.134-146.
Reduction in peak delays	10-50%	Depending on the location measured, morning peak delays in Gothenburg reduced by between 10-50%	Borjesson, M. and Kristoffersson, I., 'The Gothenburg congestion charge. Effects, design and politics', Transport and Research Part A, Vol. 75, 2015, pp.134-146.
Congestion reduction	10-15%	Congestion reduction in Singapore due to a cordon scheme ranged from 10-15%	IPA, Urban transport challenge: A discussion paper on a role for road pricing in the Australian context, 2010, pp.36 – 39.
Assumed congestion reduction benefit	15%	Congestion reduction benefits equivalent to 15% of the burden of congestion	Assumption

Clearly, some caution should be used in extrapolating from the examples above to testing the possible economic impacts of a potentially different form of congestion charging in Australian cities. Nevertheless, the experience noted above shows that road users do respond to the application of a financial incentive to modify travel behaviour. It therefore suggests that a well-designed road charging scheme in the Australian context would also reduce congestion and provide worthwhile travel time and reliability benefits.

The form of any congestion-related light vehicle charge that might be introduced in Australia will need to be determined by future governments. It may ultimately take the form of a mass/distance/location/time of day pricing, or some other form of charge. Following future consideration of the specifics of any charging system, further thought can be given to carefully assessing the potential net benefits in the Australian context drawing on overseas experiences. This analysis could consider other costs and benefits that have not been included here.⁷⁷

For the purpose of this report, which is to give an indication of the possible gross economic impacts, it has been assumed that a congestion charge is introduced such that it has an effect equivalent to a 15 per cent reduction in the burden of congestion estimated by ACIL Allen Consulting (detailed in Table 15). Bearing in mind the experience mentioned above and that a 15 per cent reduction in the cost of congestion could be achieved by a smaller change in the level of congestion,⁷⁸ a 15 per cent reduction in the cost of congestion is not unreasonable. Applying this assumption to ACIL Allen Consulting's forecast cost of congestion in 2028 and 2031 (as examples) results in the impacts described in Table 17.

⁷⁷ In regards to costs: There are some categories of cost appropriate for consideration in a cost-benefit analysis that have not been considered here; the London scheme evaluation included the cost of deterred trips – mostly to leisure travellers – for example (source: Transport for London, Central London congestion charging: Impacts monitoring fifth annual report, July 2007, p 138.). Costs to leisure travellers are not included in this analysis because they are not captured in the economic measure of GDP however they are costs that are legitimately included in a cost-benefit analysis. Establishment and transition are other costs that would need to be considered in an evaluation of a detailed reform proposal.

In regards to benefits: It is plausible that reducing congestion could increase capital productivity in the road freight industry. Reducing the incidence of congestion is considered likely to improve travel time reliability. This could reduce the travel time variance that road freight operators need to account for when scheduling services. This could result in a productivity gain, as operators would be able to schedule more services in the same time period, using the same vehicle. While this benefit is plausible, parameters with which to value this benefit have yet to be established in the literature on congestion.

⁷⁸ A 15 per cent reduction in the cost of congestion might be achieved by a less than equal magnitude change in traffic volumes as there appears to be a non-linear relationship between the two. That is, it seems likely that as traffic volumes increase, the cost of congestion increases by a greater factor. Congestion occurs due to network wide effects of increased vehicle usage. Components of congestion costs, such as reduced trip reliability, are likely to have a non-linear relationship to commonly used congestion metrics, such as vehicle speeds. This implies that the benefits of congestion reduction may be initially high and then exhibit diminishing returns to scale.

Table 17: Indicative direct impact on cost of congestion from reform

Year	2028	2031
Saving if the cost of car congestion is reduced by 15% (\$m 2010-11)	6,432	7,998

Source: ACIL Allen Consulting, Urban transport infrastructure: National economic analysis for Infrastructure Australia, December 2014, page xiv and xviii; PwC analysis.

3.5.3 Public transport

To estimate the potential direct economic impacts of the Plan's recommendation 6.14, we undertook a brief literature review and consulted with industry experts. The findings of this review are summarised below.

A review of franchising experiences in Australia and around the world, as part of a 2012 report by LEK Consulting for the Tourism and Transport Forum,⁷⁹ showed:

- Internationally:
 - in Britain, when bus services were tendered in 1995, unit costs declined by 50 to 55 per cent
 - in Sweden, buses and trains costs reduced by up to 33 per cent
 - in the Netherlands, efficiencies increased by 20 to 50 per cent
 - the United States of America's bus industry achieved cost savings of 30 to 46 per cent.⁸⁰
- In Sydney, the privately run Manly Fast Ferry had a fare of \$8.50 (in August 2011) with a journey time of 17 minutes between Circular Quay and Manly relative to a fare of \$9.00 for the publicly operated Sydney Fast Ferries with a journey time of 18 minutes. Meanwhile for the same journey, Sydney Ferries cost an estimated \$13.97 for a 30 minute trip once the subsidy was added to the fare.⁸¹ Also in Sydney, a 2008 IPART review of Sydney's CityRail found cost savings of 17 per cent could be achieved.⁸²
- In Melbourne, by linking financial incentives to punctuality and reliability, the train and tram franchisees reduced delays and cancellations by 35 per cent.⁸³
- In Perth, the franchising of buses in 1996 and 1998 resulted in unit costs falling 29 per cent from \$3.58 per service kilometre in 1992-93 to \$2.55 per service kilometre in 1998-99.⁸⁴

While the report noted the above step changes that are possible in reducing operating costs, these are a step change and are not repeated in subsequent rounds of franchising. As a result, when a sector is initially opened up to tendering, a large, one-off reduction can be expected. Industry experts⁸⁵ spoken to confirmed this and noted that the Australian experience shows some efficiency gains, albeit smaller, can also occur in the second and third rounds of franchising.

⁷⁹ LEK Consulting, Public transport, private operators: Delivering better services through franchising, Tourism & Transport Forum, July 2012.

⁸⁰ David Hensher and Ian Wallis, 'Competitive tendering as a contracting mechanism for subsidising transport: The bus experience', Journal of Transport Economics and Policy, 2005, cited in LEK Consulting, Public transport, private operators: Delivering better services through franchising, Tourism & Transport Forum, July 2012.

⁸¹ Ibid. p.18.

⁸² Ibid. p.30.

⁸³ Ibid. p. 21.

⁸⁴ Ibid. p.27.

⁸⁵ The project team spoke to an experienced former executive of a public transport franchise operator and a government employee familiar with tendering of public transport services.

The industry experts suggested the efficiency gains set out in Table 18 are possible for Australian bus and train operators yet to be exposed to franchising. These gains are at the low end of the range in efficiency gains of 20 to 55 per cent noted in the literature above.

Table 18: Possible direct impact assumptions from reform

Indicator	Description	Value
Operating cost savings possible from franchising trains	In first round	20%
	In second round	15%
Operating cost savings possible from franchising buses	In first round	20%
	In second round	10%
	In third round	5%

Source: Industry experts, November 2015

It was initially thought that the efficiency gains from the first round of franchising could be in the order of 30 per cent on average (with some being above this and some below). However it was decided that the efficiency gains to be modelled were more likely to be lower than this figure as:

- Some bidders for concessions had been too optimistic and ultimately were not able to achieve their ambitious cost reductions, the result being an unprofitable operation or the operator cancelling its contract and leaving. As a result, bidders and governments alike are not likely to expect similarly large gains in the first round of franchising.
- Gains are less likely to be front-ended as the private sector (especially the incumbent operator) and government are likely to have a much better understanding of the business by the time of the second round franchise, and therefore a better idea of where further costs savings could be realised.

The state of competitive tendering across Australia varies. In Melbourne, rail is operated under a franchise contract but in Sydney, Brisbane and Perth the public sector operates the train transport system. There are also differences in the bus sector:

- In Melbourne, all buses are operated by the private sector; however, only 30 per cent of the market is operated under a competitive tender arrangement with the remaining 70 per cent operated under contracts that have not been exposed to competitive tendering.
- In Sydney, the State Transit Authority, a public entity, operates a large section of the bus market, particularly in the inner suburbs of Sydney. Private operators run the remainder of the market with their services having been competitively tendered.
- In Brisbane, a similar situation exists, although the private bus operators are less advanced in competitive tendering. These operators are shortly to have their contracts renegotiated in order to drive further efficiency and better performance outcomes.

A summary of the structure of current public transport operations around Australia is provided in Appendix A.

In order to estimate the impacts of this reform, we have focussed on those operations where there are likely to be the largest gains. These are:

- Sydney Trains – the State owned operator of trains in Sydney
- Queensland Rail – the State owned operator of trains in Brisbane and South East Queensland
- Transperth – the State owned operator of trains in Perth
- State Transit Authority – the State owned operator of buses in inner Sydney
- Brisbane Transport – the local government-owned operator of buses in Brisbane
- the 70 per cent of the bus market in Melbourne currently operated by the private sector but which has not been competitively tendered.

As noted in Appendix A, there are other operators that are also currently operated without private sector franchising. These are also subject to the IA recommendation; however due to data availability and materiality, we have focussed on the operations above. To give an indication of the scale of these entities, the operating expenditure associated with these selected public transport operations is provided in Table 44 in Appendix A.

4 Model assumptions

Assumptions that are applied in the CGE model, both of the impact on the relevant sectors and also to the baseline forecast of the economy, are set out in this chapter. In addition to the assumptions set out here, more detail on the CGE model is provided in Appendix C.

4.1 Baseline assumptions

The baseline model of the economy used in the modelling for this analysis is based on long run projections of productivity, population and participation rates developed by PwC in our Intergenerational Fiscal and Economic Model (IFEM) – an overview of the IFEM is provided in Appendix D.⁸⁶ This analysis is based on the most recent data on the Australian economy and is forecast using Australian Bureau of Statistics (ABS) population projections.

The core projection is based on the ABS population projections – specifically, Series B of the ABS series 3222.0 ‘Population projections, Australia, 2012 to 2101’, which was released in November 2013. These have been updated by PwC to reflect actual population figures released since and so better reflect recent demographic trends, particularly in WA.

These updates better reflect current data and trends in population across states, resulting in marginally lower population projections than those outlined in the ABS series B population projection – see Table 19. ABS Series B projected an Australian population of 30,501,192 in 2031. ACIL Allen Consulting’s 30,497,850 population estimate for 2031 (produced in September 2014 as input to economic modelling for the Australian Infrastructure Audit) is similar but fractionally lower. The population in the IFEM model for 2031 is only 0.2 per cent lower than that in the ABS projection.

Table 19: Comparison of different population projections in 2031

	ABS Population Projection Series B November 2013	ACIL Allen Consulting September 2014	PwC IFEM November 2015
2031 Australian population projection	30,501,192	30,497,850	30,438,040
Difference from ABS’ 2031 Australian population projection	-	-3,342	-63,152
	-	-0.01%	-0.21%

Source: Australian Bureau of Statistics, 3222.0 ‘Population projections, Australia, 2012 to 2101’, November 2013. ACIL Allen Consulting, National Infrastructure Audit data set, 1 September 2014. PwC analysis.

This updated and slightly lower growth assumption is consistent with the recently announced update to Commonwealth Treasury’s population assumptions, in which it reduced the population growth assumptions underpinning long term economic projections.⁸⁷ For this reason, our projections are a more up-to-date reflection of the latest population expectations and align more closely with the Commonwealth’s official expectations.

⁸⁶ This model is being used by all State and Territory Governments to develop standardised forecasts for use in ongoing Commonwealth-State negotiations regarding the future of the Federation. Discussion of the model forecasts is provided at: www.pwc.com.au/tax/assets/pwc-igr-response-mar15.pdf, Accessed 20 December 2015

⁸⁷ www.treasury.gov.au/PublicationsAndMedia/Speeches/2015/The-Macroeconomic-Context. Accessed 20 December 2015.

Other assumptions about population and economic growth, which also reflect the above points, are described below as well as a comparison to the ACIL Allen Consulting projections. Table 20 shows the assumed annual average growth rates in population by state/territory. This shows the reduced rate of population growth projected for Western Australia is one of the largest differences between ACIL Allen Consulting's 2014 projection and PwC's 2015 projection. Overall, Australia is assumed to grow by 1.56 per cent per annum between 2011 and 2031 and by 1.19 per cent per annum between 2031 and 2040.

As a result of the population changes, the GSP/GDP growth is also lower in PwC's IFEM (see Table 21 for the assumed annual average growth rates in GSP/GDP). Economic growth in the last 12 months has also been lower than the projections, with six of the last eight quarters recording below trend growth. This explains some of the lower growth projections.

Table 20: Comparison of assumed annual average growth in population by State/Territory, 2011-2031

Jurisdiction	ACIL Allen Consulting September 2014	PwC IFEM November 2015	Difference
NSW	1.18%	1.20%	0.02%
VIC	1.59%	1.60%	0.01%
QLD	1.84%	1.80%	-0.04%
SA	0.93%	0.91%	-0.01%
WA	2.65%	2.59%	-0.06%
TAS	0.45%	0.44%	-0.01%
NT	1.58%	1.60%	0.01%
ACT	1.75%	1.69%	-0.06%
Australia	1.57%	1.56%	-0.01%

Source: PwC analysis

Table 21: Comparison of assumed annual average growth in GSP/GDP by State/Territory, 2011-2031

Jurisdiction	ACIL Allen Consulting September 2014	PwC IFEM November 2015	Difference
NSW	2.66%	2.62%	-0.04%
VIC	2.90%	2.80%	-0.10%
QLD	3.43%	3.36%	-0.07%
SA	2.36%	2.16%	-0.20%
WA	4.21%	3.94%	-0.27%
TAS	2.13%	1.78%	-0.35%
NT	3.27%	3.53%	0.26%
ACT	2.69%	2.71%	0.02%
Australia	3.06%	3.00%	-0.06%

Source: PwC analysis

To provide some indication of how the forecast growth rates summarised above impact on GSP and GDP Table 22 shows the forecast GSP and GDP in 2031 and 2040 in comparison to 2011.

Table 22: Historical and forecast real GSP/GDP (\$m)

Jurisdiction	2011	2031	2040
NSW	490,403	823,090	1,003,941
VIC	345,321	599,744	753,453
QLD	286,230	554,380	707,679
SA	98,358	150,768	179,858
WA	231,064	500,876	669,934
TAS	26,273	37,406	42,755
NT	19,621	39,262	49,628
ACT	35,914	61,309	77,896
Australia	1,532,232	2,766,837	3,485,144

Note: Values are in 2015-16 dollars. Medium term projections used in this analysis are based on economic outlook as per Commonwealth Treasury Budget 15-16. Since this analysis was conducted, Commonwealth Treasury has revised down the medium term economic outlook in MYEFO 15-16 for real GDP.

Source: PwC's IFEM, November 2015.

Table 23 compares the ACIL Allen Consulting's projections for industry growth with those from the PwC VURM CGE model baseline. Since the type of models used and the dates of the forecasts differ, comparisons are not straightforward. A number of observations about the reasons for and significance of the differences can nonetheless be made:

- some of the differences are due to a difference in the industry categories used in the models
- since the industry baseline is partly determined by macro-economic conditions, forecasts for industries (e.g. construction) that rely heavily on volatile overall investment spending can be affected by recent history and the general downgrading of macro-economic prospects in the last year (see discussion above)
- the considerably higher forecast for mining industry activity in the PwC VURM baseline reflects our view that, despite the end of the construction phase of the mining boom, production and exports from recently installed capital will continue to grow over a wide range of commodity prices since the capacity, once installed, will tend to be used
- provision by government services, and demand for services, will remain subdued relative to earlier forecasts, consistent with macro-economic forecasts for slower growth overall.

Whilst differences in industry composition in the baseline matter, the effects of policy should be interpreted as deviations from the base case. Understanding and interpreting the deviations as being from an economy that is growing overall is more important than the industry structure of the base case.

Table 23: Comparison of industry value added, 2011-2031

Industry	ACIL Allen Consulting Compounded annual growth rate 2011 – 31	PwC VURM Compounded annual growth rate 2011 – 31	Difference in baseline growth rates
Agriculture, forestry and fishing	1.5%	2.0%	0.4%
Mining	3.1%	6.7%	3.6%
Manufacturing	2.8%	3.7%	0.8%
Electricity, gas, water and waste services	2.2%	3.8%	1.6%
Construction	3.9%	2.7%	-1.2%
Wholesale trade	3.2%	n/a	n/a
Retail trade	3.0%	2.5%	-0.5%
Accommodation and food services	3.0%	2.5%	-0.4%
Transport, postal and warehousing	3.3%	3.4%	0.2%
Information media and telecommunications	3.5%	2.6%	-1.0%
Financial and insurance services	2.8%	2.9%	0.1%
Rental, hiring and real estate services	3.6%	n/a	n/a
Professional, scientific and technical services	3.0%	2.7%	-0.3%
Administrative and support services	2.9%	n/a	n/a
Public administration and safety	3.0%	2.3%	-0.7%
Education and training	3.1%	n/a	n/a
Health care and social assistance	3.1%	n/a	n/a
Arts and recreation services	3.2%	n/a	n/a
Other services	3.1%	2.3%	-0.8%
Ownership of dwellings	3.6%	3.3%	-0.2%

Source: ACIL Allen Consulting, National Infrastructure Audit – Value added growth by industry data, 26 February 2015. PwC analysis.

Note: The ACIL Allen Consulting modelling utilised a different set of industry categories to the VURM model; as such, similar categories were aligned which left some categories unmatched.

4.2 Foreign investment considerations

The modelling approach taken allows total investment to vary and for it to be determined by rates of return. Since the model assumes domestic saving is fixed as a proportion of GDP (i.e. that households' average propensity to save is set over the business cycle), if new investment opportunities occur in the economy they

will be financed by foreigners rather than by reduced investment elsewhere in the economy or increased saving by domestic residents. In the long term, mechanisms exist in the model that stabilise the ratio of payments to foreigners to GDP.⁸⁸ This means that a policy change can attract foreign capital but in the long term the model recognises that foreigners have to be paid returns and that those returns as a share of national production do not change significantly.

This recognises that an increase in total foreign investment in Australia is ‘good’ only insofar that it increases payments to Australians in the form of higher payments to Australian owners of capital, labour and land, taxes or via some sort of technological transfer mechanism. Foreign capital must be paid for over time, and might be thought of as loans to finance profitable projects without having to save up for them first.

That some particular group of investors may acquire newly privatised assets is not something that will obviously make a difference in an economy-wide model. Of course, if they have expertise in running water systems, for example, that benefit will be captured as productivity gains in the sector. But the fact that some group owns a particular asset does not obviously involve a change in the total amount of foreign investment in Australia. Rather it represents a change in the mix of investment by: source country (more Chinese and less UK investment for example), sector (more utilities and less manufacturing), portfolio (more direct investment in owning and running businesses, less indirect ownership through shares or debt), and risk (perceptions about the stability of returns in former public utilities).

4.3 Shocks modelled by sector

The benefits quantified in Chapter 3 are transformed into ‘shocks’ to the economy, to allow for input into the VURM CGE model. These shocks will stimulate the model economy, and therefore provide estimates of the direct impacts of each reform, as well as the flow-on impacts to other sectors.

4.3.1 Energy

Table 24: Reform and variables shocked for the energy sector

Reform	Shock variable
Privatisation (generators)	Capital productivity in the coal, gas and hydro – electricity generation industries
Privatisation (networks)	Efficiency of primary factors of production (capital, labour, land) in the Electricity Supply industry
Price deregulation	Efficiency of primary factors of production (capital, labour, land) in the Retail Trade industry

Source: PwC

Privatisation (generators)

The capital productivity benefits generated from privatisation were estimated to be between 1.5 per cent and 1.8 per cent. This shock was applied to the relevant electricity generation industry in the CGE model – i.e. coal electricity generation, gas electricity generation or hydroelectricity generation. The benefits were assumed to start in 2017 and require five years to completely take effect.

In order to apply the productivity change of 1.5 per cent in NSW, 1.8 per cent in Victoria and 1.65 per cent (an average of the two) in all other states where there are government-owned generation assets, the proportion of coal, gas and hydro power that is government-owned in each state was considered in order to produce a weighted average productivity impact. This was then applied to the relevant sectors by state.

⁸⁸ This works through the real exchange rate moving to accommodate the required stabilisation of the ratio between the current account and GDP.

Privatisation (networks)

The benefits of the privatisation of networks are estimated as operating cost savings in each state and territory. These operating cost savings are translated into a change in the overall efficiency of primary factors of production in the Electricity Supply industry which includes transmission and distribution businesses. That is, for the same level of output, fewer resources are being used. Similar to the privatisation of generators, this has been phased in over five years from 2017.

Price deregulation

The cost savings arising from deregulation of the electricity retail sector are assumed to result in a direct increase in the efficiency of primary factors of production. Through increased competition, it is assumed lower levels of operating expenditure (reflected in factors of production) are utilised to produce the same level of output. This has been phased in from 2017 over five years and has been applied to the Retail Trade industry, under which electricity and gas retail falls (note that while retail is a large sector, the impacts are representative of an impact only upon the electricity and gas retailers not on the whole retail sector).

4.3.2 Telecommunications

Table 25: Reform and variables shocked for the telecommunications sector

Reform	Shock variable
Privatisation of the NBN	Efficiency of primary factors of production (capital, labour, land) in the Communications industry

Source: PwC

A primary factor of production productivity shock in the Communications industry of five per cent is employed. It has also been assumed that it will be implemented in 2024 after the rollout is complete and it will take five years for the effects to phase in. The impact is scaled to represent an impact equivalent to the NBN's share of the communications industry.

4.3.3 Water

Table 26: Reform and variables shocked for the water sector

Reform	Shock variable
Privatisation of metropolitan water utilities	Efficiency of primary factors of production (capital, labour, land) in the Water Supply industry

Source: PwC

Annual savings were estimated based on a productivity gain of 10 per cent. Applying it to the CGE model, we have assumed an efficiency gain for primary factors of production. That is, for the same level of output, fewer resources will be required. As with energy, we assume this process will commence in 2017. Moreover, we have assumed that states will undertake a staggered approach in implementation, and it will take 10 years for the benefits of each privatisation to fully take effect. This slower adjustment allows for the fact that the water sector is less reformed relative to other utility sectors.

4.3.4 Impact of privatisation – energy, telecommunications, water

As discussed in section 3.4, the impact of the sale of assets is assumed to enable governments to finance debt at a lower cost. Specifically, the benefits are assumed to be an interest cost saving to government of 0.15 per cent of the value of assets to be sold. The shock has been applied as an improvement in the return to capital for government. This represents fewer resources being required to produce outputs due to the lower cost of debt. This shock is applied to sectors in which governments invest according to the CGE model database. These are the rail, water, communications, public administration and other services industries. Furthermore, we have assumed that the energy sector will not receive further government investment, as all infrastructure will have been privatised. This applies across all privatisation scenarios in this report.

As discussed earlier, the benefits are estimated to be an interest cost saving of 0.15 per cent. Using the cost savings estimated, the ‘shock’ was implemented and phased in over the time periods specified in the table below.

Table 27: Asset sales timing of benefits

Sector	First year of benefits
Energy – networks and generators	2017
Water	2017-2024 (staggered start year among states)
Communications	2024

Source: PwC

4.3.5 Transport

Table 28: Reform and variables shocked for the transport sector

Reform	Shock variable
Heavy vehicle pricing	Total productivity in the Road Freight industry
Congestion pricing	Labour productivity in the Trade, Road Passenger, Communications, Financial Services, Business Services, Public Service and Other Services industries
Public transport franchising	Efficiency of primary factors of production (labour, capital, land) in Road Passenger and Rail Passenger industries

Source: PwC

Heavy vehicle pricing

As discussed in earlier sections of the report, the direct impact assumption used for heavy vehicle pricing is a 10 per cent productivity gain, as per the ‘more fundamental road reform’ scenario in the PC’s 2006 report. This has been applied to the Road Freight industry as an overall productivity shock, smoothed over a five year period to account for time taken for effects to phase in. This starts in 2021.

Congestion pricing

As discussed in section 3.5.2, the increased travel time costs due to congestion, as estimated by ACIL Allen Consulting,⁸⁹ are used as an estimate of the burden of congestion. After consideration of congestion reduction benefits achieved in three cities – London, Stockholm and Gothenburg – it has been assumed that congestion charging in Australian capital cities could achieve a 15 per cent reduction in the burden of congestion.

The estimates were applied as a labour productivity gain to the Trade, Road Passenger, Communications, Financial Services, Business Services, Public Service and Other Services industries. These are sectors that have road use as a significant input in their production function. This implies that as a result of reduced congestion, workers are more efficient because they are able to get from A to B in a shorter period of time.

For the purposes of this modelling, it was assumed that the start date of the congestion component of a broader road user charging measure would be 2028. This date recognises the need to build upon lessons learned from any changes in heavy vehicle charging and the need for extensive preparatory work ahead of any start date for charging-based demand management. The estimated savings were phased in across two years from 2028. Two years was chosen so as to allow some time for drivers to change their patterns of road use.

⁸⁹ ACIL Allen Consulting, Urban transport infrastructure: National economic analysis for Infrastructure Australia, December 2014.

The gain which builds up over two years from 2028 is a step-change in the labour productivity of the above sectors. Our analysis period extends to 2040 but the ACIL Allen Consulting estimate of congestion is available to 2031. To be conservative, we have not extrapolated ACIL Allen Consulting's estimates to 2040 as this would require extending the assumptions that no new infrastructure projects emerge or that road users change their behaviours. The result is that the productivity savings continue but do not increase beyond 2029. To the extent that congestion does worsen and if congestion pricing continues to address the problem beyond 2029 then the economic gains may be greater than is modelled here.⁹⁰

As noted in section 3.5.2, there are other costs not included in the base estimate of congestion that could be mitigated by congestion pricing. Overseas experience suggests congestion pricing not only reduces the cost of delay, it also improves travel time reliability. The reduction in delay and the improvement in reliability should also offer some improvement in capital productivity (e.g. through fleet owners more confidently improving delivery schedules and therefore increasing the number of 'runs' from a particular vehicle). Given data limitations, we have not sought to model this potential improvement. Again, this reflects a conservative approach to the modelling.

Public transport franchising

The operating cost savings from franchising publicly operated passenger rail services were estimated to be 20 per cent in the first round and 15 per cent in the second round. For the franchising of bus services, this was estimated at 20 per cent in the first round, 10 per cent in the second round and 5 per cent in the third round.

Table 29 shows these assumed savings by year. Train franchises are assumed to have a 12 year long contract and bus franchises are assumed to have a 7 year long contract. It is assumed there is a staggered pattern to the implementation of the reform, with the first train franchise in NSW assumed to start in 2018 and the first bus franchise in NSW assumed to start in 2017.⁹¹ Other states are then assumed to follow NSW.

These estimates were applied to the operating expenditure of the services to be franchised to provide operating savings.

The operating savings of franchising trains and bus services were used to shock the economy through increased efficiency of primary factors of production in the Rail Passenger and Road Passenger industries respectively.

⁹⁰ Intuitively, it is expected that, as cities grow, levels of congestion tend to increase.

⁹¹ Although we have not been able to confirm the fact, a research paper indicates the previous State Transit Authority franchising contract ran for seven years from 2005 to 2011. Assuming the current contract also runs for seven years, this would indicate it would end in 2017. See Rhonda Daniels, Cameron Gordon, Corinne Mulley and Nick Stevens, 'Optimal contracting and incentives for public transport in Sydney: what has been learned from the Sydney Metro experience?', Australasian Transport Research Forum 2011, page 13.

Table 29: Assumed operating expenditure savings applicable for train and bus operations (%)

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Year #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Train																										
NSW	-	-	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
QLD	-	-	-	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
WA	-	-	-	-	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Bus																										
NSW	-	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
QLD	-	-	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
VIC	-	-	-	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

5 Results

This chapter sets out the estimated economy-wide impacts of the proposed reforms. Results are estimated by applying the direct impact assumptions (in Chapter 3) to a baseline CGE model (see assumptions in Chapter 4). These are presented as a deviation from baseline GDP and GSP levels. Results are presented as annual changes in 2031 and 2040.

5.1 Overall results

The package of reforms results in a GDP increase above baseline of \$27.2 billion in 2031 and \$39.0 billion in 2040. On average, the package of reforms equates to increased GDP per capita of \$893 or increased GDP per household of \$2,312 in 2031. These gains grow larger by 2040; GDP per capita is \$1,151 higher while GDP per household increases by \$2,936.

Table 30: Impact of reforms on real GDP in 2031 and 2040

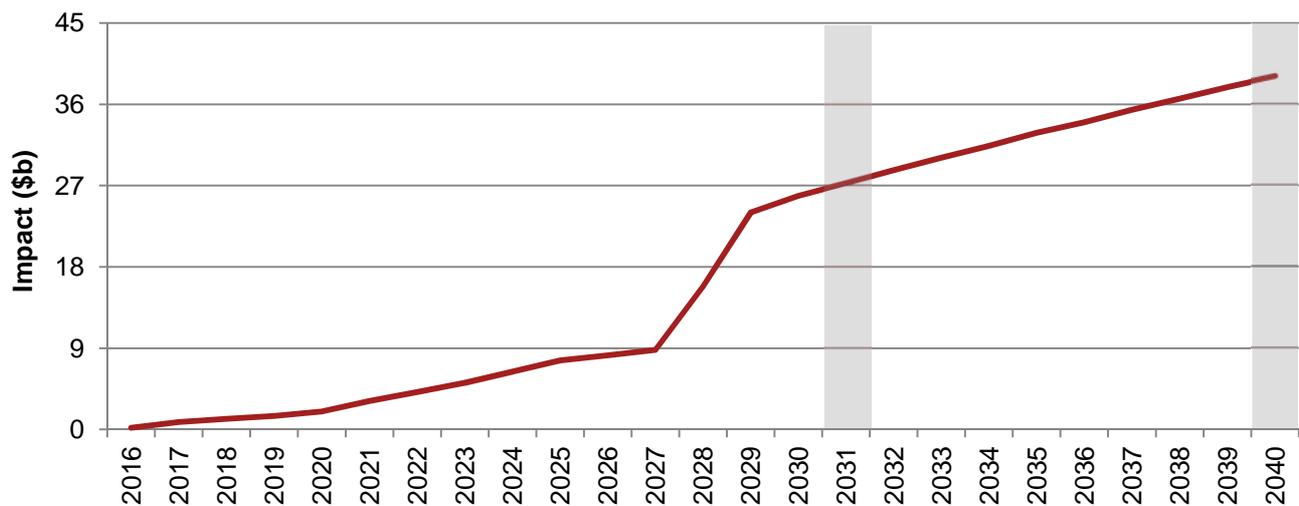
Indicator	2031	2040
GDP in baseline	\$2,766,837m	\$3,485,144m
Increase in GDP above baseline	\$27,169m	\$38,956m
Projected population	30.438m	33.854 m
Increase in GDP per capita above baseline	\$893	\$1,151
Projected number of households	11.752m	13.267m
Increase in GDP per household above baseline	\$2,312	\$2,936

Note:* Based on Australian Bureau of Statistics projections of population and numbers of households. Values are in 2015-16 dollars.

Source: Australian Bureau of Statistics, 3236.0 - Household and Family Projections, Australia, 2011 to 2036, Released 19 March 2015, Series III; Australian Bureau of Statistics, 3222.0 - Population projections, Australia, 2012 to 2101, Released November 2013; PwC IFEM, November 2015; PwC analysis.

Figure 3 shows the annual change in GDP relative to the baseline due to the reforms. This is in real 2015-16 dollars (but undiscounted). The area under the line shows the cumulative GDP.

This shows there is a steady growth in GDP and household consumption until 2028. In 2028, there is a significant increase primarily attributed to the transport sector reform of congestion pricing. This subsequently leads to an annual change of \$39 billion by 2040.

Figure 3: Incremental change in real GDP

Note: Values are in 2015-16 dollars.

Source: PwC analysis.

5.2 State and territory results

As a result of the reforms modelled here, all jurisdictions are expected to experience growth in GSP above the baseline.

On a state by state basis, Western Australia receives the greatest increase in GSP of \$13.9 billion in 2040. New South Wales and Queensland are the next highest beneficiaries with GSP growing in 2040 by \$8.9 and \$8.8 billion respectively.

Table 31: Impacts on GSP/GDP in 2031 and 2040

Year	GSP/GDP (\$m, p.a.)	
	2031	2040
NSW	7,240	8,860
VIC	4,445	4,565
QLD	6,048	8,750
SA	1,379	1,789
WA	7,182	13,914
TAS	327	404
NT	281	435
ACT	266	241
Australia	27,169	38,956

Note: Values are in 2015-16 dollars.

Source: PwC analysis.

5.3 Sectoral results

Across the individual sectors, the reforms made in the transport sector have the most significant impact on GDP and household consumption.

5.3.1 Energy

The privatisation and price deregulation reforms in the energy sector are estimated to generate additional GDP per annum of \$1.7 billion in 2031, and \$2.3 billion in 2040 – this is shown in Table 32. As the energy sector operates more at a national level than either the transport or water sector (e.g. through the National Electricity Market) jurisdiction-specific impacts have not been presented here.

Table 32: Impacts on GDP from energy reforms in 2031 and 2040

Year	GDP (\$m, p.a.)	
	2031	2040
Australia	1,734	2,279

Note: Values are in 2015-16 dollars.

Source: PwC analysis

5.3.2 Telecommunications

Of all the reforms estimated, the privatisation of the NBN has the smallest impact. This can be explained by the assumption applied which is that there is a five per cent efficiency gain applied to all primary factor input costs. The privatisation of the NBN is estimated to generate GDP per annum of \$119 million in 2031, and \$126 million in 2040.

As the telecommunications sector operates more at a national level than either the transport or water sector, jurisdiction-specific impacts have not been presented.

Table 33: Impacts on GDP from NBN reforms in 2031 and 2040

Year	GDP (\$m, p.a.)	
	2031	2040
Australia	119	126

Note: Values are in 2015-16 dollars.

Source: PwC analysis.

5.3.3 Water

The privatisation of the water sector results in an estimated overall increase in GDP per annum of \$1.5 billion by 2031, and \$1.7 billion by 2040.

Broken down into individual states, Victoria has the largest increase in GSP per annum in 2031 of \$529 million, rising to \$593 million in 2040. This is partially due to the metropolitan water companies that are subject to the reform being a larger share of the Victorian economy relative to other states. Queensland and New South Wales are other large beneficiaries of the reform.

From Table 34, it is evident that ACT GSP declines relative to the baseline by \$24 million per annum in 2031, and \$57 million per annum in 2040. The ACT is subject to this reform and its water supply sector received direct benefit from the efficiency gains assumed. However these are outweighed by resource allocations into other jurisdictions that receive larger gains. If the ACT impact were modelled on its own, it is likely there would be gains to the ACT economy in net terms; it is only due to the combined nature of the analysis that nation-wide reforms to the water sector appear to show a net negative result for the ACT.

Table 34: Impacts on GSP/GDP from water reforms in 2031 and 2040

Year	GSP/GDP (\$m, p.a.)	
	2031	2040
NSW	371	343
VIC	529	593
QLD	483	634
SA	18	3
WA	109	122
TAS	10	11
NT	7	6
ACT	-24	-57
Australia	1,504	1,654

Note: Values are in 2015-16 dollars.

Source: PwC analysis

5.3.4 Transport

Overall, the suite of transport reforms increases GDP per annum by \$23.8 billion in 2031 and \$34.8 billion in 2040.

Through the various transport reforms, Western Australia generates the highest additional GSP per annum in 2040, at \$12.2 billion. This is due to Western Australia benefitting from all of the reforms, i.e. the franchising of rail, the heavy vehicle pricing reforms and the impact from congestion pricing. The congestion costs are a large element of this impact, which is driven by ACIL Allen Consulting's estimates of congestion costs. This showed that in 2031, congestion in Western Australia is projected to be more costly than any other state or territory in Australia. As a consequence, under those assumptions, Western Australia can be seen to be a large beneficiary of congestion pricing.

Conversely, Tasmania has the lowest estimated increase in GSP from the transport reforms (\$229 million in 2031 and \$278 million in 2040 per annum). Tasmania receives direct benefits from the heavy vehicle pricing reform.

Table 35: Impacts on GSP/GDP from transport reforms in 2031 and 2040

Year	GSP/GDP (\$m, p.a.)	
	2031	2040
NSW	6,843	8,608
VIC	4,272	4,602
QLD	4,439	6,530
SA	1,437	1,909
WA	5,989	12,187
TAS	229	278
NT	287	448
ACT	269	271
Australia	23,764	34,834

Note: Values are in 2015-16 dollars.

Source: PwC analysis.

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Appendix A Overview of energy, telecommunication, water and public transport sector entities

Energy

The following tables summarise the generation and network businesses in Australia. In the case of generation businesses, there are many private operators, so these have not been specified here. As there are fewer network businesses, all have been listed in Table 38.

Table 36: Government-owned generators

Entity	Power stations	Location	Government ownership	Capacity (MW)	Fuel type
Stanwell Corporation	Stanwell; Tarong; Tarong North; Barron Gorge; Kareeya; Mackay	QLD	100%	3,139	Coal, hydro, multi-fuel
CS Energy	Callide; Kogan Creek; Wivenhoe	QLD	100%	2,000	Coal, hydro
CS Energy/ InterGen	Callide C	QLD	50%	900	Coal
Delta Electricity	Vales Point	NSW	100%	1,320	Coal
Snowy Hydro	Tumut; Upper Tumut; Colongra; Blowering; Guthega	NSW		3,288	Hydro, gas
	Murray; Laverton North; Valley Power	VIC	100%*	2,082	Hydro, gas
	Pt Stanvac; Angaston	SA		114	Diesel
Hydro Tasmania	Gordon; Poatina; Reece; John Butters; Tamar Valley; Bell Bay; others	TAS	100%	2,283	Hydro, gas
	Woolnorth; Musselroe	TAS	25%	308	Wind
Synergy	Collie Power Station, Muja C & D, Kwinana C, Cockburn Power Station, Kwinana Gas Turbine, Mungurra Gas Turbine Power Station, Pinjar C&D, Worsley Alumina Power Plant, Geraldton Power Station (Mungarra), Kwinana HEGT, Pinjar A&B, West Kalgoorlie Power Plant	WA	100%	2,2,815	Coal, gas, wind, solar

Note: Ergon Energy (a Queensland Government distribution business) and Essential Energy (a New South Wales distribution business) also have some smaller electricity generation assets, totalling 84 MW in capacity, and have not been included here. * Snowy Hydro is government-owned but shared between the Victorian (29%), New South Wales (58%) and Commonwealth (13%) governments. Although being included here, Delta Energy has since been sold by the NSW Government to Sunset Power International.

Source: Australian Energy Regulator, 'State of the Energy Market 2015', 2015; www.synergy.net.au/our-energy/electricity/electricity-generation/power-stations, Accessed 19 January 2016; PwC analysis.

Table 37: Expenditure of government-owned generators

Generator	Location	Total annual estimated expenditure (2014-15)(\$m)
Stanwell Corporation	QLD	1,418
CS Energy	QLD	761
Snowy Hydro~	NSW/VIC/SA^	1,578
Delta Electricity*	NSW	494
Hydro Tasmania~	TAS	1,325
Synergy~	WA	3,123
Total		10,277

Note: * 2013-14 figures were used for Delta Electricity as 2014-15 figures were not available. Note also that Delta Electricity has since been sold by the New South Wales Government to Sunset Power International. ^Snowy Hydro has in assets in South Australia in addition to its hydro power stations in Victoria and New South Wales.

Source: Stanwell Corporation, 2015 Annual Report; CS Energy, 2015 Annual Report; Snowy Hydro, 2015 Annual Report; Delta Electricity, 2015 Annual Report; Hydro Tasmania 2015 annual report; Synergy 2015 annual report; PwC analysis.

Table 38: Electricity transmission and distribution network businesses

State/ Territory	Utility	Description*	Ownership^
NSW	Transgrid	TNSP	Privately operated under a 99 year lease
	Endeavour Energy	DNSP	State but 50.4% will be leased from 2016
	Ausgrid	DNSP	State but 50.4% will be leased from 2016
	Essential Energy	DNSP	State
VIC	AusNet Services	TNSP & DNSP	Private
	CitiPower	DNSP	Private
	PowerCor	DNSP	Private
	Jemena	DNSP	Private
	United Energy	DNSP	Private
QLD	Powerlink	TNSP	State
	Energex	DNSP	State
	Ergon Energy	DNSP	State
TAS	TasNetworks	TNSP & DNSP	State
SA	SA Power Networks	DNSP	Private
	ElectraNet	TNSP	Private
ACT	ActewAGL	DNSP	Territory 50%, private 50%
NT	Power and Water Corporation	TNSP & DNSP	Territory
WA	Western Power	TNSP & DNSP	State

Note: *TNSP = Transmission Network Service Provider, DNSP = Distribution Network Service Provider. ^State = State Government, Local = Local Government, Territory = Territory Government.

Table 39: Operating expenditure of government-owned electricity transmission and distribution networks

State/ Owner	Network	OPEX (\$m, 2014-15)	Source
NSW	Essential Energy	330	Australian Energy Regulator, <i>Essential Energy Distribution determination 2015</i> , April 2015
QLD	Powerlink	213	Australian Energy Regulator, <i>Powerlink Transmission determination 2012-13 to 2016-17</i> , April 2012
QLD	Energex	375	Australian Energy Regulator, <i>Energex Distribution determination 2015</i> , October 2015
QLD	Ergon Energy	346	Australian Energy Regulator, <i>Ergon Energy Distribution determination 2015</i> , October 2015
WA	Western power	691	Western Power, <i>Annual Report 2015</i> , 2015
TAS	TasNetworks	131	Australian Energy Regulator, <i>TasNetworks Transmission determination 2015</i> , April 2015; Australian Energy Regulator, <i>TasNetworks (Aurora Energy) Distribution determination 2012</i> , April 2012
ACT^	ActewAGL	49	Australian Energy Regulator, <i>ActewAGL Distribution determination 2015</i> , April 2015

Note: Operating expenditure is an average of the expenditure set out in the AER determinations for the years 2015-16 onwards (or in the case of Western Power, the operating expenditure for the year 2015-16). ^ActewAGL is 50 per cent owned by the ACT Government and 50 per cent by Jemena (which is in turn owned by State Grid Corporation 60 per cent and Singapore Power International 40 per cent).

Telecommunications

The following table summarises the available estimates of forecast expenditure for the NBN Co.

Table 40: Forecast NBN Co expenditure (\$ billions)

2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
4	6.8	4.2	3.5	2.8	1.5	1.2	1	1.1	1.3	1.2	1.3	1.2	1.1	1.5	1.4

Source: Independent Panel of Experts, *Independent cost-benefit analysis of broadband and review of regulation: Volume II – The costs and benefits of high-speed broadband*, August 2014, p.58 (MTM scenario)

Water

The Australian urban water sector comprises some 220 utilities.⁹² The sector structure differs across the country. Some states and territories have fully vertically integrated water utilities covering the whole jurisdiction, others are separated into local areas or have distribution separated from wholesale or bulk water. To provide an understanding of which operators have been included in this analysis, the following table summarises the entities across Australia, with shading highlighting the metropolitan water utilities that are relevant to the reform and analysis.

⁹² Infrastructure Partnerships Australia, *Doing the important, was well as the urgent: Reforming the urban water sector*, November 2015, p.28

Table 42 summarises the regulated asset base, operating expenditure and capital expenditure of the utilities that are highlighted in Table 41 as being relevant to the analysis.

Table 41: Urban water utilities

State/ Territory	Utility	Description	Ownership*
NSW	Sydney Desalination Plant	Bulk desalination plant supplying Sydney	Private
	Water NSW	Bulk dam water supplier for NSW	State
	Sydney Water	Distributor/retailer in Sydney	State
	Hunter Water	Integrated water utility	State
	Various regional council operators	In regional NSW there are numerous council operated water suppliers	Local
VIC	Melbourne Water	Bulk water supplier in Melbourne	State
	City West Water, Yarra Valley Water, South East Water	Distributor/retailers in Melbourne	State
	13 regional water utilities	Integrated water utilities in regional areas	State
QLD	SEQWater	Bulk water supplier for South East Queensland	State
	Unitywater, QUU, Logan Water, Gold Coast Water, Redland Water	Distributor retailers in South East Queensland	Local
	Various regional council utilities	In regional QLD there are numerous council operated water suppliers	Local
	WA	Water Corporation	Integrated water utility for most of WA
SA	SA Water	Integrated water utility for whole state	State
TAS	TasWater	Integrated water utility for whole state	Local
NT	Power and Water Corporation	Integrated water and power utility for whole territory	Territory
ACT	IconWater	Integrated water utility for whole territory	Territory

Note: Utilities that are highlighted are metropolitan urban water utilities relevant to the analysis. *State = State Government, Local = Local Government, Territory = Territory Government

Source: Infrastructure Partnerships Australia, Doing the important, was well as the urgent: Reforming the urban water sector, November 2015, p.28

Table 42: Asset base, operating and capital expenditure of government-owned water entities

State	Utility	RAB (\$m, 2015-16)*	OPEX (\$m, 2015-16)*	CAPEX (\$m, average)*	Source^
NSW	Sydney Water	\$14,525	\$1263	\$638	IPART NSW, <i>Review of prices for Sydney Water Corporation's water, sewerage, stormwater drainage and other services</i> , June 2012, pp. 70; 67-68; 82
	Hunter Water	\$2,262	\$124	\$75	IPART NSW, <i>Hunter Water Corporation's water, sewerage, stormwater drainage and other services</i> , June 2013, pp. 81; 63; 64
VIC	Melbourne	\$9,507	\$983	\$482	Essential Services Commission, <i>Metropolitan Melbourne Water Price</i>

State	Utility	RAB (\$m, 2015-16)*	OPEX (\$m, 2015-16)*	CAPEX (\$m, average)*	Source^
	Water				<i>Review 2013 Final Decision: Melbourne Water Determination, June 2013, pp. 37; 36; 37</i>
	South East Water	\$2,984	\$643	\$227	Essential Services Commission, <i>Metropolitan Melbourne Water Price Review 2013 Final Decision: South East Water Determination, June 2013, pp. 47; 46; 47</i>
	Yarra Valley Water	\$3,492	\$674	\$229	Essential Services Commission, <i>Metropolitan Melbourne Water Price Review 2013 Final Decision: Yarra Valley Water Determination, June 2013, pp. 41; 40; 41</i>
	City West Water	\$1,678	\$457	\$136	Essential Services Commission, <i>Metropolitan Melbourne Water Price Review 2013 Final Decision: City West Water Determination, June 2013, pp. 42; 41; 42</i>
QLD	SEQwater	\$8,436	\$244	\$130	Queensland Competition Authority, <i>Final report: SEQ Bulk Water Price Path 2015-18, March 2015, pp. 40; 42; 42</i>
	Unitywater	\$3,259	\$294	\$190	Queensland Competition Authority, <i>Final report: SEQ Price Monitoring for 2013-15 Part B – Unitywater, March 2014, pp. 59; 76; 59</i>
	QUU	\$5,018	\$618	\$367	Queensland Competition Authority, <i>Final report: SEQ Price Monitoring for 2013-15 Part B – Queensland Urban Utilities, March 2014, pp. 57-58; 74; 56-58</i>
	Logan Water	\$1,353	\$112	\$82	Queensland Competition Authority, <i>Final report: SEQ Price Monitoring for 2013-15 Part B – Logan Water, March 2014, pp. 40-41; 55w 40-41</i>
	Gold Coast Water	\$2,629	\$262	\$88	Queensland Competition Authority, <i>Final report: SEQ Price Monitoring for 2013-15 Part B – Gold Coast Water, March 2014, pp. 42-43; 56; 42-43</i>
	Redland Water	\$464	\$53	\$11	Queensland Competition Authority, <i>Final report: SEQ Price Monitoring for 2013-15 Part B – Redland Water, March 2014, pp. 40-41; 54; 40-41</i>
WA	WA Water Corporation	\$9,600	\$920	\$798	Economic Regulation Authority (WA), <i>Draft Report – Inquiry into the Efficient Costs and Tariffs of the Water Corporation, Aqwest and the Busselton Water Board, 25 September 2012, pp.</i>

State	Utility	RAB (\$m, 2015-16)*	OPEX (\$m, 2015-16)*	CAPEX (\$m, average)*	Source^
SA	SA Water	\$11,350	\$416	\$335	30; 38; 35 Essential Services Commission of South Australia, <i>SA Water's Water and Sewerage Revenues 2013/14 – 2015/16; Final Determination</i> , May 2013, pp. 155; 133; 158
TAS	TasWater	\$3,021	\$150	\$99	Office of the Tasmanian Economic Regulator, <i>2015 Price Determination Investigation – Regulated Water and Sewerage Services in Tasmania; Final Report</i> , April 2015, pp. A-1; 48; A-1
NT	Power and Water Corporation	Not public	Not public	Not public	Pricing process conducted internally by Minister. RAB and OPEX are not public according to the Utilities Commission.
ACT	Icon Water	\$2,260	\$174	\$89	Industry Panel, <i>Review of the Independent Competition and Regulatory Commission's 2013 Price Direction for Regulated Water and Sewerage Services in the ACT; Final Report</i> , April 2015, pp. 45; 83

Note: *Dollars may not completely align to analysis in previous sections of the report as some figures have required adjustment to 2015-16 dollars. ^Semicolon is used to separate page references for RAB, OPEX and CAPEX respectively.

Public transport

To provide an understanding of where the potential benefits from franchising public transport operations may lie, an overview of the public transport sector operations is described below in Table 43.

Table 44 provides a summary of the estimated operating expenditure of the public transport operations included in the analysis.

Table 43: Status of public transport operations across metropolitan centres

State	Rail	Bus	Light Rail	Ferry
NSW	Sydney Trains	Sydney Transit Authority	ALTRAC Light Rail	Harbour City Ferries & 8 other operators# + Stockton Ferry in Newcastle
	Country Link	25+ bus operators*		
VIC	Metro Trains	Melbourne Metropolitan Bus Franchise (Transdev)	Yarra Trams	n/a
	V/Line	25+ bus operators^		
QLD	Queensland Rail	Brisbane Transport	GoldLinQ (Gold Coast Light Rail)	Various operators~
		Various operators		
WA	Transperth	3 bus operators	n/a	Captain Cook Cruises
	TransWA			
SA	Adelaide Metro	4 bus operators	Adelaide Metro	n/a
TAS	n/a	MetroTas	n/a	n/a
NT	n/a	Various operators	n/a	n/a
ACT	n/a	ACTION	n/a	n/a

Legend:

Currently operated by private sector under competitive tendering

Service is assumed to benefit from competitive tendering

Notes: * such as Busways, ComfortDelgro, Cabcharge, Westbus. ^Currently run by private operators such as Dyson, Grenda, CDC, Ventura but is not competitively tendered. #Including Manly Fast Ferries and Bass & Flinders Cruises. ~ such as TransdevTSL (CityCat & City Ferry)

Table 44: Estimated operating expenditure of selected public transport organisations

Transport service	Estimated operating expenditure	Notes
NSW rail (Sydney Trains)	\$3,224,020,000	a Total expenses comprised of: <ul style="list-style-type: none"> operating expenses: <ul style="list-style-type: none"> \$1,106,990,000 employee and other payroll costs \$83,425,000 personnel service expenses \$1,733,007,000 other operating expenses depreciation and amortisation expenses \$138,702,000 finance costs \$161,896,000
QLD rail (Queensland Rail)	\$1,476,148,000	b Note that this is similar to the Queensland Rail operator service charge of \$1,575,976,000 reported for 2014 by the Department of Transport and Main Roads. Both figures are likely to include metro and outer suburban Queensland Rail.
WA rail (Transperth)	\$488,395,000	c
NSW bus (State Transit Authority)	\$1,692,682,000	d STA's services are provided under a contract basis.
QLD bus (Brisbane Transport)	\$282,000,000	e Brisbane City Council operates the Brisbane Transport bus service. The operating expenditure is an estimate for the year 2012-13; the latest for which data is available.
VIC bus (Melbourne private bus contracts that have not yet been tendered)	\$652,000,000	f This estimate is based on the \$931,380,000 Public Transport Victoria paid for services providers and transport agencies under the bus services category in 2015. We assume 70% of this cost is to service providers other than Transdev, which operates the Melbourne Metropolitan Bus Franchise that accounts for 30% of the Melbourne bus market. This estimate is rounded up to the nearest \$1 m.

Notes and sources:

a – Source: Sydney Trains, 'Sydney Trains 2014 Annual Report', 2014, p. 22.

b – Source: Queensland Rail, 'Annual and Financial Report 2013 – 2014', 2014, p.1.

c – Source: 'Public Transport Authority, Annual Report 2014-15', 2015, p.16.

d – Source: Department of Transport, 'Transport for NSW: 2013-14 Annual Report', p.90.

e – Brisbane Transport is operated as a unit of the Brisbane City Council under a service contract with TransLink, which was a statutory authority until 1 January 2013 when it was subsumed into the Department of Transport and Main Roads. Individual data on Brisbane Transport operating expenditure beyond 31 December 2012 does not appear to be publicly available. In the last available TransLink annual report (the half year to 31 December 2012), Brisbane Transport accounted for \$141 million in service contract expenses, hence an estimated \$282 million per annum. Source: TransLink Transit Authority, 'Final Report (1 July 2012 – 31 December 2012)', 2013.

f – Source: Public Transport Victoria, 'Annual Report 2014-15', 2015, p. 59. Transdev, Transdev Melbourne commences bus operations, 4 August 2013

Appendix B Experience in the UK water sector

One international experience that may be relevant to privatisation of metropolitan water utilities in Australia is the UK where the water sector was privatised by the government in 1989 to create 10 listed water and sewerage operators.⁹³ In the late 1980s the water sector was under public ownership and suffering from under investment. Aging infrastructure was contributing to poor-quality drinking water, pollution and failing assets.⁹⁴ With the government owner unwilling to borrow funds to invest in upgrading the water assets, the decision was made by the UK Government to sell the assets. At the same time, new economic regulations were introduced to oversee the monopoly service providers to ensure prudent expenditure was allowed and quality standards were met. Once privatised, the water companies raised funds and invested £50 billion between 1990 and 2005. While customer costs increased in the first 10 years to pay for the investment, water bills have been relatively flat in real terms since 2000.⁹⁵

The summary achievements in the UK water sector include:

- Large savings have been made in general and support expenditure, with other savings being made in materials and consumables. Increased energy efficiency has mitigated the impact of increased power prices.⁹⁶
- Operating expenditure in 2003-04 was broadly the same as in 1998-99 while water and sewerage companies had improved their drinking water quality, environmental performance and customer service.⁹⁷
- Adjusted for exceptional items and 'atypicals', operating expenditure in 2003-2004 was approximately 15 per cent lower than in 1993-1994 showing efficiency gains were steadily achieved over the decade following the privatisation and regulation reforms.⁹⁸
- From 1989 to 2010 water bills were 30 percent lower than they would have been without regulation.⁹⁹

It is tempting to contrast the privatised UK water with Australia's publicly-owned water sector, where water prices have tracked above inflation since about 2005-2006 – see Figure 4– and suggest that the gains experienced there may be expected in Australia. However it is likely that with the millennium drought in the 2000s, the investment in drought-proofing is what has driven much of these price increases, as well as a general move towards more cost reflective user charging by most metropolitan water utilities.

⁹³ PwC UK, The role and impact of specialist investors in UK infrastructure, September 2015.

⁹⁴ Office of Water Services, The development of the water industry in England and Wales, 2006, pp. 22-23

⁹⁵ Office of Water Services, Future water and sewerage charges 2010-15: Final determinations, p.28

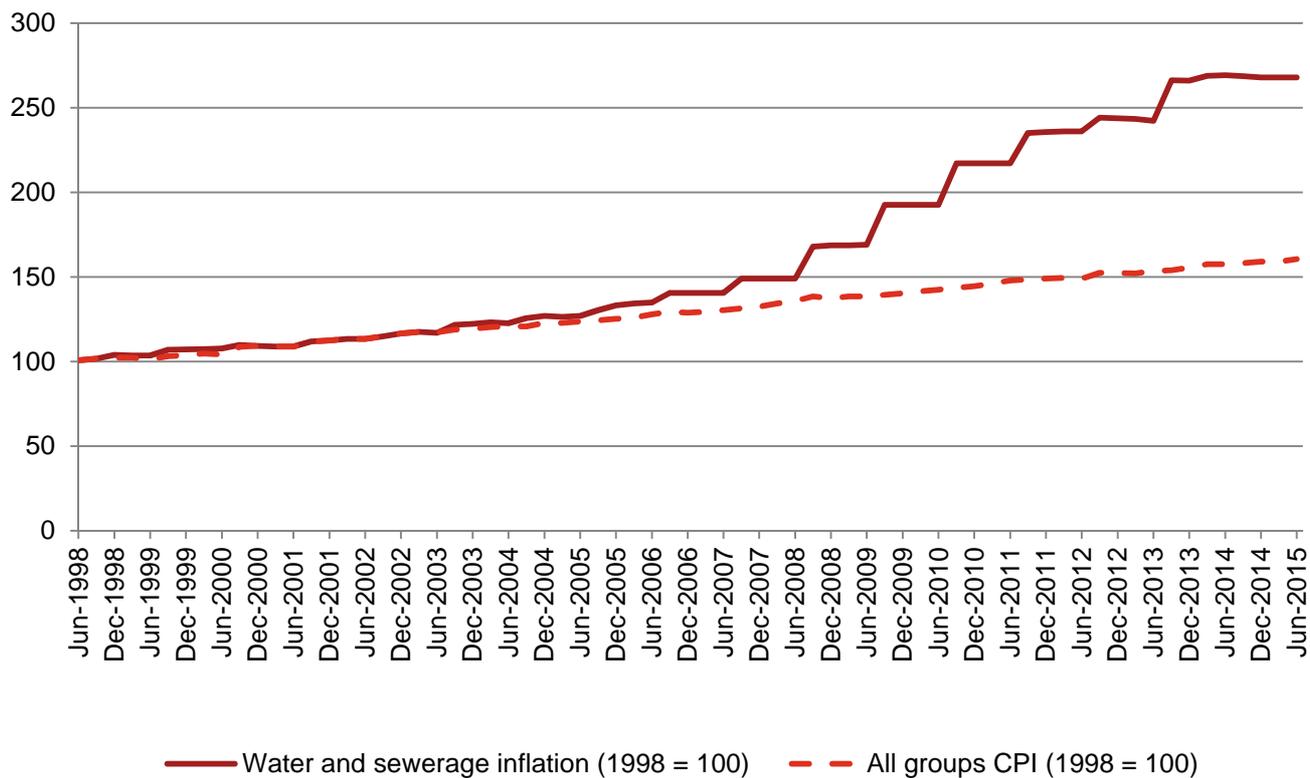
⁹⁶ Office of Water Services, The development of the water industry in England and Wales, 2006, p.72

⁹⁷ Office of Water Services, The development of the water industry in England and Wales, 2006, p.71

⁹⁸ Office of Water Services, The development of the water industry in England and Wales, 2006, p.73

⁹⁹ Ofwat's response to the Independent Review of Charging Household Water and Sewerage Services, 2011. Cited in Peter Martin, 24 Years Later: A Look at Water Privatisation in England and Wales, 2013

Figure 4: Australian water prices versus inflation, 1998-2015



Source: Australian Bureau of Statistics, 6401.0 Consumer price index, Australia, Sep 2015, 28 October 2015; PwC analysis

It is also important to note that although there is little private ownership of water utilities, many utilities incorporate some outsourcing to the private sector through competitive tendering. This has brought efficiency gains (in 2014 Hunter Water for example, awarded Veolia a \$279 million contract to operate and maintain 25 of its water and wastewater treatment plants and is expecting to save \$23 million as a result¹⁰⁰). As a result of some reforms in the water sector in recent decades, some states have consolidated water operators to rationalise the number of operators while maintaining a sufficient number to benchmark one another. Some of these reforms also encompassed governance reforms (such as structuring water utilities to be corporate entities) and improved regulatory oversight.

These factors are important to recognise when considering the efficiency gains experienced in the UK are a result of both privatisation, competition and regulation oversight being introduced around the same time. It is unlikely therefore that similar gains experienced in the UK could simply be expected to occur in Australia through privatisation alone.

¹⁰⁰ Veolia, 'Hunter Water awards Veolia with major contract', June 26 2014. ABC, 'Private operator to take control of Hunter Water treatment plants', June 27 2014

Appendix C *VURM Framework*

The Victoria University Regional Model (VURM) is a multi-regional Computable General Equilibrium (CGE) model of Australia's eight regional economies — the six States and two Territories. Each region is modelled as an economy in its own right, with region-specific prices, region-specific consumers, region-specific industries, and so on. There are four types of agent: industries, households, governments and foreigners.

Based on the model's current database (which was recently updated, see below), in each region 79 industries produce 83 commodities. The database can be disaggregated to more industry/commodity pairs if required and each industry can produce a variety of commodities. Capital is industry and region specific. In each region, there is a single household sector and a regional government. There is also a Federal government. Finally, there are foreigners, whose behaviour is summarised by demand curves for regional international exports and supply curves for regional international imports.

In recursive-dynamic mode, VURM produces sequences of annual solutions connected by dynamic relationships such as physical capital accumulation. Policy analysis with VURM conducted in a dynamic setting involves the comparison of two alternative sequences of solutions, one generated without the policy change and the other with the policy change or 'shock' in place. The first sequence, called the base case projection, serves as a control path from which deviations are measured to assess the effects of the policy shock.

VURM is a flexible model and can be easily modified to meet suit particular tasks. Its origins lie with the Monash Multi Regional Forecasting (MMRF) model.

The model comprises: a CGE core incorporating input-output production and consumption relationships, foreign accounts and the modelling of product and factor markets and a number of satellite modules providing more detail on the model's government finance accounts, household income accounts, population and demography, and energy and greenhouse gas emissions.

Each of the 'satellite' modules is linked into other parts of the model, so that, projections from the model core can feed through into relevant parts of a module and changes in a module can feed back into the model core.

The model also includes extensions to the core model theory dealing with links between demography and government consumption, the supply and interstate mobility of labour, and export supplies.

Full electronic documentation of the VURM is available at: <http://www.copsmodels.com/elecpr/g-254.htm>

Appendix D IFEM framework

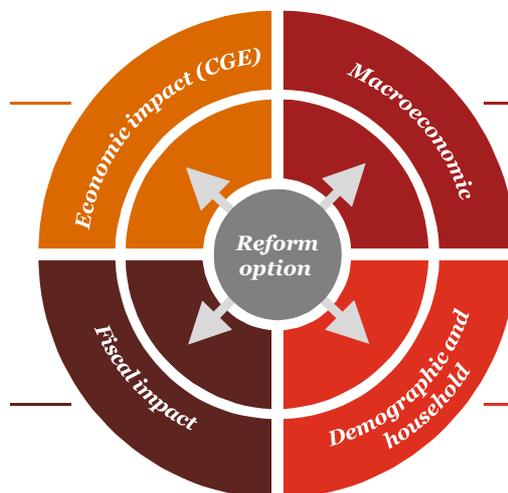
The **economic impact** module is calibrated to the fiscal, macroeconomic and demographic projections and provides detailed economy wide impacts of tax changes.

It allows us to further decompose the impacts on economic outcomes such as GSP/GDP, prices and investment.

The **fiscal impact** module incorporates detailed historic state and commonwealth expenditure and revenue data, including the latest Budget 15-16 information.

Drawing from the demographic and macroeconomic projections, it provides detailed projections of state and Commonwealth expenditure and revenue, including transfers between states and Commonwealth.

This module allows us to develop a deep understanding and quantification of fiscal impacts of tax changes.



The **macroeconomic** module provides a consistent long run projection of state and national GSP/GDP, developed using a framework consistent with Commonwealth Treasury Intergeneration Report (IGR) framework.

This sets the backbone for fiscal and economic impact analysis.

The **demographic and household** module provides long run population projections consistent with ABS population projections. It provides a projection by age and overlays these with income and consumption profiles which will allow us to incorporate the impacts of ageing on consumption.

This module allows us to capture the impact of demographic trends on spending, generation of income and consumption taxes and expenditure pressures by income quintile.

PwC's Intergenerational Fiscal and Economic Model (IFEM) framework incorporates macroeconomic modelling, Commonwealth and State fiscal modelling and household modelling into one integrated framework. It includes individual projections through 2050 of each State and Commonwealth expenditure and revenue head. The above diagram summarises each of the components within IFEM.

The IFEM output provides a credible and consistent long run macroeconomic baseline in a CGE analysis and outputs are designed to form inputs into economy-wide modelling conducted in a CGE model. The IFEM has been used in this analysis providing the economic growth assumptions for the baseline to 2040.

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