Deloitte Access Economics

NSW Business Chamber

ECONOMIC IMPACT OF A WESTERN SYDNEY AIRPORT

Thinking business

Contents

Foreword		3
Executive Summary		5
Key Findings		7
1	Introduction	8
2	Background	9
2.1	Profile of Western Sydney	9
2.2	Tourism and Travel activity in the Western Sydney Region	10
3	Previous studies on aviation capacity in the Sydney region	12
3.1	Joint Study and technical appendices	12
3.2	Wilton Study	15
3.3	Commonwealth Bank research	16
3.4	Tourism and Transport Forum	17
3.5	ACCC Airport Monitor	17
4	Benchmark analysis of other major airports	17
4.1	Major airports in Australia and New Zealand	17
4.2	Second airports – global examples	19
4.3	Implications for a Western Sydney Airport	19
5	Western Sydney Airport growth scenarios	21
5.1	Overview of scenarios	21
5.2	Scenario development methodology	21
5.3	Scenario 1 projections	23
5.4	Scenario 2 projections	25
5.5	Scenario 3 projections	26
5.6	Aggregate time saving	27
6	Economic impacts	27
6.1	Direct employment	27
6.2	Broader economic impacts	28
References		35
Appendix A : Passenger movement numbers, market shares and CGE result tables		37
Appendix B : CGE modelling		48
Limitation of our work		51

Report prepared by Deloitte Access Economics for the NSW Business Chamber

Glossary

ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
BITRE	Bureau of Infrastructure, Transport and Regional Economics
CBA	Commonwealth Bank of Australia
CGE	Computable General Equilibrium
DAE	Deloitte Access Economics
FTE	Full Time Equivalent (employment)
GA	General Aviation
GPA	Glasgow Prestwick Airport
GRP	Gross Regional Product
GSP	Gross State Product
GVA	Gross Value Added
IVS	International Visitor Survey
KSA	Kingsford Smith Airport
LCC	Low Cost Carrier
NVS	National Visitor Survey
PPA	Passenger Movements Per Annum
ROS	Rest Of Sydney
RPT	Regular Public Transport
SA2	Statistical Area Level 2 (ABS definition)
SAC	Sydney Airport Corporation
TRA	Tourism Research Australia
TTF	Tourism and Transport Forum
WS	Western Sydney
WSA	Western Sydney Airport

Foreword

Western Sydney represents one of the fastest growing economies in NSW and Australia. More than one in eleven Australians now call Western Sydney home.

However, while its population continues to grow and diversify, Western Sydney faces a dramatic jobs deficit. This jobs deficit affects the economic and social prosperity of local residents as many are left with no other option but to commute to the Sydney CBD on already congested transport networks to seek out employment opportunities. In 2006, it was estimated that there was a shortfall of over 180,000 jobs in the region and this is expected to increase to over 320,000 jobs by 2036 without significant action.

An airport at Badgerys Creek – the "Black Caviar" of the proposed sites for Sydney's second airport – would not only help meet Sydney's burgeoning aviation demand, it would also serve as the catalyst for job creation, investment and economic growth that the region so desperately needs.

The residents of Western Sydney deserve an airport. Despite the population of Western Sydney being greater than that of South Australia and greater than the combined populations of Tasmania, Northern Territory and the Australian Capital Territory, it does not reap the benefits of having the same level of air transport access residents of Adelaide, Hobart, Darwin and Canberra enjoy.

The NSW Business Chamber's Thinking Business program, of which this report forms part, builds on the Chamber's experience of working with leaders across business and government to bring about change that supports growth, development, jobs and lasting prosperity for NSW.

Leveraging our diverse membership, the program identifies existing or emerging issues that are not being sufficiently addressed in public debate and provides a platform for business to put forward its perspective on how these issues might best be resolved.

The program works through three stages; we identify issues concerning our members; we investigate how they might best be addressed; and we act on their behalf across government and industry to resolve these problems and build a better environment in which to operate businesses.

Stephen Cartwright
CEO, NSW Business Chamber

David Borger
Director, Western Sydney,
Sydney Business Chamber

This report demonstrates that Western Sydney would benefit immensely from having a local airport – an airport operating from 2027 will generate close to an additional 30,000 jobs and $9 billion in economic output for Western Sydney by 2050. These jobs and economic effects will be spread across the Western Sydney region as the airport grows.

Western Sydney businesses and residents cannot afford more delay and uncertainty surrounding this issue. We need bipartisan support for an airport at Badgerys Creek from all tiers of government, and we need to start planning for an airport now given construction lead times.

We thank Deloitte Access Economics for preparing this report as well as the members of the expert Steering Group who provided valuable input to ensure the modelling undertaken was based on realistic growth scenarios for a Western Sydney Airport. We also thank the local Chambers, businesses, community groups and civic leaders who have been encouraging the Chamber's pursuit of this issue thus far. We will continue to put the case forward for this essential piece of infrastructure to government decision makers to ensure that it is delivered for the benefit of both Western Sydney and NSW.

Stephen Cartwright
CEO, NSW Business Chamber

David Borger
Director Western Sydney, Sydney Business Chamber

Executive Summary

The development of a second Sydney passenger airport has been a long running issue. Past government policy has alternated between further capacity at Kingsford Smith Airport (KSA), expansion of existing general aviation airports and the development of a greenfield site. Over the past few decades, there have been a number of studies commissioned on future aviation capacity, culminating in the *Joint Study on Aviation Capacity in the Sydney Region* released in March 2012. The conclusion of the Joint Study was that a second major airport facility will be required and that immediate steps should be taken to mitigate the long lead time of such a development. This view is broadly unanimous among the aviation and tourism industries. The Joint Study identified the Badgerys Creek site in Western Sydney as the preferred option for a second Sydney airport.

This report examines the economic impact of the development of a Western Sydney Airport (WSA) at Badgerys Creek on the Western Sydney and broader Sydney region, under three potential growth scenarios. The sources of economic impact include capital expenditure during construction and expansion, additional visitor expenditure, additional freight activity and time saved in surface travel by passengers electing to use the WSA.

The Western Sydney region

Western Sydney has both a lot to offer, and a lot to gain from a second Regular Public Transport (RPT) facility at Badgerys Creek. It is a dynamic, multicultural region: historical population growth from 2001-2011 was double the rest of NSW and it has a higher proportion of residents born overseas. It has a number of key industries that depend on air transport services based in the area. While aviation-dependent industry sectors are typically underrepresented in the Western Sydney region, significant numbers of employees living in Western Sydney commute to other parts of the city to work in these industries. Hence, it is foreseeable that a WSA would trigger regional growth in these industries, given the availability of land, labour and key transport linkages. In some cases, this process has already begun: the Transport, Postal and Warehousing sector saw the largest absolute growth of any industry in Western Sydney between 2009-10 and 2010-11, with an additional $411.6 million in gross regional product generated.

Western Sydney currently represents around a quarter of the domestic aviation demand inbound and outbound from the greater Sydney region. The equivalent figure for international travel is 22%. Western Sydney's shares have grown significantly over the past eight years and this trend is projected to continue in line with population, which is expected to reach 2.96 million by 2036[1]. Interestingly, business travel is the most common reason for domestic air travel into and out of Western Sydney, closely followed by visiting friends and relatives, and holidaymaking.

Views on existing capacity in the Sydney basin

The Joint Study forms the primary basis of existing literature on future aviation capacity in the Sydney region. It estimates that from 2027, there is likely to be large-scale capacity issues at KSA, due to the significant growth of demand in both international and domestic aircraft movements. However, there are a number of contrasting views on the issue:

- Commonwealth Bank research determined KSA will reach capacity in 2025.
- The Sydney Airport Corporation released a statement arguing that there will be ample capacity to meet forecast demand to 2045.
- The Tourism and Transport Forum (TTF) released a report in January 2013 placing the need for a new airport by 2035. This is in line with the current Sydney Airport master plan forecasts.

One point raised by the Joint Study and reiterated by TTF is that planning for a second RPT facility in the Sydney Basin should commence within the next 12 months.

Scenario development

Three scenarios depicting the expansion of a WSA have been developed, each based on a phased expansion profile. Each scenario is designed to reflect a different growth outcome:

- Scenario 1 depicts the WSA expanding only as required to accommodate the unmet demand for a constrained KSA, as forecast in the Joint Study.
- Scenario 2 allows for demand growth additional to that forecast by the Joint Study, between 5-20 per cent, dependent on the type of traveller. Consequently, the airport's growth profile is accelerated relative to the baseline.
- Scenario 3 explores the possibility of a greater degree of freight activity in the earlier stages of the airport, with the same passenger movement numbers as Scenario 2.

In addition to the three fully worked scenarios, three sensitivities were estimated. Two of these are upper and lower bounds for the timing of maximum capacity at Kingsford Smith, based on Scenario 1. The final sensitivity is based on passenger volumes at Badgerys Creek presented in the recently released Wilton Study.

The modelling assumes construction of the airport commencing in 2020 and operations commencing in 2027.

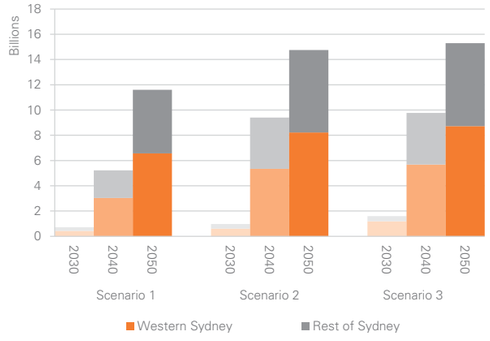
1 NSW Department of Planning and Infrastructure 2011 revised population projections.

Passenger flows to both the WSA and KSA have been modelled using an airport patronage model based on a framework used in the Joint Study, while average visitor expenditures were estimated based on International and National Visitor Survey data. Airfreight tonnage was estimated as a ratio of passenger movements, reflecting the large proportion carried by belly hold. Some variability of freight intensity was incorporated into Scenario 3. These inputs, along with a measure of total time saved in surface travel, form the inputs to economy-wide, Computable General Equilibrium (CGE) modelling.

Economic impacts of a Western Sydney Airport

Chart i compares the increase in gross economic value added from the WSA under the three scenarios modelled. All scenarios show a large increase in the Airport's economic contribution over time, with the 2050 figures ranging from $11.6 billion in gross regional product under Scenario 1 to $15.2 billion under Scenario 3. Western Sydney gains the larger share of additional economic value relative to the rest of Sydney.

Chart i: Scenario results – Additional Gross Regional Product generated by a Western Sydney Airport



Source: DAE analysis. Dark colours represent Western Sydney, light colours represent Rest of Sydney.

These trends are reflected in the comparison of results of additional Full Time Equivalent (FTE) employment in both regions, as shown in Chart ii. By 2050, additional employment generated by the WSA is estimated to range from 35,216 jobs under Scenario 1 to 46,285 jobs under Scenario 3. Construction employment is expected to peak at 1,529 jobs during the third phase of expansion. The expansion phase level of construction activity is expected to be larger than the initial development, as the activity will be concentrated over a shorter period of time.

Chart ii: Scenario Results – Additional FTE employment generated by a Western Sydney Airport

Source: DAE analysis.

At the sub-regional level, the Liverpool local government area (LGA), which incorporates the Badgerys Creek site, will receive a significant portion of direct airport employment, estimated at between 16,251 and 20,013 FTE positions in 2050. Aside from Liverpool, the most significant beneficiaries from a WSA are Blacktown LGA and Parramatta LGA, which will receive a $623 million and $599 million increase in gross output, respectively. Besides these primary subregions, the aggregate wage income will be fairly evenly spread, with the top five LGAs in Western Sydney receiving more than $200 million in additional aggregate wage income by 2050. This wage income includes the incremental increase in wages for existing jobs, relative to business as usual.

From a Western Sydney industry perspective, predictably the Air Transport sector is anticipated to benefit most from the WSA, growing to $6.4 billion. Aside from this, the Business Services sector (including car hire, travel agency services, etc.) will see an additional $1.7 billion in output, as well as an additional 1,312 small and 101 medium businesses. Other major beneficiaries include the Communication, Finance and Investment and Manufacturing sectors.

Summary of findings

The analysis presented in this report demonstrates that a second Sydney airport located in Western Sydney would generate significant economic benefits for the region, providing a major economic boost to Western Sydney's local economies and indeed to the state of New South Wales more broadly. The impacts stem both from alleviating pending capacity constraints in the Sydney basin and from the productivity and competitiveness gains that a second airport located in Western Sydney would generate. While the industries and sub-regions to benefit most significantly would be those with strong links to the air transport sector, invariably the economic impacts would be dispersed widely.

The overall scale of the airport's economic impacts is most evident when the cumulative benefits are considered. In net present value terms, the impact on the Western Sydney economy over the period 2020 to 2050 is estimated at between $9.2 billion and $15.6 billion, while the impact on the whole of Sydney economy is estimated at between $15.7 billion and $25.6 billion. These impacts are particularly large given that no activity will occur for the next seven years. Average additional employment over the period 2020 to 2050 is estimated at between 12,645 and 19,982 FTE for Western Sydney, and between 20,601 and 31,736 FTE for the Sydney region overall, bearing in mind that most of the additional employment will be generated in the latter part of the modelling period.

However, the realisation of these benefits – or, to put it another way, the avoidance of costs emanating from capacity constraints in the Sydney basin – requires haste on the part of policymakers. As the Joint Study points out, the planning phase for a greenfield airport development is between 6-12 years. This is exclusive of actual airport construction. The modelling undertaken here assumes that airport construction commences in 2020. In order to have an operational airport to absorb unmet demand at KSA, the remaining 7 years before construction would need to be used for necessary planning and technical studies. Hence, in the interests of the continued economic development of Sydney – and indeed Australia – policymakers should consider the decision to commission a site for a second airport a matter of priority.

Deloitte.

Key Findings

A second Sydney Airport located at Badgerys Creek in Western Sydney would generate considerable economic benefits for the region and to the State of New South Wales more broadly. The Western Sydney Airport (WSA) will facilitate a significant volume of international visitors to Australia, as well as domestic visitors to the Sydney region. This will occur through direct movements at the new airport, as well as the relief of capacity constraints at Kingsford Smith Airport (KSA):

- Under Scenario 1: **6.1 million international** and **20.9 million domestic** passenger movements in the year 2050.
- Under Scenarios 2 and 3: **9.1 million international** and **24.0 million domestic** passenger movements in the year 2050.

Besides passengers, WSA will facilitate airfreight tonnage that would not have otherwise been transported through a constrained KSA:

- Under Scenario 1: **487.5 kilo-tonnes** in the year 2050.
- Under Scenario 2: **600.3 kilo-tonnes** in the year 2050.
- Under Scenario 3: **667.9 kilo-tonnes** in the year 2050.

The combination of additional tourism expenditure, freight tonnage and reduced surface travel will have a pronounced effect on the output of the broader regional economy in 2050:

- Under Scenario 1: **$6.6** billion in Western Sydney, **$11.6 billion** in Greater Sydney.
- Under Scenario 2: **$8.2 billion** in Western Sydney, **$14.7 billion** in Greater Sydney.
- Under Scenario 3: **$8.7 billion** in Western Sydney, **$15.3 billion** in Greater Sydney.

The net present value (NPV) of these economic impacts to the year 2050 ranges between $15.7 and $25.6 billion in today's terms. Table ii gives the economic impact of the airport in 2050, disaggregated across the regions within Western Sydney, based on current industry profiles.

A WSA will generate and facilitate employment in Western Sydney and across Sydney more broadly. Table i shows the number of new jobs that will be created through construction of the airport, direct airport employment and through wider employment generated across the region.

Table i: Overall employment figures

Construction Employment	**Phase 1 (2020-27)**	**Phase 2 (2032-33)**	**Phase 3 (2037-40)**
Scenario 1	269	369	1,177
Scenarios 2 and 3	269	369	1,529
Direct Airport Employment	**2030**	**2040**	**2050**
Scenario 1	1,280	7,625	16,251
Scenarios 2 and 3	1,628	13,462	20,013
Total Employment	**2030**	**2040**	**2050**
Scenario 1 - Western Sydney	1,940	12,249	21,655
Scenario 1 - Total Sydney	3,181	19,928	35,216
Scenario 2 - Western Sydney	3,062	21,158	27,234
Scenario 2 - Total Sydney	4,671	35,225	44,766
Scenario 3 - Western Sydney	5,553	22,257	28,590
Scenario 3 - Total Sydney	7,411	36,430	46,285

Source: DAE analysis. Note Construction and direct airport employment are measured in gross terms and are calculated outside the computable general equilibrium model. The timing of expansions under Scenarios 2 and 3 are brought forward three years.

Table ii: Localised effects (employment and aggregate wages) - 2050

LGA	Scenario 1		Scenario 2		Scenario 3	
	Emp. (FTE)	Total wages ($ m)	Emp. (FTE)	Total wages ($ m)	Emp. (FTE)	Total wages ($ m)
Bankstown	547	$217	714	$280	749	$289
Blacktown	863	$322	1,132	$417	1,172	$429
Liverpool	15,808	$4,887	19,605	$6,123	20,656	$6,426
Parramatta	872	$323	1,122	$413	1,178	$428
Penrith	548	$197	717	$255	742	$262
Other Western Sydney	3,017	$1,115	3,945	$1,441	4,094	$1,482
Total	**21,655**	**$7,062**	**27,234**	**$8,929**	**28,590**	**$9,316**

Source: DAE analysis. Aggregate wages are in 2013 dollars.

1 Introduction

Planning for future growth of aviation demand in the Sydney region has been a long running debate – committees at the state and federal level have been examining the issue since the 1970s. In that time government policy has alternated between developing a second Regular Public Transport (RPT) Facility, and further expansion of capacity at Kingsford Smith Airport (KSA):

- An intergovernmental group was set up in 1977 to study the major airport needs of Sydney.
- In 1986 land at Badgerys Creek was purchased with the purpose of building a 'Sydney-West' airport.
- In 1994 the third runway at KSA was opened.
- In 1999 an Environmental Impact Statement was completed for the Badgerys Creek site, after an alternative site – at Holsworthy – was ruled out.
- From 2000-2009 several other options were canvassed, including the expansion of Newcastle and Canberra airports to accommodate additional demand from the Sydney region.

More recently, *The Joint Study on aviation capacity in the Sydney region* was released in March 2012. The study was commissioned to consider the short and long term aviation infrastructure needs of the Sydney Region. It determined that from 2027, there is likely to be capacity issues at KSA leading to unmet aviation demand.

The NSW Business Chamber, which commissioned this study, represents the interests of around 30,000 businesses across NSW, ranging from owner-operators to corporations, and from manufacturers to service providers. In order to continue to advance the discussion regarding the merits of locating Sydney's second airport at Badgerys Creek, the Chamber has recognised the need to analyse the economic benefits that would be generated for the region, its residents and businesses and for the local, state and national economy more broadly.

On this basis, Deloitte Access Economics was engaged to conduct a scenario-driven analysis of the potential economic benefits that a Badgerys Creek-based WSA would generate. The approach employed by Deloitte Access Economics has drawn together the findings of the existing research on the impacts of a WSA; the views of a steering group comprising local business and industry leaders; and economic modelling underpinned by Deloitte Access Economics' in-house computable general equilibrium (CGE) model.

Objectives of the analysis

The overarching objective of this report – and the analysis underpinning it – is to demonstrate the nature and magnitude of growth and benefit opportunities that a second airport based in Western Sydney would generate for the region. Specifically, the report estimates the regional impact for Western Sydney, in terms of gross economic value added and additional full-time equivalent employment. These headline economic findings are supported by qualitative analysis around the industries that will likely benefit most significantly from a second airport in the region.

Report structure

The structure of this report is as follows:

- Chapter 2 – overviews the economic and social profile of Western Sydney, as well as current tourism and travel demand into and out of the region.
- Chapter 3 – summarises the previous literature on aviation demand and capacity in the Sydney region.
- Chapter 4 – provides a benchmark analysis of major airports in Australia and New Zealand, as well as selected non-primary airports globally.
- Chapter 5 – outlines the methodology of scenario development and the constructed parameters for each scenario.
- Chapter 6 – presents the outcomes of the economic modelling and the conclusions of the analysis.
- Appendix A – provides additional detail in relation to the passenger movement figures for the WSA under the modelled scenarios, and tabulated CGE results.
- Appendix B – contains details on the CGE modelling methodology.

2 Background

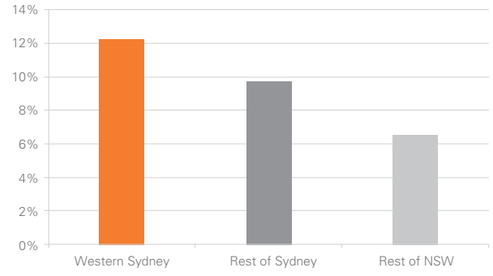
This chapter provides a brief overview of the profile of Western Sydney, from a demographic and economic perspective, highlighting those industries which would stand to gain from a second RPT facility in Western Sydney. The chapter also provides more general reasoning as to why a second airport at Badgerys Creek would likely become the preferred local airport for individuals and business based in Western Sydney, rather than simply a satellite second airport.

2.1 Profile of Western Sydney

2.1.1 People

Western Sydney[2] is a dynamic region: with population growth of 12% in the decade to 2011, the region out-paced the rest of Sydney and had twice the growth of the rest of NSW (Chart 2.1). In 2011, the population of Western Sydney was just over 2 million and by 2036 it is forecast to reach 3 million, according to the NSW Department of Planning and Infrastructure projections. This represents 70% of the population increase across Sydney more broadly, much of which is due to the significant land releases expected for the region.

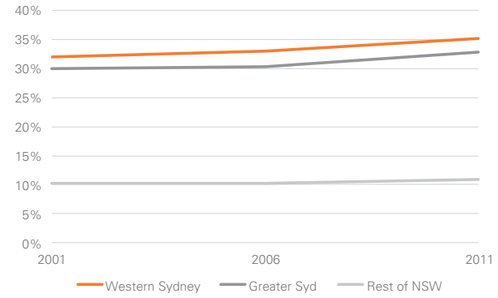
Chart 2.1: Percentage Change in population 2011-2036



Source: ABS Census Data.

Western Sydney has a diverse population base, with a greater proportion of residents born outside Australia than both other parts of Sydney and other parts of NSW (the latter being considerably more pronounced). The source of this migration has largely been South Asia and the Middle East. In contrast, while the rest of Sydney also has a relatively large proportion of people born outside of Australia, these are predominantly from Europe. For both regions, the migrant share of the local population has grown over the past two census intervals. This has important implications for the international air travel sector – and hence for the Badgerys Creek airport proposal – as 25% of inbound international passengers to Western Sydney cited visiting friends and relatives as their purpose of visit.

Chart 2.2: Percentage population born outside Australia



Source: ABS Census Data.

2.1.2 Economy and industry

Overall, industries that are heavily dependent on air transport are largely underrepresented in the Western Sydney region. However, these industries are present in the rest of Sydney, and draw heavily on workers based in Western Sydney. Hence, a second airport located in Western Sydney would likely attract business to Western Sydney, closer to their labour force and air transport linkages. In the draft Sydney metropolitan strategy, the State Government recognised that encouraging this transition was vital to curb a growing jobs deficit in Western Sydney, estimated to reach 300,000 by 2031[3].

Air transport use by business, in terms of passengers and freight, is highly concentrated in a small number of industry sectors. Indeed, the top five sectors make up over 50% of usage of air transport; the top 10 sectors use two thirds of air transport; and the top 20 sectors make up nearly 80% of usage. The top five users of air transport by ABS Input-Output classification are as follows:

1. Professional, Scientific and Technical Services – 21%
2. Wholesale Trade – 10%
3. Building Cleaning, Pest Control, Administrative and Other Support Services – 9%. (This includes travel agency and tour operation services)
4. Public Administration and Regulatory Services – 8%. (This includes foreign government representation)
5. Telecommunication Services – 5%.

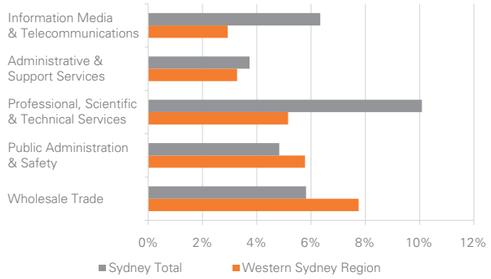
2 Western Sydney is defined as the following Local Government Areas: Auburn, Bankstown, Blacktown, Blue Mountains, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith, The Hills Shire, and Wollondilly.

3 NSW Department of Planning and Infrastructure Draft Metropolitan Strategy 2013. This jobs deficit is the sum of additional jobs required in the West, Southwest, and West Central/Northwest regions.

Chart 2.3 indicates that overall, these top five air transport dependent industry sectors are underrepresented in the Western Sydney region. Wholesale Trade is an exception – it is overrepresented in Western Sydney, contributing 7.8% of local output, relative to a 4.8% national average, and 5.8% whole of Sydney average, as shown in Chart 2.3. Wholesale traded goods include basic materials, machinery and equipment, motor vehicles and parts, groceries and liquor/tobacco, textiles, and pharmaceuticals.

The uplift in transport, logistics and freight forwarding businesses that the wholesale trade sector would rely upon is explored in more detail in Section 5.5, which outlines a more freight-focussed scenario.

Chart 2.3: Gross Regional Product by industry sector



Source: RDA Sydney.

While aviation-dependent industry sectors are overall underrepresented in Western Sydney, the region does provide a considerable amount of the labour force for those sectors in the rest of Sydney. For the top five largest air transport users, Western Sydney contributes the following percentages of labour force:

1. Professional, Scientific and Technical Services – 20%
2. Wholesale Trade – 36%
3. Building Cleaning, Pest Control, Administrative and Other Support Services – 36%
4. Public Administration and Regulatory Services – 32%
5. Telecommunication Services – 37%.

These workers would foreseeably be willing to work closer to home, rather than face a lengthy daily commute. Hence prospective businesses looking to take advantage of a new air transport hub at Badgerys Creek should not face labour supply issues. This also applies for existing businesses looking to relocate operations. The creation of an air transport hub at Badgerys Creek would link with other long term surface transport and business precinct projects, as have been identified in the draft metropolitan strategy.

Implications for a Western Sydney Airport

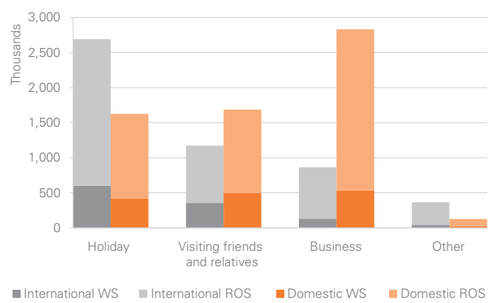
Private and business demand for aviation in Western Sydney is set to grow considerably in the next several decades. This will be driven by strong population growth, as well as the existing wholesale trade sector, which is a major user of air transport services. A WSA would gain from this growth, as it would be the preferred location for aviation activity for these individuals and businesses. At the same time, a WSA would augment this growth, providing a fillip to industry sectors that are major air transport users, but are currently underrepresented in Western Sydney.

2.2 Tourism and travel activity in Western Sydney Region

Chart 2.4 shows the breakdown of inbound and outbound passengers to/from Western Sydney (WS) and the Rest of Sydney (ROS), by purpose of visit. This data is from the International and National Visitor's Survey (IVS and NVS). The trips consist of all outbound and inbound air passengers to each Statistical Area Level 2[4] (SA2) defined as being in Western Sydney, or Rest of Sydney (the remaining area of Greater Sydney as defined by the ABS).

Western Sydney is dominated by the rest of Sydney for all trip types, but makes up 29% of domestic trips and 30% of international trips to visit friends and relatives. Interestingly, business is the most common purpose of travel for domestic trips into and out of Western Sydney, noting that outbound passengers may list their home region in Western Sydney, but commence travel from the Rest of Sydney.

Chart 2.4: Travellers to/from Western Sydney and Rest of Sydney – by purpose



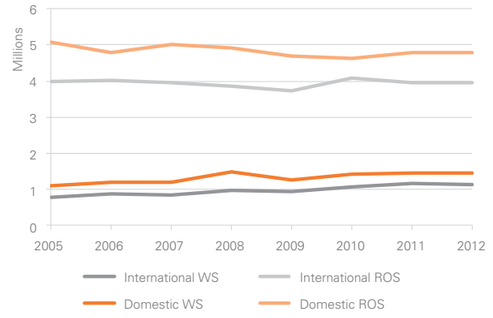
Source: National/International Visitor Survey Data Q1 2013.

In 2012, 40,000 international and 48,000 domestic air travellers spent at least one night in Western Sydney for the purposes of a holiday. There are several major tourist attractions in Western Sydney, including Featherdale Wildlife Park, Katoomba and the Blue Mountains, as well as Wet n' Wild due to open in December 2013. These numbers do not count those domestic tourists who travel to Sydney through means other than air transport. A more convenient air travel connection would promote these visitors to the region.

2.2.2 Trend of inbound/outbound travellers in Western Sydney

Over the past decade, Western Sydney has significantly grown its share of aviation activity in the Sydney Region. Chart 2.5 indicates that over a period of modest growth in aviation worldwide, both international and domestic passengers to and from Western Sydney have grown, while equivalent figures for the rest of Sydney have remained steady or declined. The net result is that Western Sydney has grown its share of all domestic traffic from 18% in 2005 to 25% in 2012. The increase in WS share of international traffic has been from 16% in 2005 to 22% in 2012.

Chart 2.5: Travellers to/from Western Sydney and Rest of Sydney – timeline



Source: National/International Visitor Survey Data.

This trend shown in Chart 2.5 is reflected in the comparison between current passenger distributions in Figure 2.1, and projection of passenger numbers in Figure 2.2. The second projection is constructed using the unconstrained growth forecast of aviation demand from the Joint Study (as discussed in section 3.1), and projecting the change in population composition over time using NSW Department of Planning and Infrastructure data.

Growth of major source markets – China and India

The future demand for aviation in the Sydney region is dependent on international visitor growth: two key growth markets are Indian and Chinese visitors. The Indian market now ranks tenth for NSW international arrivals, but is sixth in terms of its share of NSW visitor nights. Although still developing off a base of about 70,000 visitor nights per annum, Indian visitors have the longest average length of stay in NSW (47.8 nights).

The Tourism Forecasting Council (TFC) expects inbound tourism to Australia from China to increase at an annual average growth rate of 7.2% over the period to 2020. Indian visitor arrivals are expected to increase at an annual average growth rate of 8.5% - the highest of all inbound markets. Given the large proportion of Western Sydney residents born overseas, as shown in Chart 2.2, and the Western Sydney share of arrivals to visit friends and relatives (VFR) shown in Chart 2.4, the growth in Indian and Chinese visitor arrivals will be reflected in passenger volumes into Western Sydney.

The composition of outbound international and domestic passenger numbers, as well as inbound passengers visiting friends and family, is assumed to change proportionally with population changes. The percentage composition of inbound passengers with other purposes of visit (i.e. Holiday, Business or Other) is assumed to remain constant over the projection[5]. Figure 2.1 and Figure 2.2 provide a visual projection of the growth in aviation demand in Sydney overall for the next 40 years, as well as the 'westward shift' in aviation activity, depicted by the darker shades of red in western SA2's in 2050 relative to 2013.

4 An SA2 is a designation used by the Australian Bureau of Statistics (ABS) that corresponds to a local area of 3,000 to 25,000 persons.

5 For instance, as Blacktown East SA2 has a higher population growth rate than other areas (2.02%), its proportion of outbound passengers, and inbound passengers visiting friends and family, will increase accordingly. The percentage attributed to Blacktown East of inbound passengers visiting for the purposes of a holiday, business or other remains constant.

Figure 2.1: Distribution of aviation demand in 2013

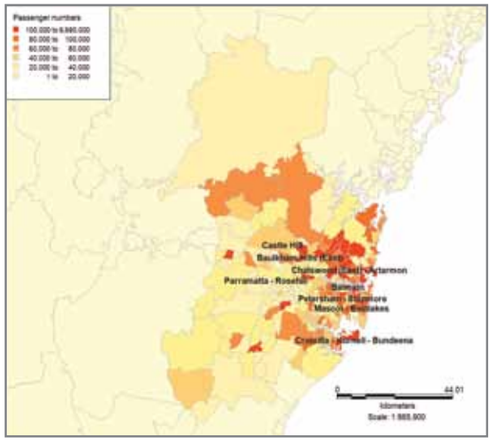
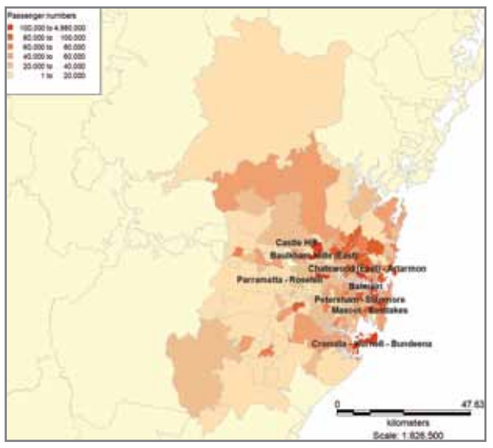


Figure 2.2: Distribution of aviation demand in 2050



3 Previous studies on aviation capacity in the Sydney region

This chapter examines the main existing literature on future aviation capacity in the Sydney region. The analysis draws on a number of sources, including intergovernmental panels, as in the Joint Study; regulatory bodies, as in the ACCC; industry bodies, such as the Transport and Tourism Forum; and private investors; such as the Commonwealth Bank of Australia.

3.1 Joint Study and technical appendices

The *Joint Study on aviation capacity in the Sydney region* was provided to the Federal and NSW Governments and publicly released in March 2012. It is seen as the definitive work on examining the options for addressing Sydney's future aviation needs. It examines the current and future demand for aviation in the Sydney region, the capacity of existing airports to meet this demand, the impacts if this demand is not met, and options to develop new infrastructure. The headline findings of the report were that from 2027 there is likely to be growing unmet demand for aviation and the Badgerys Creek site is the best candidate for a new RPT facility from a cost-benefit perspective.

3.1.1 Current and future demand for aviation in the Sydney region

As part of the assessment of aviation capacity in the Sydney region, the Joint Study describes the current and future demand for aviation capacity in considerable detail. The sections relevant to this analysis are chapter 3, and appendix A2 and A3.

Chapter 3 of the Joint Study includes discussion of headline KSA traffic figures as at 2010:

- KSA handled 35.7 million passenger movements, and 286,600 aircraft movements;
- Around 80% of KSA's half millions tonnes of freight was international; and
- The majority of freight was belly hold: 70% of international inbound, 80% of international outbound, and 75% of domestic.

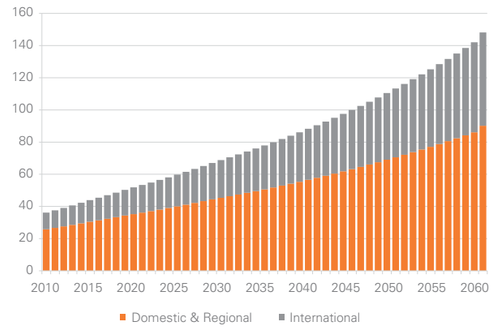
The IVS/NVS data in Appendix A2 is consistent with that presented in Section 2.2 of this report. The other particularly relevant information is the mode of surface transport passengers use to access KSA: over 84% use some form of road travel, with the remaining 16% taking public transport, which may be a bus or train. 94% of meeters & greeters and 79% of KSA employees take a private car.

The forecasts in Appendix A3 maintain an average growth in passenger movements in the Sydney region of 2.9% per year to 2060, yielding the following totals:

- 17.9 million international and 32.7 million domestic movements in 2020;
- 29.7 million international and 47.1 million domestic movements in 2035; and
- 62.7 million international and 82.9 million domestic movements in 2060.

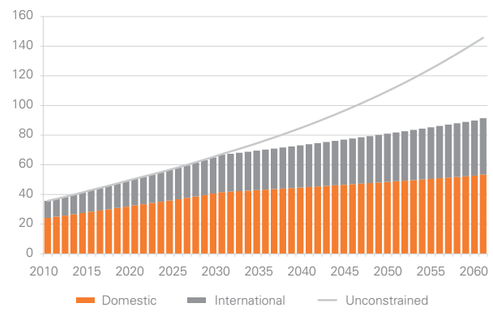
These estimates are given in Chart 3.1. These considerations are relevant to understand the current demand profile at KSA, and how this profile will grow over time, absent any capacity restrictions. The surface access data is important to model the generalised costs of surface travel to a WSA.

Chart 3.1: Unconstrained demand for aviation at Kingsford Smith Airport



Source: Joint Study Appendix A3.

Chart 3.2: Constrained demand for aviation at KSA - with unmet demand 'wedge' (million passenger movements pa)



Source: Joint Study Appendix A3.

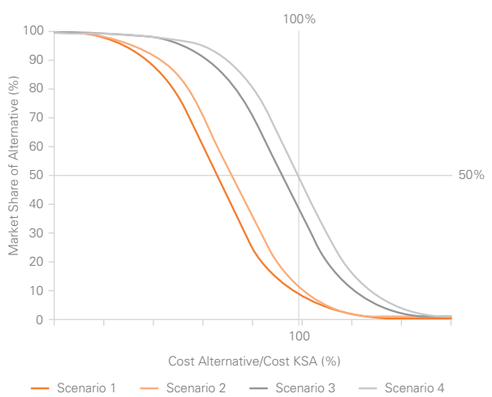
3.1.2 Accommodating unmet demand at a second RPT airport

From the unmet demand profile quantified in Appendix A3, Appendix C8 goes further to examine how this unmet demand could be accommodated at an additional RPT airport. Chapter 8 examines some of the feasibility issues surrounding placement of a new facility, and Appendix B7 assesses the economic impact of not proceeding with additional aviation capacity in the Sydney region.

Appendix C8 developed an airport patronage model, disaggregated into domestic/international and business/domestic classifications, and assessing demand from each Statistical Area (2) (SA2). Using this model, four scenarios were developed, to assess the effect of establishing a second airport of different capacities on the level of unmet demand. The location of the new RPT airport within these scenarios was at the military airport facility RAAF Richmond. For each level of capacity, the competitive dynamics between a new airport and KSA were determined, based on the relative overlap of airport catchments, and the scalability of the second airport site. Along with benchmark data from other second airports worldwide, the competitive analysis was drawn together to form a logistic demand curve for each level capacity. These are shown in Chart 3.3.

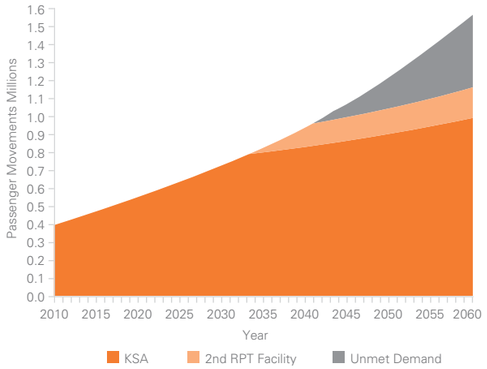
Using IVS/NVS data on visitor trips to and from each Statistical Local Area (SLA) by purpose of visit, the passenger demand for the second airport could be forecast. The forecast demand for a second RPT facility was then incorporated into the profile of unmet demand, as shown in Chart 3.4. This depicts the second RPT facility absorbing unmet demand over time, until its own capacity is reached, and unmet demand continues to grow again. Finally, Chart 3.5 compares the point at which each scenario would reach maximum capacity, as a precursor to the concept of phased expansion.

Chart 3.3: Joint Study Appendix C8 Airport patronage model demand functions



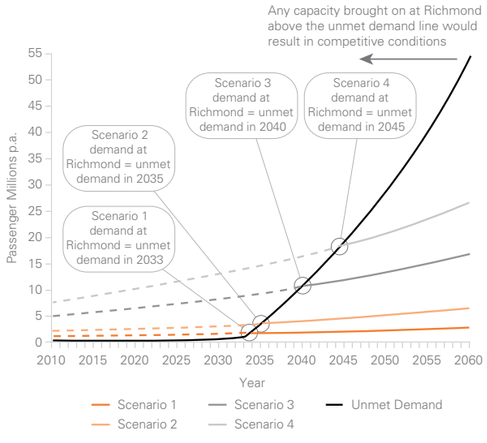
Source: Joint Study Appendix C8.

Chart 3.4: Joint Study Appendix C8 additional capacity of a second RPT airport



Source: Joint Study Appendix C8.

Chart 3.5: Joint Study Appendix C8 – additional capacity scenarios



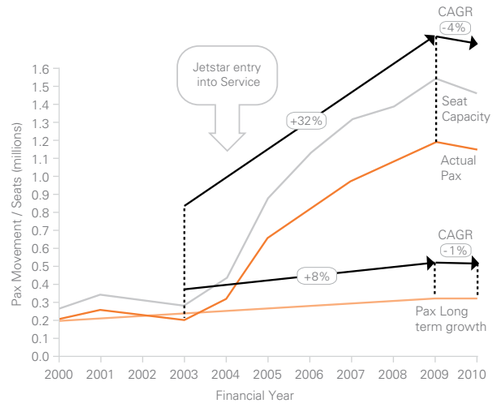
Source: Joint Study Appendix C8.

Appendix C8 also explored the possibility of a second airport increasing the size of the base market itself. This was reflected in a case study of Newcastle Airport, which experienced a high level of growth shortly after Low Cost Carriers (LCC) were introduced, as shown in Chart 3.6. This level of growth was attributed to two factors:

- Increased breadth and frequency of routes offered; and
- Increased price competition resulting in lower airfares for passengers.

Both of these factors would lead to a growth of base level aviation demand following the establishment of a WSA.

Chart 3.6: Joint Study Appendix C8 – stimulated demand from LCC entry



Source: Joint Study Appendix C8.

Part eight of the Joint Study assessed the best localities within a 90 minute radius of the major Sydney population for different airport types:

- Type 1: full service airport with runway length up to 4,000 metres, serving all RPT segments, capable of accommodating a future parallel runway layout;
- Type 2: land constrained full-service airport serving all RPT segments, capable of accommodating one runway;
- Type 3: limited service airport serving all RPT segments, accommodating a single shorter runway of up to 2,600 metres; and
- Type 4: minimum service airport serving GA and limited RPT.

Within the four airport types, only Types 1 and 3 were investigated to the individual site level. For the Type 1 airport locations examined, Badgerys Creek represented the greatest benefit-cost ratio (2.7), while for the Type 3 locations examined, Badgerys Creek represented the second greatest benefit-cost ratio (1.2). This is consistent with the broader findings of the Joint Study, which evaluate the Badgerys Creek site to be the best candidate for a second RPT airport.

A series of generic capital costs were also outlined for developing a greenfield airport site, as shown in Table 3.1. These are taken in conjunction with specific high-level estimates of earthworks and transport infrastructure connections to the Badgerys Creek site:

- $360 million in earthworks to create an airfield platform;
- $190 million for necessary road linkage upgrades; and
- $1130 million for dedicated rail connections.

Based on technical analysis from Worley Parsons and others, the Joint Study estimated that timing for the planning of a greenfield site, including site location confirmation, environmental impact statements, public consultation, planning and rezoning, and preliminary design would range between 6 and 12 years. This is exclusive of actual construction.

These estimates of project timing and capital expenditure provide an instructive guide for the CAPEX component of this analysis and highlight the need for measures to be taken as a matter of urgency, given the long lead times in airport development.

Table 3.1: Joint Study airport cost breakdown ($m)

Cost Category	Type 1 airport	Type 3 airport
Runways/taxiways	551.0	84.0
Apron surfaces	274.1	130.6
Car parking	201.6	48.0
Landing aids/lighting	84.1	21.1
International terminal	1,811.6	0
Domestic terminal	583.2	852.2
Other capital costs	27.5	13.2
Contingency	1,059.9	344.7
Project management & design	706.6	229.8
Total	**5,299.7**	**1,723.6**

Source: Joint Study Part 8.

Appendix B7 assessed the negative economic impact of not investing in additional aviation capacity in the Greater Sydney area. The approach was to measure the impacts in terms of foregone expenditure, value-added (i.e. profits and wages), and FTE employment numbers. The particular avenues of negative economic impact that were quantified were the following:

- Losses to the tourism and associated industries that attract expenditure from interstate visitors;
- Losses to the freight industry in terms of value of tonnage not flown;
- Passenger welfare lost due to delays and foregone trips, including knock-on effects to other airports;
- Losses to the aviation and airport industries, including landside retail; and
- Losses to hotels and business parks in the airport vicinity.

These losses were input to into the Monash Multi-Regional Forecasting model under three scenarios; high, medium and low. The capital expenditure foregone was modelled as a series of expansions. The modelled indirect state-wide losses for NSW in 2050 are given in Table 3.2.

Table 3.2: NSW economic impact of constrained aviation capacity - 2050

Scenarios:	GSP (2010 $m)	FTE employment ('000 persons)
Low	3,320	7.2
Medium	10,472	26.3
High	24,274	61.5

Source: Joint Study Appendix B7.

Appendix B7 also highlighted a number of qualitative impacts of aviation demand being constrained:

- Reputation – Sydney (and NSW/Australia) faces a reputational risk if world-class aviation linkages cannot be accessed.
- Facilitating regional growth – Sydney acts as a gateway for the rest of New South Wales and Australia, hence regional growth would be jeopardised if aviation transport through Sydney was constrained.
- Social impacts – there is a positive social impact of providing connectivity for family and friends living interstate or overseas, and expanding the choice of transport options available to consumers.

The sources of foregone expenditure and method of airport infrastructure CAPEX modelling serve to inform the approach of this analysis. The economy-wide modelling results provide a benchmark to the results estimated here - albeit from the alternative perspective to this.

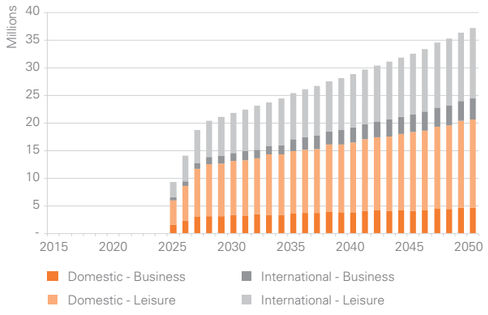
3.2 Wilton study

The *Study of Wilton and RAAF Base Richmond for Civil Aviation Operations* was released by the Federal Government in May 2013. It was commissioned as a technical scoping study to locate a second airport at Wilton, as well as expanding the use of RAAF Richmond to include RPT capabilities. As part of the study, Booz &

Company were commissioned to model the volume of passenger traffic at Badgerys Creek, along with the other two sites. The same methodology was used as was described in Section 3.1.2 above, confirming this as a suitable approach for the analysis contained in this report.

The economic impact of developing a large scale airport, operational by 2025, was modelled by Ernst & Young, following a similar approach used for the technical appendix B7 of the joint study. The passenger volume used for this study was the Booz & Company high capacity Tier 2 modelling scenario (essentially replicating a KSA capacity airport). The projected freight volume is shown in Chart 3.7. While the conditions under which such a growth trajectory would be achieved are debatable, for the purpose of this report, it has been modelled as a sensitivity to the central case results.

Chart 3.7: Ernst & Young modelled passenger volume at Badgerys Creek airport



Source: Ernst & Young Economic and social analysis of potential airport sites, 2013.

This update of the Booz & Company work from the Joint Study in the context of Wilton consolidates their methodology of estimating airport patronage, which is adopted for this analysis. It also underscores that the forecasts of constrained and unconstrained demand used in the Joint Study are the best references currently available.

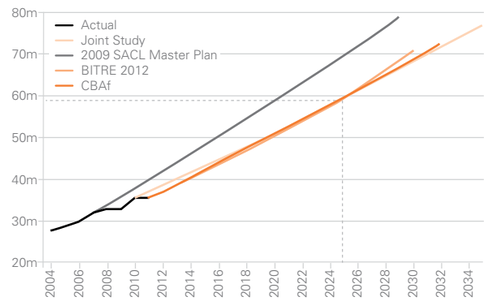
The economic impact of a large scale airport coming online by 2025 is significantly different to the scenarios modelled here, but nevertheless serves as an upper bound comparator to this analysis.

3.3 Commonwealth Bank research

The Commonwealth Bank of Australia (CBA) released a research report in January 2013, titled *Sydney versus the World,* examining the capacity and utilisation of KSA. It benchmarks the capacity utilisation of KSA against the 30 largest airports in the world by passenger movements. The research identifies Beijing Airport as the most efficient in terms of capacity utilisation, representing a 61% improvement on KSA's current utilisation rate. The same utilisation of KSA capacity would give a capacity of 59 million passenger movements per annum.

Chart 3.8, taken from the CBA report, compares unconstrained passenger volume forecasts for KSA. With the exception of the Sydney Airport Corporation, the forecasts are very similar for the first 30 years. These forecasts suggest that if KSA was able to match Beijing Airport's utilisation, then it would have sufficient capacity to meet forecast demand until 2025.

Chart 3.8: CBA research – comparison of KSA unconstrained demand estimates



Source: CBA Equity Research Report Sydney versus the world.

Sydney Airport Corporation (SAC) issued a media release in response to the CBA research, contesting some of the assumptions used. In particular, the CBA analysis assumes no large-scale capacity expansion (e.g. gates, terminals, runways), which disregards the $2 billion spent over the past 10 years. By contrast, the SAC argues that there is 'ample capacity to meet forecast demand to at least 2045'.

This research provides a useful comparison of recent passenger movement forecasts and verifies that the 2010 Joint Study forecast is tracking well against actual data and more recent forecasting efforts.

3.4 Tourism and Transport Forum

The Tourism and Transport Forum (TTF) released a report in January 2013 titled *Sydney's Aviation Future – Meeting the Challenge of Growing Demand.* The TTF is an industry body representing the tourism, transport and aviation sectors. The report concurs with the broad findings of the Joint Study; however, it places a greater focus on the need for reform of curfews, slot and movement caps, as well as noise sharing agreements at KSA. The report states that these place "artificial constraints" on airport capacity, and do not reflect the safety and noise reduction of modern aircraft. The report also suggests that other general aviation and military airports may be better utilised, for peripheral aviation activity, such as dedicated freight and business/charter flights.

Importantly, the report endorses the Joint Study finding that there is a longer term requirement for a second RPT airport in the Sydney Region, and confirms Badgerys Creek as the most suitable location. It also suggests that planning and technical design of the new airport should commence in the next 12 months. However, it defers the need for a new WSA out to 2035; eight years later than the Joint Study. These findings are consistent with the recently released 2013 Sydney Airport draft Master Plan, which projects demand in 2033 to be 74 million passenger movements, in line with unconstrained forecasts shown in Chart 3.8.

The divergence of findings in relation to the timing and extent of capacity constraints at KSA, and the growth that a second Sydney site would achieve, highlights the uncertainty inherent to this issue and provides the basis for including variation in the scenarios modelled in this study.

3.5 ACCC Airport monitor

In April 2013, the Australian Competition and Consumer Commission (ACCC) released their annual monitoring report of the quality, prices, costs and profits of the five largest capital city airports in Australia; Adelaide, Brisbane, Melbourne, Perth and Sydney. The role of the ACCC in this context is one of monitoring only – it does not enforce price restrictions or minimum quality standards.

The report included several key findings on the profitability and quality of service provided at KSA:

- KSA reported the highest aeronautical margins and revenue of the five airports monitored for the year to June 2012;
- KSA also recorded the highest revenue and margin of car park spaces, as well as the largest increase in general landside revenues; and
- Of the five airports, KSA had the lowest quality of service based on the survey responses from passengers and airlines. Part of the drop in quality of service was due to the increasing issue of congestion at KSA, increasing the frequency and duration of delays.

To a certain extent, these results are an indication of the inherent restrictions of the Mascot airport site, rather than the performance of Sydney Airport Corporation. Either way, the findings suggest aviation users and airlines would benefit from a second airport, through less restricted landside access.

4 Benchmark analysis of other major airports

Benchmarking analysis is an important element in developing a picture of the growth path of a WSA, as well as the capital expenditure during subsequent expansions of the airport. Other Australian and New Zealand airports provide instructive comparators, as they have similar mixes of international/domestic travellers, similar capital costs; and employment to passenger movement ratios. In most cases, data is more readily available for local examples than overseas airports. However, there are only two examples of genuine second airports, and there have been no recent greenfield airport developments in Australia or New Zealand. Accordingly, comparisons were sought predominantly in Australia and New Zealand, as well as global examples of recently developed secondary airports.

4.1 Major airports in Australia and New Zealand

The majority of RPT aviation activity in Australia is located in the capital cities. These are the primary sources of comparison for the WSA. Table 4.2 gives a broad overview of the major airports in Australia and New Zealand, with passenger/freight volume, population and growth of catchments, and any available data on capital expenditure, employment figures, or economic contribution of those airports.

As the second airport for the second largest city in Australia, Avalon is at first glance a strong benchmark comparison for the WSA. However, there are several key differences between Avalon and a potential airport at Badgerys Creek:

- The Avalon RPT facility was not a greenfield development;
- Tullamarine Airport doesn't have capacity concerns to the same extent as KSA;
- A significantly lower percentage of Melbourne's population live a shorter distance to Avalon (relative to Tullamarine) than Badgerys Creek (relative to KSA); and
- Population growth trends do not favour a transition of aviation activity to Avalon to the same degree as Badgerys Creek.

In addition, data on Avalon passenger movements is not provided to the Bureau of Infrastructure, Transport and Regional Economics (BITRE) for commercial-in-confidence reasons, making accurate comparisons less feasible.

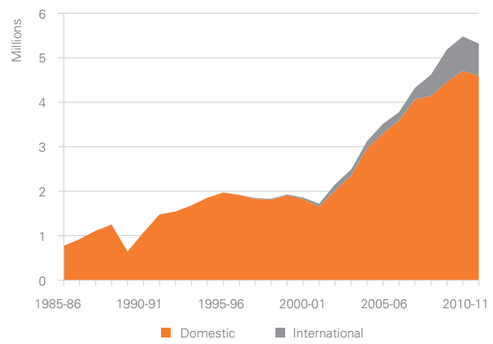
4.1.1 Gold Coast Airport

Gold Coast Airport is one of the most comparable benchmark airports in Australia, because, after Avalon, it is the only secondary airport in Australia, with its passenger catchment overlapping with Brisbane. On a common market basis, Gold Coast has 20% of the total market share with Brisbane, with 5.3 million passenger movements last year. The airport has undergone a number of major capital works in the past two decades:

- Total of $55 million in capital works from 1998 to 2008; including $25 million runway works in 2007;
- $100 million terminal redevelopment opened in 2010 - more than double its previous size to approximately 28,700 m^2, including a common-user terminal adopted in Adelaide and elsewhere; and
- $8.8 million in runway and tower maintenance in 2011.

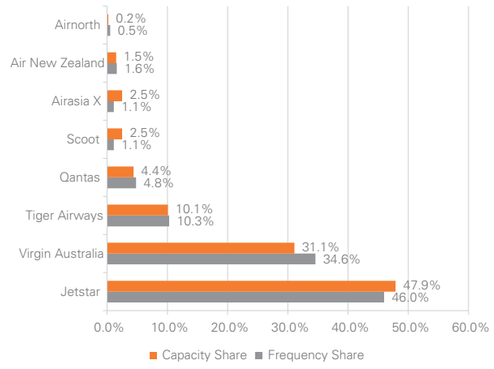
Chart 4.1 shows a remarkable trend in passenger figures over the past decade; an average growth rate of 14% from 2001-02. This is partly due to the expansion into international operations during that time. This has been reflected in international freight, which has experienced compound average growth of 22% over the four years to June 2012. Chart 4.2 shows the relatively heavy focus on low-cost and hybrid carriers for Gold Coast Airport, specifically Jetstar, Virgin, and Qantas. These two features of strong passenger movement growth and a focus on low cost carriers will likely be reflected in a future WSA.

Chart 4.1: Gold Coast - Long term trend of passenger movements



Source: BITRE data.

Chart 4.2: Gold Coast - Weekly one way capacity and frequency share



Source: Innovata April 2013.

4.2 Second airports – global examples

As discussed above, there are few examples of second airports in Australia. After a preliminary examination of 15 non-primary airports in Europe, North America and UK, London Luton and Glasgow Prestwick were identified as relevant examples. These two airports were selected based on the level of market share, pre GFC growth and availability of data. These two examples are chosen to reflect different stages of WSA airport growth, and highlight different aspects of aviation activity (i.e. freight vs. passenger traffic).

4.2.1 London Luton

London Luton airport is located 51km north of central London, hosting 9.6 million passenger movements, or 7% of the total traffic in the region. It competes with four other major London airports: Heathrow (50%), Gatwick (26%), Stanstead (15%) and London City (6%). It is serviced almost exclusively by Low Cost Carriers (LCC's), 99.5% by frequency. Luton airport represents a small share of the overall freight task – moving 29,600 tonnes of air freight in 2012, or 2% of the total market share. The UK Civil Aviation Authority estimates that the airport has a catchment area of approximately 15 million people, based on the relative location of other airports, and the services they provide. Since purchasing the airport in 1998, the current owners (London Luton Airport Operations Ltd.) have spent £215 million improving and upgrading the airport, including £40 million spent for a new terminal and £23 million on the Luton Airport Parkway Station. London Luton directly employed 516 people as at December 2011.

4.2.2 Glasgow Prestwick

Last year Glasgow Prestwick Airport (GPA) hosted 1.3 million passenger movements, or 13% of market share relative to Glasgow Airport. This level is down from a peak of 2.4 million in 2008-09. It has a smaller catchment area than Luton; two million people live within 60 minutes of the airport. The airport has a significant focus on its airfreight capability, moving 14,000 tonnes of freight in 2011-12, 83% of Glasgow city total. This is partly due to a lack of curfew, meaning goods can land late at night and be transported to London in time for start of business the following day.

A study conducted in 2008 assessed the economic contribution of GPA and the reliance of local businesses on the air transport services that the airport provides. Table 4.1 outlines the Gross Value Added (GVA) and employment figures for the local region and the rest of Scotland. These figures show that even a small airport by passenger movements can be responsible for a significant amount of economic value employment. As part of the study, survey results showed that 8% reported that they would face major problems without the freight service GPA provides, and 58% of local businesses reported using the airport in the previous year for business trips, with an average of six trips per year.

Table 4.1: Glasgow Prestwick Airport Economic Contribution 2008

Industry	Ayrshire		Rest of Scotland	
	GVA (£ million)	Employment	GVA (£ million)	Employment
Airport Wages and Salaries	10.6	481	9.5	430
Supply contracts	7.4	164	5.2	117
Tenant, Freight and Aerospace	16.9	470	23.3	678
Passenger Expenditure	13.2	618	40.5	1,717
Total	48.1	1773	78.6	2,941

Source: SQW Consulting. Note that the average AUD/GBP exchange rate in 2008 was 0.45 cents.

4.3 Implications for a Western Sydney Airport

With a current airport catchment of 4.4 million, including 2 million in Western Sydney, WSA will attract some market share from KSA, particularly as KSA becomes increasingly capacity constrained. Hence, comparisons can be made against existing airports based on catchment size. The main point of difference for the WSA is the future capacity constraint of KSA. This means it will experience a certain degree of 'inorganic' growth as it takes up the future demand that cannot be met at KSA.

With WSA growing through a process of phased expansion, benchmark comparisons of growth paths are less instructive than static comparisons between a WSA and existing Australian airports. For instance, the initial phase of operations (3-5 years) of the WSA may resemble Canberra or Darwin airports, then expanding to a similar scale as Gold Coast or Adelaide. Longer term (25 years +) the airport will need to handle significantly more passengers, and so the final stage within each scenario of this analysis may resemble Brisbane or Tullamarine. The economic contribution and employment figures recorded in Table 4.2 can be used to compare final CGE results.

Table 4.2: Comparison of existing airports in Australia and New Zealand

Airport	Passenger movements (millions)	Passenger movements in city (millions)	% market share (rank)	International Freight tonnage (kt)	Greater city catchment (2011 - thousands)	Population growth (2011)	Employment (FTE)	Capital expenditure/ economic contribution
Sydney	35,987	35,987	100	417,891	4,392	1.1%	35,600 directly (2012)	N/A
Melbourne Tullamarine	27,956	29,356	95.2	233,212	4,000	1.7%	10,965 directly (2007)	N/A
Melbourne Avalon	1,400	29,356	4.8	0	4,000	1.7%	1000 FTE at Airport, 800 Qantas maintenance	$38 million in exclusive visitor spending (2010)
Brisbane	20,874	26,200	79.7	104,222	2,066	2.3%	17,000 directly (2011)	Capital expenditure: $555 million since 2007
Gold Coast	5,327	26,200	20.3	5701	1,200	2.9%	1000 directly, 3500 indirectly (2009)	Economic contribution: $153.8 million direct, $2205 million indirect (2004/05)
Adelaide	6,947	6,947	100	18,149	1,225	0.9%	5,267 directly, 8514 indirectly (2008)	Economic contribution: $1.6bn in 2008, $770 million in 2003, $385 million in 1998
Perth	11,997	11,997	100	72,161	1,729	2.4%	N/A	N/A
Canberra	3,159	3,159	100	0	368	1.4%	975 directly (2005)	N/A
Darwin	2,045	2,045	100	316	129	1.9%	N/A	$60 million committed to 2014
Hobart	1,815	1,815	100	0	216	0.9%	N/A	N/A
Auckland	14,161	14,161	100	N/A	1,303	1.4%	N/A	N/A
Christchurch	5,551	5,551	100	N/A	348	1.5%	N/A	N/A
Wellington	5,192	5,192	100	N/A	449	1.2%	N/A	In master plan: NZD $450 million to 2030

Note: (Freight tonnage is international only – this is the majority of freight on a national average basis. Data is not available for local freight.). Sydney airport market share excludes Newcastle, Canberra, and local general aviation traffic. As Melbourne's second airport, Avalon's catchment was based on greater Melbourne, but could include Geelong, an additional 210,000 persons. New Zealand airport statistics are based on the 2006 census. Gold Coast catchment data was from the 2012 Annual Report, not census data. Sources: ABS Census, BITRE, Statistics New Zealand,Airport Master plans and holding company annual reports.

5 WSA Growth scenarios

This chapter outlines the methodology of scenario development, drawing on the existing literature discussed in Chapter 3 and the benchmark analysis summarised in Chapter 4. The scenarios are presented in turn, with some rationale of the issues each of them is designed to explore.

5.1 Overview of scenarios

To address the range of possible future growth outcomes for the WSA, three different growth scenarios were analysed.

Each scenario is designed to reflect a different growth outcome:

- Scenario 1 depicts the WSA expanding only as required to accommodate the unmet demand for a constrained KSA, as forecast in the Joint Study.
- Scenario 2 allows for demand growth additional to that forecast by the Joint Study, between 5-20 per cent, dependent on the type of traveller. It is assumed that this additional growth is spurred by residents and businesses taking advantage of the opportunities that improved air access and lower costs of air travel generates. Consequently, the growth profile for the airport is accelerated relative to the baseline.
- Scenario 3 explores the possibility of a greater degree of freight activity in the earlier stages of the airport, with the same passenger movement numbers as Scenario 2.

In addition to the three fully worked scenarios, three sensitivities were estimated. Two of these are bounds for the timing of maximum capacity at KSA, based on Scenario 1. The final sensitivity is based on passenger volume numbers at Badgerys Creek developed during the Wilton Study.

5.2 Scenario development methodology

The economic impact measured using CGE modelling is based on a series of economic 'shocks' that describe the additional visitor expenditure, freight tonnage and time saved by aviation users in each scenario. These economic shocks were developed by the following process:

1. Determining the profile of the 'wedge' of unmet demand, as described in Chapter 3;
2. Developing a phased expansion of capacity at a WSA that will accommodate this unmet demand;
3. Modelling passenger flows from locations in Sydney and Western Sydney using an airport patronage model based on the framework in Appendix C8 of the Joint Study;
4. Forecasting average expenditures for inbound visitors, both international and domestic passengers; and
5. Determining the additional visitor and freight expenditure that will be generated, along with aggregate time saved.

5.2.1 Unmet demand profiles

The profile of unmet demand motivates the requirement for a WSA, and informs the growth path of capacity. It is the difference between the unconstrained and constrained demand forecasts. In all scenarios, the unconstrained forecast used is from the Joint Study – the discussion in Sections 3.1.1 and 3.1.2 determines that the Joint Study forecast is best suited for this analysis, as it includes the full window of this analysis, and is broadly consistent with other forecasts. For each of the scenarios, the constrained demand forecast is also that one used in the Joint Study. The sensitivity of constraint timing is assessed in Section 6.2.4 as part of the final results.

Chart 5.1: Unmet demand profile – annual passenger movements

Source: Joint Study Appendix C8.

5.2.2 Phased expansion profiles

The unmet demand profiles represent a realistic, if conservative, demand for a WSA. Hence the WSA capacity projections for Scenarios 1, 2 and 3 were designed to accommodate the unmet demand profile, with phases of expansion, rather than continual capacity increases. The model of phased expansion is consistent with benchmark analysis of other airports in Australia and New Zealand, and analysis within Appendix B7 of the Joint Study. Each scenario has three phases of expansion: an initial development of the greenfield site followed by two enlargements. The capital expenditure associated with each phase is taken from benchmark data from other airports discussed in section 4.1, as well as costing estimates in Part 8 of the Joint Study. The timing and magnitude of these expansions are discussed for each scenario in Sections 5.3 to 5.5.

The capacity projection for Scenarios 2 and 3 is based on the unmet demand profile, plus some portion of stimulated demand from the lower generalised costs of air travel. The level of stimulated demand is based on estimated cost differences and benchmark price elasticities of demand for business and leisure travellers. This is discussed in further detail in Section 5.4.

5.2.3 Modelling passenger flows

Passenger flows to the two airports are determined using an airport patronage model based on the framework developed in Appendix C8 of the Joint Study. Generalised costs of using each airport were estimated by ABS classification Statistical Area 2 (SA2), based on travel time to each airport location. Travel time was calculated using the Google Maps API; this assumes all passengers travelled to the airport by road.

According to the Joint Study, in 2010 85% of visitors used road travel for surface access to KSA. Hence while rail linkages will be an important part of the surface access solution, particularly for inbound passengers, point-to-point road travel times provide a reasonable proxy for average travel time. If rail options to both airports decrease average travel times, then the cost ratios will be biased towards 1; but sensitivity analysis shows that a 10% change in average travel time results in a 2% change in visitor expenditure outputs.

The patronage model is based on logistic demand curves that project market shares for the two airports, for each stage of airport expansion. An example demand curve is given in Chart 3.3 in Section 3.1.2.

Using these cost ratios for each SA2, the relative market shares for each airport can be calculated, by international/domestic and business/leisure classification. These shares are multiplied by the IVS/NVS visitor data described in Section 2.2, to give an overall weighted average market share at each stage of airport development. This market share is disaggregated into business/leisure, and international/domestic classifications, to match with the unmet demand forecasts.

5.2.4 Forecasting visitor average expenditures

Average visitor expenditure is estimated by SA2 using Tourism Research Australia data, by purpose of visit. All non-business reasons for travel (e.g. visiting friends and family, holiday, education) are classified as leisure travel, to match the unmet demand forecasts. The international expenditure per visitor was taken from the International Visitor Survey report data for the first quarter of 2013. The domestic passenger expenditure was taken from Tourism Research Australia's regional tourism profile of Sydney. Western Sydney expenditure per night was 14% lower than the rest of Sydney: this corresponds to half the difference in average accommodation prices between Western Sydney and the rest of Sydney, based on ABS survey of tourist accommodation data. While there will be some cross-boundary spend, the SA2 averages are aggregated up to total Sydney and Western Sydney figures. Travellers who list their home in the Greater Sydney area are excluded from additional expenditure.

Table 5.1: Expenditure per visitor ($)

Type of passenger	In Sydney	In Western Sydney
International Business	$1,807	$1,544
International Leisure	$2,093	$1,788
Domestic Business	$585	$500
Domestic Leisure	$729	$623

Source: Tourism Research Australia IVS and regional tourism profile of Sydney, ABS survey of tourist accommodation.

5.2.5 Projecting aggregate expenditure

Aggregate visitor expenditure is the product of the unconstrained demand forecasts, the WSA aggregate market share from the patronage model, and the average visitor expenditure weighted by nights spent in the subregion. This expenditure is given by year, and disaggregated into business/leisure and foreign/domestic travellers.

In addition to the aggregate visitor expenditure of those travelling into WSA, there are two other main elements to GE inputs:

- Additional freight: the additional freight value is calculated as the product of WSA passenger movements, a benchmark freight tonnes per passenger, and average value of freight per tonne. For Scenarios 1-3, the benchmark figure is 0.018 tonnes per passenger movement, based on benchmark analysis discussed in Section 4.1. Scenario 3 incorporates some upside to the freight intensity, as discussed in Section 5.5 in further detail. The average value of freight is $8,663 per tonne, drawn from Appendix B7 of the Joint Study, and adjusted to 2013 values.
- Aggregate time saving: this represents the total value of time saved by aviation users that use the WSA rather than KSA. Total time saved is calculated as the product of market shares of WSA by location, percentage aviation activity by location, the time saving of travel to WSA over KSA, and the unconstrained forecast of passenger movements. This time saving is multiplied by average weekly earnings to give an indicative estimate of the value of time saved.

5.2.6 Direct employment on airport and during construction

In addition to the economy-wide employment estimates, derived via the CGE modelling, estimates were calculated for the number of workers employed directly during the construction phase and the number employed in an ongoing capacity onsite at the airport, once it is operational (in both aeronautical-related and non-aeronautical related activities). These figures are included to illustrate the number of jobs that will be focussed around the Badgerys Creek site. A portion of these jobs will be created at the expense of others in the broader Sydney region, hence these figures are not directly comparable to the CGE results.

Indicative on-airport employment figures were calculated on a FTE per passenger movement basis, based on benchmarks from several Australian and international examples, as shown in Table 5.2. The value of 600 jobs per million passenger movements adopted in the modelling here is lower than some of the other benchmark airports, and represents a conservative estimate of likely on-airport employment, given uncertainty regarding how airport development will proceed. The utilisation of a parameter at the lower end of the benchmark range reflects factors such as the availability of land in Western Sydney relative to Mascot and new zoning developments such as the Western Sydney Economic Area (WSEA) to the north of Badgerys Creek. These factors render it less certain whether the ancillary commercial operations based onsite in the case of Sydney and Brisbane would be located nearby, rather than onsite. Construction workforce figures were developed based on input-output analysis using the Heavy and Civil Engineering Construction sector as a benchmark and, as noted, are not directly comparable with the economy-wide employment estimates.

Table 5.2: Direct employment per passenger movement benchmarks

	Direct employees	Annual passenger movements (millions)	Employees per thousand passenger movements
Heathrow	69,700	69.5	1.00
Sydney	35,600	35.6	1.00
Brussels	17,903	17.9	1.00
Brisbane	17,000	20.2	0.84
Adelaide	5,267	6.6	0.80
Manchester	16,970	22.1	0.77
Dublin	13,500	23.5	0.57
Melbourne	10,965	22.2	0.49
Canberra	975	3.2	0.30
Gold Coast	1,000	4.6	0.22
BITRE Lower job density benchmark			0.60
Value used in modelling			**0.60**

Year of publication: Melbourne: 2007; Brisbane: 2011; Sydney: 2012; JFK: 2011; Heathrow: 2011; Dublin: 2008; Manchester: 2005; Adelaide: 2008; Brussels: 2009; Canberra: 2005, Gold Coast 2010.

Source data: BITRE, Optimal Economics Ltd; Sinclair Knight Merz; IBISWorld; Manchester Airport Group; Brussels Airport; ACIL Tasman; Adelaide Airport Corporation; Dublin Airport. Note: The methodologies used in these studies vary and hence the results are not perfectly comparable.

5.3 Scenario 1 projections

Scenario 1 is based on a conservative growth profile of the WSA, which would provide additional aviation capacity to the Sydney region as forecast by the Joint Study. The projected capacity of the airport is broken into three phases:

- An initial capacity of 3 million passenger movements per annum (PPA), domestic traffic only, operational from 2027 to 2032. This is based around the 'type 3' airport classification discussed in the Joint Study
- An expansion to 7 million PPA in 2033, with the introduction of short-haul international routes (e.g. Trans-Tasman, SE Asia) – similar to Gold Coast Airport
- A further expansion to 22 million PPA in 2040, as the KSA constraint binds fully, accompanied by major capex. This reflects the 'type 1' airport classification discussed in the Joint Study.

The capital expenditure figures for each stage of development are given in Table 5.3, with an indicative breakdown of expenditure type.

This scenario is designed to reflect the most conservative growth path for the WSA, such that there is no unmet aviation demand as forecast by the Joint Study. This scenario does not represent KSA being adversely affected by the WSA to any significant extent. However, sustained growth will generate 33.5 million passenger movements in 2050.

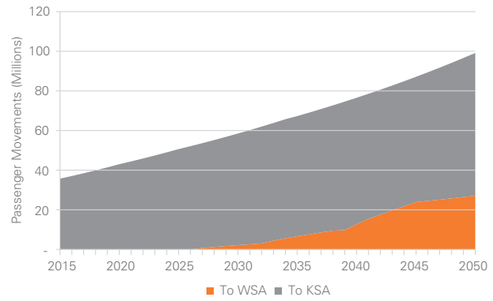
The capex estimates for stages 1 and 3 are adapted from the Joint Study, and stage 2 is based on similar expansions at Gold Coast, Adelaide, and Brisbane airports. Passenger movement projections are derived from the patronage model explained in the outline. The growth profile of the WSA relative to KSA is given in Chart 5.2 and the composition of passenger movements is shown in Chart 5.3. These figures are supported by descriptive tables given in Appendix A. The growth path of freight tonnage is depicted in Chart 5.4.

Table 5.3: Indicative capex projections (current $m) – Scenario 1

Capex stage:	Stage 1	Stage 2	Stage 3
(Expenditure years)	(2020-2027) ($ million)	(2031-2033) ($ million)	(2036-2039) ($ million)
Road & Rail	205	-	1,219
Earthworks	173	-	216
Runways/ taxiways	180	91	324
Apron surfaces	141	-	155
Car parking	52	108	166
Landing aids/ lighting	23	-	68
Terminals	920	367	1,670
Other capital costs	14	-	15
Project management & design	248	105	447
Total	1,955.3	670.9	4,279.8

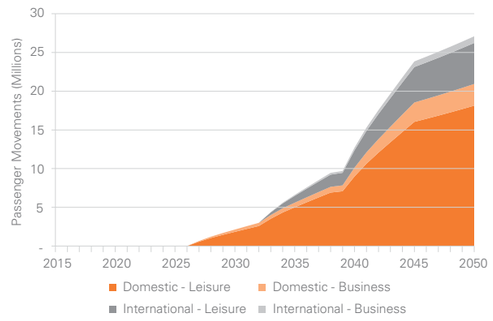
Source: DAE analysis. Note: These estimates are intended as a stylised representation of the likely capex associated with the airport, for the purposes of economic modelling. A detailed examination of costs and, therefore, capital expenditure has not been undertaken.

Chart 5.2: KSA/WSA growth profile – Scenario 1



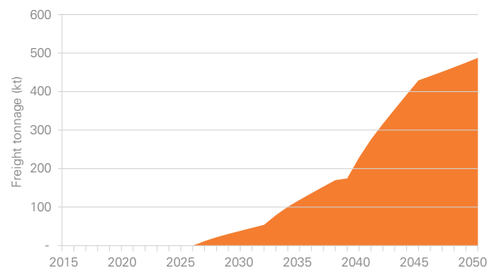
Source: DAE analysis.

Chart 5.3: WSA growth composition – Scenario 1



Source: DAE analysis.

Chart 5.4: WSA Freight growth – Scenario 1



Source: DAE analysis.

5.4 Scenario 2 projections

This scenario reflects a more optimistic growth profile of the WSA, based on WSA stimulating additional activity, over and above that projected by the Joint Study. The projected capacity of the airport is again broken into three phases:

- An initial capacity of 3 million passenger movements per annum (PPA), domestic traffic only, operational from 2027 to 2032. This is based around the 'type 3' airport classification discussed in the Joint Study.
- An expansion to 7 million PPA in 2032, with the introduction of short-haul international routes (e.g. Trans-Tasman, SE Asia).
- A further expansion to 30 million PPA in 2037, as the KSA constraint binds fully, accompanied by major CAPEX. This reflects the 'type 1' airport classification discussed in the Joint Study, with the addition of a second runway, cost benchmarked against Brisbane Airport's new runway.

The capital expenditure figures for each stage of development are given in Table 5.4, with an indicative breakdown of expenditure type.

This scenario explores the effect of a reduction in the cost of air travel as a result of the development of the WSA, as well as an unlocking of latent demand (i.e. demand that was constrained by non-price factors). This reflects the initial low-cost focus of the WSA, and the reality that many people live closer (in travel time) to the Badgerys Creek site than KSA – and that this proportion will increase over time.

The fall in generalised costs under this scenario is estimated to be 25% for domestic travellers using the WSA, and 10% at KSA, relative to KSA costs as the sole airport. The equivalent percentages for international costs are 5% at WSA, and no change at KSA. The price elasticity benchmarks used are 1.2 for leisure travellers, and 0.4 for business travellers, taken from an IATA InterVISTAS Study, using Australian data.

While the final expansion represents a certain level of market share taken from KSA, there are factors to suggest that the increased demand at WSA following the final expansion would be additional. Specifically, the CBA analysis discussed in section 3.2 contends that KSA will reach capacity before 2027, and the Joint Study indicates that the unmet demand estimates are conservative. Furthermore, the latest BITRE forecast as shown in Chart 3.8 on page 18 suggests that unconstrained demand will be greater than the Joint Study forecast.

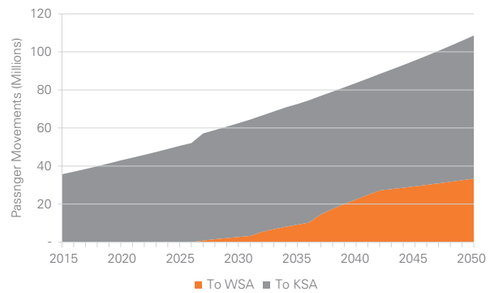
The growth profile of the WSA relative to KSA is given in Chart 5.5, and the composition of passenger movements is shown in Chart 5.6. These figures are supported by descriptive tables given in Appendix A. The growth path of freight tonnage is depicted in Chart 5.7.

Table 5.4: Indicative capex projections (current $m) – Scenario 2

Capex stage:	Stage 1	Stage 2	Stage 3
(Expenditure years)	(2020-2027) ($ million)	(2030-2032) ($ million)	(2033-2037) ($ million)
Road & Rail	205	-	1,219
Earthworks	173	-	216
Runways/ taxiways	180	91	1,403
Apron surfaces	141	-	155
Car parking	52	108	166
Landing aids/ lighting	23	-	68
Terminals	920	367	1,670
Other capital costs	14	-	15
Project management & design	248	105	648
Total	1,955.3	670.9	5,560.2

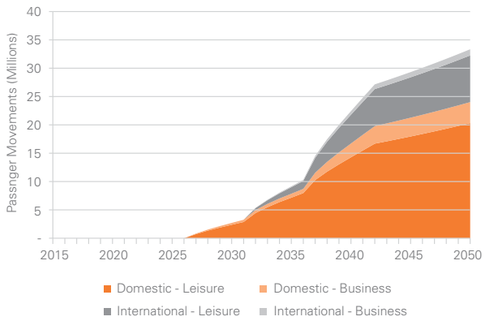
Source: DAE analysis. Note: These estimates are intended as a stylised representation of the likely capex associated with the airport, for the purposes of economic modelling. A detailed examination of costs and, therefore, capital expenditure has not been undertaken.

Chart 5.5: KSA/WSA growth profile – Scenario 2



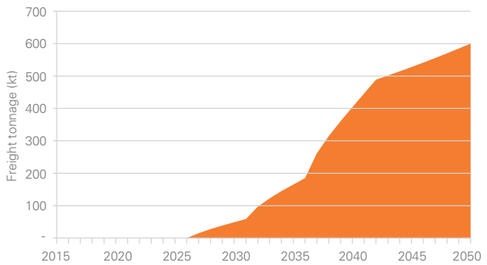
Source: DAE analysis.

Chart 5.6: WSA growth composition – Scenario 2



Source: DAE analysis.

Chart 5.7: WSA Freight growth – Scenario 2



Source: DAE analysis.

5.5 Scenario 3 projections

For the previous two scenarios, freight tonnage was projected on a pro rata basis using a benchmark of 18 tonnes per thousand passenger movements, based on comparator Australian airports identified in Chapter 4. However, there are global examples of much higher freight intensities: Glasgow Prestwick has a ratio of 90 tonnes per thousand passengers, albeit with a low level of passenger activity. Scenario 3 of our analysis uses a set of ratios part way between these two bounds. Table 5.5 and Chart 5.8 show higher freight intensities during the earlier stages, relative to Scenario 2. By 2037, in stage 3, the airport is assumed to have matured such that the freight intensity returns closer to the baseline Scenario 2. Note that passenger growth is assumed as Scenario 2, so passenger movement projections are as given in Table A.5 and Table A.6.

This is a relevant scenario for a WSA given Western Sydney is emerging as a key freight hub. The NSW 2021 Regional Action Plan: Western Sydney states that:

> Western Sydney is a key engine room of the NSW economy and will continue to grow and diversify, maintaining its position as the largest manufacturing region in Australia. It will continue to be a pivotal transport and logistics hub due to its strategic location, strong skills base, significant road and rail infrastructure, extensive freight services and market access.

In terms of exports, processed food & beverage manufacturing, metal manufacturing, and machinery and equipment manufacturing each account for approximately 6% of total NSW exports. In 2006, 42.7% of Western Sydney's manufacturing workforce was employed in these three manufacturing sectors.

In 2010-11, the transport, postal & warehousing industry was the third largest contributor to Western Sydney's GRP, worth $5.4 billion. The industry recorded the largest absolute growth of any industry between 2009-10 and 2010-11 - $411.6 million.

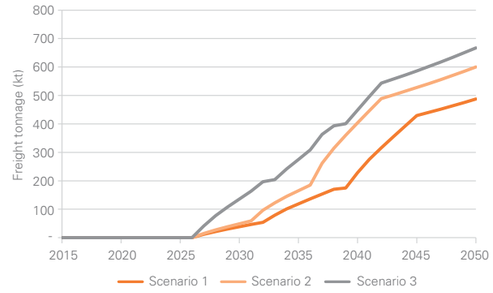
There is also current and planned infrastructure to support the growth of Western Sydney as a freight hub. This includes the establishment of an intermodal terminal at Moorebank, the construction of the WestConnex motorway which will provide Western Sydney with improved access to the Port Botany precinct, as well as a potential, a future intermodal terminal at Eastern Creek and Western Sydney Freight Line. Toll Group recently announced the establishment of a $170 million freight-sorting facility in Western Sydney to manage its parcel handling, reflecting that the strategic advantages of Western Sydney in supporting freight is already being recognised by industry.

Table 5.5: Freight Intensity Scenarios

Scenario	Tonnes per thousand PPA	Freight Tonnage 2030	Freight Tonnage 2035	Freight Tonnage 2040
Scenario 2	All Stages - 18	48,838	164,981	403,846
Scenario 3	Stage 1 - 50	135,662	274,969	448,718
	Stage 2 - 30			
	Stage 3 - 20			

Source: DAE analysis.

Chart 5.8: Freight tonnage comparison – Scenario comparison



Source: DAE analysis.

5.6 Aggregate time saving

The reduced surface travel time for aviation users will grow as Sydney's population centre shifts westward, route options expand and surface access constraints become increasingly acute around KSA. This efficiency gain will be significant when aggregated across all travellers, as shown in Table 5.6. The time saved per passenger movement increases from around half a minute per movement to over one minute per movement as a broader range of flights are offered at the WSA, and travellers choose the airport based on relative location more than service offering.

Table 5.6: Aggregate time saving 2030-2050

	WSA passenger movements (thousands)		Time saved at WSA (million minutes)	
Year	Scenario 1	Scenario 2 & 3	Scenario 1	Scenario 2 & 3
2030	2,133	2,713	0.7	0.9
2035	6,605	9,166	4.3	6.1
2040	12,709	22,436	13.8	22.1
2045	23,843	29,323	25.0	28.5
2050	27,085	33,355	28.3	32.4

Source: DAE analysis.

6 Economic impacts

This chapter examines the economic impact of a WSA on the Western Sydney economy and the Sydney metropolitan area more broadly, based on the methodology described in Section 5. This is broken into direct employment – that generated by on-airport construction and operating activity – and regional economic impacts emanating from the broader flows of passengers and freight.

While direct employment figures are estimating the same FTE employment concept as the CGE employment results discussed subsequently, the two figures have distinct interpretations:

- The direct employment figures indicate the number of people that will be employed directly to serve the construction or operation of the airport; and
- The CGE employment figure indicates the number of net additional jobs that will be created across the economy that would not have been generated absent further aviation capacity in the Sydney region.

Hence not all direct airport employment will be additional; rather the additional employment will be spread more broadly throughout the economy.

6.1 Direct employment

The two primary sources of direct employment are through the construction and phased expansion of the airport and direct on-airport employment (e.g. in retail, aircraft maintenance, passenger and aircraft facilitation, etc.). These figures were estimated outside the CGE modelling process and, in the case of on-airport employment, will be influenced heavily by the form that the airport development takes (e.g. the level and nature of retail, commercial and industrial activity that it supports). The direct employment results are given in Table 6.1.

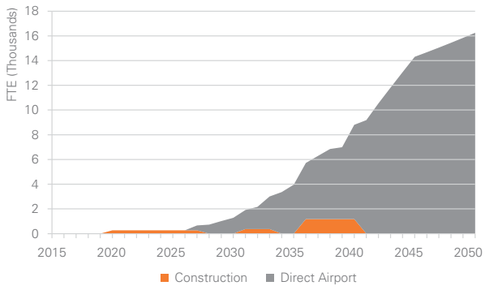
Table 6.1: Direct employment (FTE) - Scenario comparison

Construction	Phase 1	Phase 2	Phase 3
Scenario 1	269	369	1,177
Scenario 2 & 3	269	369	1,529
Direct on-site	**2030**	**2040**	**2050**
Scenario 1	1,280	7,625	16,251
Scenario 2 & 3	1,628	13,462	20,013

Source: DAE analysis. Note that Phase 1 of construction is 7 years, hence employment is lower than Phase 3 on an annual basis, but is a larger stimulus over the duration of construction.

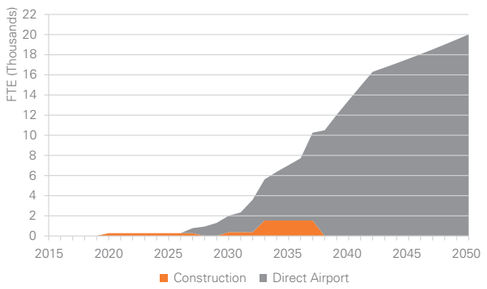
Construction-related employment is assumed to commence in 2020, with 269 workers employed directly through the seven years of greenfield development. The level of construction employment will be greater during the expansion phases, up to 1,529 jobs in Stage 3, as construction activity is concentrated into a shorter timeframe than the initial development. Once the airport becomes operational, direct airport employment becomes the primary driver; with an estimated 13,462 jobs by 2040. Chart 6.1 and Chart 6.2 illustrate growth in direct employment over time under each scenario. Since direct airport employment is benchmarked from passenger movements, Scenarios 2 and 3 have the same employment growth profile.

Chart 6.1: Construction and direct airport employment – Scenario 1



Source: DAE analysis.

Chart 6.2: Construction and direct airport employment – Scenario 2 and 3



Source: DAE analysis.

6.2 Broader economic impacts

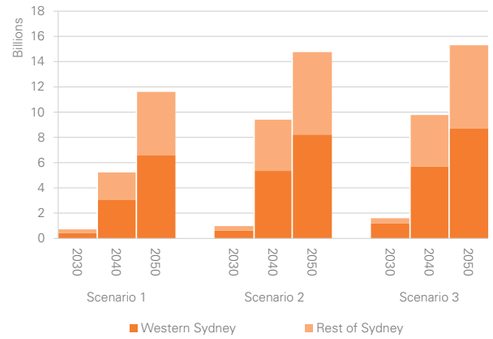
The economic impacts in this study are reported in terms of deviations from a 'business as usual' case. This counterfactual illustrates how the economy is likely to develop over time in the absence of the WSA. Modelling was undertaken over the period 2020 to 2050 for two specific economic regions: (i) Western Sydney and (ii) Rest of Sydney.

The approach uses Computable General Equilibrium (CGE) modelling to estimate how the additional capital investment, visitor expenditure and traveller time savings impact the regional economy over time. The impacts are measured in terms of the incremental contribution to economic output and employment potentially generated by the WSA. All figures of Gross Regional Product are given in real terms (2013 dollars).

Chart 6.3 compares the increase in gross economic value added from the WSA under the four scenarios. All scenarios show a large increase in the airport's economic contribution over time, with the 2050 figures ranging from $11.6 billion in Scenario 1 to $15.2 billion in Scenario 3. Scenario 3 represents the highest initial economic value, at $1.6 billion in 2030 and $9.8 billion in 2040; this is due to the higher freight intensities in tonnes per passenger in the earlier stages of airport expansion. Western Sydney gains the larger share of additional economic value relative to the rest of Sydney.

These trends are reflected in the comparison of results of additional Full Time Equivalent (FTE) employment in both regions, as shown in Chart 6.4. The 2050 figures for additional employment range from 35,216 jobs under Scenario 1 to 46,285 jobs under Scenario 3. The latter, freight intensive scenario represents the highest additional employment in the early stages, and the majority of additional jobs are created in Western Sydney. The years 2030, 2040 and 2050 are fairly representative of the full growth profile of GRP and employment, which are given in Chart A.1 to Chart A.3. The economic impact for the Western Sydney region under the three scenarios is given in Table A.11, and for the Rest of Sydney in Table A.12.

Chart 6.3: Scenario results – Additional Gross Regional Product generated by a WSA



Source: DAE analysis. GRP is in 2013 dollars. Dark colours represent Western Sydney, light colours represent Rest of Sydney.

Chart 6.4: Scenario results - FTE employment generated by a WSA

Source: DAE analysis. Dark colours represent Western Sydney, light colours represent Rest of Sydney.

Comparisons with earlier findings

The CGE results for the whole of Sydney (that is, the sum of Western Sydney and Rest of Sydney) are broadly comparable to those reported in the Joint Study Appendix B7. In comparing the scenario results with those in from the Joint Study (given in Table 3.2 on page 16), the Scenario 1 result is 12% higher than the medium case in terms of Gross State Product, and 34% higher in terms of employment. Scenarios 2 and 3 are between the medium and high results.

It is logical that the Joint Study results would tend to be lower overall, as the study focusses on foregone tourism expenditure, rather than also including the additional on-site economic activity of an airport. The comparison with the Ernst & Young study of a new airport at Badgerys Creek (as part of the Wilton study) is given as part of the sensitivity analysis in Section 6.2.4.

Cumulative impacts

The cumulative effect of the WSA represents a large economic impact on the Western Sydney economy, as shown in Table 6.2. In net present value terms, the modelled impact is between $9.2 billion and $15.6 billion in today's terms, for the 37 years to 2050. For the whole of Sydney, the modelled impact is between $15.7 billion and $25.6 billion. These impacts are particularly large, given that no additional activity will occur for the next seven years. The results for average employment over the period follow a similar pattern, between 12,645 and 19,982 full time equivalent jobs in Western Sydney and 20,601 and 31,736 full time equivalent jobs in Greater Sydney.

Table 6.2: Cumulative economic impact 2013-2050

	Region	Scenario 1	Scenario 2	Scenario 3
GRP ($ millions)	Western Sydney	$9,153	$13,318	$15,573
	Rest of Sydney	$6,574	$9,827	$10,042
	Total Sydney	$15,728	$23,145	$25,615
Employment (FTE - average)	Western Sydney	12,645	18,131	19,982
	Rest of Sydney	7,956	11,565	11,754
	Total Sydney	20,601	29,696	31,736

Source: DAE analysis. Note: NPVs have been calculated using a discount rate of 7 per cent. All values are in real 2012-13 terms.

6.2.1 Western Sydney Industry specific impacts

Underlying the headline gross value added figures reported above are several key industries projected to experience significant levels of additional economic activity as a result of the WSA. The complex relationships between sectors mean that results at a highly disaggregated level become less meaningful, as the CGE model is less well resolved. The industry sectors examined were as follows: Agriculture, Coal, Oil, Gas, Other Minerals, Manufacturing, Electricity, Water, Construction, Trade, Road Transport, Water Transport, Air Transport, Communication, Finance and Insurance, Business Services, Recreation, and Other Services and Government. Table 6.3 gives a breakdown of the key industries that are most impacted, in terms of 2050 output, by the WSA.

Technical services identified as air transport-dependent in Section 2.1.2, is projected to employ between 2,850 and 3,741 additional persons in 2050, relative to business as usual. Other Services and Government, including government administration and customs agency sectors, is forecast to employ between 5,704 and 7,490 additional persons in 2050 relative to business as usual. Manufacturing, which in general relies on intermediate goods and capital rather than labour, has a lower incremental employment than other sectors.

Table A.13 to Table A.15 detail the absolute and percentage impacts for the selected industry sectors, while Table A.16 to Table A.18 outline the additional employment by industry under each scenario.

Table 6.3: Key industry sector disaggregation

Business Services	Manufacturing	Other Services and Government	Trade
Rental and hiring services, such as car hire	Transport equipment (incl. aircraft repair)	Police services	Wholesale trade, such as food, pharmaceuticals and professional equipment
Travel agency services	Professional and scientific equipment	Customs services	Retail trade, including food and clothing
Private security services	Industrial machinery	Foreign government representation	
Professional, Scientific, and Technical services	Electrical and electronic equipment		

Source: ABS ANZSIC- IOIG concordance (cat. no. 5209.0).
Air transport is a more specific subdivision in this context.

Table 6.4 illustrates how increased economic activity from construction capital expenditure, visitor expenditure, and surface travel time savings flow through to key sectors under each scenario. As would be expected, the Air Transport industry in Western Sydney is projected to experience significant growth as a result of the WSA, adding between $4.7 and $6.4 billion in output by 2050. The increase in Air Transport employment follows the same pattern, with projections ranging between 4,122 and 5,317 jobs in 2050. It is worth noting that while the surface travel time savings to private passengers are quantified, key industries will also benefit from reduced travel times and congestion from the WSA – these benefits are additional to what is being considered here.

The subsequent industries by order of long-term impact on employment are as follows: Other services and Government, Trade, Business Services and Manufacturing. Along with Air Transport, these represent 83% of all output activity and 84% of all employment impacts in the Western Sydney region.

The Trade Sector, which includes wholesale trade of fast-moving goods such as food and pharmaceuticals, is projected to employ between 4,956 and 6,190 additional persons in 2050, relative to business as usual. Business Services, which includes the Professional, Scientific, and

Table 6.4: Economic impact in Western Sydney by top five industry sectors at 2050

		2030		2040		2050	
Industry	Scenario	Output ($m)	FTE	Output ($m)	FTE	Output ($m)	FTE
Air Transport	1	365	582	2,203	2,543	4,705	4,122
	2	465	732	3,892	4,151	5805	4,915
	3	1,214	1,783	4,280	4,497	6381	5,317
Business Services	1	95	286	600	1,567	1,293	2,850
	2	121	379	1,064	2,761	1,605	3,543
	3	239	740	1,125	2,918	1,695	3,741
Manufacturing	1	37	-34	261	-33	1,004	444
	2	1	-81	516	-26	1,222	540
	3	170	116	622	85	1,387	687
Other Services and Government	1	89	541	561	3,028	1,210	5,704
	2	113	709	996	5,349	1,502	7,091
	3	223	1,393	1,052	5,655	1,586	7,490
Trade	1	165	472	1,110	2,765	2,423	4,956
	2	211	642	1,980	4,883	3,033	6,225
	3	211	588	1,980	4,858	3,033	6,190
Other Sectors	1	101	93	1,151	2,379	2,174	3,579
	2	273	681	1,890	4,040	2,820	4,920
	3	315	933	1,919	4,244	2,865	5,165
Total	1	852	1,940	5,886	12,249	12,809	21,655
	2	1,184	3,062	10,338	21,158	15,987	27,234
	3	2,372	5,553	10,978	22,257	16,947	28,590

Source: DAE analysis.

6.2.2 Local level impacts

The varying concentrations of different industries across the LGAs of Western Sydney mean that, while all regions enjoy some degree of economic benefit, the benefits of enhanced access to air services will not be uniformly distributed across the regions. An additional modelling tool that uses relative LGA industry concentrations was used, to provide insight into the likely spread of economic impacts at the LGA level.

Besides the Liverpool LGA, which will contain the Airport; Table 6.5 and Table 6.6 show the LGAs of Bankstown and Parramatta will enjoy particular benefits from the modelled airport at Badgerys Creek under each scenario, in large part driven by the relative concentration of Manufacturing and Business Services in both regions, as well as Financial Services in Parramatta. The wage impact in Western Sydney is fairly evenly spread – with the top 5 LGAs receiving above $200 million in additional aggregate wage income, including the incremental increase in wages for existing jobs. Note that the output figures in Table 6.6 include intermediate goods and services, and so are not directly comparable with GRP.

Table 6.5: Additional FTE employment and aggregate wage income by LGA - 2050

	Scenario 1		Scenario 2		Scenario 3	
LGA	Emp. (FTE)	Total wages ($ m)	Emp. (FTE)	Total wages ($ m)	Emp. (FTE)	Total wages ($ m)
Bankstown	547	$217	714	$280	749	$289
Blacktown	863	$322	1,132	$417	1,172	$429
Liverpool	15,808	$4,887	19,605	$6,123	20,656	$6,426
Parramatta	872	$323	1,122	$413	1,178	$428
Penrith	548	$197	717	$255	742	$262
Other Western Sydney	3,017	$1,115	3,945	$1,441	4,094	$1,482
Total	21,655	$7,062	27,234	$8,929	28,590	$9,316

Source: DAE analysis. Aggregate wages are in 2013 dollars.

Table 6.6: Additional aggregate output by LGA - 2050

LGA	Scenario 1 ($ m)	Scenario 2 ($ m)	Scenario 3 ($ m)
Bankstown	416 (3.2%)	524 (3.3%)	553 (3.3%)
Blacktown	623 (4.9%)	790 (4.9%)	824 (4.9%)
Liverpool	8648 (67.5%)	10724 (67.1%)	11459 (67.6%)
Parramatta	599 (4.7%)	752 (4.7%)	787 (4.6%)
Penrith	387 (3%)	492 (3.1%)	509 (3%)
Other Western Sydney	966 (16.4%)	1664 (16.1%)	1735 (15.8%)
Total	12808 (100%)	15986 (100%)	16947 (100%)

Source: DAE analysis. Output is in 2013 dollars.

6.2.3 Impacts on Small and Medium Enterprises

In conjunction with the results of the DAE-RGEM CGE model, an additional modelling tool based on ABS data business count data by number of employees has been used to develop the estimates in Table 6.7. This shows the number of additional small (less than 20 employees) and medium businesses generated in each industry sector under each scenario. The Business Services sector is projected to experience the largest increase in small business count, with 1,000 additional businesses by 2050 under Scenario 1 – around a quarter of the total 3,821 additional businesses. This is because it is comprised of more small businesses than the manufacturing or communication sectors. Scenario 3 has an overall increase in small businesses of 5,064 by 2050. Note that these figures exclude non-employing small businesses.

Table 6.7: Small and Medium Business Counts by Industry - 2050

	Scenario 1		Scenario 2		Scenario 3	
	Small	Medium	Small	Medium	Small	Medium
Air Transport	569	33	702	40	771	44
Business Services	1,000	77	1,242	96	1,312	101
Manufacturing	64	14	78	17	88	19
Other Services and Government	450	33	559	41	590	43
Trade	848	116	1,062	146	1,062	146
Other	890	47	1,227	65	1,240	65
Total	3,821	320	4,869	404	5,064	419

Source: DAE analysis.

The spread across industry sectors for medium businesses – defined as employing between 20 and 200 employees – is similar to that for small business, with a large proportion of additional businesses being established in the Business Services sector; 77 of the additional 320 businesses in 2050 under Scenario 1. Again, this reflects the ability of other sectors, particularly in the Trade sector, to capture increasing returns to scale. Scenarios 2 and 3 represent a significant increase on the baseline scenario, with additional medium business counts of 404 and 419 respectively. Note that these figures include existing businesses that may relocate operations into the Western Sydney region to be closer to the business activity surrounding the WSA. Table A.22 to Table A.27 detail the small and medium business counts for the years 2030, 2040, and 2050.

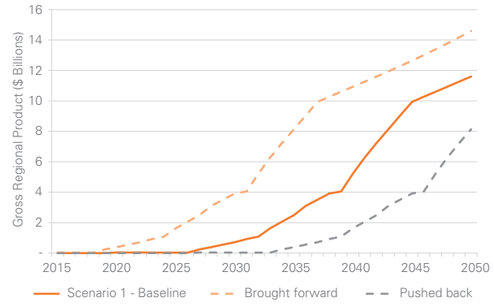
6.2.4 Sensitivity Analysis

In addition to the three fully worked scenarios, three sensitivities were estimated. The first two are bounds for the timing of maximum capacity at KSA, based on Scenario 1. The final sensitivity is based on passenger volume numbers at Badgerys Creek developed during the Wilton Study.

Chart 6.5 illustrates the sensitivity results with respect to timing of a passenger volume constraint at KSA. The sensitivity bounds represent the passenger volume profile brought forward and pushed back eight years. The latter case is relevant for the case put forward by the Tourism and Transport Forum and Sydney Airport Corporation, that there will be sufficient capacity to meet aviation demand in the Sydney region until at least 2035. This case reduces the economic impact of the airport at Badgerys Creek significantly, as passenger and freight volume that passed through the second airport would be either slower than anticipated, or no longer additional.

In the lower bound case, the impact on GRP for all of Sydney in 2050 falls from $11.6 to $8.1 billion in today's terms. The main effect is a 'hollowing out' of the GRP impact curve in Chart 6.5, which is illustrated in net present value comparisons: the lower sensitivity bound has an NPV of $5.5 billion, relative to the baseline NPV of $15.7 billion. The converse sensitivity has a NPV of $37.3 billion – while this is more of an abstract case; some stakeholders contend that the Joint Study estimate of unmet demand is a conservative one, making some upside consideration relevant.

Chart 6.5: Modelled GRP comparison of constrained Kingsford Smith Airport timing

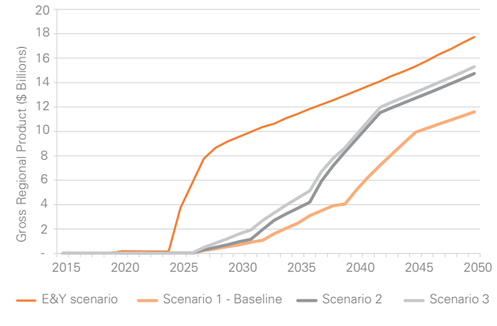


Source: DAE analysis.

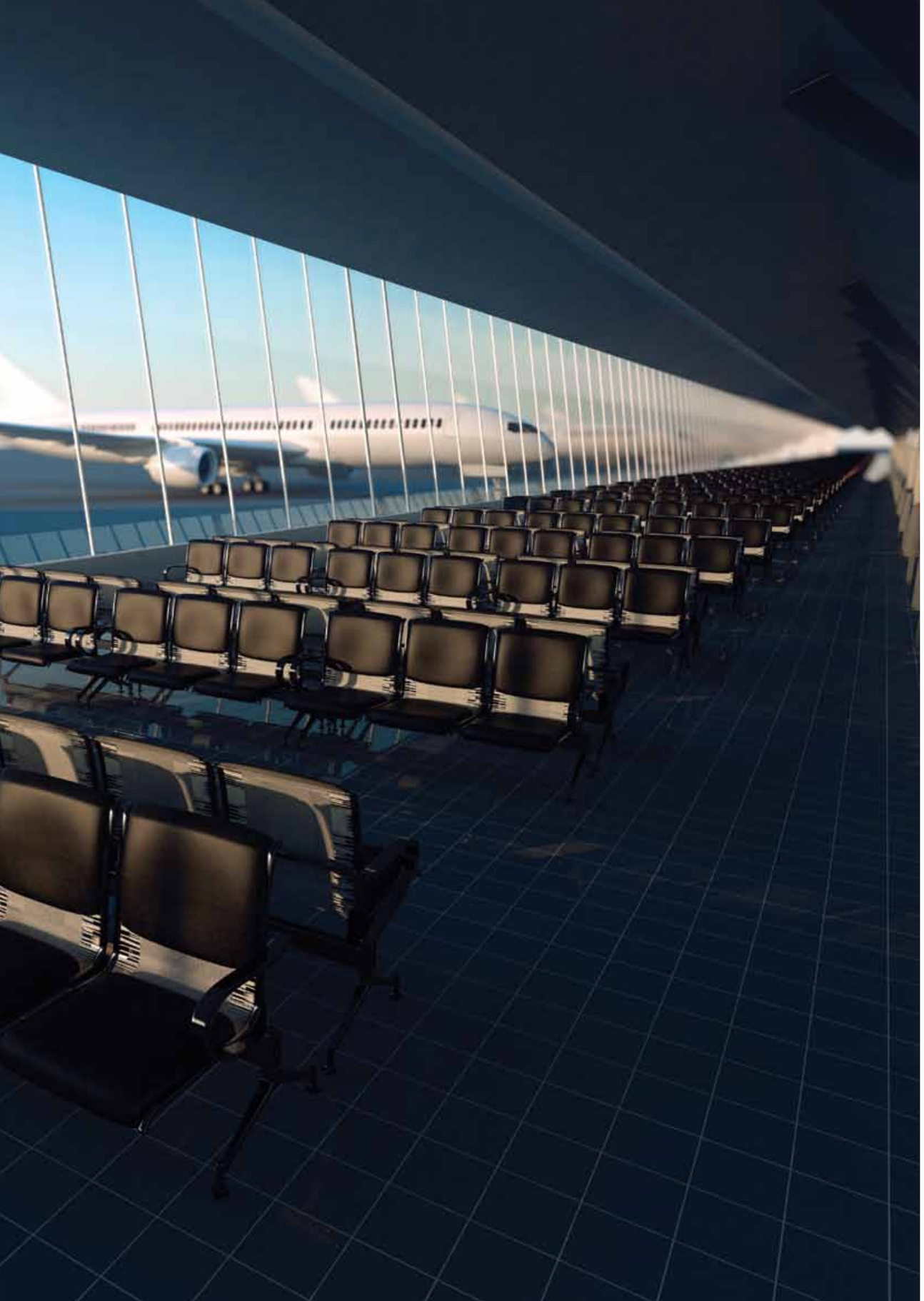
Alternative passenger volume forecasts were developed in the Ernst & Young report *Economic and Social Analysis of Potential Airport Sites,* commissioned as an appendix to the Wilton and RAAF Base Richmond study. These passenger volumes, shown in Chart 3.7 in Section 3.2, were modelled using the framework developed in this analysis. A comparison of total GRP impact for Ernst & Young passenger volumes and the three scenarios developed here is shown in Chart 6.6. The economic impact is much larger and more immediate under the Ernst & Young scenario, represented by a NPV of $55.7 billion, which is over three times larger than the baseline developed in this analysis. The scenarios presented in this analysis are balanced, but clearly other modelling efforts see some upside scope from the Joint Study unmet figures.

In terms of employment, the mid-range estimate in the Ernst & Young report was a total of approximately 45,500 FTE for 2050. Deloitte Access Economics' estimate of total employment, based on Ernst & Young passenger volume estimates, is 17% higher, at 53,663 FTE for Sydney overall. This additional employment is explained by the incremental tourism impact, particularly in the Rest of Sydney, which was not explicitly modelled in the Ernst & Young scenario.

Chart 6.6: Modelled GRP for Greater Sydney - comparison for Ernst & Young passenger volumes



Source: DAE analysis and Ernst & Young 2013.



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Appendix A: Passenger movement numbers, market shares, and CGE result tables

Passenger movements - Scenarios 1

Table A.1: Passenger movement projections (thousands p.a.) – Scenario 1

	Domestic		International		
Year	Business	Leisure	Business	Leisure	TOTAL
2015	-	-	-	-	-
2020	-	-	-	-	-
2025	-	-	-	-	-
2030	298	1,835	-	-	2,133
2035	595	5,004	124	881	6,605
2040	1,142	8,991	334	2,242	12,709
2045	2,501	16,037	725	4,579	23,843
2050	2,803	18,129	862	5,290	27,085

Source: DAE analysis.

Table A.2: WSA market share – Scenario 1

	Domestic		International		
Year	Business	Leisure	Business	Leisure	TOTAL
2015	-	-	-	-	-
2020	-	-	-	-	-
2025	-	-	-	-	-
2030	3.2%	6.6%	-	-	3.6%
2035	5.8%	15.9%	2.2%	4.5%	9.8%
2040	10.0%	25.3%	5.0%	9.8%	16.6%
2045	19.6%	40.1%	9.0%	17.4%	27.4%
2050	19.8%	40.2%	9.0%	17.5%	27.3%

Source: DAE analysis.

Table A.3: WSA passenger composition – Scenario 1

	Domestic		International		
Year	Business	Leisure	Business	Leisure	TOTAL
2015	-	-	-	-	-
2020	-	-	-	-	-
2025	-	-	-	-	-
2030	14.0%	86.0%	-	-	100%
2035	9.0%	75.8%	1.9%	13.3%	100%
2040	9.0%	70.7%	2.6%	17.6%	100%
2045	10.5%	67.3%	3.0%	19.2%	100%
2050	10.4%	66.9%	3.2%	19.5%	100%

Source: DAE analysis.

Passenger movements - Scenario 2 and 3

Table A.4: WSA Passenger movement projections (thousands p.a.) – Scenario 2

	Domestic		International		
Year	Business	Leisure	Business	Leisure	TOTAL
2015	-	-	-	-	-
2020	-	-	-	-	-
2025	-	-	-	-	-
2030	327	2,386	-	-	2,713
2035	694	7,167	156	1,148	9,166
2040	2,436	14,286	642	5,072	22,436
2045	3,313	17,965	920	7,126	29,323
2050	3,710	20,322	1,094	8,230	33,355

Source: DAE analysis.

Table A.5: WSA market share – Scenario 2

	Domestic		International		
Year	Business	Leisure	Business	Leisure	TOTAL
2015	-	-	-	-	-
2020	-	-	-	-	-
2025	-	-	-	-	-
2030	3.4%	7.6%	-	-	4.3%
2035	6.5%	19.7%	2.8%	5.8%	12.6%
2040	20.2%	34.2%	9.5%	22.0%	26.8%
2045	24.7%	38.0%	11.5%	26.7%	30.7%
2050	24.8%	38.1%	11.5%	26.7%	30.7%

Source: DAE analysis.

Table A.6: WSA passenger composition – Scenario 2

	Domestic		International		
Year	Business	Leisure	Business	Leisure	TOTAL
2015	-	-	-	-	-
2020	-	-	-	-	-
2025	-	-	-	-	-
2030	12.1%	87.9%	-	-	100%
2035	7.6%	78.2%	1.7%	12.5%	100%
2040	10.9%	63.7%	2.9%	22.6%	100%
2045	11.3%	61.3%	3.1%	24.3%	100%
2050	11.1%	60.9%	3.3%	24.7%	100%

Source: DAE analysis.

Tabulated CGE inputs

Table A.7: Summary of operational CGE inputs - Scenario 1

Year	Tourism Expenditure		Value of time saved	Value of additional freight
	Western Sydney	Rest of Sydney		
2025	-	-	-	-
2030	274,709,383	398,311,584	470,039	331,439,709
2035	931,252,713	1,482,307,040	2,764,127	1,026,374,310
2040	1,850,619,500	2,977,453,795	9,045,121	1,974,921,740
2045	3,507,512,103	5,639,447,408	16,588,288	3,705,045,805
2050	4,037,809,842	6,391,475,820	18,792,670	4,208,827,393

Source: DAE analysis.

Table A.8: Summary of operational CGE inputs - Scenario 2

Year	Tourism Expenditure		Value of time saved	Value of additional freight
	Western Sydney	Rest of Sydney		
2025	-	-	-	-
2030	351,978,059	510,264,611	604,141	421,624,185
2035	1,294,190,560	2,045,039,934	3,909,402	1,424,298,411
2040	3,299,946,919	5,520,238,155	14,969,458	3,486,433,374
2045	4,384,132,767	7,294,326,250	19,379,677	4,556,631,568
2050	5,054,253,341	8,283,670,187	22,005,646	5,183,184,049

Source: DAE analysis.

Table A.9: Summary of operational CGE inputs - Scenario 3

Year	Tourism Expenditure		Value of time saved	Value of additional freight
	Western Sydney	Rest of Sydney		
2025	-	-	-	-
2030	351,978,059	510,264,611	604,141	1,171,178,291
2035	1,294,190,560	2,045,039,934	3,909,402	2,373,830,686
2040	3,299,946,919	5,520,238,155	14,969,458	3,873,814,860
2045	4,384,132,767	7,294,326,250	19,379,677	5,062,923,965
2050	5,054,253,341	8,283,670,187	22,005,646	5,759,093,387

Source: DAE analysis.

Table A.10: Summary of CGE inputs – Ernst & Young scenario

Year	Tourism Expenditure		Value of time saved	Value of additional freight
	Western Sydney	Rest of Sydney		
2025	1,343,012,094	2,516,351,770	5,781,308	1,450,462,472
2030	3,239,963,053	6,100,646,410	13,362,433	3,391,372,550
2035	3,808,772,250	7,100,377,033	15,362,934	3,934,830,894
2040	4,408,495,628	8,154,906,551	17,345,273	4,478,289,237
2045	5,052,801,307	9,221,221,983	19,572,327	5,058,983,617
2050	5,832,741,424	10,519,733,767	22,206,579	5,770,136,168

Source: DAE analysis.

CGE results – results growth profiles

Chart A.1: Scenario 1 CGE results

Source: DAE analysis.

Chart A.2: Scenario 2 CGE results

Source: DAE analysis.

Chart A.3: Scenario 3 CGE results

Source: DAE analysis.

Chart A.4: Ernst & Young CGE results

Source: DAE analysis.

Tabulated CGE results

Table A.11: Economic Impacts for Western Sydney under each scenario

Year (non-cumulative)	2030		2040		2050	
	GRP ($m)	Employment (FTE)	GRP ($m)	Employment (FTE)	GRP ($m)	Employment (FTE)
Scenario 1	433	1,940	3,032	12,249	6,568	21,655
Scenario 2	609	3,062	5,349	21,158	8,222	27,234
Scenario 3	1,189	5,553	5,682	22,257	8,721	28,590
Scenario 1 – delayed	32	450	984	4,486	4,672	17,475
Scenario 1 – brought forward	6,380	21,402	6,019	20,889	8,230	23,767
Ernst & Young Scenario	5,166	23,973	7,093	27,797	9,438	31,121

Source: DAE analysis. GRP is in 2013 millions of dollars.

Table A.12: Economic Impacts for Rest of Sydney under each scenario

Year (non-cumulative)	2030		2040		2050	
	GRP ($m)	Employment (FTE)	GRP ($m)	Employment (FTE)	GRP ($m)	Employment (FTE)
Scenario 1	277	1,241	2,194	7,680	5,035	13,561
Scenario 2	359	1,609	4,052	14,067	6,526	17,532
Scenario 3	410	1,857	4,089	14,173	6,578	17,695
Scenario 1 – delayed	1	4	643	2,729	3,466	11,336
Scenario 1 – brought forward	4,886	13,414	4,586	13,203	6,361	14,786
Ernst & Young Scenario	4,402	17,348	6,243	19,737	8,303	22,542

Source: DAE analysis. GRP is in 2013 millions of dollars.

Impact on industry output by scenario

Table A.13: Impacts on industry output ($m) – Scenario 1

Industry	2030	2040	2050
Air Transport	365 (42%)	2,203 (195.9%)	4,705 (325.7%)
Business Services	95 (0.4%)	600 (1.9%)	1,293 (3.1%)
Manufacturing	37 (0%)	261 (0.2%)	1,004 (0.5%)
Other Services and Government	89 (0.2%)	561 (1%)	1,210 (1.7%)
Trade	165 (0.3%)	1,110 (1.4%)	2,423 (2.3%)
Other Sectors	101	1,151	2,174
Total	852	5,886	12,809

Source: DAE analysis. Deviation is in 2013 dollars. Percentage change from business as usual in parentheses.

Table A.14: Impacts on industry output ($m) – Scenario 2

Industry	2030	2040	2050
Air Transport	465 (53.5%)	3,892 (346.2%)	5,805 (401.8%)
Business Services	121 (0.5%)	1,064 (3.4%)	1,605 (3.8%)
Manufacturing	1 (0%)	516 (0.3%)	1,222 (0.6%)
Other Services and Government	113 (0.3%)	996 (1.8%)	1,502 (2.1%)
Trade	211 (0.4%)	1,980 (2.5%)	3,033 (2.8%)
Other Sectors	273	1,890	2,820
Total	1,184	10,338	15,987

Source: DAE analysis. Deviation is in 2013 dollars. Percentage change from business as usual in parentheses.

Table A.15: Impacts on industry output ($m) – Scenario 3

Industry	2030	2040	2050
Air Transport	1,214 (139.7%)	4,280 (380.6%)	6,381 (441.7%)
Business Services	239 (1%)	1,125 (3.6%)	1,695 (4%)
Manufacturing	170 (0.1%)	622 (0.4%)	1,387 (0.7%)
Other Services and Government	223 (0.6%)	1,052 (1.9%)	1,586 (2.2%)
Trade	211 (0.4%)	1,980 (2.5%)	3,033 (2.8%)
Other Sectors	315	1,919	2,865
Total	2,372	10,978	16,947

Source: DAE analysis. Deviation is in 2013 dollars. Percentage change from business as usual in parentheses.

Impact on industry employment by scenario

Table A.16: Impacts on industry employment (FTE) – Scenario 1

Industry	2030	2040	2050
Air Transport	582 (29.8%)	2,543 (122.7%)	4,122 (189.5%)
Business Services	286 (0.3%)	1,567 (1.6%)	2,850 (2.6%)
Manufacturing	-34 (0%)	-33 (0%)	444 (0.2%)
Other Services and Government	541 (0.2%)	3,028 (0.9%)	5,704 (1.5%)
Trade	472 (0.2%)	2,765 (1.2%)	4,956 (1.8%)
Other Sectors	93	2379	3579
Total	1,940 (0.2%)	12,249 (1.1%)	21,655 (1.7%)

Source: DAE analysis. Percentage change from business as usual in parentheses.

Table A.17: Impacts on industry employment (FTE) – Scenario 2

Industry	2030	2040	2050
Air Transport	732 (37.5%)	4,151 (200.3%)	4,915 (226%)
Business Services	379 (0.4%)	2,761 (2.9%)	3,543 (3.3%)
Manufacturing	-81 (0%)	-26 (0%)	540 (0.2%)
Other Services and Government	709 (0.3%)	5,349 (1.7%)	7,091 (1.9%)
Trade	642 (0.3%)	4,883 (2%)	6,225 (2.3%)
Other Sectors	681	4,040	4,920
Total	3,062 (0.3%)	21,158 (1.9%)	27,234 (2.1%)

Source: DAE analysis. Percentage change from business as usual in parentheses.

Table A.18: Impacts on industry employment (FTE) – Scenario 3

Industry	2030	2040	2050
Air Transport	1,783 (91.4%)	4,497 (217%)	5,317 (244.5%)
Business Services	740 (0.9%)	2,918 (3%)	3,741 (3.4%)
Manufacturing	116 (0.1%)	85 (0%)	687 (0.3%)
Other Services and Government	1,393 (0.5%)	5,655 (1.8%)	7,490 (2%)
Trade	588 (0.3%)	4,858 (2%)	6,190 (2.2%)
Other Sectors	933	4,244	5,165
Total	5,553 (0.3%)	22,257 (1%)	28,590 (1.1%)

Source: DAE analysis. Percentage change from business as usual in parentheses.

Impact on sub-regional output by scenario

Table A.19: Impacts on regional output – Scenario 1 ($m)

LGA	2030	2040	2050
Bankstown	20 (2.4%)	178 (3%)	416 (3.2%)
Blacktown	31 (3.6%)	281 (4.8%)	623 (4.9%)
Liverpool	638 (75%)	4016 (68.2%)	8648 (67.5%)
Parramatta	33 (3.9%)	266 (4.5%)	599 (4.7%)
Penrith	20 (2.4%)	179 (3%)	387 (3%)
Other Western Sydney	108 (12.7%)	13 (12.7%)	966 (16.4%)
Total	851 (100%)	5885 (100%)	12808 (100%)

Source: DAE analysis. Output is in 2013 millions of dollars.

Table A.20: Impacts on regional output – Scenario 2 ($m)

LGA	2030	2040	2050
Bankstown	32 (2.7%)	309 (3%)	524 (3.3%)
Blacktown	55 (4.6%)	483 (4.7%)	790 (4.9%)
Liverpool	821 (69.4%)	7109 (68.8%)	10724 (67.1%)
Parramatta	50 (4.2%)	465 (4.5%)	752 (4.7%)
Penrith	36 (3%)	307 (3%)	492 (3.1%)
Other Western Sydney	190 (16%)	16 (16%)	1664 (16.1%)
Total	1184 (100%)	10336 (100%)	15986 (100%)

Source: DAE analysis. Output is in 2013 millions of dollars

Table A.21: Impacts on regional output – Scenario 3 ($m)

LGA	2030	2040	2050
Bankstown	62 (2.6%)	328 (3%)	553 (3.3%)
Blacktown	90 (3.8%)	505 (4.6%)	824 (4.9%)
Liverpool	1773 (74.8%)	7603 (69.3%)	11459 (67.6%)
Parramatta	86 (3.6%)	487 (4.4%)	787 (4.6%)
Penrith	54 (2.3%)	318 (2.9%)	509 (3%)
Other Western Sydney	305 (12.9%)	13 (12.9%)	1735 (15.8%)
Total	2371 (100%)	10976 (100%)	16947 (100%)

Source: DAE analysis. Output is in 2013 millions of dollars.

Table A.22: Impacts on regional output in 2050 – All LGA's ($m)

LGA	Scenario 1	Scenario 2	Scenario 3
Auburn	413 (3.2%)	521 (3.3%)	544 (3.2%)
Bankstown	416 (3.2%)	524 (3.3%)	553 (3.3%)
Blacktown	623 (4.9%)	790 (4.9%)	824 (4.9%)
Blue Mountains	127 (1%)	162 (1%)	164 (1%)
Camden	124 (1%)	159 (1%)	164 (1%)
Campbelltown	292 (2.3%)	368 (2.3%)	384 (2.3%)
Fairfield	339 (2.6%)	428 (2.7%)	450 (2.7%)
Hawkesbury	146 (1.1%)	186 (1.2%)	193 (1.1%)
Holroyd	213 (1.7%)	269 (1.7%)	285 (1.7%)
Liverpool	8,648 (67.5%)	10,724 (67.1%)	11,459 (67.6%)
Parramatta	599 (4.7%)	752 (4.7%)	787 (4.6%)
Penrith	387 (3%)	492 (3.1%)	509 (3%)
The Hills Shire	438 (3.4%)	557 (3.5%)	574 (3.4%)
Wollondilly	42 (0.3%)	54 (0.3%)	57 (0.3%)
Total	12,808 (100%)	15,986 (100%)	16,947 (100%)

Source: DAE analysis. Output is in 2013 millions of dollars

Impact on sub-regional output by scenario

Table A.23: Impacts on regional employment and aggregate wages – Scenario 1

LGA	2030		2040		2050	
	Emp. (FTE)	Total wages ($ m)	Emp. (FTE)	Total wages ($ m)	Emp. (FTE)	Total wages ($ m)
Bankstown	24	$10	308	$109	547	$217
Blacktown	42	$15	515	$165	863	$322
Liverpool	1,636	$317	8,809	$2,262	15,808	$4,887
Parramatta	55	$16	492	$158	872	$323
Penrith	29	$9	331	$101	548	$197
Other Western Sydney	155	$52	1,793	$566	3,017	$1,115
Total	1,940	$420	12,249	$3,360	21,655	$7,062

Source: DAE analysis. Aggregate wages are in 2013 dollars.

Table A.24: Impacts on regional employment and aggregate wages – Scenario 2

LGA	2030		2040		2050	
	Emp. (FTE)	Total wages ($ m)	Emp. (FTE)	Total wages ($ m)	Emp. (FTE)	Total wages ($ m)
Bankstown	78	$24	510	$180	714	$280
Blacktown	138	$37	847	$272	1,132	$417
Liverpool	2,156	$454	15,451	$3,967	19,605	$6,123
Parramatta	123	$34	838	$267	1,122	$413
Penrith	90	$23	547	$167	717	$255
Other Western Sydney	478	$126	2,965	$938	3,945	$1,441
Total	3,062	$697	21,158	$5,791	27,234	$8,929

Source: DAE analysis. Aggregate wages are in 2013 dollars.

Table A.25: Impacts on regional employment and aggregate wages – Scenario 3

LGA	2030		2040		2050	
	Emp. (FTE)	Total wages ($ m)	Emp. (FTE)	Total wages ($ m)	Emp. (FTE)	Total wages ($ m)
Bankstown	125	$34	537	$187	749	$289
Blacktown	192	$49	878	$279	1,172	$429
Liverpool	4,235	$829	16,313	$4,166	20,656	$6,426
Parramatta	199	$50	881	$277	1,178	$428
Penrith	124	$30	566	$171	742	$262
Other Western Sydney	679	$171	3,081	$965	4,094	$1,482
Total	5,553	$1,163	22,257	$6,044	28,590	$9,316

Source: DAE analysis. Aggregate wages are in 2013 dollars.

Table A.26 Impacts on regional employment and aggregate wages in 2050–all Western Sydney LGA's

LGA	Scenario 1 FTE	Scenario 1 Wages ($ m)	Scenario 2 FTE	Scenario 2 Wages ($ m)	Scenario 3 FTE	Scenario 3 Wages ($ m)
Auburn	543	$205	707	$264	737	$272
Bankstown	547	$217	714	$280	749	$289
Blacktown	863	$322	1,132	$417	1,172	$429
Blue Mountains	174	$57	227	$74	233	$75
Camden	196	$68	261	$89	268	$91
Campbelltown	384	$146	499	$188	520	$194
Fairfield	463	$181	602	$232	629	$240
Hawkesbury	210	$78	277	$101	287	$104
Holroyd	289	$118	378	$152	395	$157
Liverpool	15,808	$4,887	19,605	$6,123	20,656	$6,426
Parramatta	872	$323	1,122	$413	1,178	$428
Penrith	548	$197	717	$255	742	$262
The Hills Shire	688	$233	900	$301	927	$308
Wollondilly	69	$31	94	$41	98	$42
Total	21,655	$7,062	27,234	$8,929	28,590	$9,316

Source: DAE analysis. Aggregate wages are in 2013 dollars.

Impact on small business count by scenario

Table A.27: Changes in the number of Small businesses under Scenario 3

Industry	2030	2040	2050
Air Transport	44	266	569
Business Services	74	464	1,000
Manufacturing	2	17	64
Other Services and Government	33	209	450
Trade	58	389	848
Other	13	588	890
Total	224	1,933	3,821

Source: DAE analysis.

Table A.28: Changes in the number of Small businesses under Scenario 2

Industry	2030	2040	2050
Air Transport	56	471	702
Business Services	94	823	1,242
Manufacturing	0	33	78
Other Services and Government	42	370	559
Trade	74	693	1,062
Other	172	873	1,227
Total	438	3,264	4,869

Source: DAE analysis.

Table A.29: Changes in the number of Small businesses under Scenario 3

Industry	2030	2040	2050
Air Transport	147	517	771
Business Services	185	870	1,312
Manufacturing	11	40	88
Other Services and Government	83	392	590
Trade	74	693	1,062
Other	184	882	1,240
Total	683	3,394	5,064

Source: DAE analysis.

Impact on medium business count by scenario

Table A.30: Changes in the number of Medium businesses under Scenario 1

Industry	2030	2040	2050
Air Transport	3	15	33
Business Services	6	36	77
Manufacturing	0	4	14
Other Services and Government	2	15	33
Trade	8	53	116
Other	1	30	47
Total	20	154	320

Source: DAE analysis.

Table A.31: Changes in the number of Medium businesses under Scenario 2

Industry	2030	2040	2050
Air Transport	3	27	40
Business Services	7	64	96
Manufacturing	0	7	17
Other Services and Government	3	27	41
Trade	10	95	146
Other	9	46	65
Total	32	266	404

Source: DAE analysis.

Table A.32: Changes in the number of Medium businesses under Scenario 3

Industry	2030	2040	2050
Air Transport	8	30	44
Business Services	14	67	101
Manufacturing	2	8	19
Other Services and Government	6	29	43
Trade	10	95	146
Other	9	46	65
Total	51	275	419

Source: DAE analysis.

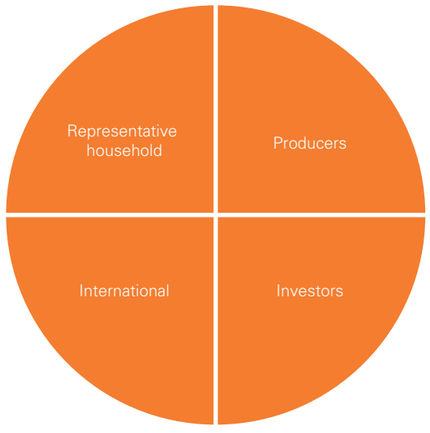
Appendix B: CGE modelling

The Deloitte Access Economics – Regional General Equilibrium Model (DAE-RGEM) is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium model of the world economy. The model allows policy analysis in a single, robust, integrated economic framework. This model projects changes in macroeconomic aggregates such as GDP, employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced.

The model is based upon a set of key underlying relationships between the various components of the model, each which represent a different group of agents in the economy. These relationships are solved simultaneously, and so there is no logical start or end point for describing how the model actually works.

Figure B.1 shows the key components of the model for an individual region. The components include a representative household, producers, investors and international (or linkages with the other regions in the model, including other Australian States and foreign regions). Below is a description of each component of the model and key linkages between components. Some additional, somewhat technical, detail is also provided.

Figure B.1: Key components of DAE-RGEM



DAE-RGEM is based on a substantial body of accepted microeconomic theory. Key assumptions underpinning the model are:

- The model contains a 'regional consumer' that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending).
- Income is allocated across household consumption, government consumption and savings so as to maximise a Cobb-Douglas (C-D) utility function.
- Household consumption for composite goods is determined by minimising expenditure via a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and imported sources. In the Australian regions, households can also source goods from interstate. In all cases, the choice of commodities by source is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption for composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via a C-D utility function.
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of creating capital.
- Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Composite intermediate inputs are also combined in fixed proportions, whereas individual primary factors are combined using a CES production function.
- Producers are cost minimisers, and in doing so, choose between domestic, imported and interstate intermediate inputs via a CRESH production function.
- The model contains a more detailed treatment of the electricity sector that is based on the 'technology bundle' approach for general equilibrium modelling developed by ABARE (1996).
- The supply of labour is positively influenced by movements in the real wage rate governed by an elasticity of supply.
- Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. A global investor ranks countries as investment destinations based on two factors: global investment and rates of return in a given region compared with global rates of return. Once the aggregate investment has been determined for Australia, aggregate investment in each Australian sub-region is determined by an Australian investor based on: Australian investment and rates of return in a given sub-region compared with the national rate of return.
- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.
- Prices are determined via market-clearing conditions that require sectoral output (supply) to equal the amount sold (demand) to final users (households and government), intermediate users (firms and investors), foreigners (international exports), and other Australian regions (interstate exports).
- For internationally-traded goods (imports and exports), the Armington assumption is applied whereby the same goods produced in different countries are treated as imperfect substitutes. But, in relative terms, imported goods from different regions are treated as closer substitutes than domestically-produced goods and imported composites. Goods traded interstate within the Australian regions are assumed to be closer substitutes again.
- The model accounts for greenhouse gas emissions from fossil fuel combustion. Taxes can be applied to emissions, which are converted to good-specific sales taxes that impact on demand. Emission quotas can be set by region and these can be traded, at a value equal to the carbon tax avoided, where a region's emissions fall below or exceed their quota.

The representative household

Each region in the model has a so-called representative household that receives and spends all income. The representative household allocates income across three different expenditure areas: private household consumption; government consumption; and savings.

Going clockwise around Figure B, the representative household interacts with producers in two ways. First, in allocating expenditure across household and government consumption, this sustains demand for production. Second, the representative household owns and receives all income from factor payments (labour, capital, land and natural resources) as well as net taxes. Factors of production are used by producers as inputs into production along with intermediate inputs. The level of production, as well as supply of factors, determines the amount of income generated in each region.

The representative household's relationship with investors is through the supply of investable funds – savings. The relationship between the representative household and the international sector is twofold. First, importers compete with domestic producers in consumption markets. Second, other regions in the model can lend (borrow) money from each other.

Some detail:

- The representative household allocates income across three different expenditure areas – private household consumption; government consumption; and savings – to maximise a Cobb-Douglas utility function.
- Private household consumption on composite goods is determined by minimising a CDE (Constant Differences of Elasticities) expenditure function. Private household consumption on composite goods from different sources is determined is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption on composite goods, and composite goods from different sources, is determined by maximising a Cobb-Douglas utility function.
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of generating capital.

Producers

Apart from selling goods and services to households and government, producers sell products to each other (intermediate usage) and to investors. Intermediate usage is where one producer supplies inputs to another's production. For example, coal producers supply inputs to the electricity sector.

Capital is an input into production. Investors react to the conditions facing producers in a region to determine the amount of investment. Generally, increases in production are accompanied by increased investment. In addition, the production of machinery, construction of buildings and the like that forms the basis of a region's capital stock, is undertaken by producers. In other words, investment demand adds to household and government expenditure from the representative household, to determine the demand for goods and services in a region.

Producers interact with international markets in two main ways. First, they compete with producers in overseas regions for export markets, as well as in their own region. Second, they use inputs from overseas in their production.

Some detail:

- Sectoral output equals the amount demanded by consumers (households and government) and intermediate users (firms and investors) as well as exports.
- Intermediate inputs are assumed to be combined in fixed proportions at the composite level. As mentioned above, the exception to this is the electricity sector that is able to substitute different technologies (brown coal, black coal, oil, gas, hydropower and other renewables) using the 'technology bundle' approach developed by ABARE (1996).
- To minimise costs, producers substitute between domestic and imported intermediate inputs is governed by the Armington assumption as well as between primary factors of production (through a CES aggregator). Substitution between skilled and unskilled labour is also allowed (again via a CES function).
- The supply of labour is positively influenced by movements in the wage rate governed by an elasticity of supply is (assumed to be 0.2). This implies that changes influencing the demand for labour, positively or negatively, will impact both the level of employment and the wage rate. This is a typical labour market specification for a dynamic model such as DAE-RGEM. There are other labour market 'settings' that can be used. First, the labour market could take on long-run characteristics with aggregate employment being fixed and any changes to labour demand changes being absorbed through movements in the wage rate. Second, the labour market could take on short-run characteristics with fixed wages and flexible employment levels.

Investors

Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. The global investor ranks countries as investment destination based on two factors: current economic growth and rates of return in a given region compared with global rates of return.

Some detail:

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.

International

Each of the components outlined above operate, simultaneously, in each region of the model. That is, for any simulation the model forecasts changes to trade and investment flows within, and between, regions subject to optimising behaviour by producers, consumers and investors. Of course, this implies some global conditions must be met such as global exports and global imports are the same and that global debt repayments equals global debt receipts each year.

Limitation of our work

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