

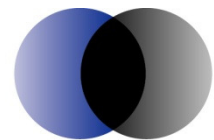


Economic Impact Study

Economic impact study of ERA's
operations in the Northern
Territory

Prepared for Energy Resources of Australia

December 2009



ACIL Tasman

Economics Policy Strategy

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Executive summary

This report examines the economic impact of the Ranger mine of Energy Resources Australia Ltd (ERA) on the town of Jabiru, the Alligator Rivers region and the wider Northern Territory and its relative economic contribution compared to other industries in the Territory.

Ranger mine generates around 10 percent of global uranium production. In 2008 5,272 tonnes of Uranium oxide were produced.

Energy Resources of Australia (ERA) is one of the largest uranium producers in the world, with its Ranger mine generating 10 per cent of global uranium production¹. In 2008, the Ranger operations produced 5,272 tonnes of uranium oxide (U₃O₈), which was exported to power utilities in Japan, South Korea, Europe and North America.

As at October 2009, ERA employed 524.6 persons. These employees are predominantly located at the Ranger mine (456.6 persons or 87 per cent).

ERA is considering two projects at its Ranger operation involving the development of

- a heap leach facility and
- an underground exploration decline

Demographic and social profile

The demographic and social profile of Jabiru and the surrounding Alligator region has the following characteristics:

- While the surrounding region has a relatively large Indigenous population Jabiru has relatively small Indigenous population
- Jabiru has a large number of tourist visitors
- The mining industry (represented by the Ranger mine) is by far the largest employer in Jabiru followed by tourism and the service sector associated with the town's role as a service centre.
- Jabiru's workforce is relatively highly skilled and well paid

Ranger and the economy

ERA's contribution to the Northern Territory economy has been estimated by ACIL Tasman using input-output analysis.

Ranger's operations in 2008 are estimated to have contributed \$230 million in gross product at factor cost to the Northern Territory economy. In 2007-08

¹ World Nuclear Association (2009), ACIL Tasman calculation



the Northern Territory's gross product at factor cost was \$14,367 million. Therefore, ERA is estimated to directly contribute 1.6 percent of the gross product of the Northern Territory economy in that period. This is a very large contribution by a single industrial operation and is larger than many entire Northern Territory industries such as the cattle and fishing industries.

The flow-on impacts of the Ranger operations through its wages and salaries payments and its purchases of Northern Territory goods and services, produces additional benefits to the local economy. This indirect impact is equivalent to an additional 0.6 percent of gross product, taking ERA's overall impact on the Territory economy to 2.2 percent of gross product, which equates to \$320 million in 2008.

In 2008 ERA also contributed to the NT economy through its capital expenditure, resulting in a further contribution of 0.6 percent of gross product (at factor cost), lifting the total contribution to 2.8 percent, which equates to a \$400 million contribution to the Territory economy.

The Ranger operations in 2008 (in both production and construction activity) is estimated to have created direct and indirect employment in the order of 1,900 full time equivalent jobs in the Northern Territory, which includes over 450 jobs at the Ranger operation

ERA's Ranger operations are part of the Northern Territory's significant resources industry. Mining (including oil and gas) contributed over \$4.4 billion to the Northern Territory economy in 2007-08. Minerals based mining contributed approximately 11 percent of the Territory economy while the oil and gas sector contributed 19 percent .

This exceptional value does not include the value of minerals processing in the Northern Territory, such as the processing of bauxite to make alumina at the Alcan Refinery on the Gove Peninsula. Alumina production's direct contribution is estimated at 1.8 percent.

Tourism is estimated to have contributed 5.8 percent of economic activity.

Ranger and energy

This implies that the 2008 uranium production from the Ranger mine provided enough fuel to generate approximately 182 TWh of electricity – equivalent to approximately 0.95 per cent of global electricity production. This is a very substantial contribution by a single mine.

Assuming an average generation efficiency of 35 per cent, 69.5 million tonnes of thermal coal would be required to generate the same amount of electricity as



the uranium produced from the Ranger mine. This is 60 per cent of Australia's total 2007/08 exports of thermal coal.

Greenhouse gas abatement

Nuclear electricity generation technologies are used to provide base load power and typically displace coal-fired technologies. In total, it is estimated that the electricity generated from the uranium produced from the Ranger mine avoided 165 million tonnes of greenhouse gases in 2008. Conservatively, 3,281 Mt CO₂-e have been avoided as a result of the uranium produced over the 26 year life of the Ranger mine to date. This is over five times Australia's current emissions.

In terms of gas powered electricity generation its lifecycle emissions is over 8 times higher than the lifecycle emissions associated with the electricity generated from the uranium from the Ranger mine.

Other impacts

There are a range of other impacts that do not necessarily lend themselves to quantification in economic modelling but represent key impacts on the local and Northern Territory economy.

ERA's performance in Indigenous employment as a percentage of total employment on average is superior to the adjusted Territory wide percentage and significantly higher than the Northern Territory Government

Externalities and economic facilitation effects are not easily quantified but generate benefits to the economy related to the development of technology, industries and services in the Territory and the level of infrastructure.



1 Introduction

ACIL Tasman has undertaken this study for Energy Resources of Australia Ltd (ERA) to analyse the economic impact of ERA's operations in the Northern Territory. ERA operates the Ranger mine, which is located within (but is not part of) Kakadu National Park in the Northern Territory, near Jabiru.

This work builds upon a study done by ACIL Tasman for ERA in 2006 on the economic impact of ERA's operations and their potential closure. In October 2006, ERA announced life extension investments for the mine's processing operations and possible expansion of the Ranger pit to extend the mine's life. Recently, ERA announced plans to extend its operations further subject to ongoing feasibility studies and relevant approvals.

1.1 Purpose

The principal purpose of this study is to provide detailed, authoritative data on the economic impact and consequent social impact of the ERA's operations in Jabiru on the Northern Territory as a whole.

In particular, this report will contribute to the Environmental Impact Statement being prepared for a proposed heap leach facility. The report will provide input for ERA's submissions to governments and other stakeholders in relation to its expansion plans and the significance of ERA's operations from a range of perspectives.

1.2 Report structure

The report consists of 6 sections:



Table 1 **Report structure**

Section	Description
Background	Background information on ERA's operations including: <ul style="list-style-type: none">- Location- Employment- Expansion plans
Demographic and employment profile	Profile of Jabiru using Australian Bureau of Statistics (ABS) census data to examine the town's demographic and economic profile.
Ranger and the economy	ERA's contribution to the Territory economy The relative importance of mining compared to the other industries, especially the oil and gas industry, in terms of employment and direct economic impacts
Ranger and energy	The importance of the Ranger mine's operations in relation to world energy markets including greenhouse abatement. <ul style="list-style-type: none">- The percentage of world electricity fuelled by ERA's energy exports.- The Greenhouse implications of ERA's energy exports in terms of contribution to abatement.
Other issues	In addition to measurable economic impacts there are a range of other issues that need to be identified and recognised in terms of ERA's impact on the local economy including: <ul style="list-style-type: none">- Indigenous employment- Spillover benefits- Economic facilitation effects



2 Background

2.1 Energy Resources of Australia

Energy Resources of Australia (ERA) is one of the largest uranium producers in the world, with its Ranger mine generating 10 per cent of global uranium production². In 2008, the Ranger operations produced 5,272 tonnes of uranium oxide (U₃O₈), which was exported to power utilities in Japan, South Korea, Europe and North America.

Box 1 Energy Resources of Australia

ERA is a publicly listed company that has mined and produced uranium oxide from its Ranger mine in the Alligator Rivers area of the Northern Territory since 1980. The open cut Ranger mine is on Aboriginal land, and is surrounded by, but separate from, Kakadu National Park, approximately 260km east of Darwin. The company's head office is located in Darwin.

The Ranger ore bodies were discovered by joint venturers Electrolytic Zinc Company of Australasia Ltd (EZ) and Peko-Wallsend Operations Limited (Peko) in 1969. After a prolonged period of negotiation and inquiry an agreement covering mining was signed with the Northern Land Council (NLC), representing the interests of the Aboriginal owners of the area in 1977 and construction at the Ranger site commenced in 1979.

ERA was established as a public company in 1980 and the first uranium oxide produced in August 1981. Production over the life of the mine has totalled over 100,000 tonnes of Uranium Oxide.

ERA has grown to be the third largest uranium producer in the world, selling its products to power utilities in Japan, South Korea, Europe and North America.

Ranger's ore treatment plant was originally designed to process about one million tonnes of ore per year and produce approximately 3,000 tonnes of U₃O₈. The plant was expanded in 1997 which increased production capacity to more than 5,000 tonnes per year.

Source: ERA Website and Annual Report 2008

2.1.1 Jabiluka

In 1991, ERA purchased the Jabiluka uranium ore body from Pancontinental Mining. At that time the Northern Land Council, on behalf of the Traditional Owners, assigned Indigenous approvals to ERA. Final Northern Territory

² World Nuclear Association (2009), ACIL Tasman calculation



approvals for the development of the mine were received in June 1998 and stage one development work at the proposed Jabiluka mine has been undertaken. However, at the completion of this development the mine has been put on a standby and environmental care and maintenance basis. ERA (and its successors) is obliged to secure Mirarr consent prior to any future mining development of uranium deposits at Jabiluka³.

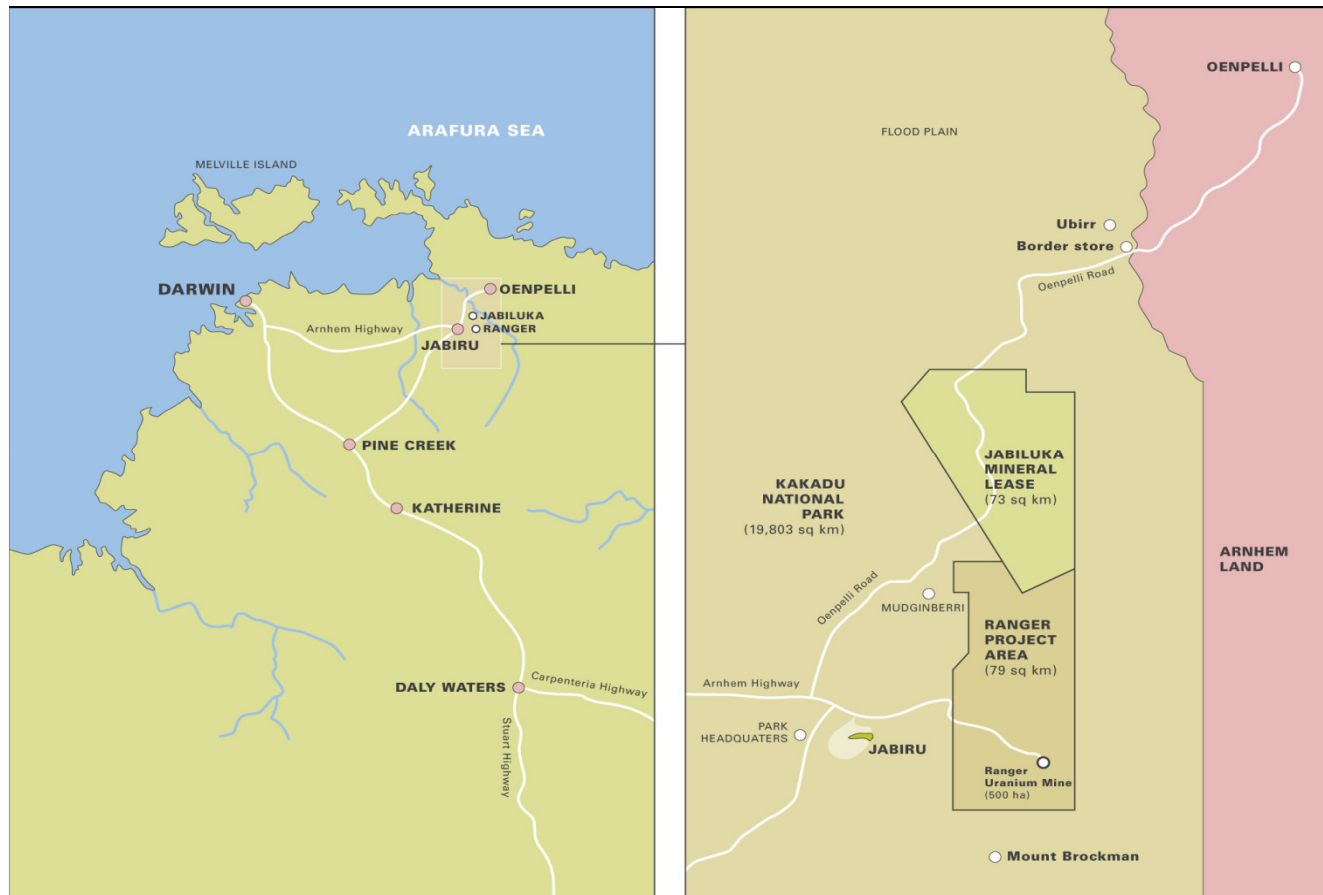
2.2 Location

ERA operates the Ranger mine in the Northern Territory, approximately 250 kilometres east of Darwin near the town of Jabiru (see Figure 1). It is on Aboriginal land surrounded by, but separate from, Kakadu National Park, in the Alligator Rivers Region of the Territory.

³ Jabiluka Long Term Care and Maintenance Agreement 2005



Figure 1 Ranger Mine location



Source: ERA

2.3 Employment

As at October 2009, the company employed 524.6 persons. These employees are predominantly located at the Ranger mine (87 per cent) as shown in Table 2. Employment is undertaken primarily on a full time basis with 96 per cent of the workforce in this category.

Table 2 ERA staff by location and business unit (2009)

Business units	Location	Staff
ERA	Ranger	456.6
ERA	Darwin	43.6
EWL Sciences	All locations	24.4
Total		524.6

Note: EWL Sciences is a specialist environmental consulting business and wholly owned subsidiary of ERA based in Darwin that provides strategic environmental advice to ERA and external clients.

Data source: ERA



2.4 Expansion

ERA is considering two projects at its Ranger operation involving the development of

- a heap leach facility and
- an underground exploration decline

Box 2 Expansion

Underground exploration decline

ERA formally applied for statutory approval of an underground exploration decline at its Ranger operations in April 2009. In its Annual Statement of Reserves and Resources released to the ASX on 30 January 2009, ERA announced the discovery of a very significant ore body in an area known as Ranger 3 Deeps, located in an easterly direction and adjacent to the current Ranger 3 operating pit. ERA's current Mineral Resource Statement includes a total of 34,000 tonnes of uranium oxide from the Ranger 3 Deeps zone or related to Ranger 3 Deeps. ERA had announced the definition of a significant mineral exploration target at Ranger 3 Deeps in a release to the ASX on 17 November 2008.

ERA has approved \$4 Million to study the feasibility of constructing an exploration decline at Ranger 3 Deeps, to enable close spaced underground exploration drilling of the resource and to undertake underground exploration drilling to the north where the resource remains open. The study is expected to be concluded in the second half of 2009. Subject to receiving the necessary approvals, construction of the exploration decline may commence in the first half of 2010.

Heap Leach Facility

ERA has formally applied for statutory approval of a heap leach facility at its Ranger operations. If approved, the heap leach facility is expected to treat 10 million tonnes of low grade mineralised material per year, contained in stockpiles and the operating Ranger pit, to produce a total of between 15 to 20,000 tonnes of uranium oxide.

Source: ERA Media Release Various 2009



3 Demographic and employment profile

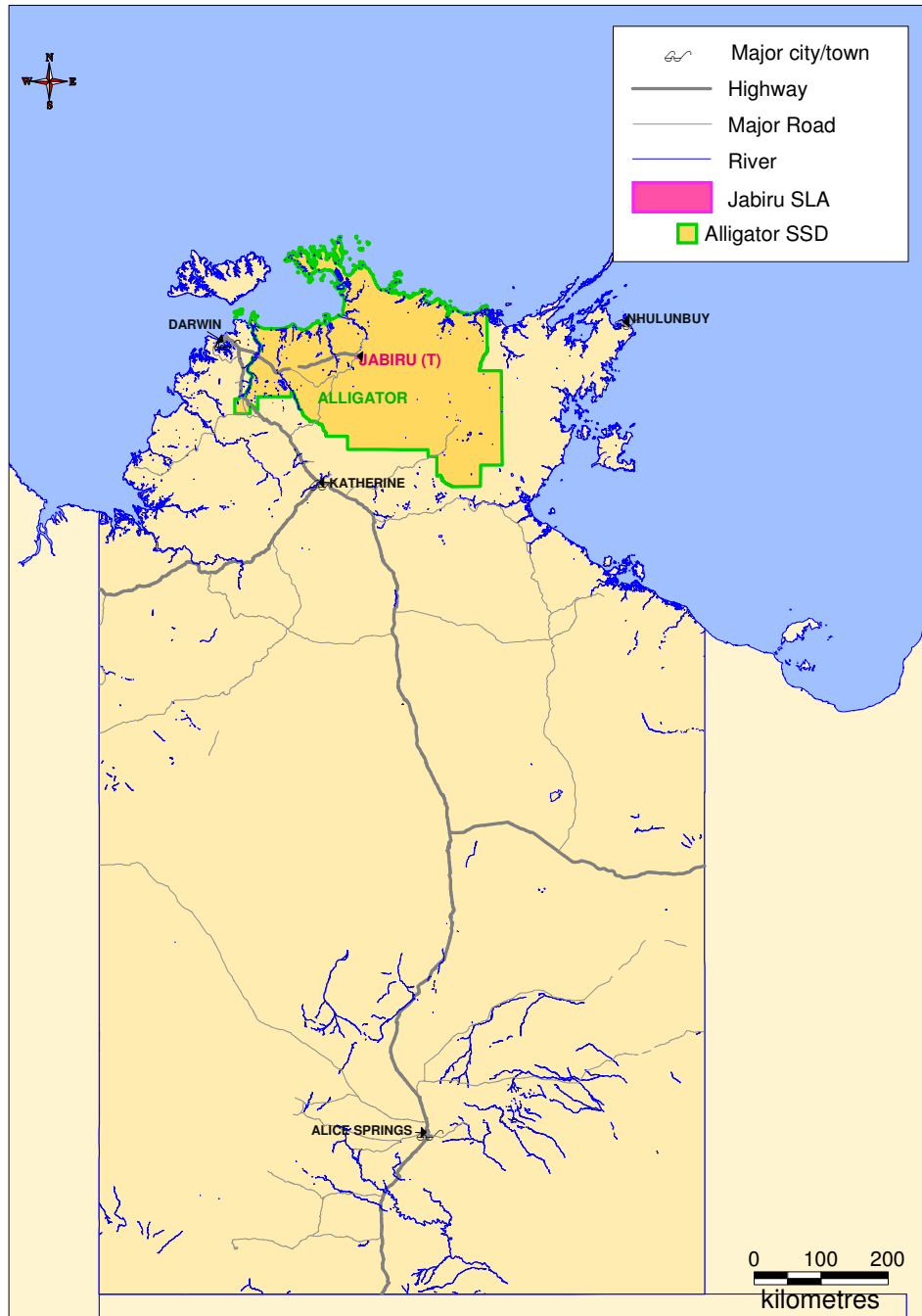
While mining dominates the economy of the Jabiru region, tourism constitutes an important alternative source of income and employment in the region. Jabiru is the major service centre in Kakadu National Park and the broader region of West Arnhem and used as a base for tourists wishing to access the park. It is also the hub for the newly formed West Arnhem Shire⁴.

The most recent Australian Bureau of Statistics (ABS) Census of Population and Housing was conducted in 2006 and provides a variety of information on the demographic and employment profile of the town of Jabiru (Statistical Local Area or SLA) and its surrounding region, referred to by the ABS as Alligator (Statistical Sub division or SSD) which includes Jabiru. The locations of the Alligator SSD and the Jabiru SLA are shown in Figure 2.

⁴ West Arnhem Shire was formed in July 2008 as part of the local government reform process implemented by the Northern Territory Government



Figure 2 Location of Jabiru SLA and the Alligator SSD in the Northern Territory





3.1 Demographic profile of Jabiru and surrounding region

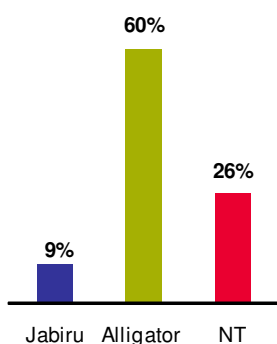
Some key indicators of the demographic profile of Jabiru and its surrounding region are provided in Table 3. Comparative statistics for the Northern Territory as a whole are also provided.

Table 3 **Snapshot of demographic profile Jabiru (SLA), Alligator (SSD) and the Northern Territory**

	Jabiru	Alligator	Northern Territory
Total number of persons (excluding overseas visitors)	1,134	5,994	192,900
Total Indigenous persons	156	4,238	53,665
Total number of visitors/tourists from outside the statistical land area	619	1,448	30,707
Number of private dwellings (includes unoccupied)	643	1,960	74,193
Median age	32	26	31
Average household size	2.5	4.5	3

Data source: Australian Bureau of Statistics Census of Population and Housing 2006

Indigenous people make up a relatively small proportion of Jabiru’s population



This snapshot shows a significant Indigenous population in the Alligator region of around 60 per cent which is in excess of the Northern Territory percentage of 26 per cent. This data also shows that most of the Indigenous population lives outside the town of Jabiru.

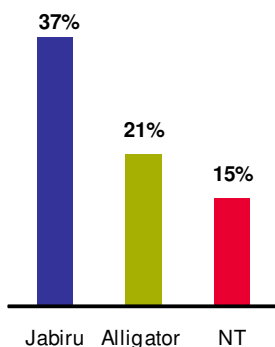
The results are indicative of the population having somewhat different drivers than the Alligator SSD and the Territory. One reason for this difference is the Ranger mine and the other is the importance of Jabiru as a centre for tourism.

3.2 Tourists and other visitors

Over 200,000 visitors⁵ annually visit Kakadu National Park. Jabiru, because of its role as the major centre in the region, serves these visitors and many tourists stay overnight in Jabiru

The 2006 Census data reveal that visitors and tourists accounted for around 37 per cent of Jabiru’s population on Census night – a much larger proportion of the census night population than in the Alligator Statistical Subdivision (which includes Jabiru), or the Northern Territory as a whole (15 per cent).

Tourists in Census night population



⁵ Kakadu Regional Tourism Profile 2006/07, Tourism Research Australia



Visitor numbers⁶ to Kakadu have increased from an average 100,000 people per year in the mid 1980s to approximately 225,000 during 2008-09. Visitor numbers to Jabiru and Kakadu National Park vary significantly between the ‘wet’ and ‘dry’ seasons. Visitor numbers are greatest during the ‘dry’ season (June to September) and lowest during the ‘wet’ season (December to March), ranging from approximately 40,000 in July to as low as 10,000 in January.

This seasonal variation is further supported by the traffic volumes⁷ for the Arnhem and Kakadu Highways that provide access to Jabiru. The Arnhem Highway has a monthly average daily traffic of around 1,400 vehicles per day (VPD) in July and 800 in January while the Kakadu Highway averages 1,400 VPD in July and 120 in January.

The 2006 Census was conducted in August, which represents the high season for tourist visitors, so visitor numbers were at or close to their peak. The data, nevertheless, reflects the importance of tourism to Jabiru.

3.3 Jabiru’s permanent population

Jabiru’s permanent population in 2006 was 1,134 people⁸. The characteristics of that permanent population are provided in Table 4.

⁶ Tourism NT

⁷ Traffic Impact Study – Stage 2 Arnhem and Kakadu Highways, Hyder Consulting, Monthly Average Daily Traffic 2007

⁸ This Census data are based on the “Usual Residents Profile” which differs from other “Census Community Profiles” in that it provides data based on where people ‘usually’ live or their ‘usual address’ rather than where they were counted on census night.

Table 4 **Characteristics of Jabiru's permanent population 2006 (usual residents)**

	Males	Females	Persons
Total persons	669	465	1,134
Counted at home	615	423	1,038
Aged 15 years and over	504	355	859
Aged 65 years and over	4	4	8
Born in Australia	388	283	671
Born overseas ^a	68	60	128
Speaks English only	408	295	703
Speaks other language ^b	46	47	93
Australian citizen	413	306	719
Employed ^c	308	203	511
Unemployed ^c	0	3	3
Not in the labour force ^c	32	61	93

^a Includes 'Australian External Territories', 'Inadequately described', 'At sea', and 'Not elsewhere classified'. ^b Includes 'Non-verbal so described' and 'Inadequately described' ^c Applicable to persons aged 15 years and over
Data source: ABS 2006 Census, Usual Residents profile, Cat. No 2004.0

Of Jabiru's permanent residents, 156 or 13.8 per cent identified as Indigenous. This compares to the Alligator region which had over 70 per cent of the population in this category. Table 5 sets out this information and provides equivalent data for Darwin and the Northern Territory as well.



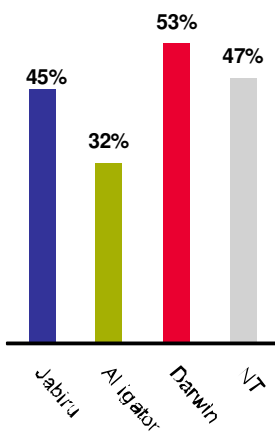
Table 5 Permanent population, Jabiru and selected statistical regions

	Jabiru	Alligator	Darwin	Northern Territory
Total permanent resident population	1,134	5,994	105,990	192,900
Total permanent Indigenous residents	156	4,238	10,258	53,665
Percentage Indigenous (%)	13.8	70.7	9.7	27.8
Total labour force	514	1,918	56,187	91,183
Percentage of total population (%)	45.3	32.0	53.0	47.3

Note: The ABS advises that because of small numbers in Jabiru and Alligator some of the results reported here and in following tables have been randomised to protect confidentiality. Hence the results reported here for employed persons may not necessarily be fully consistent with data on occupations reported below.

Data source: Australian Bureau of Statistics Census of Population and Housing 2006

Workforce in the permanent population



Numbers employed by industry

Census data indicates that some 514 permanent Jabiru residents (or around 45 per cent of the Jabiru population aged 15 years or over) were in the labour force in 2006. Compared to the wider Alligator SSD, this is a significantly larger proportion of the permanent population but lower than both Darwin and the broader Territory share.

Jabiru had relatively low unemployment levels on census night, with only 3 persons aged 15 years or over indicating they were unemployed. Another 93 persons aged 15 years or over did not have employment but were not looking for work.

3.3.1 Employment

The census data indicates that the mining industry (represented by the Ranger mine) is by far the largest employer in Jabiru. Employment by occupation and industry is set out in Table 6. The census data shows the mining industry employed 186 people, which equates to 36.7 per cent of total employment in the town.

The number of employees is somewhat less than the 2008 ERA figure of 456 on-site employees. This can be explained by several factors:

- some contractor employees identifying in other industries in the Census
- some absences from Jabiru on census night
- Increased use of fly-in fly-out to supply labour to the mine.

In addition and as explained later, direct employment is only part of the Ranger mine’s contribution to employment in the township.

The second largest employer in the township is the ‘accommodation cafes and restaurants’ industry, which accounts for 13.4 per cent of total employment. This reflects the importance of tourism in the Jabiru economy as well as the Ranger mine’s role in generating visitors to the area. Tourism is not an



“industry” according to the standard statistical definition. The tourism industry is defined by commonalities in its consumers, rather than its producers⁹.

Tourist expenditure is spread across a number of industries. The industries that benefit most from tourist expenditure are the transport and storage industry (in which tourism accounts for nearly half of all employment in the Northern Territory), accommodation, cafes, restaurants and food outlets industry (one third), the retail trade industry (one quarter), the communication services industry and the cultural and recreational industry (one tenth).

Its role as a regional centre is also reflected in the contribution of the industries - administration & safety, education & training and health care & social assistance which in total account for 20.5 per cent of employment.

⁹ Australian Bureau of Statistics (2009) Australian National Accounts: Tourism Satellite Account, 2007-08 (Australian Bureau of Statistics: Canberra)



Table 6 Jabiru's employment – occupation and industry census night 2006 (usual residents)

	Managers		Professionals		Technicians & trades workers		Community and personal service workers		Clerical and Administrative workers		Sales workers		Machine operators & drivers		Labourers		Inadequately described/Not stated		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Agriculture, forestry & fishing	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Mining	10	18.5%	40	39.2%	60	58.8%	6	10.2%	12	21.8%	0	0.0%	52	82.5%	3	8.3%	3	27.3%	186	36.7%
Manufacturing	5	9.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	5	1.0%
Electricity, gas, water & waste services	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Construction	3	5.6%	0	0.0%	10	9.8%	0	0.0%	4	7.3%	0	0.0%	0	0.0%	3	8.3%	0	0.0%	20	3.9%
Wholesale trade	3	5.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	0.6%
Retail trade	7	13.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	17	68.0%	0	0.0%	0	0.0%	0	0.0%	24	4.7%
Accommodation & food services	6	11.1%	0	0.0%	10	9.8%	24	40.7%	9	16.4%	0	0.0%	0	0.0%	16	44.4%	3	27.3%	68	13.4%
Transport, postal & warehousing	0	0.0%	12	11.8%	0	0.0%	0	0.0%	0	0.0%	5	20.0%	5	7.9%	0	0.0%	0	0.0%	22	4.3%
Information media & telecommunications	0	0.0%	0	0.0%	3	2.9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	0.6%
Financial & insurance services	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Rental, hiring & real estate services	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	6	9.5%	0	0.0%	0	0.0%	6	1.2%
Professional, scientific & technical services	0	0.0%	5	4.9%	4	3.9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	9	1.8%
Administrative & support services	3	5.6%	0	0.0%	5	4.9%	6	10.2%	3	5.5%	0	0.0%	0	0.0%	5	13.9%	0	0.0%	22	4.3%

	Managers		Professionals		Technicians & trades workers		Community and personal service workers		Clerical and Administrative workers		Sales workers		Machine operators & drivers		Labourers		Inadequately described/Not stated		Total	
Public administration & safety	8	14.8%	10	9.8%	0	0.0%	6	10.2%	8	14.5%	0	0.0%	0	0.0%	0	0.0%	5	45.5%	37	7.3%
Education & training	3	5.6%	26	25.5%	0	0.0%	8	13.6%	6	10.9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	43	8.5%
Health care & social assistance	3	5.6%	9	8.8%	0	0.0%	9	15.3%	0	0.0%	0	0.0%	0	0.0%	3	8.3%	0	0.0%	24	4.7%
Arts & recreation services	3	5.6%	0	0.0%	0	0.0%	0	0.0%	4	7.3%	3	12.0%	0	0.0%	0	0.0%	0	0.0%	10	2.0%
Other services	0	0.0%	0	0.0%	4	3.9%	0	0.0%	9	16.4%	0	0.0%	0	0.0%	3	8.3%	0	0.0%	16	3.2%
Inadequately described/Not stated	0	0.0%	0	0.0%	6	5.9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	8.3%	0	0.0%	9	1.8%
																				0.0%
Total	54	100.0%	102	100.0%	102	100.0%	59	100.0%	55	100.0%	25	100.0%	63	100.0%	36	100.0%	11	100.0%	507	100.0%

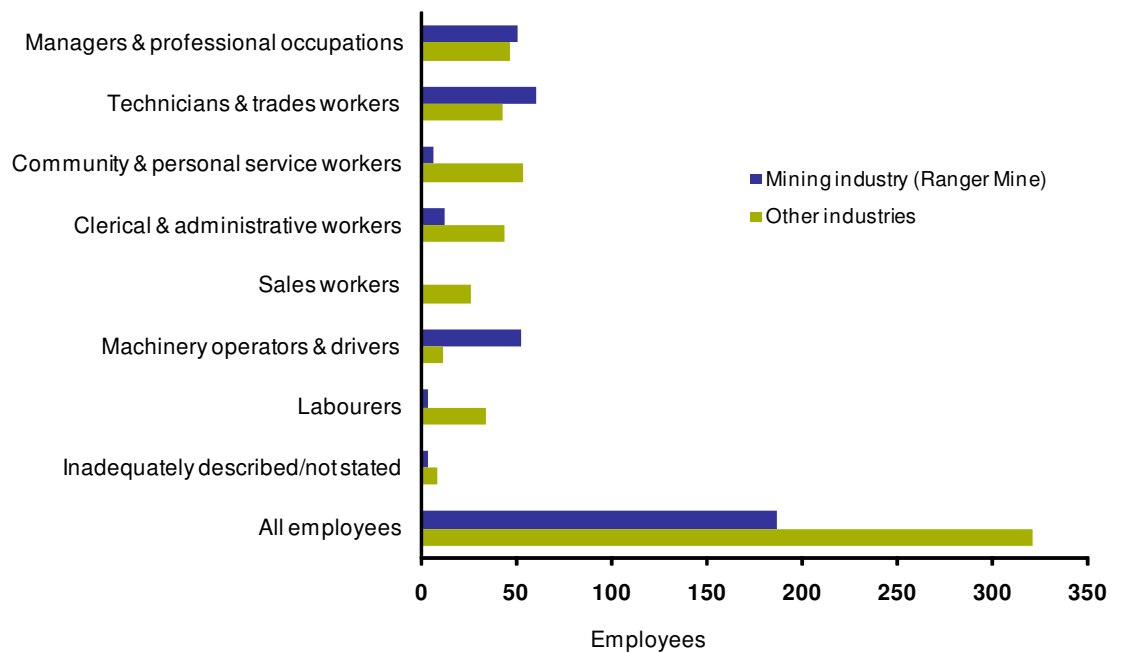
Data source: Australian Bureau of Statistics Census of Population and Housing 2006





The mining industry also stands out as employing a larger share of Jabiru’s employees who are highly skilled (Figure 3). This employment profile suggests that Ranger mine employees earn higher incomes on average compared with employees in the town as a whole.

Figure 3 Occupations of employees at the Ranger mine and in other industries in Jabiru (usual residents only), census night 2006



Data source: ACIL Tasman estimates based on ABS Census 2006.

3.4 Income

The 2006 Census indicates that Jabiru’s usual residents earned a higher average income than usual residents in the Alligator SSD, Darwin and the Northern Territory as a whole. The weekly income for individuals is set out in Figure 4 and it shows that:

- Just over 86 per cent of employed persons residing in Jabiru had weekly incomes of \$400 or more

This share compares to:

- Around 40 per cent in the Alligator SSD;
- Around 79 per cent in Darwin SSD;
- Around 65 per cent in the Northern Territory;

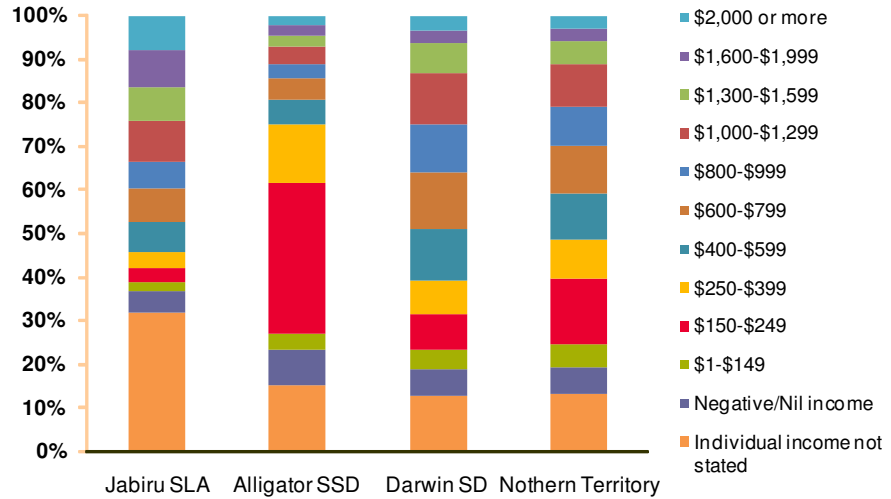
- Around 39 per cent of Jabiru employees had weekly incomes of \$800 or more

This share compares to:



- Around 14 per cent in the Alligator SSD
- Around 36 per cent in Darwin SSD
- Around 30 per cent in the Northern Territory.

Figure 4 Weekly income individuals aged 15 years and over (usual residents)



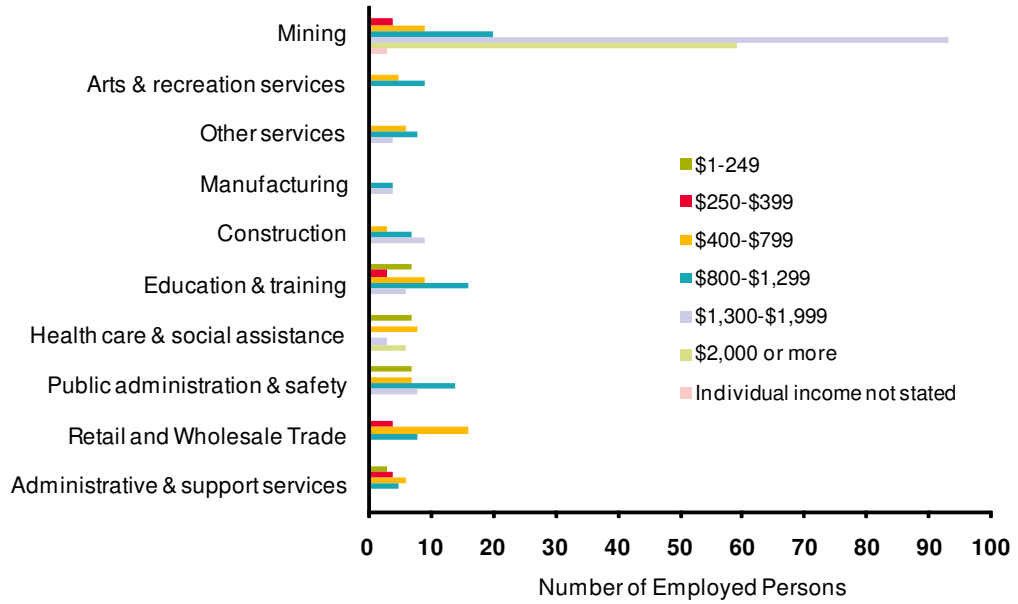
Data source: ACIL Tasman estimates based on ABS 2006 Census of Population and Housing.

Mining industry employees and government employees are likely to account for the high wages earned in Jabiru compared to the wider local region and the Northern Territory as a whole. The usual resident census data does not report income information by industry or by occupation. However, such data is reported by the ABS for persons who resided in the Jabiru SLA on census night (see Table 7). This data, which is summarised in the following figure, reveal that persons employed by the mining industry and residing in the Jabiru SLA on census night in 2006 were much more likely to be earning higher incomes than persons working in other industries.

Such data, while not fully conclusive, support the view that the Ranger mine’s Jabiru based employees bring considerably higher disposable incomes and wealth to the town than employees in other industries and contributes to significant consumer expenditure in the town.



Figure 5 Industry by weekly individual income of persons residing in Jabiru SLA on census night 2006 (based on place of enumeration but excluding overseas visitors)



Data source: ABS 2006 Census of Population and Housing, Expanded Community Profile, Catalogue 2005.0



Table 7 Industry by weekly individual income of persons residing in Jabiru SLA on census night 206 (based on place of enumeration but excluding overseas visitors)

	Negative/Nil Income	\$1-249	\$250-\$399	\$400-\$799	\$800-\$1,299	\$1,300-\$1,999	\$2,000 or more	Individual income not stated	Total
Agriculture, forestry & fishing	0	0	0	0	0	0	0	0	0
Mining	0	0	4	9	20	93	59	3	188
Manufacturing	0	0	0	0	4	4	0	0	8
Electricity, gas, water & waste services	0	0	0	0	0	4	0	0	4
Construction	0	0	0	3	7	9	0	0	19
Wholesale trade	0	0	0	0	4	0	0	0	4
Retail trade	0	0	4	16	4	0	0	0	24
Accommodation & food services	0	0	7	40	14	4	0	0	65
Transport, postal & warehousing	0	0	0	12	3	3	0	0	18
Information media & telecommunications	0	0	0	0	3	0	0	0	3
Financial & insurance services	0	0	0	0	0	0	0	5	5
Rental, hiring & real estate services	0	0	0	0	4	0	0	0	4
Professional, scientific & technical services	0	3	0	0	3	0	0	0	6
Administrative & support services	3	3	4	6	5	0	0	0	21
Public administration & safety	0	7	0	7	14	8	0	0	36
Education & training	0	7	3	9	16	6	0	0	41
Health care & social assistance	0	7	0	8	0	3	6	0	24
Arts & recreation services	0	0	0	5	9	0	0	0	14
Other services	0	0	0	6	8	4	0	0	18
Inadequately described	0	0	0	0	4	0	0	0	4
Not stated	0	0	0	0	0	0	0	0	0
Total	3	27	22	121	122	138	65	8	506

Data source: Australian Bureau of Statistics 2006 Census data



4 Ranger and the economy

This section considers the importance of the Ranger mine's operations in light of its contribution to the Northern Territory economy and its performance relative to other industries in the Territory.

4.1 Data

ACIL Tasman worked with ERA to collect a variety of data about the current operations at the Ranger mine. The data collected included major purchases and expenditures (categorised by source – the Northern Territory, the rest of Australia or overseas) as well as workforce data for current operations including:

- number of people employed or man-hours worked
- wages and salaries.

The data demonstrated the Ranger operation's links to the NT economy via its local purchases. The data indicated that nearly one third of goods and services used in the operations are supplied from within the Territory.

4.2 Input-output analysis

The Ranger mine's contribution to the Northern Territory economy has been estimated by ACIL Tasman using input-output analysis.

4.2.1 Input-output

An input-output table is an accounting framework that provides a summary, or a "snapshot", of the transactions occurring within an economy over a selected period. In simple terms, the tables show, for a given industry, which other industries it purchases from and to which other industries it sells.

Input-output tables set out the purchases and sales of the various sectors of a regional economy. They show flows between industries and imports and exports across the region's borders. By capturing all the linkages in the economy, the input-output tables provide a means of estimating the direct and indirect effects of a given economic stimulus.

Input-output analysis involves the derivation of input-output multipliers. These multipliers provide a means of estimating the total economic impacts that arise from, in this case, the Ranger mine's operations. Total impacts include the initial (or direct) effect of the stimulus and the indirect effects that arise as a result of the linkages between industries in an economy.



The total economic impact identified by use of input-output multipliers includes the direct effect of the initial increase in demand and the indirect (or “flow-on”) effects. The flow-on effects result from the linkages between industries in the economy.

Gross product at factor cost measures an industry's contribution to an economy by summing its payments to the factors of production: land, labour and capital. It is the standard measure used in Australia to represent the size of an economy. At the state or Territory level it represents the contribution to Gross State Product (GSP);

4.2.2 Northern Territory input-output tables

Input-output analysis relies on the use of input-output tables. Input-output tables provide a complete picture of the flows of products and services in the economy for a given year, illustrating the relationship between producers and consumers and the interdependencies of industries.

The recently developed input-output table for the Northern Territory economy¹⁰ has been used to place ERA's contribution to the Territory economy into perspective. The latest Northern Territory input-output table describes the Territory economy in the financial year 2006-07. Elements of this table (selected contributions to value-added at factor cost) have been scaled up to 2007-08 to incorporate the latest available Australian Bureau of Statistics data¹¹. The scale up process assumed that the structure of the NT economy has not changed from 2006-07.

4.3 ERA's contribution to the Territory economy

Ranger's operations in 2008 are estimated to have contributed \$230 million in gross product at factor cost¹² to the Northern Territory economy. In 2007-08 the Northern Territory's gross product at factor cost was \$14,367 million¹³.

Therefore, ERA is estimated to directly contribute 1.6 percent of the gross product of the Northern Territory economy in that period. This is a very large contribution by a single industrial operation and is larger than for many entire Northern Territory industries. Ranger's contribution to the Territory economy

**Ranger directly contributes
1.6 percent of the Territory
economy**

¹⁰ ACIL Tasman (2009). Input-Output Tables for the Northern Territory.

The Northern Territory input-output table was developed for the Northern Territory Department of Business and Employment and pertains to the 2006-07 financial year.

¹¹ ABS (2008). 2007-08 Australian National Account, State Accounts. Catalogue no. 5220.0.

¹² Gross product at factor cost includes payments to land, labour and capital.

¹³ ABS (2008). 2007-08 Australian National Account, State Accounts. Catalogue no. 5220.0.



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is higher than the contribution ACIL Tasman calculated in 2006 of 1.0 per cent as a consequence of improved uranium prices.

The impact of the Ranger mine is larger than the estimated impact of the following industries:

- Beef cattle (which contributes 0.9 percent to Northern Territory gross product at factor cost based on the 2006-7 Northern Territory input-output table)
- Horticulture (0.6 percent)
- Fishing (0.6 percent)
- Wholesale trade (1.5 percent)
- Cultural and recreational services (1.4 percent) and
- Electricity, gas and water supply (1.4 percent).

Indirect impact

The flow-on impacts of the Ranger operations through its wages and salaries payments and its purchases of Northern Territory goods and services, produces additional benefits to the local economy. This indirect impact is equivalent to an additional 0.6 percent of gross product, taking ERA's overall impact on the Territory economy to 2.2 percent of gross product, which equates to \$320 million in 2008.¹⁴

Total contribution

In 2008 ERA also contributed to the NT economy through its capital expenditure, resulting in a further contribution of 0.6 percent of gross product (at factor cost), lifting the total contribution to 2.8 percent, which equates to a \$400 million contribution to the Territory economy.

Employment

The Ranger operations in 2008 (in both production and construction activity) is estimated to have created direct and indirect employment in the order of 1,900 full time equivalent jobs in the Northern Territory, which includes over 450 jobs at the Ranger mine¹⁵. It should be noted that where the Ranger operation utilises fly-in fly-out workers, these workers are primarily sourced from the Darwin area and so count as Northern Territory employees with all of the benefits to the Territory economy that that implies.

Ranger's total contribution to the Territory economy is 2.8 percent or \$400 million

Ranger created direct and indirect employment in the order of 1,900 jobs in the Territory

¹⁴ The indirect gross product impacts are calculated using the cost data provided by ERA in conjunction with the multipliers derived from the NT input-output table for 2006-07.

¹⁵ The total employment effect is calculated using the cost data provided by ERA in conjunction with the multipliers derived from the NT input-output table for 2006-07.



4.4 Relative importance of mining

ERA's Ranger operations are part of the Northern Territory's significant resources industry. Mining (including oil and gas) contributed over \$4.4 billion to the Northern Territory economy in 2007-08¹⁶. Assuming the contributions made by different mining activities remained in the same proportions as found in the 2006-07 Northern Territory input-output table, minerals based mining contributed approximately \$1.5 billion to the gross product (at factor cost) of the Northern Territory economy in 2007-08. This represents approximately 11 percent of the Territory economy.

This exceptional value does not include the value of minerals processing in the Northern Territory, such as the processing of bauxite to make alumina at the Alcan Refinery on the Gove Peninsula.

This 11 percent contribution can be compared with the contributions made by other sectors of the Northern Territory economy, as shown in Table 8. Only the 19 percent contribution made by the oil and gas sector exceeds the contribution of minerals based mining to the Territory economy.

¹⁶ ABS (2008). 2007-08 Australian National Account, State Accounts. Catalogue no. 5220.0.

Table 8 **Contributions to NT Gross State Product at Factor Cost, 2007-08**

Industry	Industry contribution (\$m)	Share of the NT economy (percent)
Agriculture	356	2.5
Minerals based mining	1,537	10.7
Oil and gas	2,804	19.5
Services to mining	100	0.7
Manufacturing	1,130	7.9
Electricity, gas and water supply	207	1.4
Construction	803	5.6
Wholesale trade	217	1.5
Retail trade	509	3.5
Accommodation, cafes and restaurants	352	2.5
Transport and storage	650	4.5
Communication services	306	2.1
Finance and insurance	487	3.4
Property and business services	902	6.3
Government administration and defence	1,036	7.2
Education	479	3.3
Health and community services	638	4.4
Cultural and recreational services	208	1.4
Personal and other services	329	2.3
Ownership of dwellings	1,318	9.2
TOTAL	14,367	100.0
Ranger mine	230	1.6

Data source: Australian Bureau of Statistics (2008) 2007-08 Australian National Accounts: State Accounts and Northern Territory Input-Output table for 2006-07.

Minerals processing

The manufacturing sector, which Table 8 shows contributed 7.9 percent to the Northern Territory economy in 2007-08, includes alumina production from the mineral bauxite. In 2006-07, the value of bauxite produced in the Territory was \$483 million¹⁷. Assuming this value remained unchanged in 2007-08, it is estimated that alumina refining contributed \$259 million to the Northern Territory economy¹⁸, valuing its direct contribution at 1.8 percent compared to the Ranger operations contribution of 1.6 percent.

¹⁷ ABS (2008). *Regional Statistics, Northern Territory*. Catalogue no. 1362.7.

¹⁸ Based on an initial multiplier of 0.54 for the Non-ferrous metal ores industry from the 2006-07 NT input-output table.



Tourism

The direct contribution of the tourism industry is not shown in Table 8. As discussed in Section 3.3.1. the tourism industry is made up of contributions from several of the industries shown in Table 8, most notably Retail trade, Accommodation, cafes and restaurants, Transport and storage and Cultural and recreational services.

In 2006-07 Tourism is estimated to have contributed \$776 million of gross product to the Northern Territory economy representing 5.8 percent of economic activity in that year¹⁹. Therefore, tourism's contribution to the economy, while greater than the contribution of most of the industries shown in Table 8, is significantly less than the contributions made by minerals based mining and by oil and gas.

4.5 Employment

While the resources sector makes a stronger contribution to the size of the Northern Territory economy than other sectors as shown in Table 8, it makes a relatively small contribution to employment. This because the mining industry is capital-intensive and employs relatively few people compared with its output.

Census data²⁰ shows 1,931 persons or 2.28 per cent were employed in the mining industry in the Northern Territory. Of this number, 108 employees were employed in the oil and gas sector with the remainder in minerals based mining and services to mining.

By comparison, tourism is a labour-intensive industry and directly and indirectly employs 14,100 people in the Northern Territory, equivalent to 13.7% of all jobs in the Northern Territory²¹. In terms of direct employment, the tourism industry is the 6th largest industry in the Northern Territory, employing slightly more people than the construction industry.

¹⁹ "Economic Contribution of Tourism to the Northern Territory Economy 2006-07", http://www.tourismnt.com.au/nt/system/galleries/download/NTTC_Research/NT_TSA_06-07_revised.pdf.

²⁰ ABS Census of Population and Housing Industry of employment by occupation

²¹ ACIL Tasman calculations based on Van Ho, T., Spurr, R., Pambudi, D., Forsyth, P., Dwyer, L., Hoque, S. (2008) *Tourism satellite account Northern Territory 2006-07* (Cooperative Research Centre for Sustainable Tourism Pty Ltd: Australia)



5 Ranger and energy

This section considers the importance of ERA's operations in relation to its contribution to broader world energy markets including greenhouse abatement.

5.1 Energy generation

5.1.1 Nuclear power

Nuclear power is a major contributor to the world's base load electricity generation capacity. There are currently 436 nuclear reactors in operation worldwide across 30 countries, 216 of which are located in the USA, France and Japan²². The net capacity of these reactors is approximately 370 GWe, which is approximately 8.5 per cent of total electricity generation capacity worldwide. A further 52 reactors with net capacity of 45.9GWe are under construction in 14 countries, 16 of which are located in China²³.

In 2008, nuclear power accounted for approximately 15 per cent of global electricity generation²⁴.

5.1.2 Contribution of the Ranger mine to global generation

Ranger produces 10% of the world's uranium

Ranger is the world's second largest uranium mine, supplying around 10 per cent of the world's and over 50 per cent of Australia's 2008 uranium production²⁵.

...which fuels almost 1% of the world's electricity

As with fossil fuel generation technologies, the wide range of technologies and the complexities of the nuclear fuel cycle mean that the raw uranium requirements differ substantially by reactor. In general, most current reactors require between 20-30 grams of uranium to produce one MWh of electricity, although the CANDU reactors in Canada have substantially lower raw uranium requirements (Refer Table 9). The average uranium requirement of countries supplied by Australian uranium was 24.8 g U/MWh in 2007/08 (Table 9).

This implies that the 2008 uranium production from the Ranger mine provided enough fuel to generate approximately 182 TWh of electricity – equivalent to approximately 0.95 per cent of global electricity production. This is a very substantial contribution by a single mine.

²² IAEA 2009

²³ IAEA 2009

²⁴ IEA 2008, NIE 2009

²⁵ World Nuclear Association (2009), ACIL Tasman calculation



Table 9 Uranium requirements for electricity generation by region

Country	Uranium requirements (g U/MWh)	Country	Uranium requirements (g U/MWh)
Belgium	23.1	Spain	24.5
Canada	18.8	Sweden	22.8
China	30.8	Taiwan	22.8
France	25.3	Ukraine	23.5
Germany	24.1	UK	39.2
Japan	34.9	USA	23.3
Russia	23.3	World average	25.1
S. Korea	23.9	Australian end users	24.8

Data source: ACIL Tasman estimates from World Nuclear Association (2009) data available at: <http://www.world-nuclear.org/info/reactors.html>. Australian end users sourced from ASNO (2008) Annual Report, available at: http://www.asno.dfat.gov.au/annual_report_0708/ASNO_2007_08_ar.pdf.

Ranger fuels same electricity as 60% of Australia's coal exports

Assuming an average generation efficiency of 35 per cent, 69.5 million tonnes of thermal coal²⁶ would be required to generate the same amount of electricity as the uranium produced from the Ranger mine. This is 60 per cent of Australia's total 2007/08 exports of thermal coal.

5.2 Greenhouse gas abatement

To allow better comparison of the greenhouse gas implications of a wide range of technologies using a wide range of fuels and processes, many researchers go beyond estimating the direct emissions associated with the combustion of a fuel and estimate the emissions generated over the lifecycle of a product or service. For example, for electricity generation technologies, lifecycle emissions include estimates of the greenhouse gas emissions generated from the extraction, purification and transportation of fuels as well as estimates of the emissions embodied in the materials used to construct and decommission the facilities. Lifecycle emissions can be very difficult to compute as they are generally very data intensive and process and time dependent. Further, it can be difficult to attribute the emissions associated with activities that result in multiple products (for example, the extraction of multiple commodities from a single mine as in the case of the Olympic Dam mine).

Figure 6 provides a summary of the range of greenhouse gas emissions associated with the lifecycle of a range of current electricity generation technologies. Although there is a wide range of variation within different categories it is clear that fossil fuel technologies produce substantially more greenhouse gas emissions than non-fossil fuel technologies.

²⁶ Using an average energy content of exported NSW and QLD thermal coal of 27.0 GJ/t as used by ABARE (2008).

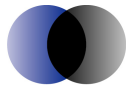
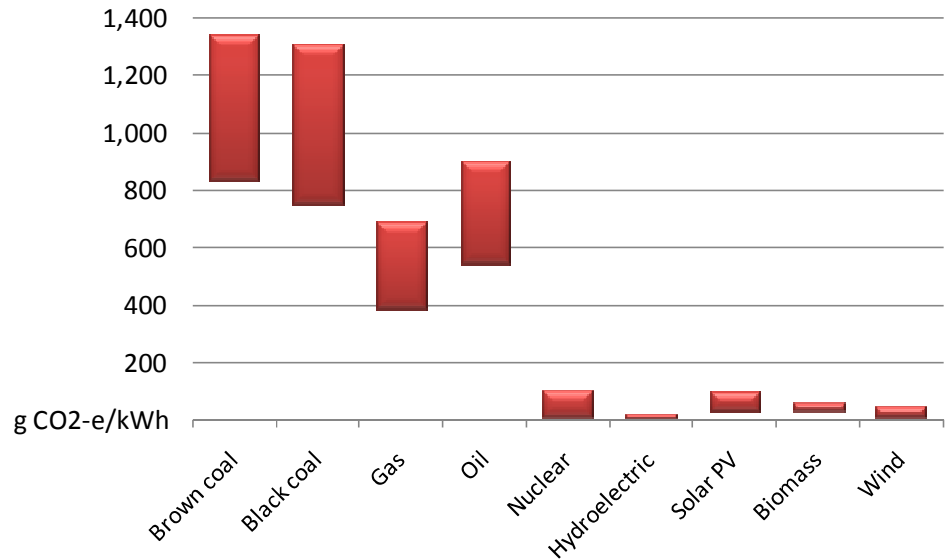


Figure 6 **Lifecycle greenhouse gas emissions from different electricity generation technologies**



Note: Life cycle emissions include fuel extraction, transportation, combustion and tailings disposal as well as plant construction and decommissioning.

Data source: Spadaro, J.V., Langlois, L. and Hamilton, B. (2000) and Lenzen (2008)

Nuclear

Unlike fossil fuels, nuclear power plants do not emit greenhouse gases²⁷ when they generate electricity. However, as with all generation technologies, a range of processes used to build and fuel the plants do emit greenhouse gases. Lifecycle emissions from nuclear energy include emissions associated with the construction of the plant and raw materials, mining and processing the fuel, routine operation of the plant, disposal of used fuel, and decommissioning.

There have been over a hundred studies that have attempted to quantify the greenhouse gases attributable to the generation of electricity using nuclear power (Sovacool 2008). These studies have produced widely varying estimates of lifecycle emissions from 1.36 to over 200 g CO₂-e/kWh. Much of the variation can be explained by the ore grade (namely the percentage of uranium per tonne of mined ore) and the enrichment method (for example the gas diffusion enrichment method requires some 40 or 50 times the energy of the centrifugal enrichment method). Further differences in lifecycle emission estimates arise from differing assumptions regarding the operating life of the reactor and the source of the energy used to generate electricity required in various stages of the fuel cycle.

²⁷ Nor do nuclear power plants emit so-called 'criteria pollutants', which include particulate matter, ground-level ozone, carbon monoxide, sulphur oxides, nitrogen oxides, and lead.



Lifecycle emissions from Ranger uranium are ~55-60 g CO₂-e/kWh

A meta-analysis of 103 lifecycle studies by Sovacool (2008) estimated that the mean lifecycle emissions for nuclear energy is 66 g CO₂-e/kWh. A more detailed study by Lenzen (2008) estimated greenhouse gas emission intensities for light- and heavy- water reactors of between 10 and 130 g CO₂-e/kWh, with light water and heavy water reactors averaging 60 and 65 g CO₂-e/kWh, respectively.

At between 0.22-0.29 per cent, the ore grades at the Ranger mine are amongst the highest in the world²⁸. This means that significantly less energy has to be used on mining and milling uranium compared to other mines using similar processes. Information provided by ERA shows that total emissions associated with the Ranger mine activities was 128.2 kt CO₂-e in 2008, which implies an emissions intensity of 0.7 g CO₂-e/kWh of electricity generated. This is a factor of 10 below the intensities quoted in the Lenzen (2008) and Sovacool (2008) studies. Consequently, all else equal, the lifecycle emissions associated with nuclear power using uranium from the Ranger mine are likely to be approximately 55-60 g CO₂-e/kWh.

Coal

Every tonne CO₂ produced from Ranger's uranium avoids 15 tonnes of CO₂

The life cycle emissions associated with coal fired generators are the highest of any current electricity generation technology, typically in the order of 850 to 1,200 g CO₂-e/kWh, depending on the generation technology and source of the coal. Brown coal-fired plants typically have higher emissions than black coal-fired plants due to the need to use a portion of the embodied energy to remove impurities in the coal (such as water). The direct combustion emissions from a brown coal fired power plant typically exceed 1,100 g CO₂-e/kWh and can even exceed 1,300 g CO₂-e/kWh for plants with low generation efficiencies. Assuming an average life cycle emission intensity of 965 g CO₂-e/kWh for coal fired generation and 55-60 g CO₂-e/kWh for nuclear implies that every tonne of CO₂-e generated from the use of Ranger's uranium has avoided 15 tonnes of CO₂-e that would otherwise have been emitted.

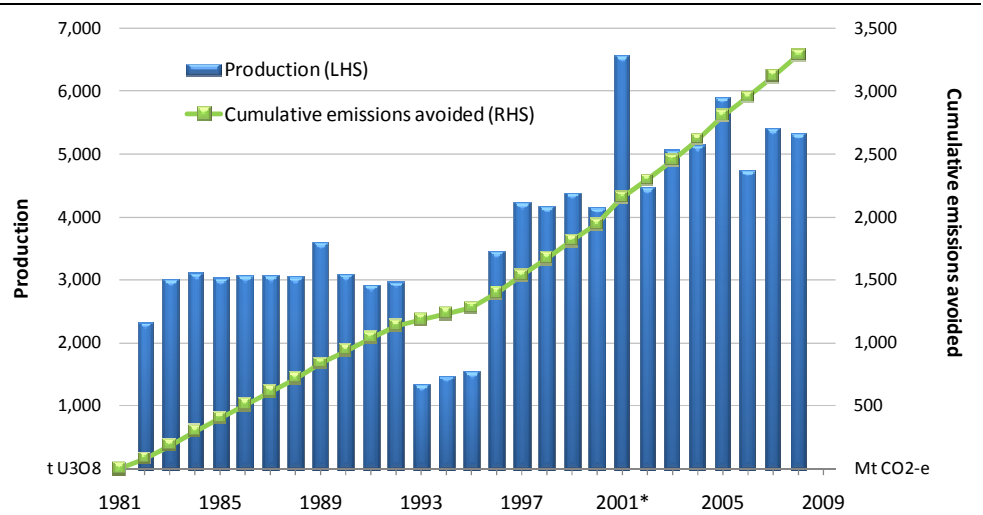
165 Mt CO₂-e avoided in 2008 and over 3,200 Mt CO₂-e to date

Nuclear electricity generation technologies are used to provide base load power and typically displace coal-fired technologies. In total, it is estimated that the electricity generated from the uranium produced from the Ranger mine avoided 165 million tonnes of greenhouse gases in 2008. Conservatively, 3,281 Mt CO₂-e have been avoided as a result of the uranium produced over the 26 year life of the Ranger mine to date (Figure 7). This is over five times Australia's current emissions.

²⁸ ERA Annual Report 2008



Figure 7 **Annual Ranger uranium production and cumulative avoided greenhouse gas emissions**



Note: Due to changes in company reporting, all years prior to 2001 are financial years, 2002 onwards are calendar years while 2001 production is for the 18 months between 1 July 2000 and 21 December 2001. Emissions avoided based on nuclear electricity generation technologies displacing base load black coal technologies.

Data source: ERA production data and ACIL Tasman emission estimates

Gas and LNG

Estimates of lifecycle emissions from natural gas based electricity range from around 380 to 690 g CO₂-e/kWh and are largely dependent whether the generation technology is single cycle or combined cycle. Based on Australia’s fugitive emission characteristics, ACIL Tasman estimates that lifecycle emissions of current gas plants using Australian gas are between 380 and 565 g CO₂-e/kWh (Table 10).

All Australian gas is currently liquefied prior to export and re-gasified in the recipient country. This process is energy intensive. Assuming the energy used in the liquefaction process is 9 per cent per tonne of liquefied gas, transportation uses 5 per cent of delivered LNG and that re-gasification uses 1.5 per cent of sent out natural gas, ACIL Tasman estimates that the lifecycle emissions from electricity generated using Australian LNG are between 441 and 656 g CO₂-e/kWh (Table 10).



Table 10 **Lifecycle emissions from natural gas and LNG-fired electricity**

	Open cycle gas turbine	Average plant ^a	Combined cycle gas turbine
	g CO ₂ -e/kWh	g CO ₂ -e/kWh	g CO ₂ -e/kWh
Thermal efficiency	35%	46%	52%
Natural gas			
Combustion	528.0	401.7	355.4
Fugitive emissions	34.3	26.1	23.1
Facilities construction/decommissioning	2.8	2.2	1.9
Total	565.1	430.0	380.3
LNG			
Combustion	528.0	401.7	355.4
Gas liquefaction/transportation/regasification	85.4	64.9	57.5
Fugitive emissions	37.4	28.5	25.2
Facilities construction/decommissioning	4.9	3.8	3.3
Total	655.7	498.9	441.3

^a Estimated average plant efficiency of gas fired capacity of recipient countries of Australian LNG.

Notes: Combustion emissions calculated using 51.33 kg CO₂-e per GJ as per Australian national greenhouse gas inventory emission factors (DCC 2009b). Fugitive emissions estimated based on Australian 2007 national greenhouse gas inventory (DCC 2009a). Gas use for liquefaction, transportation and regasification are assumed to be 9%, 5% and 1.5%, respectively, per unit of final product, or alternatively, 116.2 units of raw gas are required per 100 units of combusted gas. Emissions from facilities construction/decommissioning are assumed to be 0.5% and 0.75% of total emissions for gas- and LNG-fired generators, respectively, and are based on Yamada (2008).

Data source: ACIL Tasman estimates

LNG lifecycle emissions are over 8 times greater than that of Ranger's uranium.

ACIL Tasman estimates that the average generation efficiency of gas-fired electricity plant installed in countries receiving Australian LNG is approximately 46 per cent. This implies that the average lifecycle emissions of electricity generated from Australian LNG is approximately 500 g CO₂-e/kWh, which is over 8 times higher than the lifecycle emissions associated with the electricity generated from the uranium from the Ranger mine.



6 Other impacts

There are a range of other impacts that do not necessarily lend themselves to quantification in economic modelling but represent key impacts on the local and Northern Territory economy. In the case of the Ranger mine these types of impacts include:

- Indigenous employment
- External effects
- Economic facilitation effects

6.1 Indigenous employment

Growing Indigenous employment is an emerging benefit for both ERA and the broader Northern Territory economy.

Indigenous economic development and the future of the Northern Territory economy and society are intertwined. Engaging more Indigenous people and organisations in economic activity will help to overcome Indigenous disadvantage, and will also provide benefits and opportunities for all Territorians.

Box 3 Indigenous employment

COAG Target :

Halving the gap in employment outcomes between Indigenous and non-Indigenous Australians within a decade.

- Between 2001 and 2006, for those aged 15–64 years:
 - the employment to population ratio increased for Indigenous people from 43 per cent to 48 per cent, and for non-Indigenous people from 68 per cent to 72 per cent. The gap remained around 24 percentage points.
 - labour force participation increased for Indigenous people from 54 per cent to 57 per cent and for non-Indigenous people from 73 per cent to 76 per cent
 - the unemployment rate decreased for Indigenous people from 20 per cent to 16 per cent and for non-Indigenous people from 7 per cent to 5 per cent.
- The Indigenous labour force participation rate was lower, and the unemployment rate was higher, than for non-Indigenous people in all remoteness areas, states and territories and age groups

Source: SCRGSP (Steering Committee for the Review of Government Service Provision) 2009, *Overcoming Indigenous Disadvantage: Key Indicators 2009*, Productivity Commission, Canberra.



6.1.1 Indigenous employment at ERA

In recent years ERA has built on successes in training and work place experience to deliver improved Indigenous employment outcomes.

The Company has used traineeships, a job sharing programme, apprenticeships, work experience training, school based trainees and a careers expo to raise awareness about the employment opportunities within ERA.

One of the strategies put in place to promote local Indigenous employment was to engage with the nearby Gunbalanya community. A team of nine trainees was engaged to work within processing operations in July 2008, with the goal of taking up ongoing employment after a 12 month traineeship²⁹.

The ERA 2008 Annual Report states that Indigenous employment represents 18 per cent of the company's workforce.

At the end of the year, ERA employed 95 Indigenous Australians, a 46 per cent increase from the previous year. This represents 18 per cent of the Company's workforce.

The historical performance of Indigenous employment at ERA is shown in Table 11.

Table 11 Indigenous employment ERA ('000)

Year	Total Indigenous Persons Employed	Total Persons Employed	Percent
1999	36	272	13.2%
2000	45	257	17.5%
2001*		231	21.0%
2002*		184	21.0%
2003	30	238	12.6%
2004	25	273	9.2%
2005	46	354	13.0%
2006	46	385	11.9%
2007	65	419	15.5%
2008	95	519	18.3%

Note: *Percentage provided in Annual Report rather than number of Indigenous employees

Data source: ERA Annual Reports 2000 to 2008

In July 2009 ERA had 101 Indigenous employees representing 18.8 per cent of the workforce. ERA has a goal of Indigenous employment reaching 20 per cent of the work force by the end of 2009.

²⁹ ERA Annual Report 2008, p 15



6.1.2 Comparison

The performance of ERA in employing Indigenous employees can be compared to the broader economy as well as the Northern Territory Government to provide some comparative analysis about the company's relative success in generating jobs.

Employment in the Northern Territory

Australian Bureau of Statistics (ABS) data on the employment of Aboriginal and Torres Strait Islanders³⁰ in the Northern Territory is set out in Table 12. This employment data is compared to the overall employment levels in the Northern Territory.

It should be noted that this Indigenous employment data for the Northern Territory is subject to substantial sampling error that makes these gains uncertain. The small size of the Indigenous population, its wide dispersion, and the relatively high proportion who live in remote areas present particular difficulties in producing reliable labour force estimates for the Indigenous population. Moreover, these jobs include Community Development Employment Program (CDEP) employment, which is often subject to less stringent employee performance than mainstream, unsubsidised employment.

The effect of CDEP related employment is difficult to clearly identify, but the Overcoming Indigenous Disadvantage 2009 Report had the following comments:

Indigenous employment rates in remote areas are likely to include high rates of CDEP participation³¹.

In the 2004-05 National Aboriginal and Torres Strait Islander Health Survey, the CDEP program accounted for 21.9 per cent of all Indigenous employment, ranging from 4.0 per cent in major cities to 68.0 per cent in very remote areas³².

A Northern Territory Government Discussion Paper on CDEP³³

Prior to 1 July 2007, there were approximately 8,000 people in the NT participating in the Community Development Employment Program (CDEP) each of whom was

³⁰ Labour Force Characteristics of Aboriginal and Torres Strait Islander Australians, *Australian Bureau of Statistics Cat. No. 6287.0*

³¹ SCRGSP (Steering Committee for the Review of Government Service Provision) 2009, *Overcoming Indigenous Disadvantage: Key Indicators 2009*, Productivity Commission, Canberra p 8.11

³² SCRGSP (Steering Committee for the Review of Government Service Provision) 2009, *Overcoming Indigenous Disadvantage: Key Indicators 2009*, Productivity Commission, Canberra p 8.8

³³ *CDEP Discussion Paper March 2008: Review of Community Development Program*, Office of Indigenous Policy. Northern Territory Government



counted by the Australian Bureau of Statistics as employed. While outcomes were variable, this program provided an opportunity for individuals to develop work skills, and communities to be provided with services that may not otherwise have been provided. However, in the minds of many participants, administrators and commentators, it had become a destination rather than a program which concentrated on providing a transition into the paid workforce.

Consequently, ACIL Tasman has adjusted the data in Table 12 to account for the number of CDEP participants identified as employed by the ABS according to the Northern Territory Government. The ratio of CDEP employment to total Indigenous employment calculated by the ABS has then been applied to the preceding years to provide an historical series.

Indigenous employment in the Northern Territory together with adjusted data to account for CDEP employment is provided in Table 12.

Table 12 **Employment - Northern Territory ('000)**

Year	Total Indigenous Persons Employed*	Total Indigenous Persons Employed <i>Adjusted for CDEP participants**</i>	Total Persons Employed	Percent	Percent <i>Adjusted for CDEP participants**</i>
2002	18.3	10.1	99.7	18.4%	10.1
2003	16.5	9.1	97.8	16.9%	9.3
2004	14.5	8.0	98.0	14.8%	8.2
2005	12.8	7.0	98.1	13.0%	7.1
2006	15.3	8.4	103.3	14.8%	8.1
2007	17.8	9.8	108.9	16.3%	9.0

Note: *This data is subject to error as discussed in explanatory notes of the publication ** Adjusted to account for CDEP participants

Data source: Australian Bureau of Statistics Cat. No. 6287.0 and 6202.0

Government employment

There has been a steady increase in the representation of Indigenous people as employees within the Northern Territory Public Sector since June 2002 as shown in Table 13. Indigenous employment as a percentage of total Northern Territory public sector employment is shown in the fourth column.

Table 13 **Indigenous employees employed in the Northern Territory Public Service**

Year (June)	Total Indigenous Persons Employed	Total Persons Employed in Public Sector	Percentage of overall PS employment
2002	732	14,303	5.1
2003	768	14,538	5.3
2004	907	15,103	6.0
2005	1,007	15,754	6.4
2006	1,156	15,833	7.3
2007	1,261	16,131	7.8

Data source: Office of the Commissioner for Public Employment NT Public Sector Staffing

6.1.3 Comparison

The percentage of Indigenous employment from the above tables in Sections 6.1.1 and 6.1.2 is set out in Table 14. The Indigenous employment percentage for the Northern Territory includes the adjusted percentage to account for CDEP participants.

Table 14 **Indigenous employment (percentage)**

Year (June)	ERA	Northern Territory	Northern Territory Adjusted	Northern Territory Government
2002	21.0	18.4	10.1	5.1
2003	12.6	16.9	9.3	5.3
2004	9.2	14.8	8.2	6.0
2005	13.0	13.0	7.1	6.4
2006	11.9	14.8	8.1	7.3
2007	15.5	16.3	9.0	7.8
Average	13.9	15.7	8.6	6.3

Data source: Various

ERA's performance in Indigenous employment as a percentage of total employment on average is superior to the adjusted Territory wide percentage and significantly higher than the Northern Territory Government.



6.2 Externalities

6.2.1 The concept of externalities

The economic concept of externalities or external economies³⁴ is an important component of the overall contribution of the Ranger mine to the Northern Territory. Externalities are the uncompensated benefits that one person's activity provides to another. These benefits are not intentionally provided, rather they are incidental “extras”—they spill over to others as a result of decisions that one person makes for their own purposes. Therefore, these externalities benefit third parties, including competitors and potential competitors. For example, as employees leave an innovative company, or as other companies learn from their dealings with that company or from competing with it, they acquire knowledge about innovative products and processes that they can put to use elsewhere

Externalities are by definition external to a firm, but internal to an industry in a geographic region, and go beyond the direct benefits as measured by economic modelling and other traditional economic analysis. While the more traditional measures of economic and social impact remain relevant, the identification, characterisation and quantification of externalities adds a new dimension to the understanding of the impact of the Ranger mine in the Northern Territory. In particular, the “new industry” and complex technical characteristics of ERA's operations over the years has added significant benefits Northern territory economy.

However, externalities may not occur automatically. There will be a range of factors that dampen their operation. These include lack of capacity in local industry and workforce, lack of infrastructure and services and market failures.

6.2.2 Technology and industry

The highly developed technical nature of the Ranger mine suggests they it has become a key component of the fast growing “technology layer” of industry in the Northern Territory. Development of such technology-based industry is important to ensure that the Territory economy captures more of the benefits of industries such as mining, minerals processing, oil and gas and defence. Development of this industry layer will also lead to a more sustainable economy that can expand beyond servicing just local industry.

Externalities tend to operate on a vertical basis by providing benefits to suppliers and consumers. The Ranger mine has assisted the development of

³⁴ This section is a summary of a literature review ACIL Tasman undertook on externalities from Foreign Direct Investment. A full reference list is available.



the local supplier and support service base which has grown on the back of oil and gas and the mining industries. The Northern Territory has specialist expertise in areas such as engineering, software and equipment, scientific analysis, environmental rehabilitation, and health and safety. Already, Territory specialist companies service industry interstate and internationally.

Darwin's growing importance as a mining and resources service centre provides synergies of capabilities and technologies. This contributes to the potential both to attract additional activities and to stimulate investment in industry capacity which in turn attracts further development opportunities in the Northern Territory.

These issues are particularly relevant given the highly sophisticated processes ERA uses in its treatment process which will stimulate development of additional capabilities and technical capacity in the broader economy. As suppliers and service providers build their technical knowledge and range of products they are better placed to develop markets in Australia and internationally.

6.3 Economic facilitation effects

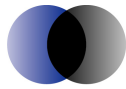
There are other economic activities in the Alligator region which, even though they are not solely reliant on the Ranger mine, would be significantly affected if the mine was not there. The report that ACIL Tasman prepared in 2006³⁵ examining the impact of the possible closure of the mine highlighted the possible negative side of these facilitation effects in terms of the loss of services and the magnitude of growth required in replacement industries.

Equally, ERA's role as a provider of key economic infrastructure in Jabiru assists the local economy, in particular the tourism industry which operates in Kakadu National Park and also supports a level of infrastructure that is not necessarily equalled in other parts of the Northern Territory.

Along with mine construction, the town of Jabiru was created in an otherwise sparsely populated area. Its development was as a result of mining development nearby and as discussed in Section 3.2, Jabiru's role as a visitor service centre is supported by the level of economic activity provided by mining.

The strength of the accommodation, cafes and restaurants industry is largely due to the tourist trade using Jabiru as a gateway to the Kakadu National Park.

³⁵ Impact of the closure of Ranger Mine on Jabiru, ACIL Tasman 2006



However, it should be noted that ERA is also a user of the accommodation sector in Jabiru to house some of its workforce and provide catering etc at the mine. Also, ERA employees residing in Jabiru make use of the services of Jabiru’s cafes and restaurants and retail outlets. Importantly, given the seasonal nature of tourism in Kakadu employees use these services year round. In addition, as Section 3.4 shows Ranger employees are relatively well remunerated providing disposable income to purchase these services.

6.3.1 Utilities

Electricity supply in Jabiru is currently provided by ERA from the Ranger mine’s own power station. This supply to the town is provided under contractual arrangements with the Power and Water Corporation (PWC) which provides electricity reticulation services.

Under the agreement PWC charges users a standard Northern Territory electricity tariff. This revenue less administration and maintenance costs is returned to ERA. ERA maintain that the net income from electricity does not cover the marginal costs incurred. The company estimates that it subsidises the town’s electricity use by \$1.5 million to \$2 million a year

6.3.2 Transport

The Northern Territory Government Department of Planning and Infrastructure maintains the Arnhem and Kakadu Highways in the park.

Table 15 Average annual daily traffic

Year	2003	2004	2005	2006	2007	Growth 2003-07
Arnhem Highway						
West of Adelaide River Bridge	821	910	917	955	987	20.2%
East of Stuart Highway	5,042	5,133	5,227	5,442	5,762	14.3%
Kakadu Highway						
South of Arnhem Highway	338	357	370	369	371	9.8%
East of Stuart Highway	227	211	213	229	297	30.8%

Note: Annual Average Daily Traffic (AADT) for both highways over the most recent 5-year period between 2003 and 2007

Data source: Department of Planning and Infrastructure Road Network Division 2008 and Traffic Impact Study - Stage 2: Arnhem and Kakadu Highways, Hyder Consulting Pty Ltd

Approximately 75 per cent of visitors to Kakadu enter via the Arnhem Highway as it is the most direct route from Darwin with many being accommodated in Jabiru³⁶.

The largest proportion of this traffic is made up of visitor and tourist flow with the proportion of commercial vehicles approximately 20 per cent, as shown in Table 16.

Table 16 Visitor numbers by vehicle

	Short	Short - Towing	Total	Truck or Bus	Truck	Total
Arnhem Highway (Kakadu North Entry)						
Number of vehicles	55,564	8,058	63,622	9,636	5,456	78,714
Percentage	70.6	10.2	80.8	12.2	6.9	
Kakadu Highway (Kakadu South Entry)						
Number of vehicles	13,707	3,549	17,256	2,428	1,319	21,003
Percentage	65.3	16.9	82.2	11.6	6.3	

Note: Visitor Numbers to Kakadu according to AustRoads Vehicle Classification. Truck or bus consists of Two or Three Axle Truck or Bus

Data source: Parks Australia (2008-09)

Mining and processing at Ranger mine relies on the supply and bulk haulage by road of materials such as fuels, sulphuric acid, ammonia, pyrolusite, lime, kerosene, explosive and amine, and this has been taking place using the Arnhem and Kakadu Highways as transport routes over 29 years³⁷. In addition these routes are used by employees and contractors to travel to and from the mine.

Preliminary data on traffic flows and potential impacts along the Arnhem and Kakadu Highways indicates that, in 2007, the Ranger operations contributed less than 5% of the annual average daily traffic and approximately 11% of the total commercial vehicle traffic along the Arnhem Highway, and less than 1% of the annual average daily traffic and less than 3% of commercial vehicle traffic along the Kakadu Highway³⁸.

The Arnhem Highway which links Jabiru to Darwin requires ongoing widening and pavement upgrading as well as all weather access³⁹. The economic importance of the Ranger mine to the region and the Territory and the focus that DPI places on economic development suggests that the Ranger mine in

³⁶ Traffic Impact Study - Stage 2: Arnhem and Kakadu Highways, Hyder Consulting Pty Ltd

³⁷ Heap Leach Facility Referral

³⁸ Heap Leach Facility Referral

³⁹ Department of Planning and Infrastructure Road Network Division



combination with tourism has an important economic facilitation effect in delivering appropriate road infrastructure.

6.3.3 Airport

The infrastructure in the Ranger operations area include the Jabiru airport and associated infrastructure, which includes Australian Government buildings on land leased from ERA as well as tourist facilities, a workshop owned by the Gagudju Association and a temporary contractor camp.

The airport supports the fly-in-fly-out approach used by Ranger to source employees and contractors. This airport and infrastructure also supports the tourist industry of Kakadu National Park and access for surrounding communities.

6.3.4 Skilled staff

In the 2006 study ACIL Tasman ascertained that the Town Council employed around 32 full time equivalent staff. Eight of these staff were married to mine employees. The Council suggested that several of these employees had skills (such as financial management skills) which would ordinarily be difficult to attract to a remote location.

The composition of the workforce identified in Section 3.3.1 with the preponderance of managerial and professional staff and associated income levels suggests that the additional skilled staff available amongst spouses provides an important economic facilitation effect flowing from the operations of the Ranger mine.



A Mining and Energy in the Northern Territory⁴⁰

A.1 Mining and energy

A.1.1 Contribution to the economy

Output

In terms of contribution to Gross State Product (GSP), mining is the most significant Northern Territory industry, accounting for 23.6 per cent of GSP in 2007-08, more than three times the national figure of 7.6 per cent. The Territory's mining output is dominated by several very large minerals and energy projects.

Employment

The mining industry is capital-intensive and employs relatively few people compared with its output. According to data collected by the ABS, 3,300 Territorians, 3 per cent of employment in the Northern Territory, were employed in the mining industry in 2007-08.

International trade

Mining and energy production makes up the bulk of exports from the Northern Territory. In 2007-08, the Northern Territory exported \$2.6 billion in mineral and energy exports, making up almost 60 per cent of \$4.5 billion of total exports. Because of the predominance of the mining sector, the Northern Territory economy is highly trade-exposed, with a ratio of merchandise exports to GSP of 29.4 per cent, almost twice as high as the national ratio of 15.9 per cent. In addition, the Northern Territory often runs a large trade surplus, with a surplus of \$2.3 billion in 2007-08.

Downstream processing

The mining sector has the potential to create significant downstream value adding activity. The alumina production at the Rio Tinto Alcan refinery, which uses bauxite feedstock, and liquefied natural gas (LNG) manufacturing at Wickham Point together account for almost two-thirds of the Northern Territory' manufacturing value-added. While the value of the feedstock is

⁴⁰ Summary of Northern Territory Treasury Budget Related Paper *Northern Territory Economy* Mining and Energy

attributed to the mining industry, the value of this downstream production is attributed to the manufacturing industry.

A.2 Mineral production⁴¹

The majority of mineral production in the Northern Territory comes from four mines set out in Table A1.

Table A1 **Mineral production – major producers⁴²**

Location	Mineral	Owner
Groote Eylandt	Manganese	BHP Billiton
Macarthur River	Lead - zinc	Xstrata
The Granites	Gold	Newmont
Nhulunbuy (Gove)	Bauxite	Rio Tinto Alcan

Recent production data for the major minerals is set out in Table A2.

Table A2 **Mineral production in the Northern Territory (2007-08)**

Mineral	Quantity (Tonnes)	Value (\$ Million)
Manganese	3,727,470	\$937.9
Uranium Oxide	5,254	\$423.0
Zinc/Lead Concentrate	299,616	\$331.6
Gold	13.6	\$322.2
Bauxite	5,250,989	\$267.3
Iron Ore	741,055	\$56.8
Crushed Rock	697,824	\$12.9
Mineral Sands Concentrate	24,400	\$10.8
Sand	226,718	\$3.3
Vermiculite	8,319	\$3.2
Silver	1.4	\$0.4
Copper Concentrate	2.0	\$0.0

Note: ERA's Uranium Oxide production included for comparison purposes

Data source: *Department of Regional Development, Primary Industry, Fisheries and Resources*

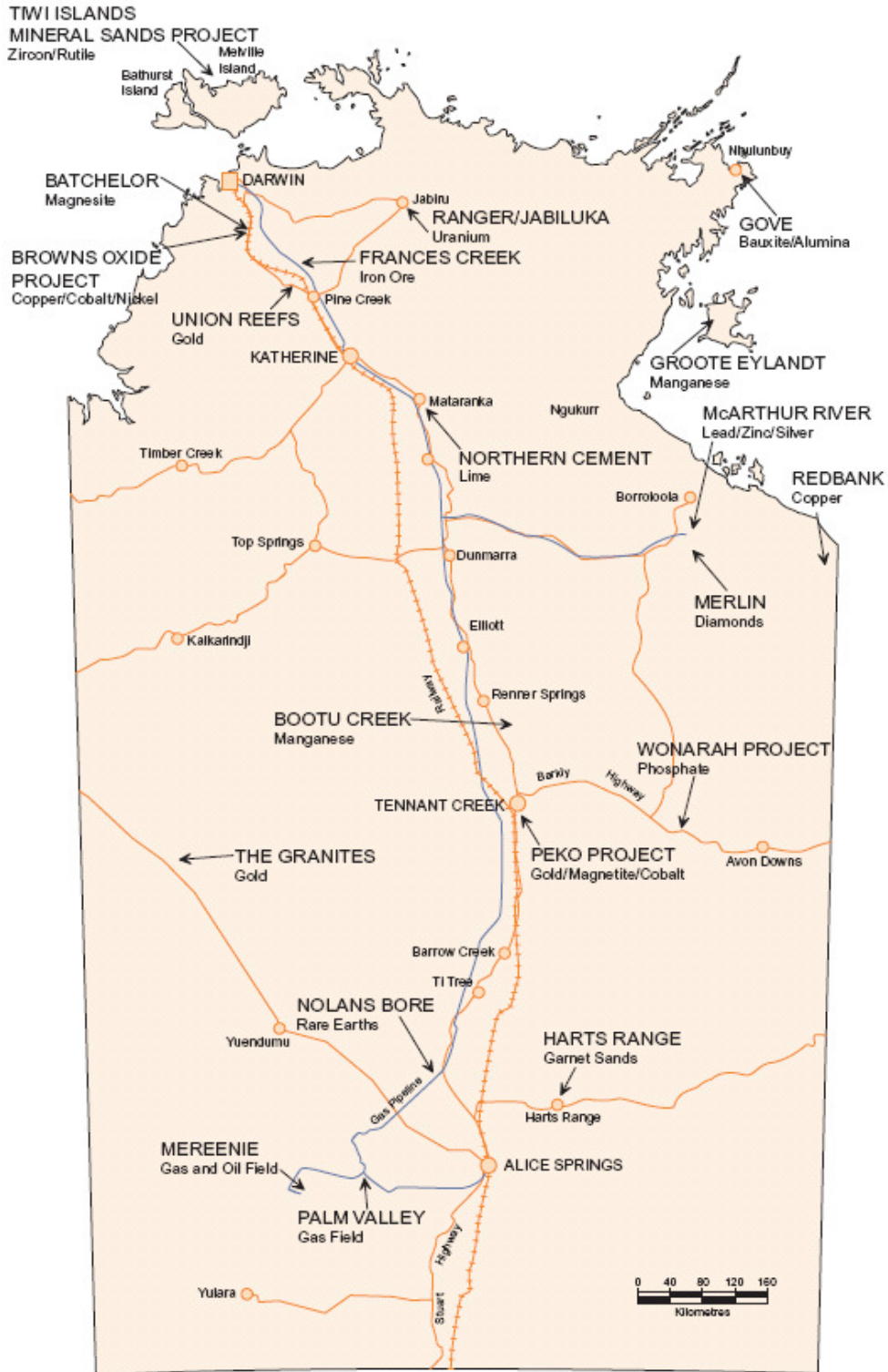
The location of key onshore mining and energy resource operations (including the Ranger mine) is provided in the map in Figure A1.

⁴¹ ERA's Ranger mine is included in the energy section of this Appendix

⁴² Uranium production by ERA is discussed in the Energy section in Section B.2.



Figure A1 Onshore mining and energy resources



Source: NT Treasury (2009) Northern Territory Economy, Budget 2008-09

A.3 Energy production

The Northern Territory's major energy operations are set out in Table A3.

Table A3 **Energy production – major producers**

Location	Mineral or product	Owner
Ranger	Uranium	Energy Resources of Australia
Amadeus Basin (Mereenie and Palm Valley)	Gas and Oil	Santos and Magellan Petroleum Australia
Bayu-Undan	Gas, LPG and condensate	ConocoPhillips
Laminaria-Corallina	Oil	Woodside
Puffin	Oil	AED Oil

Data source: Various

Recent production data for the major minerals is set out in Table A4.

Table A4 **Energy production in the Northern Territory (2007-08)**

Mineral or product	Unit	Quantity	Value
Oil	Kilolitres	3,989,997	2,619
Uranium Oxide	Tonnes	5,254	423
Offshore Gas	Petajoules	81	153
Onshore Gas	Kilolitres	543,970,448	52

Data source: Department of Regional Development, Primary Industry, Fisheries and Resources

The location of key onshore mining and energy resource operations (including the Ranger mine) is provided in the map in Figure A2.



Figure A2 Offshore oil and gas



Source: Department of Regional Development, Primary Industry, Fisheries and Resources



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