ANNUAL POWER SYSTEM REVIEW

DECEMBER 2006

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Disclaimer

This review is based upon information received from participants in the Territory's electricity supply industry, and agencies within government on a 'reasonable endeavours' basis. The information on which the review is based is current as at 31 October 2006.

The review contains certain predictions, estimates and statements that reflect various assumptions concerning load growth forecasts including accounting for major developments which may impact on the Territory's power system over the period to 2015-16. The Commission believes that the contents are accurate within the normal tolerance of economic forecasts and that the broad analyses are correct.

The purpose of this document is to review and report to the Minister in accordance with section 45 of the Electricity Reform Act 2000. It is not intended to be relied upon or used for other purposes, such as making decisions to invest in further generation or network capacity. Any person proposing to use the information in this document for such other purposes should independently verify the accuracy, completeness, reliability and suitability of the information in this document, and the reports and other information relied upon by the Commission in preparing it. The Commission and its officers accept no liability (including liability to any person by reason of negligence) for any use of the information in this document or for any loss, damage, cost or expense incurred or arising by reason of any error, negligent act, omission or misrepresentation in the information in this document or otherwise.

CHAPTER 1

INTRODUCTION

1.1 The Power System Review is published annually by the Commission in response to the requirements of section 45 of the *Electricity Reform Act 2000* ("the Reform Act").

1.2 Section 45 of the Reform Act requires the Commission to:

- develop forecasts of overall electricity load and generating capacity in consultation with participants in the electricity supply industry and report the forecasts to the Minister and electricity entities;
- review and report to the Minister on the performance of the Territory's power system;
- advise the Minister on matters relating to the future capacity and reliability of the Territory's power system relative to forecast load;
- advise the Minister, either on its own initiative or at the request of the Minister, on other electricity supply industry and market policy matters; and
- submit to the Minister, and publish, an annual review of the prospective trends in the capacity and reliability of the Territory's power system relative to projected load growth.

1.3 Last year the Commission broadened the scope of its Review to include an assessment of the arrangements under which power system planning and reliability is addressed in the Territory, in addition to its regular examination of prospective demand and supply conditions for the generation sector. The concerns raised by the Commission in relation to those arrangements are among the matters presently being considered by the NT Government in conjunction with its consideration of whether to subject the NT electricity market to the national regulatory regime. For this reason, this year's Review once again focuses primarily on conditions in the generation sector.

Consultation with interested parties

1.4 The Commission has again consulted with various parties, including participants in the Territory's electricity supply industry and agencies within Government. This report has benefited significantly from the comments received from parties consulted by the Commission, although the views expressed in the report are those of the Commission alone and are not necessarily those of the parties consulted.

Inquiries

1.5 Inquiries regarding the Review should be directed in the first instance to:

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CHAPTER

2

SUMMARY OF KEY FINDINGS

2.1 The 2006 Power System Review focuses principally on the adequacy of generation capacity and gas supplies over the medium term to 2009-10, and the longer term to 2015-16.

2.2 Most interest is likely to be centred on the medium term, when decisions regarding the next increments to capacity will be required, and gas supply arrangements continue to be stretched until the first supply of gas from the Blacktip field becomes available.

2.3 However, the Commission also notes that a number of issues raised in the 2005 Review, concerning the public policy framework within which the planning and reliability of the Territory's power system are managed, remain unresolved.

Power system planning and reliability

2.4 In its 2005 Review, the Commission included an assessment of the arrangements under which power system planning and reliability is addressed in the Northern Territory.

2.5 The Commission found that arrangements in the Territory are distinctive in that:

- the responsibilities, accountabilities and powers of the main participants – the System Controller, Power and Water Generation and Power and Water Networks and the Commission itself – are largely undefined; and
- there is limited recognition regarding the desirability of separating public interest responsibilities from commercial interests.

2.6 As a result, the management of power system planning and reliability within the NT electricity market lacks:

- clarity of definition of the role, powers and governance of the System Controller, including its relationship to Power and Water and the Commission;
- documentation of the various technical parameters that define the safety, security and reliability of the power system;
- an established process for providing independent technical support and advice on power system matters; and
- an established process and instruments for providing oversight of network management, planning and investment, appropriate to the scale of the NT system.

2.7 The Commission considers that these findings remain relevant, and that corrective action is required. Its views have been submitted to the NT Government. The Commission will await the outcome of the Government's deliberations.

2.8 In the meantime, the Commission has maintained the approach taken in the 2005 Review and reported against both the N-1 and N-2 standard, in the absence of formal reliability criteria for the NT system made explicit on the advice of an appropriately constituted expert advisory body.

Generation capacity in the medium term

2.9 The Commission has assessed the 'adequacy' of generation capacity over the 2006-07 to 2009-10 period by comparing a baseline projection of capacity with its forecast of peak demand in each of the three regulated systems, Darwin-Katherine, Alice Springs and Tennant Creek.

Demand forecasts

2.10 Demand has been forecast primarily by considering economic and demographic conditions. Information on new projects that add significantly to demand has been included where the likelihood of commencement is high.

2.11 Economic and demographic conditions are currently strong and are expected to continue to be relatively buoyant over the medium term, although at lower levels of growth than the last two years. For the Territory as a whole, output, employment and total population are forecast to record average growth rates of 4.5%, 2.5% and 1.5% respectively per annum.

2.12 Consumption and peak demand are forecast to increase by an average of 3% per annum (baseline growth) in the Darwin-Katherine system. The inclusion of demand expected from the Compass Browns Oxide Project and the Burnside Union Reef Mine lifts the forecast growth in demand and consumption to an average of 4.4% per annum. Consumption and peak demand are forecast to increase by an average of 2.5% in the Alice Springs system and 1.5% in the Tennant Creek system.

Capacity projections

2.13 Baseline capacity has been projected by adjusting existing capacity for additions and retirements that are considered to be firm – either announced or scheduled for the near term. This is comparable with the approach taken by the National Electricity Market Management Company (NEMMCO) in developing its annual *Statement of Opportunities*. It has the advantage of avoiding assessments of the likelihood of uncommitted projects proceeding.

2.14 Given the current structure of the NT power market, it is likely that Power and Water is the only party actively planning to invest in new capacity. If the Commission were to include Power and Water's long-term investment plans in the analysis it may inadvertently create the impression that additions to capacity are reserved for Power and Water.

2.15 This is not the case. The NT power market is open to investment from any source that meets the licence criteria. The Commission makes no assumption as to who will build the new capacity that its analysis indicates is required. The Commission's role is to provide information to all interested parties on the prospective supply-demand balance, to facilitate efficient investment from whatever source and to support the development of a competitive market.

Darwin-Katherine regulated system

2.16 The assessment of capacity adequacy for the Darwin-Katherine system over the medium term depends critically on the reserve standard that is applied.

2.17 If the N-1 standard is considered appropriate, capacity is adequate through to 2009-10, on the proviso that the first unit of capacity at the new Weddell power station is available as scheduled by Power and Water.

2.18 However, if N-2 is considered to be the appropriate standard the picture is quite different. Capacity is below the standard for each year, with the exception of 2007-08 when capacity is adequate but still critically tight. By 2009-10 the shortfall is approaching 10MW. If the N-2 standard is to be satisfied, additional capacity will be required by 2008-09.

Alice Springs regulated system

2.19 Conditions are expected to remain tight on the Alice Springs system.

2.20 Additional capacity is required prior to the commencement of 2009-10 in order to satisfy the N-1 reserve standard.

2.21 Based on the Commission's forecasts of demand, the reserve margin on the Alice Springs system does not meet the N-2 standard at any time over the 2006-07 to 2009-10 period.

Tennant Creek regulated system

2.22 At N-1 capacity remains adequate but tight over the medium-term period. To meet the N-2 standard, additional capacity would be required prior to 2007-08.

Generation capacity in the longer term

2.23 For the period 2010-11 to 2015-16, the Commission has assessed the requirement for new capacity by comparing its baseline capacity projection with high and low growth demand scenarios.

2.24 The high demand growth scenario assumes demand growth of 4% per annum in Darwin-Katherine, 3.5% in Alice Springs and 3% in Tennant Creek. The comparable rates in the low demand growth scenario are 2%, 1.5% and 0% respectively.

2.25 For each scenario, the additional capacity required to satisfy the N-1 and N-2 reserve standard has been calculated.

Darwin-Katherine regulated system

2.26 Under the high demand growth scenario, the N-1 standard is met for most of the period, with demand tightening in 2015-16. Again, this conclusion is subject to the proviso that the second unit of capacity at the new Weddell power station is available as scheduled by Power and Water. Approximately 50MW additional capacity is required by 2015-16 to meet the N-2 standard.

2.27 Under the low demand growth scenario, the N-1 standard is comfortably met for the entire period. The additional capacity required by 2015-16 to meet the N-2 standard falls to 10MW.

Alice Springs regulated system

2.28 In the Alice Springs system, under the high demand growth scenario, 22MW of additional capacity is required by 2015-16 to meet the N-1 standard and 32MW is required to meet the N-2 standard.

2.29 Under the low demand growth scenario, additional capacity of 14MW is required to meet the N-1 standard and 25MW is required to meet the N-2 standard, by 2015-16.

Tennant Creek regulated system

2.30 In the Tennant Creek system, projected baseline capacity is sufficient to meet the N-1 standard under both the low and high demand growth scenarios, and the N-2 standard under the low growth scenario. The N-2 reserve standard is satisfied under the high demand growth scenario by the addition of 1MW of capacity.

Adequacy of gas supplies

Gas supply-demand in the medium term

2.31 In the 2005 Review, the Commission concluded that:

> *It is now likely that, for the remaining four years of their term, gas volumes available under the existing Amadeus Basin contracts will not meet Power and Water's gas requirements.* [1]

2.32 Due to the expected gas supply-demand deficit over the medium term, Gasgo has entered into a new contract with the Mereenie producers (MSA4).

2.33 The new Mereenie contract should ensure that gas volumes available under the Amadeus Basin contracts are now adequate to meet Power and Water's gas supply requirements until 2009. [2]

Gas supply arrangements beyond 2009

2.34 On 30 June 2006, Power and Water executed an agreement with Eni Australia B.V. (Eni) for the supply of 740PJ of gas from the Blacktip field. The first supply of gas is targeted to be available for electricity generation on 1 January 2009.

2.35 Contract quantities available from Blacktip will be in excess of projected requirements under the Commission's high growth scenario through to 2015-16 and beyond. If supply matches contract quantities then it is clear that Blacktip has removed the previous uncertainty regarding gas availability beyond 2009.

2.36 Development of the Blacktip field, the construction of processing infrastructure at Wadeye and of the connecting pipeline from the wellhead to Wadeye and Wadeye to the existing north-south pipeline is on a fairly tight timetable. If delays are experienced, Power and Water can call on the 'reasonable endeavours' component of the new Mereenie contract, which applies for two years from 1 January 2009, to make up any gas shortfall. The Commission notes that while, in these circumstances, the Mereenie contract provides the prospect of adequate back-up, the availability of gas does not appear to be firm as supply is subject to a 'reasonable endeavours' qualification. To this extent, some uncertainty regarding the security of an adequate gas supply remains.[3]

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[1] Utilities Commission, Power System Review, December 2005, p.55

[2] For the purposes of this Review, Power and Water is assumed to continue as the sole generator/retailer on the three regulated systems. Power and Water's gas requirement is therefore equivalent to the aggregate regulated system requirement.

[3] Power and Water have recently advised the Commission that both the Blacktip field development and connecting pipeline are currently considered to be 'on track' for initial gas delivery as scheduled in January 2009 (Letter dated 14 December 2006).

CHAPTER

3

POWER SYSTEM PLANNING AND RELIABILITY

3.1 A reliable and efficient supply of electricity is essential to the 21st century economy and the way of life that it supports. The reliability of supply is an outcome of the standards and processes by which the power system is operated, planned and developed.

3.2 In its 2005 Review the Commission included an assessment of the arrangements under which power system planning and reliability is addressed in the Northern Territory.

3.3 The Commission found that arrangements in the Territory are distinctive in that:

- the responsibilities, accountabilities and powers of the main participants – the System Controller, Power and Water Generation and Power and Water Networks and the Commission itself – are largely undefined; and
- there is limited recognition regarding the desirability of separating public interest responsibilities from commercial interests.

3.4 As a result, the management of power system planning and reliability within the NT electricity market lacks:

- clarity of definition of the role, powers and governance of the System Controller, including its relationship to Power and Water and the Commission;
- documentation of the various technical parameters that define the safety, security and reliability of the power system;
- an established process for providing independent technical support and advice on power system matters; and
- an established process and instruments for providing oversight of network management, planning and investment, appropriate to the scale of the NT system.

3.5 For all practical purposes, power system planning and reliability (including that for transmission and distribution networks) continues to be managed – as it had been prior to the market reforms of 2000 – as an internal matter by Power and Water.

3.6 This is inconsistent with generally accepted industry practice. Among a number of disadvantages, it blurs the distinction between commercial interests and the public interest, makes the planning and investment process opaque and increases the risk that investment decisions may be sub-optimal from a power system perspective.

3.7 The Commission considers that these findings remain relevant, and that corrective action is required.

3.8 The Commission understands the NT Government is currently considering whether to extend to the Territory the regulatory arrangements that apply in the National Electricity Market.

3.9 In this context, the Commission has raised its concerns in regard to the management of power system planning and reliability in Territory. The Commission will await the outcome of the Government's deliberations.

3.10 In the meantime, the Commission has maintained the approach taken in the 2005 Review and reported against both the N-1 and N-2 standard, in the absence of formal reliability criteria for the NT system made explicit on the advice of an appropriately constituted expert advisory body.

CHAPTER

4

OUTLOOK FOR ELECTRICITY DEMAND

4.1 This chapter examines prospects for electricity demand in the Territory's regulated power systems.

4.2 The period under review extends to 2015-16. While a 10 year horizon allows longer term questions regarding the sequencing and size of capacity requirements to be explored, most interest is centered on the next few years. Medium-term system adequacy assessment exercises, for example, generally examine system adequacy for a period up to two years ahead. Similarly, NEMMCO's horizon for its annual *Statement of Opportunities* provided to help market participants evaluate investment opportunities is 10 years, but in its role as reserve trader its horizon for assessing system adequacy is limited to two years.

4.3 Consistent with the approach taken in the 2005 Review, the approach taken in this Review is to look in some detail at the next four years (2006-07 to 2009-10) and then project forward another six years using broader brush demand scenarios.

Forecasting electricity demand

4.4 Electricity is consumed by individuals in households, by service organisations such as hospitals, schools and government administration, and by commercial entities in offices, shops, manufacturing, agriculture and mining. The quantity of electricity consumed is determined by the number and type of electricity-using appliances and the rate at which they are used. Since data at this level of detail is not generally available, the demand for electricity is usually assessed by focusing on its relationship with measures of economic activity and demographic change and movements in relative prices.

4.5 By examining the relationship between overall electricity consumption and economic, demographic and relative price variables, 'top-down' forecasts of future electricity consumption can be developed based on assessments of expected economic and demographic conditions and price changes. If the data is available, top-down forecasts for broad customer groups – households, commercial offices and shops and other industrial, mining and agricultural activities for example – can also be developed.

4.6 Top-down forecasts in effect average out the actions of individual customers. However, where the market for electricity is fairly small, or there is a need to identify local impacts, as in network planning for example, a bottom-up approach that takes account of the expected consumption of large individual sources of demand, such as new mining projects for example, may also add value.

The Commission's approach

4.7 For this year's Review, the Commission sought assessments of medium and longer term conditions from agencies within the NT Government with the relevant responsibilities and expertise in economic and demographic forecasting. The Commission requested and received assessments of the Territory's economic and

demographic outlook from both NT Treasury (NTT) and the Department of Business, Economic and Regional Development (DBERD). The Commission has used this information, in conjunction with Access Economics' *Business Outlook* (September 2006), in the development of its electricity demand forecasts.

4.8 For the medium term 2006-07 to 2009-10, the Commission has identified a baseline rate of electricity consumption and peak demand growth. New projects that have a high likelihood of proceeding and a significant impact on electricity demand have been added to the baseline forecast.

4.9 For the longer term period from 2010-11 to 2015-16, the Commission has developed high and low growth scenarios. These focus on the aggregate growth in demand and energy. Due to the uncertainty involved, no attempt has been made to separately assess the impact of individual projects over this longer timeframe.

Economic and demographic conditions

4.10 Economic and demographic conditions are a primary driver of electricity demand. As economic activity increases and population levels rise, both the stock of electricity-using equipment and the rate of utilisation increase.

4.11 Conditions in the NT economy are principally influenced by three factors: global economic conditions and their link to resource development and the commodity price cycle, government spending on defence and infrastructure projects, and the performance of the tourist sector in attracting domestic and overseas visitors. If these sectors are doing well they provide a stimulus to employment, incomes and population growth more generally, which in turn flows through to the housing, retail and service sectors.

4.12 The external forecasts received by the Commission indicate a continuation of relatively buoyant economic conditions in the NT over the medium term, although at a lower rate than the strong growth experienced in the last two years. This is primarily due to the continued boom in resource and related engineering construction works, which in turn is boosting population and employment growth.

4.13 Access Economics reports that:

> *…the recent completion of some big ticket projects suggests that recent momentum in everything from job gains to housing prices may soon slow (in both cases from absolutely roistering rates of growth).*
>
> *Yet the Territory has great long term growth prospects as an economy. Short term volatility as megaprojects end and start is merely part and parcel of being a small jurisdiction subject to the whims of the world economy and of the $A.*
>
> *The Territory's economy has a good head of steam.... But the Territory may be hard pressed to keep generating the growth it has managed of late.*[4]

4.14 DBERD agrees with Access Economics' view, commenting that:

> *The economy is maturing with an increasing proportion of private sector investment and will continue to be driven by the resources boom and population growth…*
>
> *The longer term forecast for the Northern Territory economy remains robust. The key factor as we move ahead is the length of the resources boom driven by the strength of the global, and particularly the Chinese economy. Current indications are that while production increases will mean the end of large commodity price rises, underlying demand will sustain current price levels'.*[5]

[4] Access Economics, Business Outlook, September 2006, pp. 110-113.
[5] DBERD, 2006 Power System Review Submission.

4.15 In summary, the medium term economic outlook remains relatively upbeat for the NT, although at lower levels of growth than the last two years, as the forecasts in Table 4.1 illustrate. [6]

Table 4.1 – Medium Term Economic and Demographic Variables
Northern Territory – Access Economics and NT Treasury Forecasts
(percentage changes)

	2006-07		2007-08		2008-09		2009-10	
	Access	**NTT**	**Access**	**NTT**	**Access**	**NTT**	**Access**	**NTT**
Real gross state product	8.3	6.2	5.0	3.7	5.8	3.7	4.2	3.7
Real final demand	1.9	-5.0	5.4	4.5	5.4	4.5	4.4	4.5
Employment	5.4	5.0	2.5	2.4	3.4	2.4	3.4	2.4
Population	1.7	1.7	1.7	1.5	1.7	1.5	1.7	1.5

Source: Access Economics, Northern Territory Treasury

4.16 The indicative economic and demographic forecasts adopted reflect this broad consensus. Table 4.2 summarises the growth outlook used by the Commission in preparing its forecasts of electricity demand for the medium term period from 2006-07 to 2009-10.

Table 4.2 – Indicative Medium Term Economic and Demographic Forecasts
Northern Territory, 2006-07 to 2009-10
(average annual percentage changes)

Real gross state product	4.5
Real final demand	3.5
Employment	2.5
Population	1.5

4.17 For the period 2010-11 to 2015-16, the Commission asked DBERD and Treasury to consider what might realistically be achievable for the Territory if the impetus to growth from resource development, tourism and other factors was to be sustained on the one hand, or substantially reduced on the other hand. The resulting high growth and low growth scenarios are presented in Table 4.3.

Table 4.3 – Longer Term Economic and Demographic Variables
Northern Territory – DBERD and NT Treasury Forecasts
(average annual percentage changes)

	Low Growth Scenario		High Growth Scenario	
	DBERD	**NTT**	**DBERD**	**NTT**
Real gross state product	2.0	2.7	4.0	4.7
Real final demand	2.0	3.5	4.0	5.5
Employment	2.0	1.4	4.0	3.4
Population	1.0	0.0	2.0	2.4

Source: NT Department of Business, Economic and Regional Development, NT Treasury

4.18 Taking into account the views of DBERD and Treasury, the Commission has developed indicative high and low growth scenarios. Table 4.4 summarises the growth

[6] DBERD nominated the forecasts prepared by Access Economics as a suitable quantitative expression of their medium term outlook.

outlook used by the Commission in preparing its forecasts of electricity demand for the period 2010-11 to 2015-16.

Table 4.4 – Indicative Longer Term Economic and Demographic Forecasts Northern Territory, 2010-11 to 2015-16 (average annual percentage changes)

	Low Growth Scenario	High Growth Scenario
Real gross state product	2.0	4.5
Real final demand	2.0	3.5
Employment	1.0	3.0
Population	0.5	2.0

Other electricity demand influences

4.19 Electricity demand is also influenced by *energy intensity* (the rate at which electricity demand varies relative to the rate of general economic activity) and *relative prices* (the impact of changes in the price of electricity relative to the price of competing sources of energy and energy services).

4.20 Consistent with the approach taken in last year's Review, the Commission has made the assumption that both the intensity of electricity consumption and the intensity of peak demand will maintain a neutral influence on the growth in consumption and peak demand over the medium term.[7]

4.21 In relation to relative prices, the Commission has again made the assumption that price changes will exert a marginally negative influence on electricity consumption and demand over the medium term.[8]

Electricity forecasts 2006-07 to 2009-10

4.22 Similar to last year, the picture that emerges from the Commission's medium term analysis is of an electricity market supported by a relatively strong and vibrant local economy, with solid employment and population growth, no discernable trends suggesting a marked change in the intensity of electricity consumption or peak demand, but the prospect of price increases applying some negative pressure on consumption and demand at the margin.

4.23 This overall picture requires translating into forecasts of electricity consumption and peak demand for each of the three regulated networks – Darwin-Katherine, Alice Springs and Tennant Creek.

4.24 The Commission has used a log regression analysis to investigate the extent of the relationship between the selected economic and demographic variables and electricity consumption. The results indicate that a fairly close relationship exists between both employment and population and electricity consumption in the NT. Appendix B describes the Commission's methodology and results of the regression analysis in more detail.

4.25 The Darwin-Katherine region is expected to be the primary location and beneficiary of the relatively buoyant economic and demographic conditions forecast for the next few years. Accordingly, the Darwin-Katherine system is expected to record the highest rates of consumption and peak demand growth.

[7] For a more detailed discussion, please refer to the Utilities Commission's Power System Review, December 2005, pp. 39-40

[8] Utilities Commission, Power System Review, December 2005, pp. 40-41

4.26 Based on forecast output, employment and population growth averaging around 4.5%, 2.5% and 1.5% respectively, baseline growth in electricity consumption and peak demand in the Darwin-Katherine system are forecast to average 3% per annum.

4.27 The regression analysis undertaken by the Commission identifies an implied "elasticity" of the growth in electricity consumption with regard to population growth and employment growth of approximately 2.4 and 1.5 respectively. In the context of 1.5% population growth and 2.5% employment growth these elasticity measures give support to electricity demand baseline growth of approximately 4%. The Commission has selected a relatively conservative figure in order to allow a margin for the inclusion of specific project data.

4.28 In addition to the baseline forecast, the demand that arises from major projects also plays a role. In its submission, Power and Water provided a list of possible projects that could add to demand on the Darwin-Katherine system over the medium term. Two committed projects with a large demand impact have been identified by the Commission for inclusion in the electricity consumption and peak demand forecasts. These projects are the Compass Browns Oxide Project and the Burnside Union Reef Mine (both commencing in 2006-07, with an expected aggregate demand of approximately 15MW).[9] Remaining projects identified by Power and Water are assumed to be incorporated in the baseline demand, either because of their relatively small impact on demand or their uncertain status.

4.29 In summary, the Commission has projected growth in baseline demand of 3% for Darwin–Katherine, to which is added expected demand from the two major projects identified above. This results in an average annual compound rate of growth of 4.4% in peak demand. [10]

4.30 Economic and demographic conditions are expected to record marginally lower rates of growth in Alice Springs and Tennant Creek. Accordingly, electricity consumption and peak demand in these systems are forecast to grow at rates averaging 2.5% and 1.5% respectively. No major projects have been identified that impact on the Alice Springs and Tennant Creek systems.

4.31 Table 4.5 summarises the Commission's medium term electricity consumption and peak demand growth rates.

Table 4.5 – Electricity Consumption and Peak Demand Growth Rates
Northern Territory, 2006-07 to 2009-10
(average annual percentage changes)

Darwin-Katherine	3% plus 06-07 major projects (4.4% pa compound growth rate)
Alice Springs	2.5%
Tennant Creek	1.5%

4.32 Table 4.6 presents the Commission's medium term forecasts of electricity consumption and demand.

[9] Power and Water have advised the Commission that the Compass Browns Oxide Project will now commence in 2007-08, not 2006-07 as previously advised in Power and Water's 2006 Power System Review Submission. (Letter dated 14 December 2006.) This only impacts the Commission's electricity demand forecast for Darwin-Katherine in 2006-07.

[10] Because project start-up is assumed to occur mid-year, full-year energy consumption by the projects in question will not be achieved until 2007-08, resulting in a slightly different growth profile between peak demand and electricity consumption (and generation, and hence Power and Water's gas requirement).

Table 4.6 – Peak Demand and Energy
Actual and Forecast to 2009-10 – Regulated Systems

	Darwin-Katherine		Alice Springs		Tennant Creek	
Financial Year	Demand (MW)	Energy (GWh)	Demand (MW)	Energy (GWh)	Demand (MW)	Energy (GWh)
2000-01	218	1291	44	205	6	27
2001-02	223	1357	43	210	7	31
2002-03	233	1253	48	220	8	33
2003-04	227	1242	49	223	7	30
2004-05	234	1273	53	229	7	31
2005-06	236	1289	53	236	7	29
2006-07	258	1366	54	242	7	30
2007-08	265	1446	55	248	7	30
2008-09	273	1490	57	254	7	30
2009-10	281	1534	58	261	7	31

Longer term demand scenarios

4.33 For the remaining six years of the period under review the Commission has applied high and low growth demand scenarios.

4.34 A broad analysis by the Commission of consumption in the Darwin-Katherine region indicates a longer-term average annual growth rate of approximately 4% (over the period from 1991-92). While rates of growth in recent years have been significantly lower than the longer-term average, the Commission has used this average to develop a higher demand growth scenario, in which peak demand and energy use increase at an annual rate of 4%. For Alice Springs and Tennant Creek, the higher demand growth scenario assumes average annual growth in peak demand and energy use of 3.5% and 3% respectively.

4.35 For the low demand growth scenario, the Commission has adopted annual rates of growth in electricity consumption and peak demand for the period 2010-11 to 2015-16 of 2% for Darwin-Katherine, 1.5% for Alice Springs and 0% for Tennant Creek.

4.36 The statistical relationships between electricity consumption, population and employment referred to earlier may be used as a cross-check. Applying the derived elasticities to the high and low projections for population and employment reported in Table 4.4 suggests growth in electricity consumption of approximately 4.5% and 2.5% in the high and low scenarios respectively. The Commission's decision to err on the conservative side of these figures in selecting its growth rates reflects its judgement, firstly, that sustained growth in electricity consumption over the next 10 years in excess of 4% a year (combining the medium term outlook and high growth scenario) is unlikely to be achieved, even when taking a favourable view on economic conditions, and secondly, that the cyclical nature of resource development carries the potential for a significant pull-back in economic conditions beyond the present upswing.

4.37 Table 4.7 summarises the Commission's longer term electricity consumption and peak demand growth rates under both the high and low growth scenarios.

Table 4.7 – Longer Term Electricity Consumption and Peak Demand Growth Rates
2010-11 to 2015-16 (average annual percentage changes)

	Low Growth Scenario	High Growth Scenario
Darwin-Katherine	2.0	4.0
Alice Springs	1.5	3.5
Tennant Creek	0.0	3.0

4.38 Table 4.8 presents the resulting longer term forecasts of electricity consumption and demand under the Commission's high growth scenario.

Table 4.8 – Peak Demand and Energy Consumption
High Growth Scenario – Regulated Systems

	Darwin-Katherine		Alice Springs		Tennant Creek	
Financial Year	Demand (MW)	Energy (GWh)	Demand (MW)	Energy (GWh)	Demand (MW)	Energy (GWh)
2000-01	218	1291	44	205	6	27
2001-02	223	1357	43	210	7	31
2002-03	233	1253	48	220	8	33
2003-04	227	1242	49	223	7	30
2004-05	234	1273	53	229	7	31
2005-06	236	1289	53	236	7	29
2006-07	258	1366	54	242	7	30
2007-08	265	1446	55	248	7	30
2008-09	273	1490	57	254	7	30
2009-10	281	1534	58	261	7	31
2010-11	293	1596	60	270	7	32
2011-12	304	1660	62	279	8	33
2012-13	317	1726	64	289	8	34
2013-14	329	1795	67	299	8	35
2014-15	342	1867	69	310	8	36
2015-16	356	1942	71	321	9	37

4.39 Table 4.9 presents the resulting longer term forecasts of electricity consumption and demand under the Commission's low growth scenario.

Table 4.9 – Peak Demand and Energy Consumption
Low Growth Scenario – Regulated Systems

	Darwin-Katherine		Alice Springs		Tennant Creek	
Financial Year	Demand (MW)	Energy (GWh)	Demand (MW)	Energy (GWh)	Demand (MW)	Energy (GWh)
2000-01	218	1291	44	205	6	27
2001-02	223	1357	43	210	7	31
2002-03	233	1253	48	220	8	33
2003-04	227	1242	49	223	7	30
2004-05	234	1273	53	229	7	31
2005-06	236	1289	53	236	7	29
2006-07	258	1366	54	242	7	30
2007-08	265	1446	55	248	7	30
2008-09	273	1490	57	254	7	30
2009-10	281	1534	58	261	7	31
2010-11	287	1565	59	265	7	31
2011-12	293	1596	60	269	7	31
2012-13	299	1628	61	273	7	31
2013-14	305	1661	62	277	7	31
2014-15	311	1694	63	281	7	31
2015-16	317	1728	64	285	7	31

CHAPTER

5

ADEQUACY OF GENERATION CAPACITY

5.1 This chapter first outlines the generation capacity available in the Territory's regulated power systems. Against the background of the demand forecasts canvassed in the previous chapter, the prospective supply-demand position in the Territory's power system is then examined.

Existing capacity

5.2 Supply of electricity in the NT's regulated power systems is predominantly provided by Power and Water, either from its own sources or under the terms of power purchase agreements it has with a number of Independent Power Producers (IPPs). At the regional level, about 80% of all generation capacity in the Territory's regulated networks is installed in the Darwin-Katherine system, with the bulk of this capacity located at the Channel Island Power Station. The remaining 20% of generation capacity is installed in the Alice Springs and Tennant Creek regulated systems.

5.3 The Territory's generation facilities, consisting mainly of gas and liquid fuel driven turbines, are summarised in Table 5.1. Three indicators of 'supply capacity' are provided:

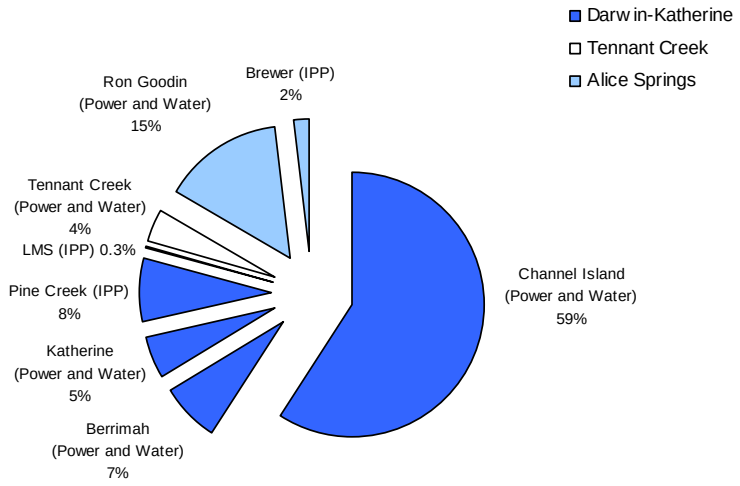
- total capacity (in MW);
- N-1 capacity (in MW), which indicates the generation capacity excluding the largest generating set in a particular system; and
- N-2 capacity (in MW), which indicates the generation capacity excluding the two largest generating sets in a particular system.

Table 5.1 – Power Facilities in Regulated Systems
30 June 2006

Region / Power station	Operator	Capacity (MW)	% of Total	Capacity at N-1	Capacity at N-2
Darwin-Katherine Regulated System:					
Channel Island	P&W	253.7			
Berrimah	P&W	30.0			
Katherine	P&W	21.3			
Pine Creek	IPP	34.1			
LMS Shoal Bay	IPP	1.1			
Total		**340.2**	**79%**	**292.2**	**244.2**
Tennant Creek Regulated System:					
Tennant Creek	P&W	16.7			
Total		**16.7**	**4%**	**12.8**	**10.8**
Alice Springs Regulated System:					
Ron Goodin	P&W	62.6			
Brewer	IPP	8.5			
Total		**71.1**	**17%**	**59.4**	**49.3**
Total Capacity in Regulated Systems		**428.0**	**100%**		

5.4 Power and Water has power purchase agreements with three IPPs which operate in regulated systems: Energy Developments Ltd subsidiary NGD (NT) Pty Ltd (Pine Creek Power), Landfill Management Services Pty Ltd (LMS Shoal Bay) and Central Energy Power Pty Ltd (Brewer). Overall, about 44MW of capacity is currently available from these IPPs.

Chart 5.1 – Regulated System Power Station Capacities



5.5 Power and Water is also responsible for the provision of power services to remote indigenous communities and townships that are not connected to the regulated power system. Some of these areas include Yulara, Borroloola, Timber Creek, Daly Waters, Newcastle Waters, Elliot, Ti-Tree and Kings Canyon. The generation capacity associated with these rural areas has not been included in system supply (for the purposes of this review) and is consistent with the treatment of associated demand in Chapter 4.

Changes to capacity during 2005-06

5.6 During the last year, Power and Water entered into an agreement with Land Management Services Pty Ltd (LMS) to provide 1.1MW of capacity. LMS generate electricity using landfill gases at the Shoal Bay Waste Depot. As a result, capacity on the Darwin-Katherine system increased to 340.2 MW.

5.7 The retirement of 2MW of capacity and the transfer of a 3.9MW unit to Tennant Creek reduced capacity on the Alice Springs system to 71.1MW.

5.8 Capacity at Tennant Creek increased to 16.7MW following the transfer of a 3.9MW unit from Alice Springs.

Baseline capacity projections

5.9 In developing its baseline capacity projections, the Commission has taken the approach of including only those additions to capacity that are considered to be firm – either because they have been publicly announced as committed and proceeding or are clearly scheduled for near term action. Retirements included in the baseline capacity projections are as advised by Power and Water.

5.10 This method is comparable with the approach taken by NEMMCO in developing its annual *Statement of Opportunities*. It has the advantage of avoiding assessments of the likelihood of uncommitted projects proceeding.

5.11 Given the current structure of the NT power market, it is likely that Power and Water is the only party actively planning to invest in new capacity. If the Commission were to include Power and Water's long-term plans in the analysis, it may inadvertently create the impression that additions to capacity are reserved for Power and Water.

5.12 This is not the case. The NT power market is open to investment from any source that meets the licence criteria. The Commission makes no assumption as to who will build the required new capacity indicated by its analysis. The Commission's role is to provide information to all interested parties on the prospective supply-demand balance, to facilitate efficient investment from whatever source and to support the development of a competitive market.

5.13 In some cases, in the years that Power and Water have nominated capacity retirements, these are linked to planned capacity additions to address the resultant shortfall. However, where these planned capacity additions are not 'firm', they have been excluded from the Commission's analysis. The Commission recognises that, in practice, the timing of the capacity retirements will be influenced by the availability of replacement capacity.

5.14 Tables 5.2 to 5.4 contain the Commission's baseline capacity projections.

Table 5.2 – Darwin-Katherine Baseline Capacity Projection (MW)

Financial Year	Retire-ments	New Capacity	Total Capacity	N-1	N-2
2006-07			340.2	292.2	244.2
2007-08		35.0	375.2	327.2	279.2
2008-09	(7.5)		367.7	319.7	271.7
2009-10			367.7	319.7	271.7
2010-11		35.0	402.7	354.7	306.7
2011-12			402.7	354.7	306.7
2012-13			402.7	354.7	306.7
2013-14			402.7	354.7	306.7
2014-15			402.7	354.7	306.7
2015-16			402.7	354.7	306.7

5.15 In September 2006, Power and Water announced its plans for the development of a new power station for the Darwin-Katherine region. The new Weddell Power Station will be located close to the Channel Island Power Station to utilise existing gas pipeline and water infrastructure. As tenders have been called for the supply of equipment for both units, the Commission has included them in its analysis. As a consequence, Darwin-Katherine capacity increases by 35MW in 2007-08 and by a further 35MW in 2010-11. In 2008-09, capacity is reduced by 7.5MW due to the expiry of the Pine Creek B power purchase agreement.[11]

[11] Power and Water has advised that it has the provision to extend the Pine Creek B power purchase agreement, should it be required (Letter dated 14 December 2006).

Table 5.3 – Alice Springs Baseline Capacity Projection (MW)

Financial Year	Retire-ments	New Capacity	Total Capacity	N-1	N-2
2006-07			71.1	59.4	49.3
2007-08			71.1	59.4	49.3
2008-09	(1.9)		69.2	57.5	47.4
2009-10			69.2	57.5	47.4
2010-11			69.2	57.5	47.4
2011-12			69.2	57.5	47.4
2012-13	(4.2)		65.0	53.3	43.2
2013-14			65.0	53.3	43.2
2014-15			65.0	53.3	43.2
2015-16	(4.2)		60.8	49.1	39.0

5.16 Capacity changes at Alice Springs reflect the retirement of a 1.9MW unit in 2008-09, the retirement of a 4.2MW unit in 2012-13 and the retirement of a 4.2MW unit in 2015-16.

Table 5.4 – Tennant Creek Baseline Capacity Projection (MW)

Financial Year	Retire-ments	New Capacity	Total Capacity	N-1	N-2
2006-07			16.7	12.8	10.8
2007-08	(6.5)	3.0	13.2	9.3	7.3
2008-09			13.2	9.3	7.3
2009-10			13.2	9.3	7.3
2010-11			13.2	9.3	7.3
2011-12			13.2	9.3	7.3
2012-13			13.2	9.3	7.3
2013-14			13.2	9.3	7.3
2014-15			13.2	9.3	7.3
2015-16			13.2	9.3	7.3

5.17 Capacity at Tennant Creek is initially expanded by the installation of two 1.5MW units, and reduced by the retirement of 6.5MW of capacity in 2007-08.[12]

Indicators of system adequacy

5.18 As discussed in Chapter 3, the Commission is awaiting the outcome of Treasury's review of current electricity sector arrangements before further considering its 2005 Review conclusion that reliability criteria for the NT system should be made explicit on the advice of an appropriately constituted expert advisory body, and that these criteria should be used in future reviews of system adequacy. Accordingly, in the absence of formal criteria, the Commission has again reported against both the N-1 and N-2 standard.

[12] Subsequent to Power and Water's submission to the Commission, Power and Water have advised that the two 1.5MW units will now be commissioned in 2006-07, not 2007-08 as previously advised. (Letter dated 14 December 2006.) This only impacts the supply-demand balance for Tennant Creek in 2006-07.

5.19 The N-1 standard allows for the loss of the largest single unit of capacity. The N-2 standard is more stringent as it allows for the loss of the two largest units of capacity.

Supply-demand balance in the medium term

5.20 In the following sections, supply-demand conditions are examined for each of the regulated systems for the period 2006-07 to 2009-10.

Darwin-Katherine regulated system

5.21 Table 5.5 indicates the reserve position of the Darwin-Katherine system at the N-1 standard and N-2 standard based on the Commission's medium-term forecast of demand and its baseline capacity projection.

Table 5.5 – Medium Term Supply-Demand Balance Forecast
Darwin-Katherine
(MW)

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2006-07	340.2	292.2	244.2	258	35	-13
2007-08	375.2	327.2	279.2	265	62	14
2008-09	367.7	319.7	271.7	273	47	-1
2009-10	367.7	319.7	271.7	281	38	-10

5.22 At N-1, capacity is adequate through to 2009-10, with each year's margin over N-1 at least 35MW. This assessment is subject to the qualification that the availability of the first unit at Weddell will be as currently advised by Power and Water (35MW in 2007-08).

5.23 The picture at N-2 is quite different. Capacity is below the standard for each year, with the exception of 2007-08 when capacity is adequate but still tight. If N-2 is the appropriate reserve criteria for the Darwin-Katherine system then, on the basis of the Commission's forecast of demand, additional capacity beyond that already committed will be required in the medium term.

Alice Springs regulated system

5.24 Table 5.6 indicates the reserve position of the Alice Springs system at N-1 and N-2.

Table 5.6 – Medium Term Supply-Demand Balance Forecast
Alice Springs
(MW)

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2006-07	71.1	59.4	49.3	54	6	-5
2007-08	71.1	59.4	49.3	55	4	-6
2008-09	69.2	57.5	47.4	57	1	-9
2009-10	69.2	57.5	47.4	58	-1	-11

5.25 At N-1, reserve conditions are adequate at the beginning of the period. However, the margin is fully eroded by 2009-10, indicating that additional capacity is required prior to 2009-10 in order to satisfy the N-1 reserve standard.

5.26 Based on the Commission's forecasts of demand, the reserve margin on the Alice Springs system does not meet the N-2 standard at any time over the 2006-07 to 2009-10 period.

Tennant Creek regulated system

5.27 Table 5.7 indicates the reserve position of the Tennant Creek system at N-1 and N-2.

Table 5.7 – Medium Term Supply-Demand Balance Forecast
Tennant Creek
(MW)

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2006-07	16.7	12.8	10.8	7	6	4
2007-08	13.2	9.3	7.3	7	2	0
2008-09	13.2	9.3	7.3	7	2	0
2009-10	13.2	9.3	7.3	7	2	0

5.28 At N-1, capacity remains adequate but tight over the medium-term period. To meet the N-2 standard, additional capacity will be required prior to 2007-08.

Supply-demand balance in the longer term

5.29 Comparisons of longer-term demand forecasts with baseline capacity projections allow estimates to be made of the total additions to capacity that will be required for the period in question. Because the baseline capacity projections do not include assumptions regarding future capacity investments that may be expected to occur, the comparison does not reflect the actual supply-demand balance that is expected to develop as we move closer to the years in question.

5.30 For each of the three regions, the Commission has compared high and low growth demand scenarios for the period 2010-11 to 2015-16 with its baseline projections of capacity.

Darwin-Katherine regulated system

5.31 Table 5.8 indicates that, if demand increased at an average rate of 4% per annum over the 2010-11 to 2015-16 period, the N-1 standard is met for most of the period, with conditions tightening in 2015-16. Approximately 50MW of additional capacity would be required to satisfy the N-2 standard over the period.

5.32 As with the supply-demand balance in the medium term, these results are dependent on the second unit at Weddell becoming available at the time advised by Power and Water (35MW in 2010-11).

Table 5.8 – Longer Term Supply-Demand Balance
High Growth Scenario
Darwin-Katherine
(MW)

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2010-11	402.7	354.7	306.7	293	62	14
2011-12	402.7	354.7	306.7	304	50	2
2012-13	402.7	354.7	306.7	317	38	-10
2013-14	402.7	354.7	306.7	329	26	-23
2014-15	402.7	354.7	306.7	342	12	-36
2015-16	402.7	354.7	306.7	356	-1	-49

Table 5.9 – Longer Term Supply-Demand Balance
Low Growth Scenario
Darwin-Katherine
(MW)

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2010-11	402.7	354.7	306.7	287	68	20
2011-12	402.7	354.7	306.7	293	62	14
2012-13	402.7	354.7	306.7	299	56	8
2013-14	402.7	354.7	306.7	305	50	2
2014-15	402.7	354.7	306.7	311	44	-4
2015-16	402.7	354.7	306.7	317	38	-10

5.33 Alternatively, as indicated by Table 5.9, if demand increased by an average of only 2% per annum, the N-1 standard is comfortably met for the entire period, and the additional capacity required by 2015-16 to meet the N-2 standard falls to 10MW.

Alice Springs regulated system

5.34 Tables 5.10 and 5.11 present the comparable analysis for the Alice Springs system.

5.35 Demand growth in the longer term of 3.5% per annum creates a requirement for 22MW of additional capacity by 2015-16 to meet the N-1 standard and 32MW of additional capacity to meet the N-2 standard.

Table 5.10 – Longer Term Supply-Demand Balance
High Growth Scenario
Alice Springs
(MW)

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2010-11	69.2	57.5	47.4	60	-3	-13
2011-12	69.2	57.5	47.4	62	-5	-15
2012-13	65.0	53.3	43.2	64	-11	-21
2013-14	65.0	53.3	43.2	67	-13	-23
2014-15	65.0	53.3	43.2	69	-16	-26
2015-16	60.8	49.1	39.0	71	-22	-32

Table 5.11 – Longer Term Supply-Demand Balance
Low Growth Scenario
Alice Springs
(MW)

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2010-11	69.2	57.5	47.4	59	-1	-12
2011-12	69.2	57.5	47.4	60	-2	-12
2012-13	65.0	53.3	43.2	61	-7	-18
2013-14	65.0	53.3	43.2	62	-8	-18
2014-15	65.0	53.3	43.2	63	-9	-19
2015-16	60.8	49.1	39.0	64	-14	-25

5.36 Alternatively, as indicated by Table 5.11, if demand growth averages only 1.5% per annum, the requirement for additional capacity falls to 14MW and 25MW respectively to meet the N-1 and N-2 reserve standards.

Tennant Creek regulated system

5.37 Tables 5.12 and 5.13 present the comparable analysis for Tennant Creek.

5.38 The projected baseline capacity is sufficient to meet the N-1 reserve standard under both the low and high demand growth scenarios.

5.39 The N-2 reserve standard is satisfied under the high demand growth scenario by the addition of 1MW of capacity. The projected baseline capacity is sufficient to meet the N-2 reserve standard under the low demand growth scenario.

Table 5.12 – Longer Term Supply-Demand Balance
High Growth Scenario
Tennant Creek
(MW)

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2010-11	13.2	9.3	7.3	7	2	0
2011-12	13.2	9.3	7.3	8	2	0
2012-13	13.2	9.3	7.3	8	2	-1
2013-14	13.2	9.3	7.3	8	1	-1
2014-15	13.2	9.3	7.3	8	1	-1
2015-16	13.2	9.3	7.3	9	1	-1

Table 5.13 – Longer Term Supply-Demand Balance
Low Growth Scenario
Tennant Creek
(MW)

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2010-11	13.2	9.3	7.3	7	2	0
2011-12	13.2	9.3	7.3	7	2	0
2012-13	13.2	9.3	7.3	7	2	0
2013-14	13.2	9.3	7.3	7	2	0
2014-15	13.2	9.3	7.3	7	2	0
2015-16	13.2	9.3	7.3	7	2	0

CHAPTER

6

ADEQUACY OF GAS SUPPLIES

6.1 In the Territory context, system *adequacy* concerns can also arise if there is insufficient gas available to generate the expected level of electricity required. This chapter addresses this issue.[13]

Natural gas supply

6.2 Over 99% of electricity in the Territory's regulated system is generated from natural gas-fuelled plant through direct powering of gas turbines and reciprocating engines and the production of steam through the recovery of waste heat from the gas turbines.

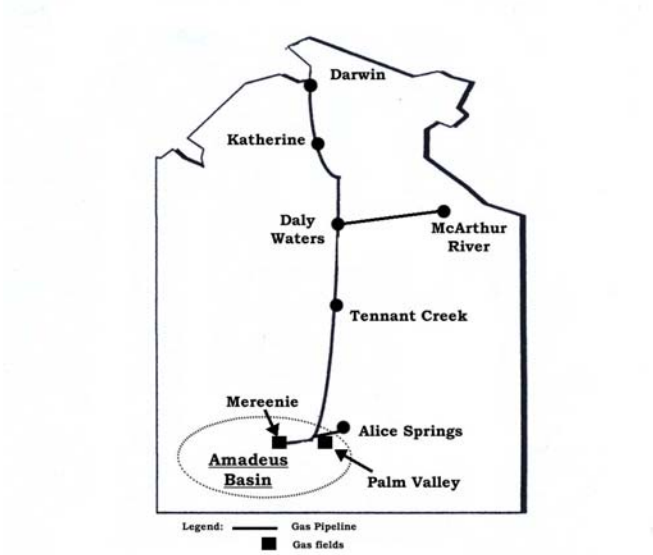
6.3 These plants are serviced by two gas fields in the Amadeus Basin: the Palm Valley field operated by Magellan Petroleum Australia Ltd and the Mereenie field operated by Santos Ltd. Each operator has significant interest in both fields. The location of these gas fields is shown in Chart 6.1.

6.4 In 1983, Power and Water entered into an agreement with the operator of the Palm Valley field to supply gas to Alice Springs primarily for electricity generation.

6.5 In 1985, the Power and Water subsidiary Gasgo contracted to purchase gas totalling 200 petajoules (PJ) over the period to 2012 from the Palm Valley field to fuel electricity generation in the Darwin-Katherine region. In the same year, Gasgo also entered into a gas purchase agreement with the operator of the Mereenie field for the supply of 66PJ over the period to 2009. Since that time, natural gas has been the major fuel source for electricity generation in the Territory.

[13] The 2002 Review addressed system *security* issues associated with fuel, finding that the gas supply system and the back-up liquid fuel supplies have proven reliable over the past 15 years and electricity supply has not been interrupted through a fuel-related contingency. The Commission indicated that it was comfortable that the levels of liquid fuel storage maintained by Power and Water and the scope for pipeline line pack should together continue to allow the maintenance of electricity supply during short-term interruptions to gas production or transportation. For this reason, the Commission has not had the need to review the matter of system security since the 2002 Review.

Chart 6.1 – Location of Amadeus Basin Gas Fields

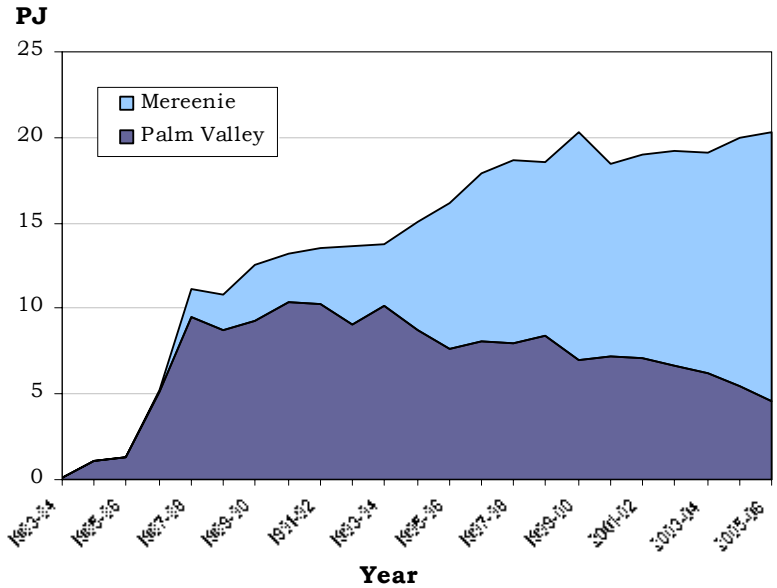


6.6 The Palm Valley field has not met original expectations and, although Gasgo has funded substantial development work as required by the gas purchase agreement, the operator has downgraded the resource (including forecast cumulative production) to approximately 50% of the original reserves figure.

6.7 The poor performance of the Palm Valley field and greater than expected energy demand resulted in two other contracts being established for the purchase of 113PJ of Mereenie gas over the period to 2009.

6.8 Chart 6.2 illustrates the declining production of the Palm Valley field and the increasing reliance upon the Mereenie field over recent years.

Chart 6.2 – Gas Sales
1983-84 to 2005-06



6.9 The Gasgo contracts for the supply of gas from Mereenie expire in 2009. Gas volumes permitting, the Palm Valley contract expires in 2012.

Gas supply-demand in the medium term

6.10 In the 2005 Review, the Commission reported that:

> *As a result of a 4.6% increase in Power and Water's gas requirement and a further decline in Palm Valley production, Power and Water used the maximum amount of gas allowed for the year under its Mereenie contracts, together with all of its "banked", or unused gas, from previous years. This has changed the expected supply-demand balance for the remainder of the contract term from approximate balance to deficit.*[14]

6.11 The Commission estimates that Power and Water will require secure supplies of approximately 21PJ of gas in 2006-07, rising to between 23PJ and 24PJ in 2009-10, to meet its gas supply requirements.[15]

6.12 Due to the expected gas supply-demand deficit over the medium term, Gasgo has entered into a new contract with the Mereenie producers (contract MSA4). There are two aspects to this contract:

- the supply of a minimum of 5.2PJ of gas from March 2006 to December 2008; and
- the supply of additional gas from January 2008 to December 2010, if this is required, on a 'reasonable endeavours' basis.

6.13 The new Mereenie contract should ensure that gas volumes available under the Amadeus Basin contracts are adequate to meet Power and Water's gas supply requirements until 2009. However, this is subject to the availability of approximately 1PJ of additional gas above the 5.2PJ minimum allowed by the MSA4 contract.

Gas supply arrangements from 2009

6.14 The Commission estimates that, from 2009 (when the Mereenie contracts expire, with the exception of the gas available on a reasonable endeavours basis under the MSA4), Power and Water will initially require secure supplies of approximately 23PJ of gas a year, rising to between 26PJ and 29PJ by 2015-16.

6.15 On 30 June 2006, Power and Water executed an agreement with Eni Australia B.V. (Eni) for the supply of 740PJ of gas from the Blacktip field. The first supply of gas is targeted to be available for electricity generation on 1 January 2009. Power and Water expects that this arrangement will meet their forecast gas demand for the next 25 years.

6.16 The location of the Blacktip Gas Field is shown in Chart 6.3. Eni will extract the gas from the Blacktip Gas Field, which is located 100km to the west of Wadeye in the Bonaparte Basin. The gas will come onshore to a processing plant near Wadeye, and will then be transported via a new gas pipeline from Wadeye that connects to the existing Amadeus north-south pipeline.

[14] Utilities Commission, Power System Review, December 2005, p.55

[15] For the purposes of this analysis Power and Water is assumed to continue as the sole generator/retailer on the three regulated systems. Power and Water's gas requirement is therefore equivalent to the aggregate regulated system requirement.

Chart 6.3 – Location of Blacktip Gas Field

Source: Power and Water Media Release, 30 June 2006

6.17 Contract quantities available from Blacktip will be in excess of projected requirements under the Commission's high growth scenario through to 2015-16 and beyond. If supply matches contract quantities then it is clear that Blacktip has removed the previous uncertainty regarding gas availability beyond 2009.

6.18 However, it should be acknowledged that development of the Blacktip field, the construction of processing infrastructure at Wadeye and of the connecting pipeline from the wellhead to Wadeye and Wadeye to the existing north-south pipeline is on a fairly tight timetable. If delays are experienced, Power and Water can call on the 'reasonable endeavours' component of MSA4 to make up any gas shortfall. The Commission notes that while, in these circumstances, the MSA4 contract provides the prospect of adequate back-up, the availability of sufficient gas does not appear to be firm as supply is subject to a 'reasonable endeavours' qualification. To this extent, the Commission considers that some uncertainty regarding the security of an adequate gas supply remains. [16]

[16] Power and Water have recently advised the Commission that both the Blacktip field development and connecting pipeline are currently considered to be 'on track' for initial gas delivery as scheduled in January 2009 (Letter dated 14 December 2006).

APPENDIX

A

GLOSSARY

Capacity – The maximum output that a generating unit can provide under specific conditions for a given time period without exceeding temperature and stress limits.

Co-Generation – Involves the capture of exhaust heat (or other useful thermal energy such as steam) from a generating facility that produces electricity, for use in industrial, commercial, heating, or cooling processes.

Demand – The amount of electricity consumed by customers at any given time or over a period of time.

Demand Side Management – The planning, implementation, and monitoring of utility activities designed to encourage consumers to modify patterns of electricity usage, including the timing and level of electricity demand. It refers only to energy and load-shape modifying activities for the purpose of reducing peak load and the need for generating capacity at such times.

Forced Outage – The shutdown of a generating unit, transmission line or other system asset for either emergency reasons or unexpected breakdown.

Gigawatt-hour (GWh) – A measure of electricity consumption in gigawatts for a one-hour continuous period. One gigawatt hour equates to one million kilowatt hours.

Interruptible Load – Load that, in accordance with contractual arrangements, can be interrupted at times of peak load. Load can be disconnected, either manually or automatically, and usually involves commercial and industrial consumers.

Kilowatt-hour (kWh) – The total amount of energy used in one hour by a device that uses one kilowatt of power for continuous operation. Electric energy is commonly sold by the kilowatt-hour, which equates to 1000 watt-hours.

Line Pack – Refers to the gas that is in the pipeline at any given point in time for the purpose of maintaining minimum pipeline operating pressure. Line pack does not increase gas supply availability, but increases short-term deliverability by moving gas from one place on the pipeline to another.

LNG – An abbreviation for liquefied natural gas. LNG consists mainly of methane – the simplest hydrocarbon.

Load – The amount of electricity required to meet demand at any given time.

Load Duration – Indicates the proportion of time that particular levels of demand (expressed as a proportion of the maximum demand for a year) are exceeded.

Load Shedding – Occurs when there is inadequate generation to meet demand resulting in disconnected load. Load shedding protocols enable the System Controller to automatically

disconnect load in order to maintain frequency and voltage and prevent the possible collapse of the system.

Megawatt (MW) – One megawatt equates to one thousand kilowatts.

Megawatt-hour (MWh) – One megawatt-hour equates to one thousand kilowatt-hours. One MWh of electricity can power ten thousand 100-watt light bulbs for one hour.

Network – That part of the power system involved in the transmission and distribution of electricity from generation sources to end-use customers.

Operating Reserves – The generation arrangements required to maintain system security by handling short-term disturbances in the system.

Petajoules (PJ) – A measure of energy in petajoules. One petajoule equates to 1000 terajoules.

Planned Outage – Occurs when a network provider disconnects supply in order to undertake maintenance or capital works on a part of its network.

Planning Reserves – The generation reserves required to maintain system adequacy by meeting annual demand peaks.

Regulated Power System – A system for generating and supplying electricity that is based on an electricity network that is subject to regulation under the *Electricity Networks (Third Party Access) Act 2000*.

Reserve Margin – The reserve level associated with the point at which, given the current demand and supply capabilities of a power system, intervention in the market is required to ensure risks to supply are minimised.

Sent-out Energy – The amount of electricity measured leaving a generator at its connection point to the transmission or distribution network, and therefore does not reflect network losses.

System Adequacy – The power system's ability to supply the aggregate energy requirements of end-use customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements.

System Security – The power system's ability to withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements.

TCF – A measure of the size of a resource in trillion cubic feet. One TCF equates to 930PJ.

Terajoules (TJ) – A measure of energy in terajoules.

APPENDIX

B

REGRESSION ANALYSIS

Econometric methods are commonly used to investigate the relationship between economy-wide economic and demographic variables, such as measures of aggregate output, employment and population, and the level of activity or consumption in a particular sector. If a statistically significant historical relationship can be identified, and the basis for a relationship is supported by logic and economic theory, then it can prove useful in forecasting exercises.

In its Power System Review, the Commission is required to make quantitative estimates of electricity demand in the Territory's three regulated power systems over the coming 10 years. While in practice these will always involve a substantial level of informed judgement, the Commission is keen to build a framework for making these judgements that is as rigorous as possible, given the constraints.

In the Territory context, these constraints are considerable. The Commission's forecasting approach has been to first identify the likely economic and demographic conditions over the period and the principal range of uncertainty, and then consider the implications for electricity demand.

As a small, principally resource-based economy, the Territory is subject to considerable swings in activity. The influence of large projects can make electricity demand particularly volatile. As a result not only are stable relationships between variables less likely, but the standard value-based measures of economic activity in the Territory, such as Gross Product or Final Demand, are difficult to estimate and often erratic.

Following the lead of Power and Water, the Commission attempts to make explicit allowance for the influence of large projects that have a good chance of coming on line. While this is useful in the near term its value rapidly diminishes as the forecasting period is extended. Even in the near term, an estimate is still required of the underlying 'trend' rate of growth, to which the influence of individual projects is added.

To investigate whether a statistical relationship exists that can add value to the forecasting task, the Commission has used regression analysis. To avoid problems with value-based data, NT population and employment were selected as independent variables.[17] Territory electricity consumption was the dependent variable.[18]

The regression was estimated for the 13 years from 1992-93 to 2004-05. Both the dependent and independent variables were converted to natural log form. This has the important advantage of producing coefficients that approximate the relationship between the rates of growth of the dependent and independent variables. In economic terms, this is equivalent to the 'elasticity' of the dependent variable with respect to the independent variable. The data and results are presented in the following tables.

[17] Population and employment data has been sourced from Australian Bureau of Statistics (ABS) catalogues.

[18] Electricity consumption data has been sourced from the Energy Supply Association of Australia (ESAA), *Electricity Australia* publications (1998 and 2005).

Table B1 – NT Regression
Raw Data Inputs

Financial Year	Population	Total Employment (000)	Electricity Consumption (GWh)
1993	170,734	76.6	1,117
1994	173,375	74.9	1,104
1995	177,552	82.6	1,203
1996	181,843	86.8	1,357
1997	186,912	89.9	1,390
1998	189,880	94.5	1,525
1999	192,735	92.3	1,549
2000	195,561	93.4	1,550
2001	197,768	98.4	1,549
2002	198,665	98.3	1,559
2003	198,544	96.2	1,615
2004	199,834	94.3	1,607
2005	202,793	97.9	1,631

Source: Population data - Australian Historical Population Statistics, 2006 (cat. no. 3105.0.65.001)
Employment data - ABS Labour Force, Australia, Spreadsheets, Oct 2006 (cat. no. 6202.0.55.001)
Electricity Consumption data – ESAA, *Electricity Australia 1998* and *Electricity Australia 2005*

Table B2 – NT Regression
Population
Summary of Results (Log_e form)

	R Square	Adjusted R Square	F Statistic
Regression	0.93	0.92	133.1
	Coefficients	**Standard Error**	***t* Statistic**
Intercept	-21.67	2.51	-8.63
X	2.38	0.21	11.53

Table B3 – NT Regression
Total Employment
Summary of Results (Log_e form)

	R Square	Adjusted R Square	F Statistic
Regression	0.92	0.92	121.3
	Coefficients	**Standard Error**	***t* Statistic**
Intercept	0.65	0.60	1.08
X	1.47	0.13	11.01

These results suggest that, on average, a 1 percentage point change in population and total employment will be associated with, approximately, a 2.4 and 1.5 percentage point change, respectively, in electricity consumption.

For comparison, the same regressions were run on Queensland data. Although Queensland is a much larger economy than the NT, it shares some characteristics in terms of the importance of its resource sector, a tropical to sub-tropical climate and a relatively high rate of population growth.

The results, summarized below, suggest a slightly higher level of sensitivity of electricity consumption in Queensland to changes in population and employment, with slightly stronger statistical significance.

Table B4 – Queensland Regression
Population
Summary of Results (Log_e form)

	R Square	Adjusted R Square	F Statistic
Regression	0.97	0.97	358.8
	Coefficients	**Standard Error**	***t* Statistic**
Intercept	-31.67	2.22	-14.24
X	2.79	0.15	18.94

Table B5 – Queensland Regression
Total Employment
Summary of Results (Log_e form)

	R Square	Adjusted R Square	F Statistic
Regression	0.95	0.95	191.6
	Coefficients	**Standard Error**	***t* Statistic**
Intercept	-2.69	0.95	-2.84
X	1.77	0.13	13.84