ANNUAL POWER SYSTEM REVIEW

DECEMBER 2007

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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 17 December 2007.

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 2016-17. 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 NT's power system;
- advise the Minister on matters relating to the future capacity and reliability of the NT'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 NT's power system relative to projected load growth.

1.3 In 2005, 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 NT, 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 does not address the management of power system planning and reliability in the NT, but instead 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 2007 Power System Review focuses principally on the adequacy of generation capacity and gas supplies over the medium term to 2010-11, and the longer term to 2016-17.

Power system planning and reliability

2.2 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.

2.3 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.

2.4 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.

2.5 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 understands these matters are under review, as part of the Government's ongoing consideration of the merits of joining the national regulatory regime.

2.6 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[1], in the absence of formal reliability criteria for the NT system made explicit on the advice of an appropriately constituted expert advisory body.

2.7 The Commission notes that the Power and Water Corporation has recently adopted the N-2 generation planning standard, as part of an increased focus on power system planning and reliability issues. This has resulted in the timeframes for additions to generation capacity being brought forward in certain instances.

[1] The N-1 generation planning standard provides an indication as to whether the generation capacity in a particular system is adequate to meet forecast peak demand with the largest generation unit out of service. The N-2 standard indicates whether generation capacity is adequate to meet forecast peak demand with the two largest generation units out of service.

Generation capacity in the medium term

2.8 The Commission has assessed the 'adequacy' of generation capacity over the 2007-08 to 2010-11 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

2.9 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.

2.10 Economic and demographic conditions in the NT are currently strong and the outlook remains robust over the medium term, although at lower levels of growth than the last three years. For the Territory as a whole, output, employment and total population are forecast to record average growth rates of 4%, 2% and 1.5% respectively per annum.

2.11 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 BOC Helium Plant increases the forecast growth in demand and consumption to an average of 3.9% per annum. Consumption and peak demand are forecast to increase by an average of 2% in the Alice Springs system and 1% in the Tennant Creek system.

Capacity projections

2.12 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.

2.13 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.

2.14 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

2.15 For the Darwin-Katherine regulated system, demand is comfortably met for the entire period at both the N-1 and N-2 standards. This assessment is subject to the qualification that the availability of the first two units at Weddell will be as currently advised by Power and Water (40MW in 2007-08 and 40MW in 2008-09).

Alice Springs regulated system

2.16 The assessment of capacity adequacy for the Alice Springs system over the medium term depends on the reserve standard that is applied.

2.17 At N-1, reserve conditions are adequate over the medium term period. However, based on the Commission's demand forecasts, additional capacity is required in this financial year in order to satisfy the N-2 reserve standard.

Tennant Creek regulated system

2.18 At both the N-1 and N-2 reserve standards, capacity in Tennant Creek remains adequate but tight over the medium term period.

Generation capacity in the longer term

2.19 For the period 2011-12 to 2016-17, the Commission has assessed the requirement for new capacity by comparing its baseline capacity projection with high and low growth demand scenarios.

2.20 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.

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

Darwin-Katherine regulated system

2.22 Under the high demand growth scenario, the N-1 standard is met for most of the period. However, the reserve margin is almost fully eroded by 2015-16, indicating that additional capacity is required prior to 2015-16 in order to satisfy the N-1 reserve standard. Approximately 60MW of additional capacity is required to satisfy the N-2 standard over the period

2.23 Under the low demand growth scenario, the N-1 standard is comfortably met for the entire period, and the additional capacity required to meet the N-2 standard falls to 19MW.

Alice Springs regulated system

2.24 In the Alice Springs system, under the high demand growth scenario, capacity is adequate but tight at the N-1 reserve standard for the period. At the N-2 reserve standard, capacity is adequate for the beginning of the period. However, the margin is fully eroded by 2014-15, indicating that additional capacity is required prior to 2014-15 in order to satisfy the N-2 reserve standard. By 2016-17, the shortfall totals 6MW.

2.25 Under the low demand growth scenario, reserve conditions are adequate at N-1 for the period. At N-2, reserve conditions are adequate but tight for the period.

Tennant Creek regulated system

2.26 In the Tennant Creek system, under the high demand growth scenario, the projected capacity is sufficient to meet both the N-1 and N-2 reserve standards for the period.

2.27 Under the low demand growth scenario, capacity is also adequate at both the N-1 and N-2 reserve standards for the period.

Adequacy of gas supplies

Peak demand in the short term

2.28 During October and November 2006, intra-day electricity demand spikes resulted in gas supply shortfalls on a total of 18 days, requiring Power and Water to consume 46TJ of diesel fuel to maintain electricity supply. This occurred because higher than forecast peak electricity demand resulted in Power and Water's demand for gas exceeding the daily maximum that could be delivered from Mereenie.

2.29 Power and Water expect that a similar daily shortfall is likely to occur again periodically during the September to December "build-up" in 2007 and 2008.

2.30 The Commission considers that Power and Water's recently established contingency gas supply arrangements with the Darwin LNG producers, together with Power and Water's diesel fuel stocks, will provide sufficient back-up to cover any shortfalls under Power and Water's primary gas contracts at times of system peak demand.

Gas supply-demand in the medium term

2.31 Subject to the availability of approximately 4PJ of gas under the MSA4 contract and provided that the first supply of gas from the Blacktip field is available for electricity generation from January 2009 as scheduled, gas volumes available under the Amadeus Basin and Blacktip contracts should be sufficient to meet Power and Water's gas supply requirements in the medium term period (from 2007-08 to 2010-11). [2]

Gas supply-demand in the longer term

2.32 In the longer term, the Commission estimates that projected gas requirements will progressively reach and then exceed the contract quantities available under the Blacktip agreement, under both the high and low growth scenarios. However, the Commission notes that the projected shortfall may be somewhat alleviated with the possibility of lower than projected gas requirements if Power and Water's average plant efficiency improves with the commencement of the new Weddell Power Station.

2.33 The Commission also notes that Eni are building reserve capacity into their facilities that will be sufficient to meet the contract quantities under the Blacktip agreement along with some spare uncontracted capacity. Eni have also reported the existence of further probable Blacktip reserves for potential development in the future.

[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. The gas requirement estimates are based on the Commission's energy forecasts and an average rate for gas usage per GWh generated.

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 the current 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 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.

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

3.6 The Government is currently considering the merits of joining the national energy regime established by the Australian Energy Market Agreement. NT Treasury has advised that it is in the process of undertaking targeted consultation with national energy market bodies and NT users, with a view to the Government making a final decision in the first half of 2008. In this context, the Commission has raised its concerns in regard to the management of power system planning and reliability in Territory.

3.7 The Commission must await the outcome of the Government's deliberations. However, while the Commission appreciates that the matters raised are under active review, it is disappointed by the slow pace evident in developing appropriate policy responses.

3.8 In the meantime, the Commission has maintained the approach taken in the 2005 and 2006 Reviews 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 2016-17. 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 2006 Review, the approach taken in this Review is to look in some detail at the next four years (2007-08 to 2010-11) 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 once again 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 2007), in the development of its electricity demand forecasts.

4.8 For the medium term 2007-08 to 2010-11, 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 2011-12 to 2016-17, 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 tourism 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 three years. This is primarily because the resource, engineering and construction boom of recent years is expected to subside with the completion of 'big ticket' projects, which in turn is likely to lead to lower levels of employment and population growth compared to previous years.

4.13 Access Economics reports that:

> *The Northern Territory's economy is still travelling at speed, but completion of the Wickham Point LNG plant and Alcan's G3 expansion mean the huge engineering spend of recent years is now tailing off. And, in turn, so too is the pace of retail spending growth, housing approvals, and population gains… On each of these indicators the Territory continues to do well. It is just that the sprint of recent years could not be maintained at the same pace forever.*[3]

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

> *The medium-term outlook still remains robust … The emphasis continues to shift from the construction to the export operations phase of a number of major projects including the Alcan G3 expansion and the Darwin Biodiesel Plant.*
>
> *The longer term forecast for the Northern Territory economy remains robust. The key factor is once again 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 historically high price levels.*[4]

[3] Access Economics, Business Outlook, September 2007, pp. 109-110.
[4] DBERD, 2007 Power System Review Submission.

4.15 In summary, the medium term economic outlook remains robust for the NT, although at lower levels of growth than the last three years, as the forecasts in Table 4.1 illustrate. [5]

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

	2007-08		2008-09		2009-10		2010-11	
	Access	**NTT**	**Access**	**NTT**	**Access**	**NTT**	**Access**	**NTT**
Real gross state product	5.2	4.6	5.5	3.4	3.9	3.4	3.7	3.4
Real final demand	-0.2	1.4	7.1	5.0	3.7	5.0	2.2	5.0
Employment	3.9	5.8	3.2	2.0	3.4	2.0	2.1	2.0
Population	2.0	1.8	1.9	1.7	1.8	1.7	1.7	1.7

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 2007-08 to 2010-11.

Table 4.2 – Indicative Medium Term Economic and Demographic Forecasts
Northern Territory, 2007-08 to 2010-11
(average annual percentage changes)

Real gross state product	4.0
Real final demand	3.2
Employment	2.0
Population	1.5

4.17 For the period 2011-12 to 2016-17, 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	2.4	4.0	4.4
Real final demand	2.0	4.0	4.0	6.0
Employment	2.0	1.0	4.0	3.0
Population	1.0	0.33	2.0	2.15

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

[5] DBERD nominated the forecasts prepared by Access Economics as a suitable quantitative expression of their medium term outlook (DBERD referred to Access Economics June 2007 Business Outlook; the figures referred to in the table above are from the September 2007 Business Outlook).

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 outlook used by the Commission in preparing its forecasts of electricity demand for the period 2011-12 to 2016-17.

Table 4.4 – Indicative Longer Term Economic and Demographic Forecasts Northern Territory, 2011-12 to 2016-17 (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 the last two Reviews, 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.[6]

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.[7]

Electricity forecasts 2007-08 to 2010-11

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 updated the log regression analysis used in the 2005 Review to investigate the extent of the relationship between the selected economic and demographic variables and electricity consumption. The results again 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.

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

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

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.

4.26 Based on forecast output, employment and population growth averaging around 4%, 2% 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 2.1 and 1.4 respectively. In the context of 1.5% population growth and 2% employment growth these elasticity measures give support to electricity demand baseline growth of approximately 3%.

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 BOC Helium Plant at Wickham Point (commencing in 2007-08 and 2009-10 respectively, with an expected aggregate demand of approximately 10MW). 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 3.9% in peak demand.[8]

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% and 1% 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, 2007-08 to 2010-11
(average annual percentage changes)

Darwin-Katherine	3% baseline plus major projects (equiv. to 3.9% pa compound growth rate)
Alice Springs	2.0%
Tennant Creek	1.0%

[8] The expected commencement date for the Compass Browns Oxide Project is early 2008. However, full production and therefore full-year energy consumption will not be achieved until 2008-09. Also, the full impact of the project is unlikely to influence peak demand until 2008-09. Consequently, in the development of its electricity forecasts, the Commission has averaged the project's expected demand and consumption over the two years.

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

Table 4.6 – Peak Demand and Energy
Actual and Forecast to 2010-11 – 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	256	1362	54	236	7	29
2007-08	266	1416	55	241	7	30
2008-09	277	1472	56	246	7	30
2009-10	290	1541	57	251	7	30
2010-11	299	1587	58	256	7	30

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 3% (over the period from 1990-91). The Commission has used this average to develop its high and low growth scenarios for Darwin-Katherine. The higher demand growth scenario assumes average annual growth in peak demand and energy use of 4% for the period 2011-12 to 2016-17. The lower growth scenario assumes average annual growth in peak demand and energy use of 2%.

4.35 For Alice Springs and Tennant Creek, the higher demand growth scenario assumes average annual growth in peak demand and energy use for the period 2011-12 to 2016-17 of 3.5% and 3% respectively. For the low demand growth scenario, the Commission has adopted annual rates of growth of 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% and 1.5% in the high and low scenarios respectively.

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
2011-12 to 2016-17 (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
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2007-08	266	1416	55	241	7	30
2008-09	277	1472	56	246	7	30
2009-10	290	1541	57	251	7	30
2010-11	299	1587	58	256	7	30
2011-12	311	1650	60	265	7	31
2012-13	323	1717	62	274	8	32
2013-14	336	1785	64	284	8	33
2014-15	349	1857	67	294	8	34
2015-16	363	1931	69	304	8	35
2016-17	378	2008	71	315	9	36

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
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2009-10	290	1541	57	251	7	30
2010-11	299	1587	58	256	7	30
2011-12	305	1619	59	260	7	30
2012-13	311	1651	60	264	7	30
2013-14	317	1684	61	268	7	30
2014-15	323	1718	62	272	7	30
2015-16	330	1752	63	276	7	30
2016-17	336	1787	64	280	7	30

CHAPTER

5

ADEQUACY OF GENERATION CAPACITY

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

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:

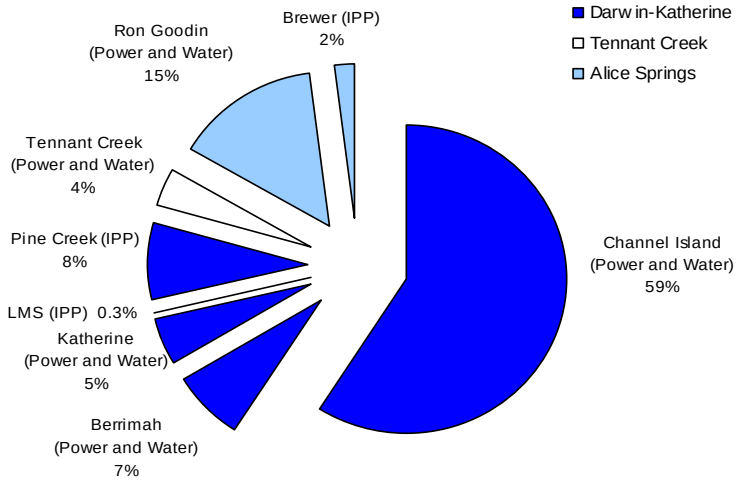
- total capacity (in MW);
- N-1 capacity (in MW), which indicates the generation capacity excluding the largest generating set in a particular system; and
- N-2 capacity (in MW), which indicates the generation capacity excluding the two largest generating sets in a particular system.

Table 5.1 – Power Facilities in Regulated Systems
30 June 2007

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 (Pine Creek A operated by its subsidiary NGD (NT) Pty Ltd and Pine Creek B operated by its subsidiary Cosmo Power Pty Ltd); Landfill Management Services Pty Ltd (LMS Shoal Bay); and Central Energy Power Pty Ltd (Brewer Power Station). 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 remote 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 2006-07

5.6 Power and Water reported no changes to capacity during 2006-07.

Baseline capacity projections

5.7 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.

5.8 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.

5.9 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.

5.10 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.

5.11 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.

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

5.13 In September 2006, Power and Water announced its plans for the development of a new power station for the Darwin-Katherine region. As Stage 1 of the new Weddell Power Station is nearing completion (including the installation and commissioning of the first 40MW generating set), the Commission has included Power and Water's first two planned capacity additions in its analysis. As a consequence, Darwin-Katherine capacity increases by 40MW in 2007-08 and by a further 40MW in 2008-09.[9] In 2008-09, capacity is also reduced by 7.5MW due to the expiry of the Pine Creek B power purchase agreement.[10]

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

Financial Year	Retire-ments	New Capacity	Total Capacity	N-1	N-2
2007-08		40.0	380.2	332.6	285.0
2008-09	(7.5)	40.0	412.7	365.1	317.5
2009-10			412.7	365.1	317.5
2010-11			412.7	365.1	317.5
2011-12			412.7	365.1	317.5
2012-13			412.7	365.1	317.5
2013-14			412.7	365.1	317.5
2014-15			412.7	365.1	317.5
2015-16			412.7	365.1	317.5
2016-17			412.7	365.1	317.5

5.14 In February 2007, Power and Water announced its plans for the development of a new power station for Alice Springs. The Owen Springs Power Station will be located at Brewer Estate. The distance of Brewer Estate from the town means that a 66kV transmission line and a new gas pipeline need to be built. Commissioning of the first 8MW generating set is estimated to be complete by the end of 2008 and the second 8MW generating set is currently scheduled for 2010-11. As tenders have been called for the installation of both units, the Commission has included them in its analysis.

[9] For the 2006 Review, the Commission included in its Darwin-Katherine baseline capacity projections and its subsequent supply-demand balance analysis the installation of a 35MW unit in 2007-08 and a further 35MW unit in 2010-11 at the Weddell Power Station. For the 2007 Review, Power and Water advised the Commission that these timeframes have been brought forward and the generating capacity of the units have been increased to 40MW.

[10] Power and Water has previously advised the Commission 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
2007-08			71.1	59.4	49.3
2008-09		8.0	79.1	67.4	57.3
2009-10			79.1	67.4	57.3
2010-11		8.0	87.1	75.4	65.3
2011-12			87.1	75.4	65.3
2012-13			87.1	75.4	65.3
2013-14			87.1	75.4	65.3
2014-15			87.1	75.4	65.3
2015-16			87.1	75.4	65.3
2016-17			87.1	75.4	65.3

5.15 Capacity at Tennant Creek is initially reduced by the retirement of 2MW, and expanded by the installation of two 1.5MW units (already purchased) of capacity in 2007-08.

Table 5.4 – Tennant Creek Baseline Capacity Projection (MW)

Financial Year	Retire-ments	New Capacity	Total Capacity	N-1	N-2
2007-08	(2.0)	3.0	17.7	13.8	11.8
2008-09			17.7	13.8	11.8
2009-10			17.7	13.8	11.8
2010-11			17.7	13.8	11.8
2011-12			17.7	13.8	11.8
2012-13			17.7	13.8	11.8
2013-14			17.7	13.8	11.8
2014-15			17.7	13.8	11.8
2015-16			17.7	13.8	11.8
2016-17			17.7	13.8	11.8

Indicators of system adequacy

5.16 As discussed in Chapter 3, the Commission is awaiting the outcome of NT 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.

5.17 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

5.18 In the following sections, supply-demand conditions are examined for each of the regulated systems for the period 2007-08 to 2010-11.

Darwin-Katherine regulated system

5.19 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
2007-08	380.2	332.6	285.0	266.4	66	19
2008-09	412.7	365.1	317.5	277.0	88	41
2009-10	412.7	365.1	317.5	290.0	75	28
2010-11	412.7	365.1	317.5	298.7	66	19

5.20 For the Darwin-Katherine regulated system, demand is comfortably met for the entire period at both the N-1 and N-2 standards, with each year's reserve margin over N-1 at least 66MW. This assessment is subject to the qualification that the availability of the first two units at Weddell will be as currently advised by Power and Water (40MW in 2007-08 and 40MW in 2008-09).

Alice Springs regulated system

5.21 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
2007-08	71.1	59.4	49.3	54.8	5	-5
2008-09	79.1	67.4	57.3	55.9	12	1
2009-10	79.1	67.4	57.3	57.0	10	0
2010-11	87.1	75.4	65.3	58.2	17	7

5.22 At N-1, reserve conditions are adequate through to 2010-11. Based on the Commission's demand forecasts, additional capacity is required within the current financial year in order to satisfy the N-2 reserve standard.

Tennant Creek regulated system

5.23 Table 5.7 indicates the reserve position in Tennant Creek 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
2007-08	17.7	13.8	11.8	7.0	7	5
2008-09	17.7	13.8	11.8	7.1	7	5
2009-10	17.7	13.8	11.8	7.2	7	5
2010-11	17.7	13.8	11.8	7.3	6	4

5.24 At both the N-1 and N-2 reserve standards, capacity in Tennant Creek remains adequate but tight over the medium term period.

Supply-demand balance in the longer term

5.25 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.

5.26 For each of the three regions, the Commission has compared high and low growth demand scenarios for the period 2011-12 to 2016-17 with its baseline projections of capacity.

Darwin-Katherine regulated system

5.27 Table 5.8 indicates that, if demand increased at an average rate of 4% per annum over 2011-12 to 2016-17, capacity is adequate at the N-1 standard for most of the period. However, the reserve margin is almost fully eroded by 2015-16, indicating that additional capacity is required prior to 2015-16 in order to satisfy the N-1 reserve standard. Additional capacity of approximately 60MW is required to satisfy the N-2 standard over the period, with the first increments required by 2012-13.

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

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2011-12	412.7	365.1	317.5	310.6	54	7
2012-13	412.7	365.1	317.5	323.0	42	-6
2013-14	412.7	365.1	317.5	336.0	29	-18
2014-15	412.7	365.1	317.5	349.4	16	-32
2015-16	412.7	365.1	317.5	363.4	2	-46
2016-17	412.7	365.1	317.5	377.9	-13	-60

5.28 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 over the period to meet the N-2 standard falls to 19MW.

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

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2011-12	412.7	365.1	317.5	304.6	60	13
2012-13	412.7	365.1	317.5	310.7	54	7
2013-14	412.7	365.1	317.5	316.9	48	1
2014-15	412.7	365.1	317.5	323.3	42	-6
2015-16	412.7	365.1	317.5	329.7	35	-12
2016-17	412.7	365.1	317.5	336.3	29	-19

Alice Springs regulated system

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

5.30 If demand increased at an average rate of 3.5% per annum over 2011-12 to 2016-17, capacity is adequate but tight at the N-1 standard for the period. Capacity is adequate at the N-2 standard for the beginning of the period. However, the margin is fully eroded by 2014-15, indicating that additional capacity is required prior to 2014-15 in order to satisfy the N-2 reserve standard. By 2016-17, the shortfall totals 6MW.

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

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2011-12	87.1	75.4	65.3	60.2	15	5
2012-13	87.1	75.4	65.3	62.3	13	3
2013-14	87.1	75.4	65.3	64.5	11	1
2014-15	87.1	75.4	65.3	66.7	9	-1
2015-16	87.1	75.4	65.3	69.1	6	-4
2016-17	87.1	75.4	65.3	71.5	4	-6

5.31 Alternatively, as indicated by Table 5.11, if demand growth averages only 1.5% per annum, reserve conditions are adequate at N 1 for the period. At N-2, reserve conditions are adequate but tight for the period.

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

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2011-12	87.1	75.4	65.3	59.0	16	6
2012-13	87.1	75.4	65.3	59.9	15	5
2013-14	87.1	75.4	65.3	60.8	15	4
2014-15	87.1	75.4	65.3	61.7	14	4
2015-16	87.1	75.4	65.3	62.7	13	3
2016-17	87.1	75.4	65.3	63.6	12	2

Tennant Creek regulated system

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

5.33 Under the high demand growth scenario, the projected capacity is sufficient to meet both the N-1 and N-2 reserve standards for the period.

5.34 Under the low demand growth scenario, capacity is also adequate at both the N-1 and N-2 reserve standards for the period.

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

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2011-12	17.7	13.8	11.8	7.5	6	4
2012-13	17.7	13.8	11.8	7.7	6	4
2013-14	17.7	13.8	11.8	7.9	6	4
2014-15	17.7	13.8	11.8	8.2	6	4
2015-16	17.7	13.8	11.8	8.4	5	3
2016-17	17.7	13.8	11.8	8.7	5	3

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

Financial Year	Total Capacity	N-1	N-2	Peak Demand	Reserve Margin over N-1	Reserve Margin over N-2
2011-12	17.7	13.8	11.8	7.3	6	4
2012-13	17.7	13.8	11.8	7.3	6	4
2013-14	17.7	13.8	11.8	7.3	6	4
2014-15	17.7	13.8	11.8	7.3	6	4
2015-16	17.7	13.8	11.8	7.3	6	4
2016-17	17.7	13.8	11.8	7.3	6	4

CHAPTER

6

ADEQUACY OF GAS SUPPLIES

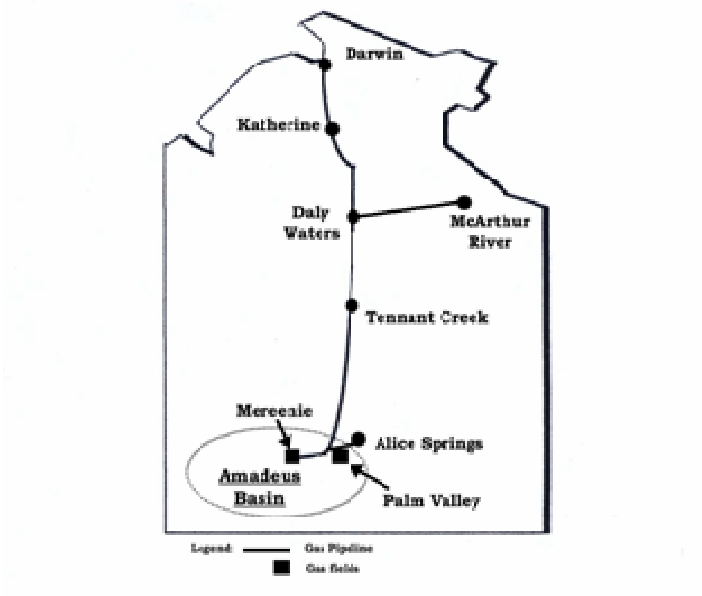
6.1 In the Territory context, system *adequacy* concerns can also arise if there is insufficient gas available to generate the expected level of electricity required. This chapter addresses this issue.

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.

Chart 6.1 – Location of Amadeus Basin Gas Fields



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.

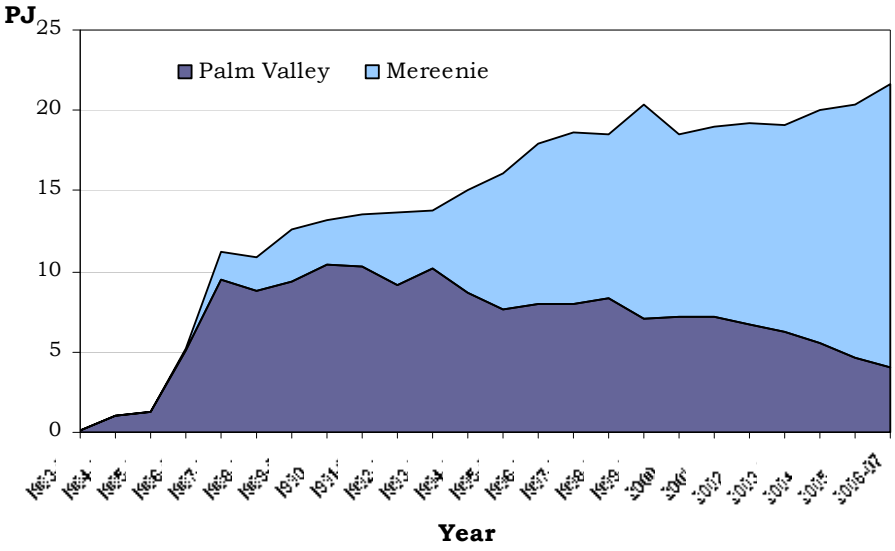
6.5 In 1985, the Power and Water subsidiary Gasgo contracted to purchase gas totalling 200 petajoules (PJ) over the period to 2012 from the Palm Valley field to fuel electricity generation in the Darwin-Katherine region. In the same year, Gasgo also entered into a gas purchase agreement with the operator 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.

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. In 2005-06, an additional contract with Mereenie producers (MSA4) was entered into for the supply of a minimum of 5.2PJ of gas from March 2006 to December 2008 and for the supply of additional gas from January 2008 to December 2010, if required, on a 'reasonable endeavours' basis.

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 2006-07



6.9 The Gasgo contracts for the supply of gas from Mereenie (with the exception of the 'reasonable endeavours' component of the MSA4 contract) expire in 2009. Gas volumes permitting, the Palm Valley contract expires in 2012.

6.10 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 from the Blacktip field 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.

6.11 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 Basin to Darwin Pipeline (ABDP). The location of the Blacktip gas field is shown in Chart 6.3 (on the following page).

Chart 6.3 – Location of Blacktip Gas Field

Source: Power and Water Media Release, 30 June 2006

Peak demand in the short term

6.12 During October and November 2006, intra-day electricity demand spikes resulted in gas supply shortfalls on a total of 18 days, requiring Power and Water to consume 46TJ of diesel fuel. This occurred because higher than forecast peak electricity demand resulted in Power and Water's demand for gas exceeding the daily maximum that could be delivered under the Mereenie gas supply contracts. This, in turn, resulted in a drawdown of the line pack (the gas in the pipeline) to manage the shortfall, which ultimately reduced the pressure in the pipeline to below the threshold operation pressure of one of Channel Island's generating units. To ensure there was no interruption to the electricity supply, the unit was switched to diesel operation.[11]

6.13 Power and Water expect that a similar daily shortfall is likely to occur again in 2007 and 2008 (until the first gas supply from Blacktip becomes available). The shortfall is most likely to occur periodically during the "build-up" months of September to December, as this is the period during which temperature and humidity are at the highest levels for the year.

6.14 The use of diesel is costly, and introduces another set of supply chain logistics, reliability issues and risks. To avoid using diesel for any future shortfall, Power and Water is currently in the process of finalising a contract with Darwin LNG producers to enable gas to be supplied via a pipeline that will interconnect with the existing ABDP. As these arrangements are not expected to be completed until late 2008, Power and Water will continue to be exposed to diesel use during 2007-08.

6.15 The Commission considers that Power and Water's recently established contingency gas supply arrangements with the Darwin LNG producers, together with Power and Water's diesel fuel stocks, will provide sufficient back-up to cover any shortfalls under Power and Water's primary gas contracts at times of system peak demand.

[11] Power and Water's main generating units are dual fuel (i.e., capable of operating on liquid fuel if gas supply is unavailable).

Gas supply-demand in the medium term

6.16 The Commission estimates that Power and Water will require secure supplies of approximately 22PJ of gas in 2007-08, increasing to 24PJ in 2010-11, to meet its gas supply requirements in the medium term.[12]

6.17 For 2007-08, the existing gas supply contracts with Mereenie and Palm Valley should be adequate to meet Power and Water's gas supply requirement (notwithstanding the potential for daily gas supply shortfalls). However, this is subject to the availability of approximately 4PJ of gas under the MSA4 contract.

6.18 In 2009, the Mereenie contracts expire (with the exception of the gas available on a 'reasonable endeavours' basis under the MSA4), and the first supply of gas is expected from the Blacktip field. For the remainder of the medium term period (2008-09 to 2010-11), contract quantities under the Blacktip agreement should be adequate to meet gas supply requirements, provided supply matches contract quantities.

Gas supply-demand in the longer term

6.19 In the longer term, the Commission estimates that projected gas requirements will progressively reach and then exceed the contract quantities available under the Blacktip agreement, under both the high and low growth scenarios. The Commission estimates a supply shortfall under the high growth scenario of approximately 1PJ in 2011-12, rising to 5PJ in 2016-17. Under the low growth scenario, the Commission estimates a supply shortfall of approximately 0.2PJ in 2011-12, increasing to 1.3PJ in 2016-17.

6.20 However, the Commission notes that the projected shortfall may be somewhat alleviated with the possibility of lower than projected gas requirements if Power and Water's average plant efficiency improves with the commencement of the new Weddell Power Station.

6.21 The Commission also notes that Eni are building reserve capacity into their facilities that will be sufficient to meet the contract quantities under the Blacktip agreement along with some spare uncontracted capacity. Eni have also reported the existence of further probable Blacktip reserves for potential development in the future.[13]

[12] 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. The gas requirement estimates are based on the Commission's energy forecasts and an average rate for gas usage per GWh generated.

[13] Eni Australia BV, Notification N70460, May 2006, ACCC Exclusive Dealing Notifications Register.

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

To investigate whether a statistical relationship exists that can add value to its forecasting task, the Commission undertook a regression analysis to investigate the extent of the relationship between selected economic and demographic variables and electricity consumption for the 2005 Power System Review. For this year's Review, the Commission has updated its regression analysis to include the most recently available data.

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.

The regression is estimated for the 14 years from 1992-93 to 2005-06. To avoid problems with value-based data, population and employment were selected as independent variables.[14] Electricity consumption was the dependent variable.[15] 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.

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

[15] Electricity consumption data has been sourced from the Energy Supply Association of Australia (ESAA), *Electricity Australia* publications (1998 and 2005) and 2005-06 NT Electricity Market Information published by the Commission (2006).

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.

Table B1 – NT Regression
Raw Data Inputs

Financial Year	Population	Total Employment (000)	Electricity Consumption (GWh)
1993	170,734	76.5	1,117
1994	173,375	74.8	1,104
1995	177,552	83.2	1,203
1996	181,843	86.0	1,357
1997	186,912	89.0	1,390
1998	189,880	90.5	1,525
1999	192,735	95.1	1,549
2000	195,561	90.3	1,550
2001	197,768	97.5	1,549
2002	198,665	98.7	1,559
2003	198,544	96.7	1,615
2004	199,834	95.8	1,607
2005	202,793	94.4	1,631
2006	210,674	101.7	1,662

Sources:
Population data - Australian Historical Population Statistics, 2006 (cat. no. 3105.0.65.001)
2006 Population data - ABS cat. no. 3218.0 Regional Population Growth Australia (table 7)
Employment data - ABS Labour Force, Australia, Spreadsheets, Oct 2007 (cat. no. 6202.0.55.001)
Electricity Consumption data – ESAA, *Electricity Australia 1998* and *Electricity Australia 2005*
2006 Electricity Consumption data - NT Electricity Market Information 2005-06 (ref UC website)

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

	R Square	Adjusted R Square	F Statistic
Regression	0.90	0.89	94.82
	Coefficients	**Standard Error**	***t* Statistic**
Intercept	-18.62	2.66	-7.00
X	2.13	0.22	9.74

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

	R Square	Adjusted R Square	F Statistic
Regression	0.89	0.87	84.93
	Coefficients	**Standard Error**	***t* Statistic**
Intercept	0.91	0.69	1.32
X	1.41	0.15	9.22

These results suggest that, on average, a 1 percentage point change in population and total employment will be associated with, approximately, a 2.1 and 1.4 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. Please note that the results for the Queensland regression analysis have not been updated for 2006 data.

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