PB ASSOCIATES

QUEENSLAND ELECTRICITY DISTRIBUTORS

CAPITAL EXPENDITURE STUDY

ERGON ENERGY

CONFIDENTIAL

Prepared for

QUEENSLAND COMPETITION AUTHORITY

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APPENDICES

1. EXECUTIVE SUMMARY

In accordance with its responsibilities under the National Electricity Code (the Code); in particular Chapter 6 Parts D and E of the Code which outline the objectives, principles and processes in relation to distribution service pricing, the Queensland Competition Authority (QCA) engaged PB Associates to undertake a consultancy to assess the reasonableness of the Queensland electricity distributors capital expenditure forecasts.

This report provides the findings of the consultancy work with respect to Ergon Energy.

The main findings of the review are summarised below:

1.1 NON-DEMAND RELATED CAPITAL EXPENDITURE

Based on the modelling carried out by PB Associates and the discussion provided in the body of this report, we consider the Ergon Energy age related replacement capital forecast for the period 2001/02 to 2004/05, as submitted to QCA to be reasonable.

Using the PB Associates model of the required replacement capital expenditure, which PB Associates believe reasonably models the actual requirements of Ergon Energy, the Ergon Energy submission is approximately 12% lower than the value forecast by the model. There are a number of explanations for this difference, including:

- Difficulty in allocation between age replacement and other augmentation. The replacement of an asset or assets is usually undertaken for a number of reasons, whether they be technical, cost and safety reasons or a combination of all these. For this reason it is often difficult to identify one sole factor for the replacement. Under such circumstances, it is reasonable for the distribution business to nominate a primary reason for the replacement and capture the replacement costs under this category.

- The replacement of aged assets is often captured in augmentation and other budgets. Network augmentation often requires the replacement and upgrading of existing network assets. The assets that are replaced in an augmentation budget contribute to an improved asset base, but are often not captured in the replacement capital expenditure budgets.

One of the most significant outcomes of this review is that due to the installation profiles of the network assets Ergon Energy is only beginning to reach the point when significant numbers of network assets will require replacement. This is illustrated by the sharp increase in capex forecast over the next 20 years.

PB Associates consider that the current levels of replacement capital expenditure, and the levels of expenditure forecast by Ergon Energy for the review period, are slightly lower than the level expected. However, for future review periods, both Ergon Energy and QCA should expect a significant increase in age related replacement expenditure in future submissions.

We believe the current levels of replacement expenditure forecast by Ergon Energy are mostly due to poor availability of asset data, which is being rectified by data collection and storage processes currently in progress within Ergon Energy.

PB Associates also notes that the unit costs identified in this report and the GHD valuations are both long-run costs. This means that the costs represent the

replacement costs based on a large volume of replacements and not individual or one-off replacements.

The modelling process used by PB Associates utilised asset lives that were different from the asset lives used for the ODRC valuation done by GHD. The report shows that there is not a significant variance in the net valuation of the assets using the methods and data sets described in this report. PB Associates are therefore of the opinion that, although the capital expenditure requirements have been calculated using the revised asset lives, this does not effect the ODRC valuation of the Ergon Energy assets provided in the GHD report.

The Ergon Energy submission to QCA for reliability improvement averages $11.5 million per year. For the levels of improvement in reliability that are forecast by Ergon Energy, PB Associates are of the opinion that the Ergon Energy submission is reasonable.

1.2 DEMAND RELATED CAPITAL EXPENDITURE

For the demand related capital expenditure two approaches were used to examine the capital expenditure forecasts: -

- **Detailed review of planning processes and specific projects.** The planning processes, methodology and several key projects were examined in detail. Approximately $37 million of expenditure on major projects was examined in detail out of approximately $192 million of demand related expenditure.

- **Comparison with other Utilities in Australia.** Various key parameters and measures of levels of overall expenditure were tabulated to enable a comparison with other distributors.

Detailed review of planning processes and specific projects:

Based upon the review of the documents and data supplied relating to five projects selected by PB Associates for detailed review, we make the following comments:

- We would consider Ergon Energy has taken steps to put processes in place to perform objective studies for their network capital expenditure

- More thorough detail studies are required for most of the projects to stand in a competitive commercial environment

- We are of the opinion that Ergon Energy do not have all the necessary data availability for full Reliability Assessment Planning (RAP)

- Study reports produced more recently indicate a significant improvement in the rigour of the financial justification of projects

- More objective processes are required to produce optimum level of demand related capex while achieving the required level of performance

- Some of the recently prepared documents such as “Network planning Criteria” indicate that Ergon Energy is introducing improved processes for more objective and informed decision making

Comparison with other Utilities in Australia:

Section	Comparison undertaken	Comments
1	Customer Driven per New Customer	Average
2	Total Demand / New Customer	Average
3	Total Demand / kVA Load Growth	High/Consistent with typical Rural DB

Table 1-1 Summary of Comparisons

PB Associates have not carried out a detailed network comparison between Ergon Energy and other DB's however we understand that Ergon Energy is predominately rural with small urban areas. The expenditure levels whilst higher than average, are consistent with rural utilities in our comparison.

On the basis of the comparisons, given that Ergon Energy is a rural utility experiencing relatively high load growth levels, our conclusion is that the demand related expenditure forecast by Ergon Energy is reasonable.

2. INTRODUCTION

2.1 BACKGROUND

In accordance with its responsibilities under the National Electricity Code (the Code); in particular Chapter 6 Parts D and E of the Code which outline the objectives, principles and processes in relation to distribution service pricing, the Queensland Competition Authority (QCA) engaged PB Associates to undertake a consultancy to assess the reasonableness of the Queensland electricity distributors capital expenditure forecasts.

The scope of the consultancy was to undertake a review to analyse and comment on the reasonableness of the capital expenditure (capex) contained in the Distributor's submissions with respect to the following:

- Forecasts of demand growth as provided by the Authority's recent Demand Forecast consultancy together with additional information provided by the Distributors;
- The age distribution of existing assets and associated asset replacement programs;
- Current and projected levels of efficient operating expenditure and any trade off between operating and capital expenditure;
- Current and projected levels of service quality; and
- The impact of differences in operating environment faced by the individual Distributors.

The deliverable from the consultancy is a final report that audits the Distributor's forecasts of capital expenditure for the four- year period 2001/2002 to 2004/2005. One of the aims of the study was to identify whether the Distributor's forecasts were reasonable and represent an efficient level of capital expenditure given factors outlined above. Where the study identified that the Distributor's proposed level of capital expenditure was not reasonable the consultancy was required to identify the appropriate level of expenditure and provide an explanation of the major differences between the Distributor's proposed capital expenditure and the level deemed appropriate by the PB Associates.

This draft report provides the findings of the consultancy work with respect to Ergon Energy.

2.2 METHODOLOGY

2.2.1 Non Demand Related Capex

Ergon Energy's proposals for non-demand related capital expenditure have been examined and compared with the PB Associates estimates. The PB Associates estimates are obtained from a replacement-forecast model developed by PB Associates.

The basis for the model's asset replacement capability is that all assets have a finite engineering life and that, if network reliability is to be assured, provision must be made to replace all assets before the end of their engineering life. However asset replacement should not be on the basis of age alone for the following reasons: -

- The condition of individual assets will vary. Some assets will require replacement before the end of their forecast engineering lives while others can be left in service longer than their nominal engineering life would indicate. It is usually the case that the majority of assets are replaced beyond their nominal engineering lives rather than before.

- Replacement due to age alone may well place unacceptable financial commitments on the company over a short time window.

- An asset replacement strategy based on age alone may allow the average age of the network assets to deteriorate to the extent that overall network reliability is put at risk.

Recognising this, the model allows the user to choose between three alternative age replacement strategies.

- Replacement based on age alone.

- Replacement based on condition and age. This approach allows the user to modify the age profiles of each asset category to take account of asset condition.

- Replacement based on risk, condition and age. The incorporation of asset risk requires an asset replacement strategy that ensures that the average remaining life of any particular asset category does fall below a predetermined minimum. This reduces the risk that reliability will be compromised by an excessive number of age related failures.

The model has been used to generate a non-demand related asset replacement expenditure forecast for Ergon Energy that minimises required expenditure while at the same time ensures that the required maximum risk is not exceeded.

The model has been populated with data provided by Ergon Energy in order to produce the annual forecast capital expenditure requirements by asset class for Ergon Energy. The resulting capital expenditure forecasts produced by the model using the asset lives, asset age profiles and replacement unit costs provided by Ergon Energy and by PB Associates are discussed in later sections of this report.

Other non-demand related expenditure such as expenditure relating to safety, operating and environmental issues will not be forecast by the model. Anticipated future expenditure levels for these classes of expenditure have been obtained from Ergon Energy and these are also discussed in later sections of this report.

2.2.2 Demand Related Capex

The demand related capital expenditure investment required to connect new customers to the network and to augment the existing network to meet the forecast demand growth on the Ergon Energy network has been reviewed.

Drivers for demand related capital expenditure include the rate of demand growth on the network and the location of that growth. The level and timing of the expenditure is very much influenced by security and reliability considerations, and the costs

associated with demand side participation. Security requirements impact on the quality of the installation and the level of redundancy built into the system.

Two approaches were used to examine the capital expenditure forecasts: -

- **Detailed review of planning processes and specific projects.** The planning processes, methodology and several key projects were examined in detail.
- **Comparison with other Utilities in Australia.** Various key parameters and measures of levels of overall expenditure were tabulated to enable a comparison with other distributors.

3. ERGON ENERGY CAPITAL FORECAST SUBMISSION

'$000	2001/02	2002/03	2003/04	2004/05	Total
Non Load Related	65,636	55,036	49,573	48,464	218,710
Demand Related	60,128	50,159	46,620	45,577	202,484
Customer Driven	53,322	61,942	63,082	62,310	240,655
System Capital (Sub total)	**179,086**	**167,137**	**159,275**	**156,351**	**1,083,042**
Non System Capital	**76,977**	**68,834**	**37,775**	**38,189**	**221,775**
Grand Total	**256,063**	**235,971**	**197,050**	**194,540**	**1,304,817**

Table 3-1 Ergon Energy Capital Expenditure Forecasts[1]

For the purposes of our analysis the System Capital Expenditure has been broadly defined into four main areas: -

1. Non – Demand Related. Capex required to maintain adequate service quality and quantity obligations of the distributor. It does not make provision for growth.

2. Demand Related. Capex required to enhance service or capability of the Network to meet future growth in response to Customer demand.

3. Customer Driven. Expenditure associated with new customer connections to the Network.

4. Land and right of way. This is listed separately in line with the previous QCA analysis purposes, however is assumed to be related demand related expenditure.

It should be noted that many projects have multiple drivers. For example age replacement could be a secondary driver for many of the demand related projects.

[1] Figures based on data as provided by Ergon, email 15/2/01, "Demand related Capex".

4. NON DEMAND RELATED CAPITAL EXPENDITURE ESTIMATES

4.1 ERGON ENERGY ESTIMATES

Table 4-1 below provides further detail of the Non Demand related expenditure as shown in Table 3-1 showing capital expenditure requirements submitted to QCA by Ergon Energy. Table 4-1 shows the items that PB Associates have classified as "non demand related", and this expenditure will be discussed in detail in this section of the report.

'$000	2001/02	2002/03	2003/04	2004/05	Total
Age related	42,440	35,404	32,906	32,170	142,920
Reliability	14,520	12,395	9,940	9,718	46,572
Emerging risk	1,961	1,636	1,520	1,486	6,604
Other	6,715	5,602	5,207	5,090	22,613
Non Demand Related	**65,636**	**55,036**	**49,573**	**48,464**	**218,710**

Table 4-1 Non Demand Related Capital Expenditure

As the "Age related" expenditure makes up over 50% of the total non-demand related expenditure, the main focus of the review has been on this portion of the forecast.

4.2 AGE RELATED EXPENDITURE

"Age related" expenditure as listed in the table above is defined by Ergon Energy as being "*for capital projects initiated for specific replacement or refurbishment of network assets (i.e. end of life, or frequently failing in service, or significantly deteriorated to unsafe or risky condition). Sometimes called capitalised refurbishment maintenance*".

In order to review the level of forecast expenditure, PB Associates has created a model of the network assets, based on the quantity, age, replacement cost, and asset lives of the network assets. The results of the replacement capital expenditure model have then been compared with the level of capex forecast by Ergon Energy.

The following sections of this report discuss the comparison of these figures and comment on the reasonableness of the capital requirements submission by Ergon Energy.

4.2.1 Base Data - Assumptions

The base data for the model is a list of asset types, age profiles, replacement costs and asset lives for each asset type in the network. Ergon Energy provided this data in spreadsheet form and PB Associates were informed that this is the same data that had been used for the asset valuation exercise recently completed by Arthur Andersen and GHD[2].

[2] Ergon Energy, Queensland Electricity Distribution Corporations ODRC Valuation of Electricity Supply Assets - GHD Management Engineering Environment, September 2000.

4.2.1.1 Age Profiles and Asset Quantity

PB Associates have not carried out verification of the data provided, however the quantities of a sample of assets considered to be the main drivers of capital expenditure were compared with the quantities listed in the valuation[3] and a good correlation was found. The asset categories checked included:

- 132kV Overhead lines,
- 66kV Overhead lines,
- 33kV Overhead lines,
- 11/22kV Overhead lines,
- 19kV SWER Overhead lines,
- LV Overhead lines,
- 11/22kV Cable,
- LV Cable,
- LV Service Connections,
- 132kV Transformers
- 66kV Transformers
- 33kV Transformers
- 11kV Transformers – Kiosk and Pad
- 11kV Transformers – Ground Mounted

GHD carried out verification activities on the Ergon Energy data and processes for capturing the data, and found that whilst the quality of data varied across the many regions covered by Ergon Energy, that "*Overall the verification resulted in good confidence in the valuation result*."[3] .

PB Associates are not aware of assumptions that may have been made by Ergon Energy in order to create age profiles where records were incomplete or not available. We have however reviewed the age profiles for consistency and found that whilst overall the profiles appear to be reasonable there are peaks in some age profiles that are consistent with a default year being used when entering data. Most of these peaks in the age profiles are in the age period between 15 and 20 years. This means that the effect that the peaks will have on the capex requirements over the review period will not be material but the capex in the later review periods could be significantly affected. PB Associates recommend that Ergon Energy should examine the causes of the peaks in the age profiles.

4.2.1.2 Asset Lives

Asset lives used in the initial PB Associates model are based on the asset lives provided for each asset category by Ergon Energy (as used in the valuation exercise). During the analysis of the results, asset lives were reviewed with respect to asset lives used in other modelling exercises carried out by PB Associates, as well as comments

[3] Ergon Energy, Queensland Electricity Distribution Corporations ODRC Valuation of Electricity Supply Assets - GHD Management Engineering Environment, September 2000.

made by SKM[4] in their oversight review of the Ergon Energy and Energex asset valuations.

4.2.1.3 Replacement Costs

Ergon Energy replacement cost data was sourced from the Asset Valuation[3]. The replacement costs from the Asset Valuation did not include GST as the date of the valuation was 31 December 1999. Ergon Energy has confirmed with PB Associates that the current budgets and forecasts do not include GST. For this reason, the Asset Valuation costs have not been inflated to include GST and therefore the forecasts produced by the model are also exclusive of GST.

Annual inflation has been considered as part of the PB Associates review. The GHD Valuation replacement costs reflected in this report have not been adjusted for inflation in the current review period.

4.2.1.4 Asset Condition

PB Associates have not been provided with data on the condition of assets and have been informed by Ergon Energy that this data is not available yet due to the work involved in combining data on the individual entities now comprising Ergon Energy.

As condition assessment data is one of the inputs for the modelling exercise we have used an estimate for condition of assets of 15% in Good Condition, 70% in Average Condition, and 15% in Poor Condition. For a well-maintained network these estimates are likely to be conservative in that the quantity of assets in good condition could well be higher than the estimate and the quantity of assets in the poor condition correspondingly lower. During discussion with Ergon Energy staff it was agreed that in the absence of better data, these estimates were reasonable.

4.2.2 Analysis

4.2.2.1 Scenario 1 – Using Valuation Data

A model was created using the data provided by Ergon Energy including age profile, asset lives, and costs, used for the valuation exercise. Based on these inputs the capital expenditure forecast for replacement of assets for the review period 2001/02 to 2004/05 is $731.5 million. The forecast over the next 20 years is as shown in Figure 4-1 overleaf.

[4] SKM Asset Valuation Report for QCA dated November 2000.

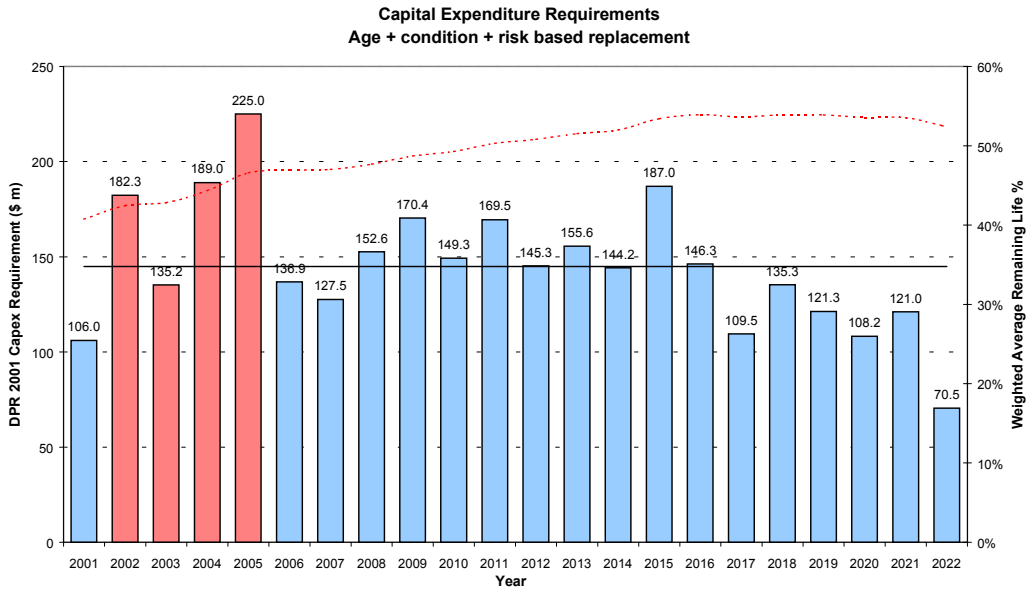

Figure 4-1 Replacement Capital Forecast - Scenario 1.

Clearly the forecasts shown in Figure 4-1, with an average of **$182 million** per year over the four-year review period, are far in excess of the Ergon Energy submission for "age related" capital expenditure of between **$32 and $42 million** per year over the next four years. There are a number of possible explanations for this mismatch in replacement forecasts as follows:

- Based on the asset lives in the valuation[3] there are a large number of assets that are older than the assigned asset life, these are termed "deferred assets". The Scenario 1 forecast includes $155 million of replacement expenditure for deferred assets over the review period, whereas Ergon Energy do not have significant replacement projects for deferred assets included in their project listing and forecast.

- The asset lives used do not reflect actual practice in replacing network assets. This may be due to effective maintenance practices prolonging the asset lives, or simple underestimation of the service life of assets due to changes in materials and manufacture of assets, or operating conditions. The high quantity of assets in the deferred category would tend to confirm that the actual replacement asset lives are much longer than the asset lives assumed for the valuation.

- Capital projects are often carried out for a number of reasons. For example a project to increase capacity of the network may also replace ageing assets and improve reliability. Generally such a project would be classified as augmentation or reliability, thus reducing the value of capital expenditure forecast for replacement. It is difficult to determine the value of the overlap without further investigation of the capital projects planned.

- Some works forecast by the model may be classified differently by the distribution business. For example miscellaneous replacements of assets by maintenance crew may be included in operating expenditure budgets thus reducing the forecast for capital expenditure even though these replacements are being carried out.

Although the above points are all probably contributing to the mismatch in forecasts, due to the magnitude of the mismatch PB Associates consider that the appropriateness of asset lives used in the model should be examined more closely. A

second scenario has been created for discussion and to assist review of these forecasts as detailed below.

4.2.2.2 Scenario 2 – Using Modified Asset Lives

It is the opinion of PB Associates that the asset lives assumed in the GHD valuation are short when utilised for capital expenditure modelling. PB Associates experience in Australia, and in the rest of the world[5], is that longer asset lives are to be expected (in general) than those found in the GHD valuation.

The asset lives used in the valuation were examined and compared with asset lives used in capital forecasting models in other States of Australia, mainly Victoria as well as with recommendations made by SKM in their review of the Ergon Energy and Energex Valuations. In general the asset lives used for similar models in Victoria were 5 to 10 years longer than those listed in the valuation of Ergon Energy.

Whilst we are not suggesting that operating conditions and therefore asset lives in Queensland are identical to other Australian states, these are useful for comparison.

The Scenario 2 model has been constructed using the age profiles and replacement costs from the valuation. The data in Scenario 2 utilises asset lives that PB Associates has gathered from Australian utilities. We have not used average Australian asset lives. Instead we have reviewed the minimum, maximum and average asset lives and, in most cases, applied the minimum asset lives. This still leaves a capital expenditure estimate that is considerably less than the Scenario 1 model.

The actual asset lives used in Scenario 2 model are shown in Appendix A and comparison with the valuation asset lives is given (where these asset lives were not changed they are not listed in the Appendix).

The model results are vastly different to the results given in Scenario 1, and are much closer to the Ergon Energy forecasts. Figure 4-2 below shows the results of the Scenario 2 model.

[5] CIGRE Working Group 37-27 Report, Ageing of the System Impact on Planning

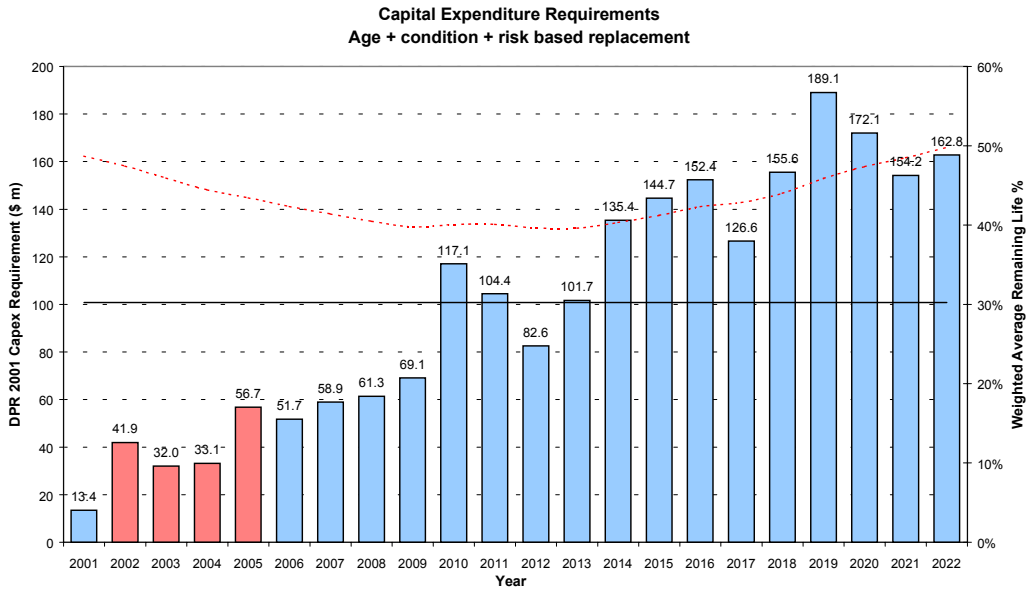

Figure 4-2 Replacement Capital Forecast - Scenario 2

The expenditure forecast from the Scenario 2 model, is close to the Ergon Energy submission to QCA. Over the four-year review period the total forecast by the model is **$163 million** compared to the "Age related" total of **$143 million** from the Ergon Energy submission.

PB Associates consider Scenario 2 to be a more realistic view of present and future replacement capital expenditure requirements for Ergon Energy. The difference between Ergon Energy's submission and the model can be explained in part by overlap between augmentation and other projects (as confirmed by Ergon Energy), and also possibly some replacement expenditure being classified as operating expenditure.

The remainder of the difference can be explained by Ergon Energy's lack of historical data with which to forecast future replacement requirements. The recent valuation exercise, and effort to combine the databases of the individual entities comprising Ergon Energy, has helped to remedy the lack of historical data. However, Ergon Energy have not yet had time to utilise this newly available data for replacement forecasting. It can be seen from a comparison of Table 4-1 and Figure 4-2 that the PB Associates model forecasts a higher expenditure requirement in year 2004/5 than the Ergon Energy forecast ($56.7 million against $32.17 million). This difference is probably due to the fact that the PB Associates model takes into account the rising expenditure requirements due to the age profiles of the assets while the Ergon Energy forecast does not take account of the original installation profile of the network.

Historical age related spend has been low due to the installation profile for the network, and the fact that the majority of assets have not yet reached the end of their asset lives. This situation is expected to change significantly in the next 20 years as the periods of intense installation activity of the 1960's and 1970's will possibly need to be repeated for replacement of these aged assets. Figure 4-2 above illustrates this with a rapidly increasing replacement requirement during the next 20 years.

4.2.3 Valuation

The PB Associates modelling process also produces a valuation based on the age profiles and asset lives used for the capital forecast model. The results of these are interesting to note in light of the above scenarios for capital replacement expenditure.

SOURCE	Depreciated Replacement Cost $'000s	Difference %
GHD Valuation (excl generation assets)	$2,157.9	0
PB Model – Scenario 1	$1,905.1	- 11.7
PB Model – Scenario 2	$2,327.2	+ 7.8

Table 4-2 Asset Valuation - Network Assets

The PB Associates valuation provides a net value of $2,327 million. This compares with an ODRC value of $2,157.9 million from the GHD Valuation – a variation of 7.8%. This is an acceptable variation given the three variables between the two reports;

- New assets have been added and others replaced over the 12 months between data snapshots,
- some replacement costs have altered, and
- asset ages have increased over the 12 months between asset snapshots.

The above table shows that there is not a significant variance in the net valuation of the assets using the 3 methods and data sets described in this report. PB Associates are therefore of the opinion that, although the capital expenditure requirements have been calculated using the revised asset lives, this does not effect the ODRC valuation of the Ergon Energy assets provided in the GHD report.

4.2.4 Conclusions – Age related Expenditure

Based on the modelling carried out by PB Associates and the discussion above, we consider the Ergon Energy age related replacement capital forecast for the period 2001/02 to 2004/05, as submitted to QCA to be reasonable.

With consideration of the Scenario 2 model, which we believe more closely models the actual requirements of Ergon Energy, it appears that the Ergon Energy submission is approximately 12% lower than the value forecast by the model. As discussed there are a number of explanations for this difference, including

- Difficulty in allocation between age replacement and other augmentation. The replacement of an asset or assets is usually undertaken for a number of reasons, whether they be technical, cost and safety reasons or a combination of all these. For this reason it is often difficult to identify one sole factor for the replacement. Under such circumstances, it is reasonable for the distribution business to nominate a primary reason for the replacement and capture the replacement costs under this category.

- The replacement of aged assets is often captured in augmentation and other budgets. Network augmentation often requires the replacement and upgrading of existing network assets. The assets that are replaced in an augmentation budget contribute to an improved asset base, but are often not captured in the replacement capital expenditure budgets.

One of the most significant outcomes of this review is that due to the installation profiles of the network assets Ergon Energy is only beginning to reach the point when significant numbers of network assets will require replacement. This is illustrated by the sharp increase in capex forecast over the next 20 years, as shown in Scenario 2.

PB Associates consider that the current levels of replacement capital expenditure, and the levels of expenditure forecast by Ergon Energy for the review period, are slightly lower than the level expected. However, for future review periods, both Ergon Energy and QCA should expect a significant increase in age related replacement expenditure in future submissions.

We believe the current levels of replacement expenditure forecast by Ergon Energy are mostly due to poor availability of asset data, which is being rectified by data collection and storage processes currently in progress within Ergon Energy.

PB Associates also notes that the unit costs identified in this report and the GHD valuations are both long-run costs. This means that the costs represent the replacement costs based on a large volume of replacements and not individual or one-off replacements.

4.3 RELIABILITY

The total capex submitted by Ergon Energy for Reliability Improvement projects is $46.572 million.

Ergon Energy have provided a copy of a SKM report entitled Reliability and Quality Improvement capex Plan, dated November 2000 [6]. This report recommends an average annual expenditure of between $12.5 million and $16 million to improve the Ergon Energy SAIDI and SAIFI figures over the period 2000/2001 to 2003/2004 as shown in Table 4-3.

Year	2000/01	2001/02	2002/03	2003/04	% Change
SAIDI *(min/yr)*	310	316	295	276	11
SAIFI *(No.)*	3.8	4.1	3.8	3.5	7.9

Table 4-3 SKM Recommended Reliability of Supply Forecast (Total)

[6] SKM Report entitled Reliability and Quality Improvement capex Plan

Year	2000/01	2001/02	2002/03	2003/04	% Change
Urban SAIDI *(min/yr)*	154	160	145	131	14.9
Rural SAIDI *(min/yr)*	440	467	432	402	8.6
Remote SAIDI *(min/yr)*	1008	1029	909	805	20.1

Table 4-4 SKM Recommended Reliability of Supply Forecast

The Ergon Energy submission to QCA averages $11.5 million per year, which is consistent with the investment recommended by SKM for the levels of reliability improvement shown in Table 4-3 and Table 4-4.

For the levels of improvement in total SAIDI PB Associates would support the figures estimated by SKM of around $48 million, i.e. $12 million per year. We would therefore suggest that the expenditure that Ergon Energy are forecasting to achieve the reliability figures shown in Table 4-3 and Table 4-4 is reasonable.

4.4 EMERGING RISK

The total capex submitted by Ergon Energy for Emerging Risk projects is $6.604 million for 2001/02 to 2004/05.

This expenditure is defined by Ergon Energy as: - *capital projects related to risks or hazards that have surfaced recently e.g. low spans and service insulation are typical projects that may be classified as "emerging risk"*.

It is also noted that "emerging risks" may be one of a number of drivers for a capital project, rather than the sole reason for capital expenditure. We interpret this as meaning that expenditure currently listed under other classifications may also help to mitigate or remove emerging risks.

Based on the limited amount of information provided to us on specific areas of expenditure in this area PB Associates are of the opinion that the Ergon Energy expenditure forecast for emerging risk is reasonable.

4.5 OTHER

The total capex submitted by Ergon Energy for "Other" projects is $22.613 million for 2001/02 to 2004/05.

A split has been provided between sub-transmission and distribution, but no further details of specific projects and the values included under this classification have been provided.

For distribution the "Other" classification is described as covering "Safety" and "Environment" related projects.

The "Safety" classification covers capital expenditure for specific safety improvement or potentially unsafe distribution and SWER networks. Projects include: shifting isolator primary fuses to another pole, and refurbishment of earthing systems.

The “Environment classification covers capital projects for specific environmental risk reduction on distribution and SWER networks, e.g. relocation of oil filled plant away from spill-sensitive areas. Projects include: relocation of lines from EMR or RFI sensitive locations.

For sub-transmission the “Other” classification is also described as covering “Safety” and “Environment” related projects. The basic definition of “Safety” is the same and no sample projects are listed. The basic definition of “Environment” is the same as for distribution and projects include replacement of EMF or RFI generating equipment for EMF or RFI sensitive reasons.

Based on the limited amount of information provided to us on specific areas of expenditure in this area PB Associates are of the opinion that the Ergon Energy expenditure forecast for safety and environmental risks is reasonable.

5. DEMAND RELATED CAPITAL EXPENDITURE ESTIMATES

5.1 ERGON ENERGY ESTIMATES

Table 5-1 below is an extract from Table 3-1 showing capital expenditure requirements as submitted to the QCA by Ergon Energy. Table 5-1 shows the items that PB Associates have classified as "Demand related", and this expenditure is discussed in detail in this section of the report.

'$000	2001/02	2002/03	2003/04	2004/05	Total
Security	4,205	3,507	3,260	3,187	14,159
Distribution	23,900	19,938	18,531	18,116	80,485
Sub Transmission	23,700	19,771	18,376	17,965	79,812
Load Energy Management	8,323	6,943	6,453	6,309	28,028
Demand Related (Sub Total)	**60,128**	**50,159**	**46,620**	**45,577**	**202,484**
Customer Driven	**53,322**	**61,942**	**63,082**	**62,310**	**240,655**
Grand Total Demand Related	**113,450**	**112,101**	**109,702**	**107,887**	**443,139**

Table 5-1 Demand Related Capital Expenditure Forecasts[7]

In order to provide a consistent comparison with other power authorities definitions and categories were chosen to align generally with the Victorian 20001 price review. Two classifications were used: -

Demand related expenditure is related to additions to the capacity of the network incurred due to increase of demand not attributable to one individual customer. The additional load generally causes existing assets to operate at a higher utilisation (which may need reinforcement). In our analysis, this was deemed to include distribution and Sub-transmission augmentation, load/Energy Management and Security projects. Reliability projects identified by Ergon Energy have been allocated to non-demand related expenditure. In addition it is noted that a number of customer requested specific projects might be included in the demand component due to the budgeting process.

Customer Driven expenditure includes all expenditure associated with new customer connecting to the network. In this case additional load generally requires new network to be constructed to connect the new customers.

5.2 REVIEW METHODOLOGY

Two approaches were used to examine the capital expenditure forecasts: -

- **Detailed review of planning processes and specific projects.** The planning processes, methodology and several key projects were examined in detail. Approximately $37 million of expenditure on major projects was examined in detail out of approximately $192 million of demand related expenditure.

[7] Customer driven expenditure includes street lighting, however this has been excluded in subsequent analysis. Figures based on data as provided by Ergon, email 15/2/01, "Demand related Capex".

- **Comparison with other Utilities in Australia.** Various key parameters and measures of levels of overall expenditure were tabulated to enable a comparison with other distributors.

5.3 REVIEW OF PLANNING PROCESSES

5.3.1 Introduction

The main drivers of demand related capital expenditure include the following:

- the rate of load growth and customer growth on the network, and the location of the growth;
- the utilisation of the existing assets; and
- the planning criteria that define level of security, reliability and quality of supply.

The review of the distribution demand related capital expenditure forecasts of Ergon Energy has been conducted in four parts that are detailed in the sections below. These parts relate to the load forecasts, planning methodology, the planning criteria, and the capital forecasting process. The aim of this review is to ascertain the procedure and methodology defined by Ergon Energy to produce the forecasts, validate that these procedures have been followed, comment on the suitability of such procedures and methodology, and comment on the level of demand related capital expenditure with respect to other benchmarks.

In order to perform this task a number of projects were reviewed using documents provided by Ergon Energy, meetings were held with Ergon Energy staff to discuss the documents and the projects, and further questions were put to Ergon Energy when queries arose.

5.3.2 Load forecasts

Load forecasting is the starting point in the preparation of demand-related capital expenditure requirements. The forecast defines the need and determines the timing for network augmentation. A significant amount of data and information needs to be recorded for this process to be accomplished.

Ergon Energy is an amalgamation of 6 distributors and covers a very large geographical area. Although at present they do not have all the required information systems in place to provide necessary accurate data to prepare comprehensive load forecasts for different network segments, sufficient amount of data is available to produce forecasts with a reasonable level of accuracy. Information is available at the connection assets to the Powerlink transmission network as Powerlink have SCADA available at these points. Some of the zone substations have SCADA or Maximum Demand metering but majority of zone substations do not have this information or historical records. Ergon Energy has prepared 12-year load forecasts for all their zone substations and used reasonable validation method using external information to validate the forecasts. They have three-year feeder load forecasts that is acceptable.

For the connection points to the Powerlink transmission network Ergon Energy provide load forecasts for ten years. Powerlink also use an independent authority, National Institute of Economic and Industry Research (NIEIR) to obtain forecasts incorporating economic activity. The Ergon Energy forecasts agree well with NIEIR forecasts when normalised.

Generally we find that the load forecasting process followed by Ergon Energy is acceptable and will result in a reasonable capex forecast of augmentation

requirements. We have reviewed the load forecasting in terms of the major network segments or types.

5.3.3 Planning Criteria

The Ergon Energy network covers a very large geographical area of about 1 million square kilometres with more than 550,000 customers. The Ergon Energy network connects into the Powerlink transmission network at 132kV, 66kV and 33kV. The total maximum demand of the Ergon Energy distribution network is around 2800MVA. This is non-diversified total maximum demand at connection assets to the Powerlink. The planning criteria of Ergon Energy is contained in the document "Network Planning Criteria – Deliverable NP02" which was recently published by Ergon Energy. These planning criteria form the basis for the planning of the Ergon Energy network.

Network planning has traditionally been based on deterministic planning criteria. The basic weakness of this approach is that while it provides 100% backup at all times, it does not take into account the probabilistic nature of system behaviour, customer demands, or component failure. "Probabilistic planning" uses probability techniques to recognise the random behaviour of different system states, components and loads. The probabilistic planning approach quantifies the risk of failures and accepts these risks. Contingency plans are prepared to manage these quantified risks. The application of this approach will enable the economic value of reliability improvements to be objectively assessed. Using modelling techniques it is possible to compare the capex outcomes of using the two different approaches and identify the savings that may be realised. A sensitivity analysis would be done to establish a more accurate value for the level of risk. This is considered important as the introduction of the necessary contingency plans that form part and parcel of the probabilistic approach will have a cost element associated with them. Although this process is more applicable at the planning of some subtransmission assets such as zone substations, where proper Markov reliability modelling could be done, it is useful at the HV feeder level as well to optimise the system performance and capex. From the documents we reviewed, we observed that Ergon Energy has identified the benefits of adoption of these planning methodologies and has started incorporating the required processes into their planning process for proper reliability assessment planning.

The Planning Criteria document recently prepared by Ergon Energy incorporates planning criteria to be applied to the Ergon Energy network. PB Associates considers that the planning criteria are sufficiently detailed enough to cover most of the planning aspects except for comprehensive reliability assessment planning purposes (RAP).

Although it is not detailed enough for RAP, the Planning Criteria document is an appropriate combination of standards applied to review and plan the network for future load growth to achieve the required level of system security, reliability and quality of supply.

However we believe there is room for further improvement and refinement in some areas. The aim of these improvements and refinements is to optimise the network performance and capital expenditure. Our comments are listed below.

1. Strict RAP methods are not used for planning of the network. Traditionally deterministic planning has been the accepted practice, however many electricity authorities now apply probabilistic approaches. Even where deterministic methods are still applied, the level of security is defined relating to the level of load, normally based upon some risk analysis. This appears to be the case for Ergon Energy, where a strict N-1 security is not applied irrespective of group demand. Further discussion regarding a risk based probabilistic approach is beyond the scope of this work but we recommend Ergon Energy develop detailed probabilistic planning approaches that will optimise the network performance and capital investment.

2. At the zone substation level some level of probabilistic planning methodologies have been incorporated. The existing planning criteria are a deviation from strict deterministic planning principles but it does not constitute proper objective probabilistic planning. PB Associates believe that the Ergon Energy should consider the introduction of risk modelled probabilistic planning methodologies to their network planning. These are now widely used in order to optimise network performance and capital expenditure in a competitive environment. It should be noted that the 1% criteria adopted by Ergon Energy is a very positive step towards optimised capital expenditure, given the limited availability of some data.

   The proper adoption of the "Reliability Assessment Planning" which is briefly discussed in the planning criteria provides a detailed, planning process that is very appropriate in the present competitive economic environment.

   A fundamental requirement in the application of the prescribed Reliability Assessment Planning process is a comprehensive and up to date knowledge of the current state and future potential for change of the network.

5.3.4 Capital forecasting

One of the objectives of this assignment is to review whether the appropriate processes have been followed in preparation of the Demand related capex of the Ergon Energy distribution network for the next 4-year regulatory period. As described in the sections above, the Distribution capital forecasts produced by Ergon Energy are based on the following items:

- Load forecast
- Planning criteria
- Planning studies
- Historical expenditure
- Current loading levels of the feeders
- Power quality issues

The main components of the Demand related capex are:

- Subtransmission
- HV Feeders
- LV reinforcements

5.4 REVIEW OF PROJECTS PLANNED

5.4.1 Project review methodology

Major subtransmission reinforcement projects can have high (>$10 million) capex requirements compared to distribution projects, which may require procurement of assets over a very short (1 or 2 year) time frame. For this reason, the transmission demand related capital expenditure requirements, from year to year, might be very lumpy. This can make benchmarking transmission demand related capital expenditure over a short time frame unreliable if due consideration of this effect is not taken into account.

Ergon Energy have provided some documents that form the basis of the Ergon Energy transmission and distribution capital expenditure forecast. In order to assess the reasonableness of the Ergon Energy demand related capital expenditure forecast a number of the larger and different types of projects have been reviewed by PB Associates.

The aim of this review is the following:

1. To assess the reasonableness of the process for examining constraints on the Ergon Energy subtransmission network;

2. To confirm that this process and the constraints are in line with the Planning Criteria.

3. To assess the reasonableness of assumption and data sources used in this analysis (e.g. load forecasts, network models, failure rates etc);

4. To assess the reasonableness of options and that a sufficient range of options has been considered;

5. To assess reasonableness of economic analysis performed to justify the preferred option, including: -

    - medium and long term project scope;
    - capital requirements;
    - load growth assumptions;
    - generation developments assumptions;
    - Ergon Energy assessment of risk;
    - Ergon Energy assessment of customer/business/state benefits.

We do not consider it within the scope of this work or the time constraints on this review to perform a detailed audit of the analysis and studies performed. Where studies and analysis performed have been indicated by Ergon Energy we have not attempted to validate that the individual studies have been performed correctly or that the interpretation of the individual studies by Ergon Energy staff is correct. Neither have we attempted to put forward other possible augmentation options.

In order to perform this review, Ergon Energy initially provided outlines of five projects so that PB Associates could ascertain a general overview of the projects. More detailed information relating to the actual studies performed, planning reports prepared and business case reports were requested by PB Associates for review. Ergon Energy provided study reports and/or planning reports for each of the projects.

5.4.2 General comments on Project Review

Based upon the review of the documents and data supplied relating to the five projects we make the following comments:

- We would consider Ergon Energy has taken steps to put processes in place to perform objective studies for their network capital expenditure
- More thorough detail studies are required for most of the projects to stand in a competitive commercial environment
- We are of the opinion that Ergon Energy do not have all the necessary data availability for proper RAP
- The later study reports indicate a significant improvement
- More objective processes are required to produce optimum level of demand related capex while achieving the required level of performance
- Some of the recently prepared documents such as “Network planning Criteria” indicate that Ergon Energy is trying to introduce proper processes for more objective and informed decision making

5.5 COMPARISON OF DEMAND RELATED CAPEX WITH OTHER DISTRIBUTION COMPANIES IN AUSTRALIA

5.5.1 Basis of Data Compared

Various key parameters and measures of levels of expenditure were tabulated to enable comparison with other distributors. Data is available in the public arena for Victoria, submitted as part of the Victorian 2001 price review. Work undertaken by PB Power in South Australia and Western Australia has shown that the Victorian figures are indicative of expenditure levels in these states as well.

The following measures were examined: -

1. Customer Driven Capex per New Customer
2. Total Demand + Customer Driven Capex per New Customer
3. Total Demand + Customer Driven Capex per kVA Load Growth

The following section details the assumptions made for determining customer numbers and growth forecasts.

5.5.1.1 Customer Projections Expenditure

Customer numbers were extrapolated linearly based on historical figures published by the ESAA. On this basis, overall customer numbers were predicted to increase at 2.8% per annum over the review period in Queensland.

5.5.1.2 Load Growth

The overall load growth figures used in the analysis were based on work previously commissioned by the QCA as follows[8]: -

Ergon Energy Annual compound growth 2001 – 2006 - 3%

[8] QCA, ”Electricity Demand Forecast fro 2001 to 2011”, February 2001

It is noted that forecast growth on a year-by-year basis is "lumpy" with a 'dip' of 2.3% per annum in 2002 – 2003. We currently do not have information that explains this dip.

5.5.2 Results of 2001 Price Review Comparisons

5.5.2.1 Customer Driven Capital Expenditure per New Customer

As part of the 2001 Electricity Price Review in Victoria, distribution companies were compared by examining "New Customer Connections capital expenditure per New Customer (NCC)". This is roughly equivalent to Ergon Energy Customer requested per New Customer. It is understood that in both cases the treatment of customer services is similar, however a component of metering is excluded in the Victorian figures, but included in the Queensland data. Due to the categorizations it is difficult to reconcile accurately this, however we believe this only have a minor effect on the absolute quantities making Ergon Energy expenditure higher.

In Victoria, the NCC incorporates costs for all types of customers and includes "100% recoverable works" which are works required that does not realise additional customers for example, deviations for road works.

Figure 5-1 below compares the forecast Ergon Energy customer driven expenditure with the maximum, minimum and average equivalent NCC capex forecast by Victorian DBs in the 2001 price review.

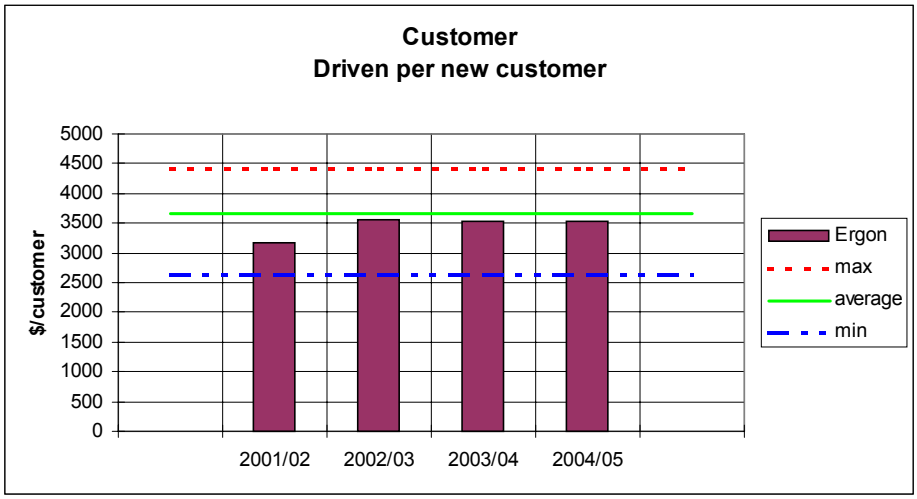

Figure 5-1 Customer Driven Expenditure

As can be seen, the level is close to average Victorian levels. This expenditure per new customer is decreasing over the forecast period, which could be explained by the following: -

- Known specific projects are included in the initial years, however in later years, these specific projects are not know and are not included in the forecast period;
- Ergon Energy's internally forecast customer projects are decreasing in the later years where we have assumed a constant linear increase.

5.5.2.2 Total Capex per New Customer

The total demand per new customer measures the total cost of network enhancement per new customer. For comparitive purposes, it has been assumed that the Customer Requested, Load/Energy management and Augmenation components of the Ergon

Energy system capex are equivalent to the total Demand Related reinforcement capex (DRR capex) in the Victorian 2001 price review.

The Ergon Energy break down of the Capex components compared is shown in Figure 5-2 below :-

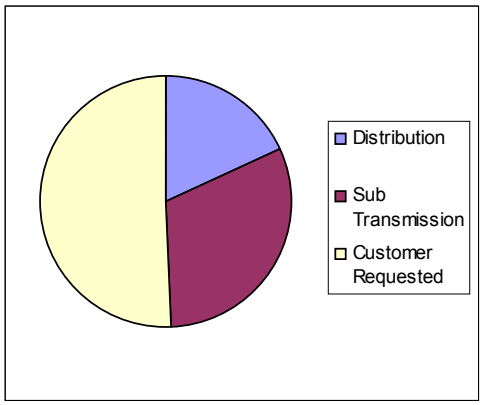

Figure 5-2 Breakdown of Capex Components

In contrast to the customer driven capex per new customer, these levels are above the average Victorian distribution company, as is shown in Figure 5-3. Over the five years the Ergon Energy expenditure is still within the Victorian limits.

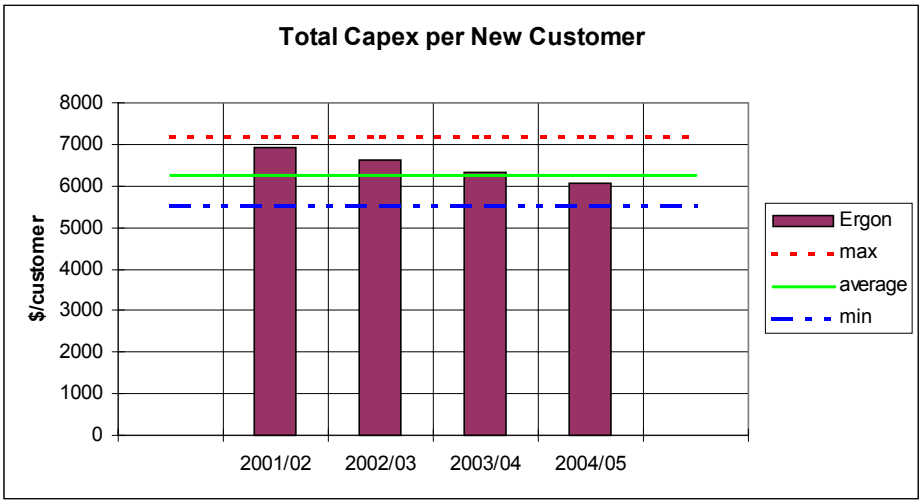

Figure 5-3 Ergon Energy Total Capex per New Customer

5.5.2.3 Total Demand Capex per kVA Load Growth

The total demand capex per kVA load growth is a measure of the ability and cost effectiveness of the Network to supply additional load. This measure is significantly affected by the nature of a network. Generally long rural networks will require high levels of expenditure to meet additional demand, while dense urban network are less costly due to the shorter distances involved and increased customer density.

Figure 5-4 and Figure 5-5 below show the total demand related capex for an increase in forecast non-coincident zone substation peak demand compared to Victorian distributors.

Results indicate that forecast expenditure is high compared to all Victorian distribution companies. The load forecast dip in 2001/2002 is highlighted by a surge in expenditure in 2001/2002.

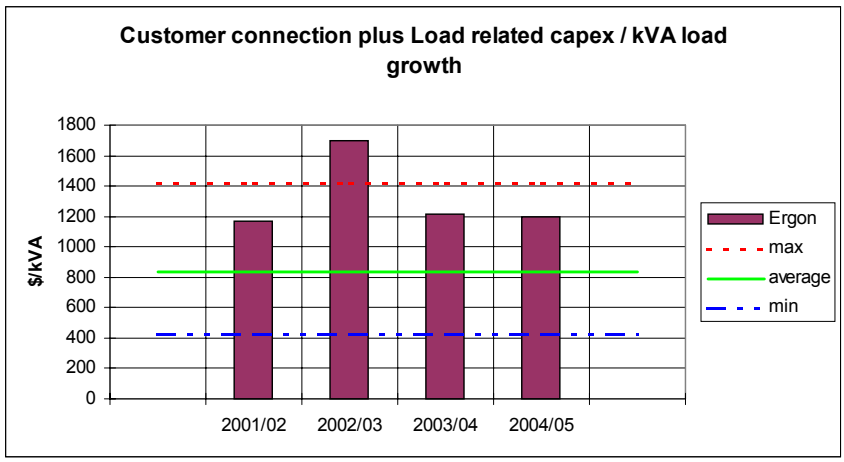

Figure 5-4 Total Demand Capex per kVA Load Growth

Figure 5-5 is a repeat of Figure 5-4, but comparing different type of networks. The Ergon Energy figures are comparable to typical rural Victorian utilities.

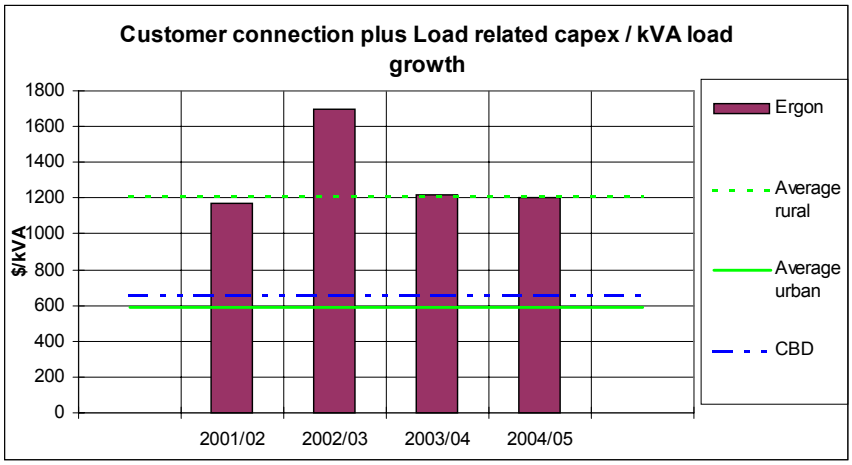

Figure 5-5 Total Demand Capex per kVA Growth (Network Comparison)

5.5.3 Discussion of Demand Related Comparison

A number of factors resulted in extreme differences in the capital expenditure parameters examined above. These are predominately due to: -

- Network density
- Differences in network utilisation levels
- Different planning thresholds
- Specific effects of equipment upgrades eg 6.6kV to 22kV conversions
- Unit costs

In the 2001 Price Review in Victoria these were examined using a PB Associates model that accounts for these different operating and planning parameters. In this review the comparison was limited to comparing the out put parameters only.

The results are summarised in Table 5-2.

Section	Comparison undertaken	Comments
1	Customer Driven per New Customer	Average
2	Total Demand / New Customer	Average
3	Total Demand / kVA Load Growth	High / consistent with typical Rural DB

Table 5-2 Summary of Comparisons

Although detailed historical expenditure levels were not made available for this review in the categories reviewed, we understand that the levels over the last few years were significantly below the forecast levels. The trend in expenditure shown is in fact consistent with expenditure levels of other distribution companies with little evidence of "carry over" investment from the previous years.

PB Associates have not carried out a detailed network comparison between Ergon Energy and other DB's, however we understand that Ergon Energy is predominately rural with small urban areas. The expenditure levels whilst higher than average, are consistent with rural utilities in our comparison.

On the basis of the comparisons, given that Ergon Energy is a rural utility experiencing relatively high load growth levels, our conclusion is that the demand related expenditure forecast by Ergon Energy is reasonable.

APPENDIX A
ASSET LIFE COMPARISON

APPENDIX A Comparison of Asset lives used in Scenario 1 and Scenario 2

	Valuation Asset Lives Scenario 1	Revised Asset Lives Scenario 2	Difference
11 CAP - CUBICLE & POLE TYPE	45	35	**-10**
11 CB INDOOR & OUTDOOR	45	50	**5**
11 FDR - RECLOSER	45	40	**-5**
132 CB OUTDOOR (all types)	45	50	**5**
132/33 or 11kV transformers, All MVA	45	50	**5**
132/66/11 transformers, All MVA (Auto)	45	50	**5**
220 CB OUTDOOR - FDR	45	50	**5**
33 CAP – 10 & 20 MVAR	45	35	**-10**
33 CB INDOOR (all types)	45	50	**5**
33/11kV transformers, All MVA	45	50	**5**
66 CAP	45	35	**-10**
66 CB – (All Types)	45	50	**5**
66/11 transformers, All MVA	45	50	**5**
66/33 transformers, 5/6-25 MVA (Auto)	45	50	**5**
Pilot Wire – (All types)	35	60	**25**
11 kV - Cable box All kVA	35	45	**10**
11 kV - Kiosk and pad mount All Sizes	35	45	**10**
11 kV Ground transformer All kVA	35	45	**10**
12.7 kV SWER pole mount 10/25kVA	35	45	**10**
12.7 kV SWER pole mount isol	35	45	**10**
19.1 kV recloser	35	40	**5**
19.1 kV SWER pole mount All sizes	35	45	**10**
22 kV - Kiosk and pad mount All sizes	35	45	**10**
22/11 kV - Pole mount All sizes	35	45	**10**
33 kV ABS	35	45	**10**
33 kV Ground 1,000 (No RMU)	35	45	**10**
33 kV polemount All sizes	35	45	**10**
33 kV Recloser	35	45	**10**
33 kV Regulator - Rural	35	45	**10**
ABS All voltages	35	45	**10**
Recloser 11/22 kV - 3 ph	35	40	**5**
Regulators pole mount – 2 & 3 ph	35	45	**10**
Sectionalisers -all sizes	35	45	**10**
SWER Reactor	35	45	**10**
Low Voltage Overhead Lines all types	35	45	**10**
Low Voltage Services – all types	35	44	**9**
Low Voltage Underground Cables – all types	60	70	**10**

	Valuation Asset Lives Scenario 1	Revised Asset Lives Scenario 2	Difference
Metering – all types	25	30	**5**
Major metering gear HV	15	30	**15**
11/22 kV Overhead Distribution Lines – all types	35	45	**10**
Overhead Transmission Lines – 132kV all types	50	45	**-5**
33 kV Overhead – wood poles	35	45	**10**
33 kV Overhead – Concrete poles	50	45	**-5**
66 kV Overhead – wood poles	35	45	**10**
66 kV Overhead – concrete poles	50	45	**-5**
Streetlight poles all types	20	40	**20**
SWER Overhead Lines – all types	35	45	**10**
132/110 kV UG (SOLID)	45	60	**15**
66kV terminations	60	50	**-10**