Benchmarking the Victorian Gas Distribution Businesses' Operating and Capital Costs Using Partial Productivity Indicators

Report prepared for
Envestra Victoria, Multinet and SP AusNet

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EXECUTIVE SUMMARY

This report discusses the efficiency performance of the three Victorian gas distribution businesses (GDBs) – Envestra Victoria, Multinet and SP AusNet – over the period 1999–2010 within a group of 11 Australian GDBs and 3 New Zealand GDBs. The report has been prepared for the three Victorian GDBs as input to the review of Victorian gas access arrangements for 2013–2017.

This report uses a range of partial productivity performance indicators to compare the opex and capital input efficiency performance of these businesses with one another. Partial productivity indicators have the advantage of being relatively easy to construct and understand. However, care needs to be exercised in interpreting the results of one or a small number of partial performance indicator results in isolation as they may give a misleading impression of overall efficiency. To gain an indication of overall relative performance, the partial indicators need to be considered together and jointly with key operating environment indicators.

For example, if a GDB is ranked poorly for most indicators then this would warrant further investigation as to whether that GDB was operating inefficiently. Conversely, if a GDB is ranked highly for most indicators then this would not warrant further investigation as the GDB is likely to be performing at levels consistent with industry best practice. If a GDB performs well on some indicators but poorly on others then the GDB's performance is harder to assess as it may be making trade–offs between different types of inputs (eg opex and capital) and more detailed analysis may be required.

Key findings

Based on these indicators and recognising the nature of their networks, the Victorian GDBs have performed well on most indicators. Opex efficiency has been particularly strong, considering that the Victorian GDBs have older systems and higher proportions of cast iron and other low pressure mains.

Some of the indicator growth rates observed in the first half of the period in the immediate aftermath of reform and ownership changes have slowed in the second half of the period as cost reductions become progressively harder to achieve after these initial gains are made. Future growth rates of key indicators are more likely to reflect, at best, the generally lower average growth rates of the more recent period due to this 'convergence' effect.

The three Victorian GDBs' operating environment characteristics can be summarised as follows:

- the highest customer densities per kilometre in the sample;
- relatively high energy densities per kilometre; and,
- mid–ranking energy densities per customer.

The three Victorian GDBs' efficiency performance in 2010 can be summarised as follows:

- the second, third and fourth lowest opex per TJ, with well above average improvement over the 12 year period;

- the first, third and fifth lowest opex per customer, with significant improvement over the period;
- while SP AusNet has shown the second highest rate of reduction in opex per customer over the last five years, the other two Victorian GDBs have had rates of reduction less than the overall sample average;
- sixth, ninth and twelfth rankings on opex per kilometre reflecting their high customer densities but with a substantial reduction over the period well in excess of the average;
- the second, third and fourth most efficient Australasian GDBs when the three principal opex drivers are combined into a comprehensive output measure;
- the first, fourth and fifth lowest capex per TJ;
- the first, sixth and eighth lowest capex per customer;
- fifth, ninth and eleventh rankings on capex per kilometre reflecting their high customer densities;
- the first, seventh and ninth best rankings on capex per unit of comprehensive output;
- Multinet had the lowest unit capex for three of the four driver normalisations and its real assets were around the same level in 2010 as they were in 1999 giving it a considerably lower than average capex indicator growth rate;
- Envestra's capex indicator growth rates were around average while SP AusNet's were above average;
- the second, third and fourth lowest capital asset values per TJ;
- the third, fourth and fifth lowest capital asset values per customer;
- ninth, tenth and twelfth rankings on capital asset values per kilometre reflecting their high customer densities;
- fourth, fifth and ninth rankings on capital asset values per unit of comprehensive output;
- Multinet had below average growth in its capital asset value indicators, Envestra Victoria had around average growth and SP AusNet had above average growth.

Background

This report extends and updates similar work reported by the authors in Lawrence, Fallon and Kain (2007a). The database used in this report is also used to form econometric estimates of cost function parameters in Economic Insights (2012a). The partial productivity performance indicators presented in this report complement the more comprehensive productivity measures presented in Economic Insights (2012a,b).

The Australian GDBs included in the study are:

- ActewAGL (ACT);
- APT Allgas (Queensland);
- ATCO Gas Australia (Western Australia);
- Envestra Albury (NSW);

- Envestra Queensland;
- Envestra South Australia;
- Envestra Victoria;
- Envestra Wagga (NSW);
- Jemena Gas Networks (NSW);
- Multinet (Victoria); and
- SP AusNet (Victoria).

The New Zealand GDBs included in the study are:

- GasNet;
- Powerco; and
- Vector.

The operating environment and performance indicators we present are:

- Energy delivered (TJ), number of customers and network kilometres (Figure 1);
- Customer density (customers per kilometre) (Figure 2);
- Energy density per kilometre (TJ per kilometre) (Figure 3);
- Energy density per customer (TJ per customer) (Figure 4);
- Opex per TJ (Figure 5);
- Opex per customer (Figure 6);
- Opex per kilometre (Figure 7);
- Opex per unit output (Figure 8);
- Capex per TJ (Figure 9);
- Capex per customer (Figure 10);
- Capex per kilometre (Figure 11);
- Capex per unit output (Figure 12);
- Asset value per TJ (Figure 13);
- Asset value per customer (Figure 14);
- Asset value per kilometre (Figure 15); and,
- Asset value per unit output (Figure 16).

This suite of performance indicators establishes the relative performance of the GDBs across major facets of their businesses while identifying key operating environment differences. They provide an opportunity to examine the priorities and trade–offs of the various GDBs – for example, comparing operating expenditure (opex) and capital input indicators together allows trade–offs between opex and capital use to be recognised.

The data used in this study have been sourced from documents in the public domain to the maximum extent possible including Access Arrangement Information (AAI) filings, regulators' final review reports and GDB Annual Reports. We have used the latest available historic information wherever possible but in a limited number of cases the data represent forecasts as presented in the regulatory proceedings rather than historic information reported after the event.

Given the datedness of current public domain data for Victoria, the data used for the three Victorian GDBs are sourced from the detailed Economic Insights (2012b) survey–based gas distribution business database.

While every effort has been made to make the publicly available data used in this study as consistent as possible, the limitations of currently available public domain data need to be recognised.

1 INTRODUCTION

Benchmarking studies provide an important source of information on the performance of a gas distribution business (GDB) relative to its peers and the associated potential for further efficiency improvements. The three Victorian GDBs – Envestra Victoria, Multinet and SP AusNet – have commissioned Economic Insights Pty Ltd ('Economic Insights') to benchmark their operating and maintenance expenditure (opex), capital expenditure (capex) and overall capital cost performance. In this report, we benchmark the efficiency performance of Envestra Victoria, Multinet and SP AusNet within a group of 11 Australian GDBs and 3 New Zealand GDBs. The study uses public domain data sources to the maximum extent possible.

Based on the indicators examined and recognising the nature of their networks, the Victorian GDBs have performed well on most indicators. Opex efficiency has been particularly strong, considering that the Victorian GDBs have older systems and higher proportions of cast iron and other low pressure mains.

Performance benchmarking provides GDBs and regulators with a means of assessing whether the GDBs are operating efficiently and, by comparing rates of return across GDBs and over time, whether operating efficiencies are being passed on to users of the service. At a more detailed level, performance benchmarking can provide insights relevant to answering the following types of questions:

- What productivity improvements have GDBs achieved?
- How close are the GDBs to best practice?
- What performance improvements would it be reasonable to expect the GDBs to achieve based on the observed performance of similar utilities?
- How should we adjust the GDBs' measured performance to allow for factors beyond management control?

This report uses a range of partial productivity performance indicators to compare the opex and capital input efficiency performance of these businesses with one another. Partial productivity indicators have the advantage of being relatively easy to construct and understand. However, care needs to be exercised in interpreting the results of one or a small number of partial performance indicator results in isolation as they may give a misleading impression of overall efficiency. To gain an indication of overall relative performance, the partial indicators need to be considered together and jointly with key operating environment indicators.

This report extends and updates similar work reported by the authors in Lawrence, Fallon and Kain (2007a). The database used in this report is also used to form econometric estimates of cost function parameters in Economic Insights (2012a). These estimates are then used to assess efficiency taking opex and capital input trade–offs and business conditions into account within a statistical framework and to forecast future opex partial productivity growth rates. A separate stream of work reported in Economic Insights (2012b) forms comprehensive total factor productivity measures of the productivity performance of the three Victorian GDBs and three other Australian GDBs using detailed survey–based data.

The partial productivity performance indicators presented in this report complement the more comprehensive productivity measures presented in Economic Insights (2012a,b). They do this by providing more disaggregated performance comparisons but only look at each aspect of overall performance in isolation rather than within a comprehensive performance measurement framework.

The following parts of this section of the report list the terms of reference for the report and Economic Insights' benchmarking experience and the qualifications of the consultants involved.

Section 2 then outlines in broad terms the data, companies and performance measures that were part of this study.

Section 3 then reports the findings of the performance indicator analysis.

1.1 Terms of reference

The terms of reference provided to Economic Insights by the three Victorian GDBs required the preparation of an expert report which considers, using partial productivity indicators, the efficiency of each GDB's performance by comparing their cost outcomes with the cost outcomes achieved by other equivalent Australian and New Zealand gas distribution network operators.

A copy of the letter of retainer for the study is presented in Attachment A.

1.2 Economic Insights' experience and consultants' qualifications

Economic Insights has been operating in Australia for 17 years as an infrastructure consulting firm. Economic Insights provides strategic policy advice and rigorous quantitative research to industry and government. Economic Insights' experience and expertise covers a wide range of economic and industry analysis topics including:

- infrastructure regulation;
- productivity measurement;
- benchmarking of firm and industry performance;
- infrastructure pricing issues; and
- analysis of competitive neutrality issues.

This report has been prepared by Dr Denis Lawrence who is a Director of Economic Insights and John Kain who is an Associate of Economic Insights. Summary CVs for Denis and John are presented in Attachment B.

Denis Lawrence has undertaken several major energy supply industry benchmarking studies including: benchmarking the productivity of Australian and US gas distribution businesses, benchmarking the performance of New Zealand's 29 electricity lines businesses and 5 gas pipeline businesses and advising the Commerce Commission on appropriate X factors for each of the distribution businesses; benchmarking the performance of Australian and New Zealand gas distribution businesses; benchmarking the productivity performance of the Australian state electricity systems against best practice in the US and Canada at both the system–wide level and for individual power plants; benchmarking the productivity, service quality and financial performance of 13 Australian electricity distribution businesses; and reviewing benchmarking work undertaken for regulators in NSW, Victoria, South Australia and Queensland. Denis recently assisted the Australian Energy Market Commission in its review of productivity–based regulation. Denis holds a PhD in Economics from the University of British Columbia, Canada, where his thesis supervisor was Professor Erwin Diewert who is one of the world's leading productivity and efficiency measurement academics.

John Kain has extensive energy supply industry experience at both an operational and analytical level. Prior to becoming a consultant John was employed by ACT Electricity and Water (ACTEW) as Chief Engineer and General Manager Engineering. Since leaving ACTEW, John has operated as an independent consultant in the energy distribution industry, specialising in the analysis of network costs and tariffs. John's clients have included the ACCC and distribution businesses. He has worked on several major benchmarking studies for Economic Insights including assisting the NZ Commerce Commission with setting price caps for electricity lines and gas pipeline businesses and providing advice to the AEMC on data requirements for performance measurement. John holds Science and Engineering degrees from Sydney University.

Denis Lawrence and John Kain have read the Federal Court Guidelines for Expert Witnesses and this report has been prepared in accordance with the Guidelines. A declaration to this effect is presented in Attachment C to the report.

2 DATA

2.1 Data sources

The data used in this study have been sourced from documents in the public domain to the maximum extent possible and relate to the period 1999 to 2010. Data for most of the Australian GDBs in the study are publicly available for most of this period. However, there are fewer consistent observations publicly available for the New Zealand GDBs, reflecting the impact of mergers, asset sales and industry restructuring. As a result, Powerco (New Zealand) only has observations for 2004 onwards and Vector (New Zealand) only has observations for 2006 onwards. GasNet (New Zealand), on the other hand, has observations available for the whole period, 1999 to 2010.

The public domain data sources used for the Australian GDBs include:

- Access Arrangement Information (AAI) filings as proposed and as amended by a regulator's decision;
- Regulators' final decisions, sometimes with amendment following appeal; and
- Annual Reports from the GDB or its parent firm.

The public domain data source used for the NZ GDBs is the Information Disclosure Data filings required by the Gas (Information Disclosure) Regulations 1997.

Data used includes throughput, customer numbers, distribution pipeline length, opex, capex and regulatory asset value. In a few cases missing observations were estimated based on growth rates for the variable or a related variable before and after the missing year. In a number of cases adjustments were made to ensure the data related to comparable activities and measures (eg unaccounted for gas allowances for non–Victorian GDBs have been excluded to put those GDBs on a comparable basis with Victorian reporting).

The data used for the Australian GDBs cover only the regulated activities. Data relating to large industrial users whose supply is not regulated are not included. Inclusion of this data would require access to information not generally in the public domain and has been beyond the scope and timeframe of this study.

Despite the existence of the National Gas Law and Regulations and their predecessors, the amount of detail provided by both regulators and GDBs differs and data are typically not drawn together in the one location. The progressive transfer of regulatory responsibilities from jurisdictional regulators to the Australian Energy Regulator (AER) has also tended to fragment the historic data available, at least in the short run. Some differences remain in the coverage of distribution activities across states although this is now more consistent than in earlier years.

In some cases the regulators' final approvals have used forecast data substantially different from that presented by the GDBs in their initial AAIs. Not all jurisdictions have required the GDBs to supply revised AAIs consistent with the final approvals. We have used the final approval information, where possible, as we consider that it is the most consistent and objective source of information available. While we have used the latest available historic information wherever possible, in a limited number of cases the data represent forecasts from regulatory decisions because actual data were not available for the more recent years.

Economic Insights (2009, p.v) noted that:

> 'The extent, quality, uniformity and continuity of currently available historical regulatory data are very variable both between jurisdictions and over time. Regulatory data have to date concentrated almost exclusively on financial variables ... (and) there are significant gaps and changes in coverage over time and across jurisdictions. ... This compromises comparability across businesses, across jurisdictions and over time.'

While every effort has been made to make the publicly available data used in this study as consistent as possible, the limitations of currently available public domain data need to be recognised. These include somewhat different coverage of activities and definitions of variables reported both across jurisdictions and over time as regulators have changed reporting requirements.

While relatively recent regulatory reviews are available for most Australian States, this is not the case for Victoria where the last regulatory review was undertaken by the Essential Services Commission (ESC) in 2007. Furthermore, with the subsequent transfer of regulatory responsibilities to the AER, the ESC ceased publication of its *Gas Distribution Businesses Comparative Performance Reports* with data for the 2007 year being the last reported.

Given the importance of current and consistent Victorian data to this study, we have sourced the data used for the three Victorian GDBs from the detailed Economic Insights (2012b) survey–based gas distribution business database. Construction of this detailed survey–based productivity database involved collection of specified data from each GDB and then extensive checking and clarification with the GDBs where necessary to ensure data compatibility both over time and between GDBs. Data collected covers revenue, billed and functional outputs, opex, system physical data, system capacity, initial asset values, remaining and overall regulatory asset lives and capex. Regulatory asset values are formed using data on the initial capital base, capex and regulatory asset lives and application of a simplified version of the AER (2008) roll forward model (see Economic Insights 2010 for an illustration of the method).

The data from the public domain and survey–based databases relate to the time periods normally reported by each GDB – some GDBs use calendar year reporting while others use financial year reporting. The public domain data were in a mix of nominal and real terms based on different years. All cost data were first converted to nominal terms (where necessary) using the all groups consumer price indexes for each country. The nominal series were then converted to real series in 2010 dollars using the all groups consumer price indexes for each country. The New Zealand data were then converted to Australian dollars using the OECD (2011) purchasing power parity for 2010. Purchasing power parities are the rates of currency conversion that eliminate differences in international price levels and are commonly used to make comparisons of real variables between countries.

2.2 Gas distribution businesses included in the study

The database formed for the study includes 11 Australian GDBs and 3 New Zealand GDBs. A brief summary of the operations of the included GDBs follows.

2.2.1 Australian GDBs

ActewAGL, Australian Capital Territory

ActewAGL is the distribution business supplying gas and electricity in the Australian Capital Territory (ACT). The total population of the ACT in 2010 was 358,000 (ABS 2011). Gas is distributed to a predominantly residential customer base with Canberra the largest market. There are few industrial users of any significance. Canberra covers a large geographical area and the majority of urban development is low density. Moreover, gas distribution in residential areas utilises a dual mains configuration with mains on both sides of a street, rather then a single sided system with longer cross-road service connection. This results in a commensurately low density distribution network measured in terms of customers per kilometre of main and TJ supplied per customer.

In 2010 ActewAGL supplied 116,164 customers with 7,663 TJ of gas from a distribution network of around 4,200 kilometres of mains.

APT Allgas Pty Ltd (Allgas), Queensland

Allgas supplies gas to consumers in several areas in and around Brisbane and to several Queensland regional areas. The Allgas distribution system is separated into three operating regions. These are:

- the Brisbane region (south of the Brisbane river to the Albert River);
- the Western region (including Toowoomba and Oakey); and,
- the South Coast region (including the Gold Coast and Tweed Heads in NSW).

About 59 per cent of the network is located in Brisbane, 19 per cent in the Western region and the remaining 22 per cent on the South Coast and Tweed Heads.

Queensland’s mild to hot climate means that residential and commercial heating demand is low. Residential demand for gas is mainly for hot water systems and cooking. In 2010 southeast Queensland’s population was around 3 million (ABS 2011). More than 70 per cent of Allgas’ gas demand is from around 100 large demand class customers.

In 2010 Allgas supplied 81,824 customers with 10,962 TJ of gas from a distribution network of 2,970 kilometres of mains.

ATCO Gas Australia, Western Australia

ATCO acquired the network previously operated by WA Gas Networks (WAGN) in July 2011. ATCO Gas Australia is the principal GDB for Western Australian businesses and households. It operates the gas distribution system in the mid-west and south-west of Western Australia. It services the Perth Metropolitan region, the Albany region and Kalgoorlie with three separate gas distribution networks.

In 2010, ATCO supplied 610,109 customers with 32,158 TJ of gas from a distribution network of 12,640 kilometres of mains.

Envestra Albury, NSW

Envestra Albury operates in the large regional centre on the border of NSW and Victoria often referred to as Albury–Wodonga. In 2010 the population of the twin cities was estimated to be 87,544. In 2010 there were 22,729 residential customers and 1,102 non-residential customers.

In 2010 Envestra Albury supplied its 23,831 customers with 3,359 TJ of gas from a distribution network of 615 kilometres of mains.

Envestra Queensland, Queensland

Envestra Queensland's distribution network can be divided into two regions:

- the Brisbane region (including Ipswich and suburbs north of the Brisbane river); and,
- the Northern region (serving Rockhampton and Gladstone).

The network consists of 2,560 kilometre of low, medium, high and transmission pressure mains. Assets used to service the Brisbane region comprise 88 per cent of the network with the balance of 12 per cent attributable to the Northern region.

Envestra Queensland is subject to similar climatic influences on residential gas demand as Allgas. Customer numbers are greater than those for Allgas but regulated volumes are smaller. However, Envestra has a number of unregulated industrial customers with very large volumes that are not reflected in the data used in this study. In 2010 there were 79,042 residential customers and 4,850 non–residential customers.

In 2006, for its regulated distribution network, Envestra Queensland supplied its 76,175 customers with 5,701 TJ of gas from a distribution network of 2,560 kilometres of mains.

Envestra SA, South Australia

Envestra SA's distribution network services the Adelaide (including the Barossa Valley), Peterborough, Port Pirie, Riverland, South–East and Whyalla regions. Adelaide's population in 2010 was 1.2 million. As with Melbourne, Adelaide's winter climate is conducive to relatively high residential gas demand for heating. In 2010 there were 391,025 residential customers and 10,312 non–residential customers.

In 2010, Envestra SA supplied its 401,337 customers with 23,841 TJ of gas from a distribution network of 7,887 kilometres of mains. The Adelaide network makes up 93 per cent of the total network length.

Envestra Victoria, Victoria

Envestra Victoria serves parts of the Melbourne gas market (population of 4.8 million in 2010) as do Multinet and SP AusNet. Envestra Victoria also serves several areas in north central Victoria. As described by Envestra Victoria in their 2008 AAI, 'the Distribution System serves the northern, outer eastern and southern areas of Melbourne, Mornington Peninsula and rural communities in northern and north–eastern Victoria, south-eastern rural townships in Gippsland and a number of outlying towns such as Bairnsdale and Paynesville (which are in the new Eastern Zone). The Distribution System is divided into four Zones – North, Central, Murray Valley and Eastern.' This description remains accurate and current as at the date of this report.

Melbourne's gas market is well established and cool to mild climatic conditions result in high residential gas consumption for heating, cooking and hot water systems. A relatively high concentration of industry also supports industrial gas demand provided that prices are competitive with other sources of energy supply. In 2010 there were 528,992 residential customers and 23,450 non–residential customers.

In 2010, Envestra Victoria supplied its 552,442 customers with 56,442 TJ of gas from a distribution network of 10,341 kilometres of mains.

Envestra Wagga Wagga, NSW

Envestra took over gas supply from the NSW Government's Country Energy from October 2010. Envestra supplies gas to the city of Wagga Wagga (estimated population of 63,500 in 2010) in southern regional NSW. In 2010 there were 18,476 residential customers and 209 non–residential customers.

In 2010 Envestra supplied its 18,685 customers with 1,576 TJ of gas from a distribution network of 680 kilometres of mains.

Jemena Gas Network, NSW

Jemena was formed from the sale of Alinta Ltd in 2007, Alinta itself having acquired the gas assets of AGL Gas Networks (AGLGN) in 2006. Jemena distributes gas to Newcastle (population of 540,800 in June 2010), north of Sydney, Sydney (population of 4,504,500 in June 2010), and Wollongong, south of Sydney (population of 203,500 in 2010), along with several smaller population centres located between these larger markets and regional country centres in NSW. Jemena has the largest distribution network and customer base of the Australian GDBs.

In 2010 Jemena supplied 1,082,706 customers with 99,200 TJ of gas from a distribution network of 24,028 kilometres of mains.

Multinet Gas, Victoria

The Multinet gas distribution system covers the eastern and south–eastern suburbs of Melbourne extending over an area of approximately 1,600 square kilometres as well as rural extensions to townships in the Yarra Valley and South Gippsland. In 2010 there were 651,551 residential customers and 16,822 non–residential customers.

In 2010, Multinet supplied its 668,373 customers with 58,686 TJ of gas from a distribution network of 9,910 kilometres of mains. Multinet has the highest customer density per kilometre of mains of the Australasian GDBs.

SP AusNet, Victoria

SP AusNet was formerly TXU networks which was formerly Westar (Assets) Pty Ltd. SP AusNet is the trading name of SPI Networks. It delivers gas to over 500,000 customers across a geographically diverse region spanning the western half of Victoria, from the Hume highway in metropolitan Melbourne west to the South Australian border and from Bass Strait to Horsham and just north of Bendigo. In 2010 there were 561,168 residential customers and 15,891 non–residential customers.

In 2010, SP AusNet supplied its 577,059 customers with 83,325 TJ of gas from a distribution network of 9,697 kilometres of mains.

2.2.2 New Zealand GDBs

GasNet Ltd

GasNet distributes gas in Wanganui, Marton and Bulls. Wanganui, with an estimated population in 2010 of 39,700, is the largest part of the distribution network.

GasNet purchased the network business from Wanganui Gas Ltd in 2008. It is 100 per cent owned by Wanganui Gas Limited which is itself owned by Wanganui District Council Holding Limited.

In 2010, GasNet supplied 10,309 customers with 1,095 TJ of gas from a distribution network of 386 kilometres of mains.

Powerco Limited

Powerco is based in New Plymouth (population 52,200 in 2010) and distributes gas in the upper central and lower central North Island. It is a dual gas and electricity network business. Powerco’s gas networks are in the Taranaki, Manawatu, Hutt Valley (estimated population 140,900), Porirua (district population of 52,000), Wellington City (population of 186,900), Horowhenua and Hawkes Bay regions. Powerco acquired part of UnitedNetworks’ gas operations in 2002 comprising the Hawkes Bay, Wellington, Horowhenua and Manawatu networks.

In 2010, Powerco supplied its 102,346 customers with 9,269 TJ of gas from a distribution network of 6,170 kilometres of mains.

Vector Ltd

Vector Ltd operates the gas distribution network in Auckland (estimated population of 863,600 including the adjacent Manukau area) as well as other major North Island centres and 40 smaller towns and cities.

Vector acquired the remaining part of UnitedNetworks’ gas operations in 2002 comprising its Auckland gas network and the National Gas Corporation’s gas distribution business in 2004 and 2005. The Vector data from 2006 represent the combined operations of Vector and the former NGC Distribution.

Vector also owns and operates significant transmission pipelines and power line networks throughout the North Island. It is listed on the NZ Stock Exchange, but is around 75 per cent owned by the Auckland Energy Consumer Trust.

In 2010, Vector supplied 150,892 gas distribution customers with 21,226 TJ of gas from a distribution network of 10,155 kilometres of mains.

2.3 Performance measures

Productivity performance plays an important role in implementing CPI–X regulation. Forecast costs will be allowed by the AER if the AER is reasonably satisfied that they reflect efficient practice. Estimates of likely future achievable productivity gains thus play an important role in determining the revenue requirement a business is allowed to recover. Judgements about whether a business is operating at efficient cost levels are often made on the basis of direct comparison with comparable peer utilities and judgements about achievable productivity gains in future years are usually influenced by recent changes in observed productivity performance in the industry.

Consequently, our performance measurement framework needs to capture productivity performance across the main drivers of costs: operating and maintenance expenditure, capital expenditure and fixed assets. This is done by incorporating a range of partial productivity indicators where opex, capital expenditure and capital asset values are normalised on a number of different bases including throughput, customer numbers and network kilometres. In the case of operating and maintenance expenditure we also present an indicator which normalises opex by a comprehensive index measure of GDB output which combines throughput, customer numbers and network kilometres using opex output cost shares in forming the output index.

The operating environment and performance indicators we have used in the study are:

- Energy delivered (TJ), number of customers and network kilometres (Figure 1);
- Customer density (customers per kilometre) (Figure 2);
- Energy density per kilometre (TJ per kilometre) (Figure 3);
- Energy density per customer (TJ per customer) (Figure 4);
- Opex per TJ (Figure 5);
- Opex per customer (Figure 6);
- Opex per kilometre (Figure 7);
- Opex per unit output (Figure 8);
- Capex per TJ (Figure 9);
- Capex per customer (Figure 10);
- Capex per kilometre (Figure 11);
- Capex per unit output (Figure 12);
- Asset value per TJ (Figure 13);
- Asset value per customer (Figure 14);
- Asset value per kilometre (Figure 15); and,
- Asset value per unit output (Figure 16).

This suite of performance indicators establishes the relative performance of the GDBs across major facets of their businesses. It provides an opportunity to examine the priorities and trade–offs of the various GDBs, for example comparing opex and capital input indicators together allows trade–offs in opex and capital use to be recognised.

3 PERFORMANCE ASSESSMENT

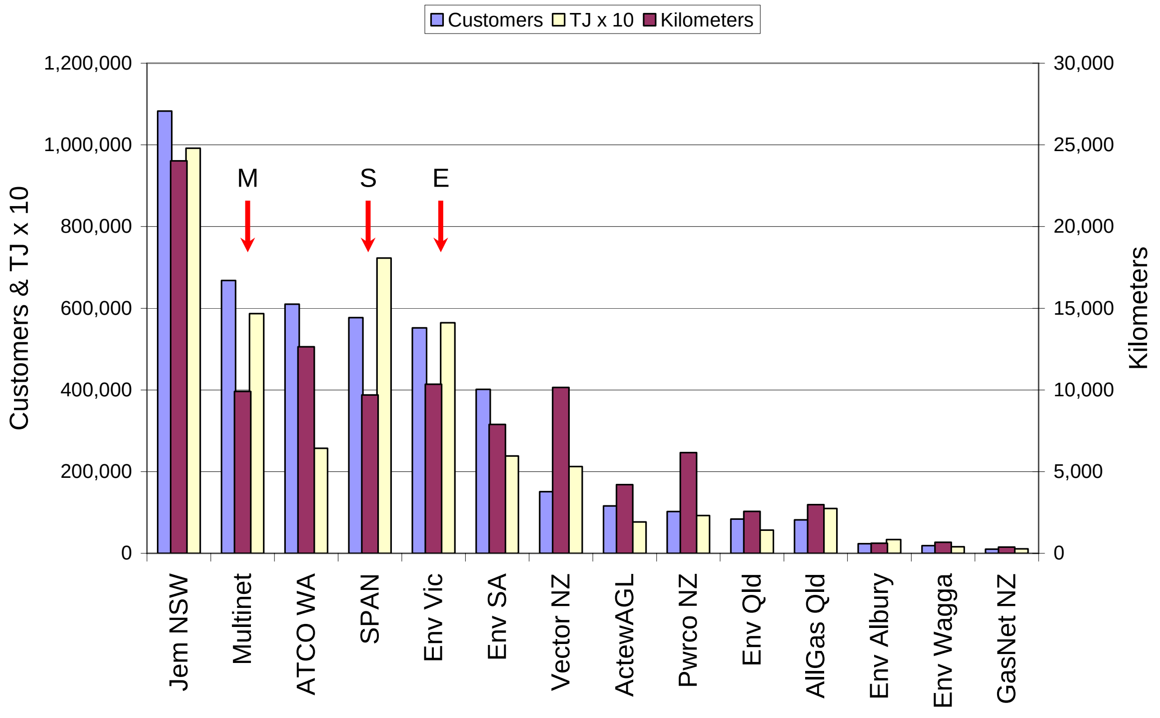
In this section key indicators are presented for the 14 GDBs covering the years 1999 to 2010. Data for the full 11 year period are available for 8 of the Australian GDBs and for GasNet in New Zealand. Data for ATCO WA are available from 2000 onwards while data for the two Queensland GDBs are available from 2001 onwards. There are fewer comparable observations available for the two larger New Zealand GDBs due to merger and restructuring activity. Powerco's composition has been relatively stable from 2004 onwards and Vector's composition has been relatively stable from 2006 onwards. Consequently, data for these periods only are included for these two GDBs.

The indicators are presented in graphical form ranked according to 2010 values. For convenience, arrows with the first letter of the business's name highlight the positions of the three Victorian GDBs.

3.1 Operating environment features

The 14 Australasian distribution businesses operate in varying environments with often substantial differences in network size, amount of throughput, demand growth, number and type of customers, and the mix of rural, urban and CBD customers .

Figure 1: **Key features of the operating environment, 2010**

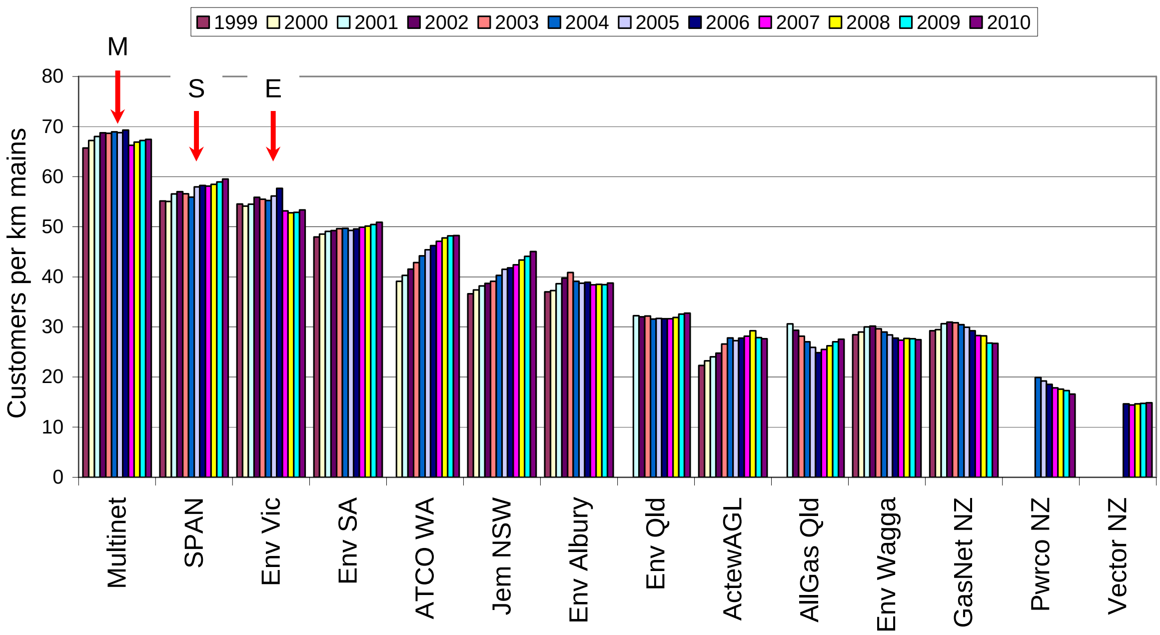


Source: Economic Insights gas utility database

While Jemena's NSW distribution network is by far the largest of the 14 included GDBs, the three Victorian GDBs occupy either the second to fourth or second to fifth positions in terms of the three key measures of size included – throughput, customer numbers and network length (Figure 1 and Table 1). Multinet is the second largest GDB in terms of customers while SP AusNet and Envestra Victoria are fourth and fifth largest behind ATCO WA. SP AusNet is the second largest GDB in terms of throughput (TJ) while Multinet and Envestra Victoria are third and fourth largest, respectively. The network lengths of the three Victorian GDBs are very similar in magnitude with Envestra Victoria having the second longest length of the included GDBs followed by Multinet and SP AusNet.

The two key operating environment characteristics which influence energy distribution business productivity levels and costs are customer density (customers per kilometre of mains) and energy density (throughput per customer). A GDB with lower customer density will require more pipeline length to reach its customers than will a GDB with higher customer density but the same consumption per customer. This would make the lower density distributor appear less efficient unless the differing densities are allowed for. Being able to deliver more energy to each customer means that a GDB will usually require less inputs to deliver a given volume of gas as it will require less pipelines than a less energy dense GDB would require to reach more customers to deliver the same total volume. The secondary energy density measure of throughput per kilometre is also relevant. These density measures for all companies in the sample for all available years are presented in Figures 2 to 4.

Figure 2: **Customer density, 1999–2010**

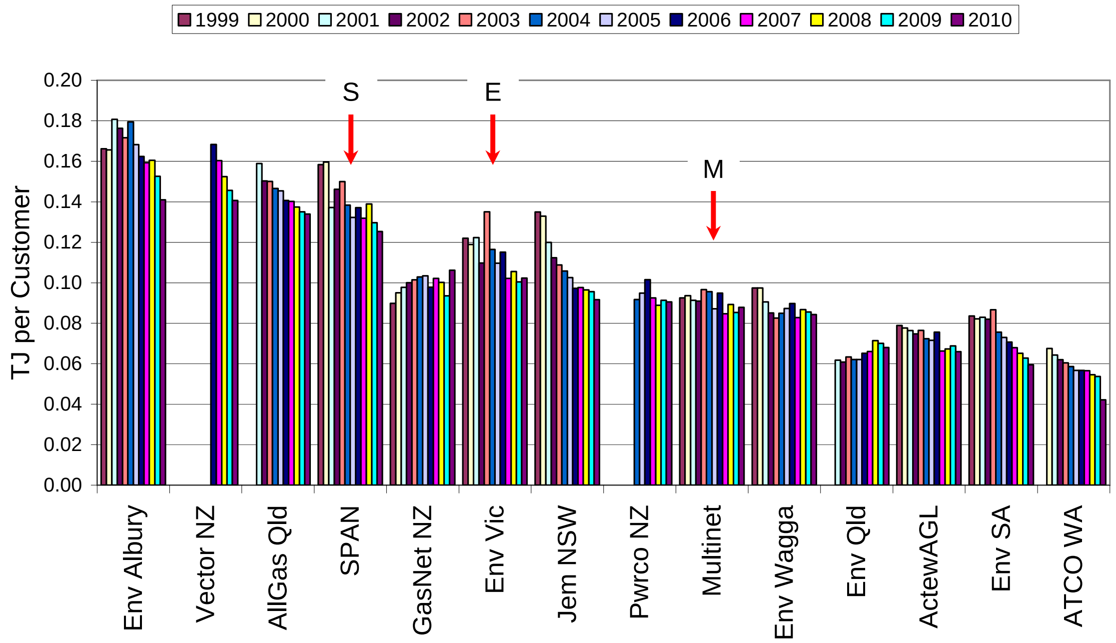


Source: Economic Insights gas utility database

Multinet has the highest customer density with around 67 customers per kilometre compared to the sample average of 38 customers per kilometre (Figure 2 and Table 1). SP AusNet and Envestra Victoria have the next highest customer densities with 60 and 53 customers per kilometre, respectively. There has been a marginal decline in Multinet's and Envestra

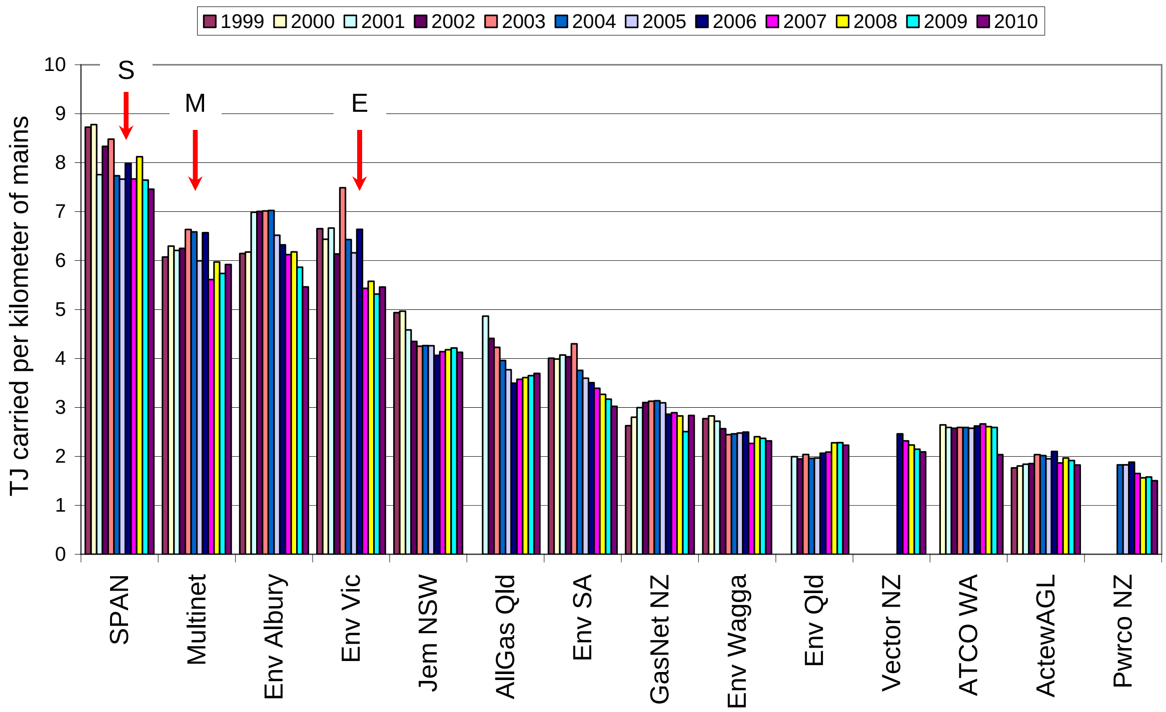
Victoria's customer densities since 2006, while customer density for SP AusNet and GDBs on average has increased marginally over the same period.

Figure 3: **Energy density per customer, 1999–2010**



Source: Economic Insights gas utility database

Figure 4: **Energy density per kilometre, 1999–2010**



Source: Economic Insights gas utility database

Multinet currently has below average energy density per customer for the 14 GDBs with around 0.088 TJ per customer compared to an average of 0.096 TJ per customer (Figure 3 and Table 1). SP AusNet and Envestra Victoria, on the other hand, have higher than average energy density with 0.125 and 0.102 TJs per customer, respectively. The energy density per customer of the three Victorian GDBs has generally fallen over the period. The three GDBs with the highest energy densities per customer are smaller GDBs with a higher concentration on serving large industrial customers compared to the more domestic customer–oriented focus of the Victorian GDBs and Jemena in NSW.

In line with their high customer densities and generally mid–range energy densities per customer, the three Victorian GDBs also have relatively high energy densities per kilometre. SP AusNet, Multinet and Envestra Victoria have energy densities per kilometre of 7.46, 5.92 and 5.46 TJs per kilometre, respectively, compared to the sample average of 3.57 TJ per kilometre (Figure 4 and Table 1). Multinet's energy density per kilometre increased from 1998 to 2003 but has since declined while those of SP AusNet and Envestra Victoria have generally declined over the period. The industrial customer–oriented Envestra Albury is the other GDB having a high energy density per kilometre.

Table 1 contains all of the performance measures for 2010 and average annual compound growth rates from 1999 or the earliest year available to 2010. Since the gas distribution industry has undergone extensive reform and changes of ownership since 1999, in Table 2 we also present average annual compound indicator growth rates from 2005 to 2010 along with the ratio of each GDB's performance indicator for 2010 to the relevant performance indicator average for 2010. Some of the indicator growth rates observed in the first half of the period in the immediate aftermath of reform and ownership changes have slowed in the second half of the period as GDBs have made easier initial 'catch–up gains'. Productivity improvements and cost reductions become progressively harder to achieve after these initial gains are made and will eventually be constrained by the rate of technological change in the industry. Since this is a mature industry with high capital intensity and long–lived, sunk assets one would not expect to see the high rate of technological change observed in industries such as telecommunications where information technology plays a greater role and which have shorter asset lives and less sunk capital. Consequently, future growth rates of key indicators are more likely to reflect the generally lower growth rates of the more recent period shown in Table 2 than those of the longer period. This is sometimes referred to as the 'convergence' effect. The quality and consistency of public domain data is also likely to be better in the more recent period.

A noteworthy observation from Tables 1 and 2 is that the growth rates of throughput have generally been less than those for both customer numbers and pipeline length for nearly all the included GDBs. This has generally led to declining energy densities over time and reflects the observed long term trend of declining average gas usage. Secondly, Multinet's throughput growth has been at the lower end of the range for the three Victorian GDBs and its growth in both customer numbers and pipeline length have been significantly below those of the other two Victorian GDBs, reflecting the more mature, inner suburban area it services.

In the following sections we examine the indicators covering opex, capex and capital asset efficiency and productivity growth.

Table 1: **Operating and performance indicators in $A2010, Australian and New Zealand GDBs, 2010 and average annual indicator growth rates since earliest year**

Company	Year/ Period	TJ	Customers	km	Cust /km	TJ/ km	TJ/ cust	Opex/ TJ	Opex/ cust	Opex/ km	Opex/ unit	Capex/ TJ	Capex/ cust	Capex/ km	Assets/ TJ	Assets/ cust	Assets/ km
Env Vic	2010	56,442	551,925	10,341	53	5.46	0.102	909	93	4960	1.302	945	97	5,160	17,602	1,800	96,074
Multinet	2010	58,686	668,373	9,910	67	5.92	0.088	873	77	5169	1.194	653	57	3,864	18,006	1,581	106,629
SPAN	2010	72,325	576,987	9,697	60	7.46	0.125	533	67	3974	0.886	996	125	7,432	16,123	2,021	120,255
ActewAGL	2010	7,663	116,164	4,200	28	1.82	0.066	2,506	165	4573	2.389	2,050	135	3,740	36,781	2,426	67,109
AllGas Qld	2010	10,962	81,824	2,970	28	3.69	0.134	1,355	181	5001	2.004	2,332	312	8,607	36,915	4,946	136,266
ATCO WA	2010	25,714	610,109	12,640	48	2.03	0.042	1,924	81	3914	1.557	1,759	74	3,578	32,322	1,362	65,756
Env Albury	2010	3,359	23,831	615	39	5.46	0.141	526	74	2874	0.862	663	93	3,620	10,224	1,441	55,839
Env Qld	2010	5,701	83,892	2,560	33	2.23	0.068	3,296	224	7340	3.315	3,203	218	7,134	53,208	3,616	118,493
Env SA	2010	23,841	401,337	7,887	51	3.02	0.059	1,929	115	5830	1.954	1,335	79	4,035	41,453	2,462	125,304
Env Wagga	2010	1,576	18,685	680	27	2.32	0.084	1,411	119	3270	1.565	1,937	163	4,489	38,320	3,231	88,792
Jem NSW	2010	99,200	1,082,706	24,028	45	4.13	0.092	1,222	112	5045	1.580	940	86	3,881	22,520	2,063	92,973
GasNet NZ	2010	1,095	10,309	386	27	2.84	0.106	1,570	167	4452	1.997	na	na	na	22,552	2,394	63,948
Pwrco NZ	2010	9,269	102,346	6,170	17	1.50	0.091	1,868	169	2806	1.951	1,150	104	1,728	42,090	3,812	63,229
Vector NZ	2010	21,226	150,892	10,155	15	2.09	0.141	1,124	158	2349	1.509	na	na	na	19,666	2,766	41,105
Average		28,361	319,956	7,303	38	3.57	0.096	1,503	129	4397	1.719	1,497	129	4,772	29,127	2,566	88,698
Average annual growth – per cent																	
Env Vic	2010/99	1.0	2.6	2.8	-0.2	-1.8	-1.6	-1.9	-3.4	-3.6	-2.9	2.0	0.4	0.2	0.2	-1.4	-1.6
Multinet	2010/99	0.6	1.0	0.8	0.2	-0.2	-0.5	-1.9	-2.3	-2.1	-2.1	-0.1	-0.5	-0.3	-0.6	-1.1	-0.9
SPAN	2010/99	0.6	2.7	2.0	0.7	-1.4	-2.1	-3.6	-5.6	-5.0	-4.7	4.6	2.4	3.1	1.6	-0.6	0.1
ActewAGL	2010/01	1.9	3.6	2.0	1.6	-0.1	-1.6	-0.2	-1.8	-0.3	-0.9	-2.5	-4.1	-2.6	-1.3	-2.9	-1.4
AllGas Qld	2010/01	1.5	3.5	4.7	-1.2	-3.0	-1.9	2.4	0.5	-0.7	1.0	5.9	3.9	2.7	3.3	1.3	0.1
ATCO WA	2010/00	-0.8	4.0	1.8	2.1	-2.6	-4.6	0.7	-3.9	-1.9	-1.8	4.0	-0.8	1.3	1.8	-2.9	-0.8
Env Albury	2010/01	0.0	2.8	2.8	0.0	-2.7	-2.7	2.3	-0.5	-0.5	0.6	7.8	4.8	4.9	1.1	-1.7	-1.7
Env Qld	2010/01	2.8	1.7	1.6	0.2	1.2	1.1	1.1	2.1	2.3	1.8	2.3	3.4	3.5	0.0	1.1	1.3
Env SA	2010/99	-1.3	1.8	1.3	0.5	-2.5	-3.1	0.9	-2.2	-1.7	-0.9	1.4	-1.6	-1.1	2.5	-0.7	-0.1
Env Wagga	2010/99	0.9	2.2	2.5	-0.3	-1.6	-1.3	-0.8	-2.1	-2.4	-1.7	1.3	0.0	-0.3	2.7	1.3	1.0
Jem NSW	2010/00	-0.5	3.2	1.3	1.9	-1.8	-3.6	-1.0	-4.6	-2.8	-2.9	-0.9	-4.6	-2.8	1.0	-2.7	-0.9
GasNet NZ	2010/99	1.6	0.1	0.9	-0.8	0.7	1.5	1.7	3.2	2.4	2.5	na	na	na	1.3	2.8	2.0
Pwrco NZ	2010/04	-1.0	-0.8	2.3	-3.0	-3.2	-0.2	0.3	0.1	-2.9	-0.4	2.9	2.7	-0.4	-2.4	-2.6	-5.6
Vector NZ	2010/06	-2.0	2.5	2.1	0.4	-4.0	-4.4	-6.1	-10.2	-9.9	-8.6	na	na	na	0.2	-4.2	-3.8
Average		0.4	2.2	2.1	0.2	-1.6	-1.8	-0.4	-2.2	-2.1	-1.5	2.4	0.5	0.7	0.8	-1.0	-0.9

Note: TJ is terajoules, km is kilometers, cust is customers, opex/unit is opex per unit of a comprehensive output index, assets is the regulatory value of fixed assets. All costs in 2010 dollars.

Table 2: **Ratio of 2010 operating and performance indicators to 2010 average and average annual indicator growth rates since 2005**

Company	Year/ Period	TJ	Customers	km	Cust /km	TJ/ km	TJ/ cust	Opex/ TJ	Opex/ cust	Opex/ km	Opex/ unit	Capex/ TJ	Capex/ cust	Capex/ km	Assets/ TJ	Assets/ cust	Assets/ km
Env Vic	2010	1.99	1.73	1.42	1.39	1.53	1.07	0.60	0.72	1.13	0.76	0.63	0.75	1.08	0.60	0.70	1.08
Multinet	2010	2.07	2.09	1.36	1.76	1.66	0.92	0.58	0.60	1.18	0.69	0.44	0.45	0.81	0.62	0.62	1.20
SPAN	2010	2.55	1.80	1.33	1.55	2.09	1.31	0.35	0.52	0.90	0.52	0.67	0.97	1.56	0.55	0.79	1.36
ActewAGL	2010	0.27	0.36	0.58	0.72	0.51	0.69	1.67	1.28	1.04	1.39	1.37	1.05	0.78	1.26	0.95	0.76
AllGas Qld	2010	0.39	0.26	0.41	0.72	1.03	1.40	0.90	1.41	1.14	1.17	1.56	2.43	1.80	1.27	1.93	1.54
ATCO WA	2010	0.91	1.91	1.73	1.26	0.57	0.44	1.28	0.63	0.89	0.91	1.17	0.58	0.75	1.11	0.53	0.74
Env Albury	2010	0.12	0.07	0.08	1.01	1.53	1.47	0.35	0.58	0.65	0.50	0.44	0.73	0.76	0.35	0.56	0.63
Env Qld	2010	0.20	0.26	0.35	0.85	0.62	0.71	2.19	1.74	1.67	1.93	2.14	1.69	1.49	1.83	1.41	1.34
Env SA	2010	0.84	1.25	1.08	1.33	0.85	0.62	1.28	0.89	1.33	1.14	0.89	0.62	0.85	1.42	0.96	1.41
Env Wagga	2010	0.06	0.06	0.09	0.72	0.65	0.88	0.94	0.92	0.74	0.91	1.29	1.27	0.94	1.32	1.26	1.00
Jem NSW	2010	3.50	3.38	3.29	1.17	1.16	0.96	0.81	0.87	1.15	0.92	0.63	0.67	0.81	0.77	0.80	1.05
GasNet NZ	2010	0.04	0.03	0.05	0.70	0.79	1.11	1.04	1.30	1.01	1.16	0.00	0.00	0.00	0.77	0.93	0.72
Pwrco NZ	2010	0.33	0.32	0.84	0.43	0.42	0.95	1.24	1.31	0.64	1.14	0.77	0.81	0.36	1.45	1.49	0.71
Vector NZ	2010	0.75	0.47	1.39	0.39	0.59	1.47	0.75	1.23	0.53	0.88	0.00	0.00	0.00	0.68	1.08	0.46
Average annual growth – per cent																	
Env Vic	2010/05	1.1	2.5	3.6	-1.0	-2.4	-1.4	1.3	-0.1	-1.1	0.3	3.8	2.4	1.4	0.3	-1.1	-2.1
Multinet	2010/05	1.0	0.9	1.3	-0.4	-0.2	0.2	-1.2	-1.1	-1.5	-1.2	-3.5	-3.4	-3.7	-0.9	-0.7	-1.1
SPAN	2010/05	1.5	2.6	2.0	0.5	-0.5	-1.1	-7.8	-8.8	-8.3	-8.3	0.3	-0.8	-0.3	1.1	0.0	0.6
ActewAGL	2010/05	1.6	3.3	3.0	0.3	-1.3	-1.6	5.0	3.3	3.6	4.0	4.7	3.0	3.3	-1.1	-2.7	-2.4
AllGas Qld	2010/05	1.8	3.5	2.2	1.2	-0.4	-1.6	5.4	3.7	4.9	4.6	3.0	1.3	2.5	2.9	1.2	2.5
ATCO WA	2010/05	-2.8	3.1	1.9	1.2	-4.6	-5.8	7.7	1.5	2.7	4.0	13.2	6.7	8.0	4.3	-1.7	-0.5
Env Albury	2010/05	-0.9	2.7	2.7	0.0	-3.5	-3.5	3.6	0.0	0.0	1.4	11.6	7.8	7.8	2.1	-1.4	-1.4
Env Qld	2010/05	4.1	2.2	1.5	0.7	2.5	1.8	0.6	2.4	3.1	1.9	4.9	6.9	7.6	-0.3	1.5	2.2
Env SA	2010/05	-2.1	2.0	1.3	0.7	-3.4	-4.0	-0.1	-4.1	-3.5	-2.5	8.0	3.6	4.3	3.3	-0.9	-0.2
Env Wagga	2010/05	1.0	1.7	2.3	-0.7	-1.3	-0.7	-1.9	-2.6	-3.2	-2.5	5.7	4.9	4.3	2.2	1.5	0.8
Jem NSW	2010/05	0.1	2.4	0.7	1.7	-0.6	-2.2	-0.1	-2.3	-0.7	-1.2	-2.1	-4.3	-2.7	0.7	-1.6	0.1
GasNet NZ	2010/05	-0.4	-0.9	1.4	-2.3	-1.7	0.5	2.5	3.0	0.7	2.3	na	na	na	2.5	3.0	0.7
Pwrco NZ	2010/05	-1.3	-0.4	2.6	-2.9	-3.8	-0.9	-1.4	-2.4	-5.2	-2.6	1.2	0.2	-2.7	-1.4	-2.4	-5.2
Vector NZ	2010/06	-2.0	2.5	2.1	0.4	-4.0	-4.4	-6.1	-10.2	-9.9	-8.6	na	na	na	0.2	-4.2	-3.8
Average		0.2	2.0	2.1	0.0	-1.8	-1.8	0.5	-1.3	-1.3	-0.6	4.2	2.4	2.5	1.1	-0.7	-0.7

Note: TJ is terajoules, km is kilometers, cust is customers, opex/unit is opex per unit of a comprehensive output measure, assets is the regulatory value of fixed assets.

3.2 Opex efficiency

The measure of opex covers regulated distribution activities only and excludes all capital costs. It includes all non–capital costs allowed by the regulatory authorities, including directly employed labour costs, contracted services, materials and consumables, administration costs and overheads associated with operating and maintaining the distribution service. It excludes unaccounted for gas for all the GDBs as this is treated differently in Victoria compared to the other Australian States and excluding this item provides the best basis for like–with–like comparisons. A similar approach has been adopted in recent benchmarking studies (see Marksman 2010, WorleyParsons 2007). In line with earlier studies, full retail contestability (FRC) costs are included as reported. All of the cost data are expressed in $A 2010 prices.

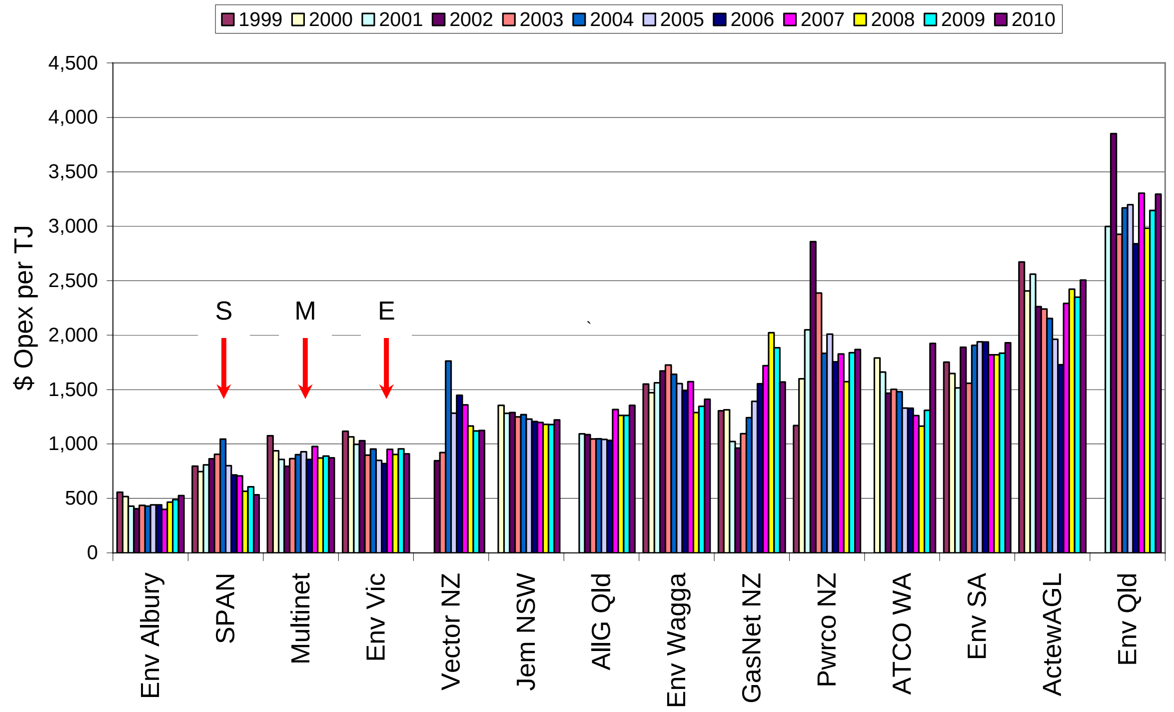
There are a number of ways of looking at the partial productivity of all opex inputs combined. The method chosen to normalise opex will have an important bearing on the relative performance of GDBs. For instance, normalising opex by the system's throughput in TJ will tend to favour those GDBs with dense networks and high consumption per customer. Conversely, examining the costs of operating and maintaining the distribution network per kilometre of line will typically tend to favour GDBs with a less dense network because they have a higher number of network kilometres per customer by which to deflate the operating cost figure.

It should also be noted that in this report we present partial indicators which are cost per unit of a particular output or cost driver. As such, a lower value of the indicator represents a higher level of efficiency or productivity. This is the inverse of a partial factor productivity (PFP) measure which is the ratio of total output to a particular input and where a higher value of the measure represents higher productivity.

The impact of reporting comparative opex using different normalisations is presented in Figures 5 to 8 and Table 1.

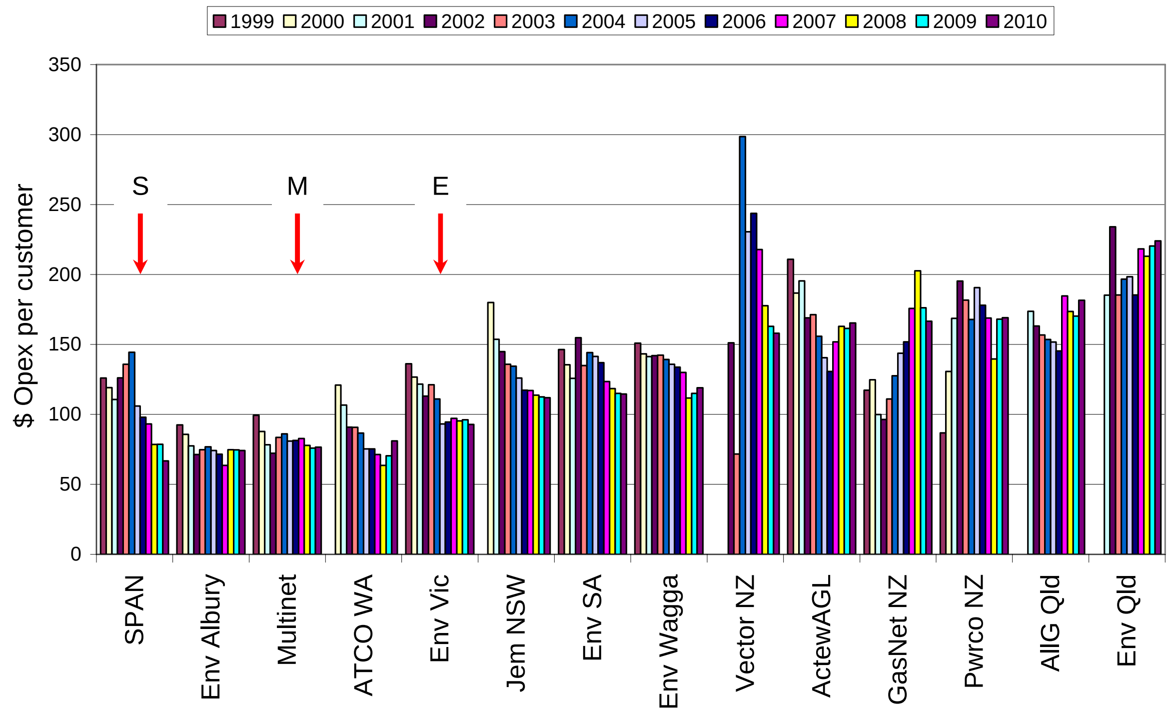
The three Victorian GDBs all have relatively low opex per TJ (Figure 5 and Table 1), ranking second, third and fourth in terms of this measure in 2010. The three GDBs' relatively high energy densities per kilometre will help them perform well on this measure but their mid–field energy density per customer rankings would disadvantage them on this measure, all else equal. The opex per TJ costs of SP AusNet, Multinet and Envestra Victoria were $533, $873 and $909, respectively, compared to an average of $1,503 in 2010. Only the industrial customer–oriented Envestra Albury performed better on this measure than the three Victorian GDBs. From figure 5 it can be seen that Multinet's and Envestra Victoria's opex per TJ both reduced between 1999 and 2003 before remaining relatively flat after that. SP AusNet's opex per TJ, on the other hand, increased between 1999 and 2004 before declining sharply after that. For the 12 year period as a whole, the rates of decline in the Victorian GDBs' opex per TJ were over four times those of the sample average. While SP AusNet has exhibited the highest rate of decline in this measure over the last five years, the rate of decline for Multinet has been closer to the sample average while Envestra Victoria has shown a rate of increase in this measure in excess of the sample average (Table 2).

Figure 5: **Opex per TJ, 1999–2010**



Source: Economic Insights gas utility database

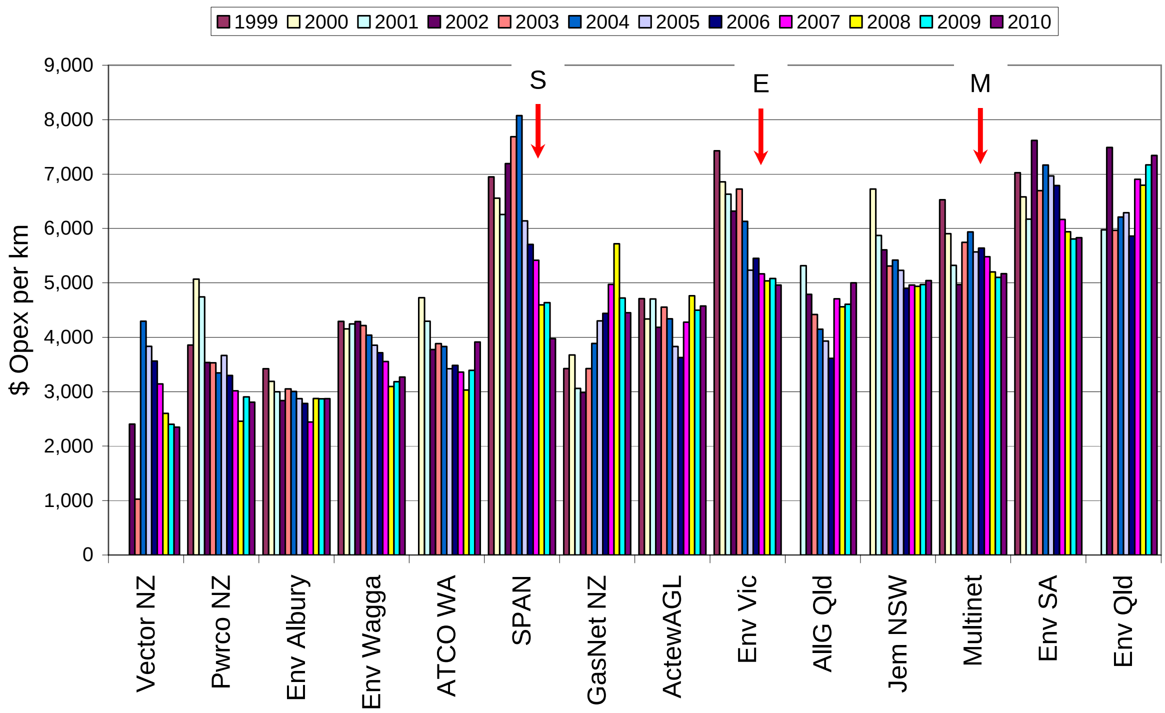
Figure 6: **Opex per customer, 1999–2010**



Source: Economic Insights gas utility database

In 2010 SP AusNet had the lowest opex per customer while Multinet and Envestra Victoria had the third and fifth lowest opex per customer rankings, respectively (Figure 6 and Table 1). While their relatively high customer densities will assist them in this measure, the Victorian GDBs have all exhibited significant improvement over the period with rates of reduction considerably higher than the average annual percentage reduction for the companies in the study. While SP AusNet has shown the second highest rate of reduction in this measure over the last five years, the other two Victorian GDBs have had rates of reduction less than the overall sample average (Table 2). The opex per customer costs of SP AusNet, Multinet and Envestra Victoria were $67, $77 and $93, respectively, compared to a sample average of $129 in 2010.

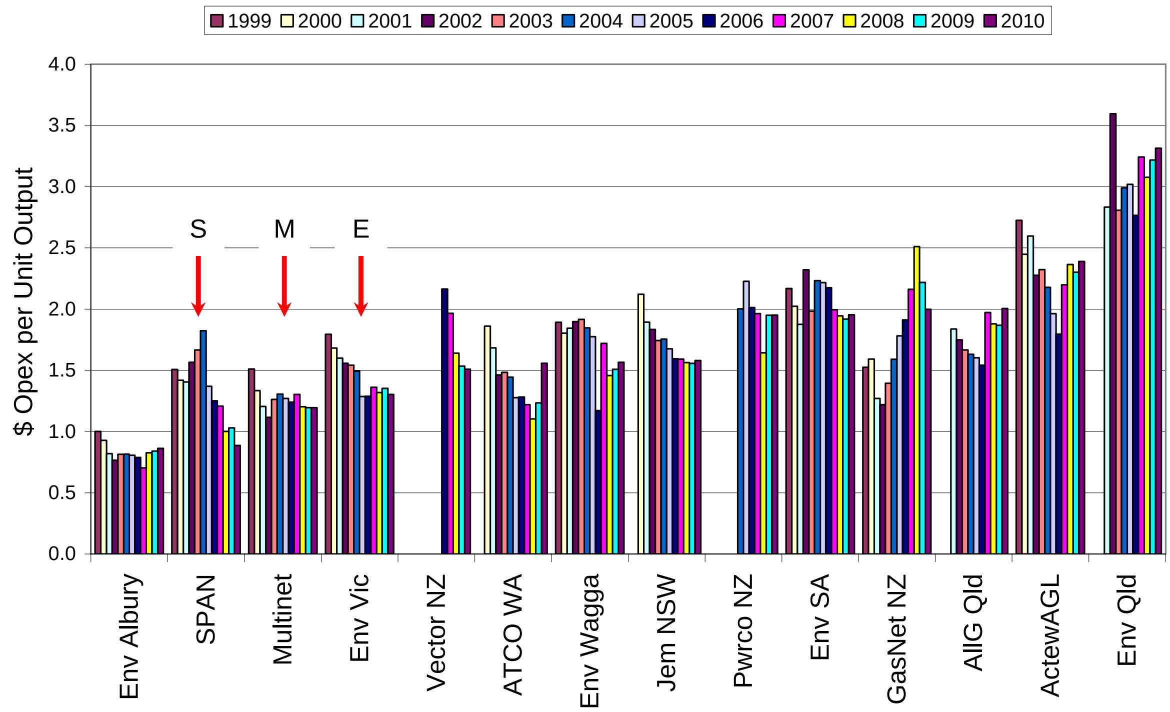
Figure 7: **Opex per kilometre, 1999–2010**



Source: Economic Insights gas utility database

In 2010 SP AusNet ranked sixth on opex per kilometre while Envestra Victoria and Multinet ranked ninth and twelfth, respectively (Figure 7 and Table 1). The opex per kilometre costs of SP AusNet, Envestra Victoria and Multinet were $3,974, $4,960 and $5,159, respectively, compared to a sample average of $4,397 in 2010. The three Victorian GDBs have again experienced a significant reduction in opex per kilometre over the period, with Envestra Victoria and SP AusNet showing falls considerably in excess of the average annual percentage reduction for the companies in the study and Multinet showing an annual rate of reduction equal to the sample average. While SP AusNet has exhibited the second highest rate of reduction in this indicator over the last five years, the rates of reduction for Envestra Victoria and Multinet have been very close to the overall sample average annual rate of reduction of –1.3 per cent (Table 2). The small and relatively non–urban based GDBs generally perform well on this measure reflecting their lower customer densities. Urban systems with high customer densities will be disadvantaged on this measure. However, the three Victorian GDBs perform relatively close to average on this indicator despite having higher proportion of low pressure mains, including old cast iron pipes which typically suffer more gas leaks and ingression of water requiring higher levels of opex per kilometre than newer high pressure mains.

Figure 8: **Opex per unit output, 1999–2010**



Source: Economic Insights gas utility database

Each of the three opex efficiency indicators examined so far focus on one particular dimension of output. To form a more comprehensive efficiency indicator we need a way of combining the various output dimensions into a comprehensive output measure. We can form an objective measure of GDB output which incorporates the three opex cost drivers examined so far – energy throughput, customer numbers and kilometres of mains – using multilateral index number methods. In Economic Insights (2012b) we present aggregate output, aggregate input and total factor productivity (TFP) estimates using the multilateral translog index. This index provides a robust method for comparing levels as well as growth rates where we have time series, cross section data.

For this report we have made two modifications to the multilateral output index reported in Economic Insights (2012b). Firstly, because we do not have the data necessary to form the system capacity output variable for all GDBs, we replace the system capacity variable with the proxy of kilometres of mains. Secondly, because we are focussing on opex costs here rather than total costs and because opex constitutes only around a third of total costs, we form output cost shares on the basis of opex rather than total costs. These shares are used as output weights in applying the multilateral index method. Following the approach used in Lawrence, Fallon and Kain (2007a), we use the opex output cost shares derived from re–estimating the cost function reported in Lawrence, Fallon and Kain (2007b). From the cost function estimates we are able to allocate costs across the three output categories and, hence, obtain cost–reflective shadow prices for the three outputs. The resulting output opex shares are 37.9 per cent for throughput, 41.5 per cent for customer numbers and 20.6 per cent for kilometres of mains. The multilateral index method is summarised in appendix 1 while the cost function method is presented in appendix 2.

In figure 8 we present the real opex per unit output (or inverse partial productivities) formed using the multilateral index. Using this comprehensive measure of opex efficiency SP AusNet, Multinet and Envestra Victoria were respectively the second, third and fourth most efficient Australasian GDBs in 2010. Only the small, industrial customer focussed Envestra Albury performed better on this comprehensive measure. The Victorian GDBs' strong overall opex efficiency performance derives from their strong performances on opex per TJ and opex per customer and their close to average performance on opex per kilometre.

3.3 Capital expenditure comparisons

Capex constitutes the other main component of a GDB's annual expenditure in addition to opex. Capex requirements can arise from a range of sources including:

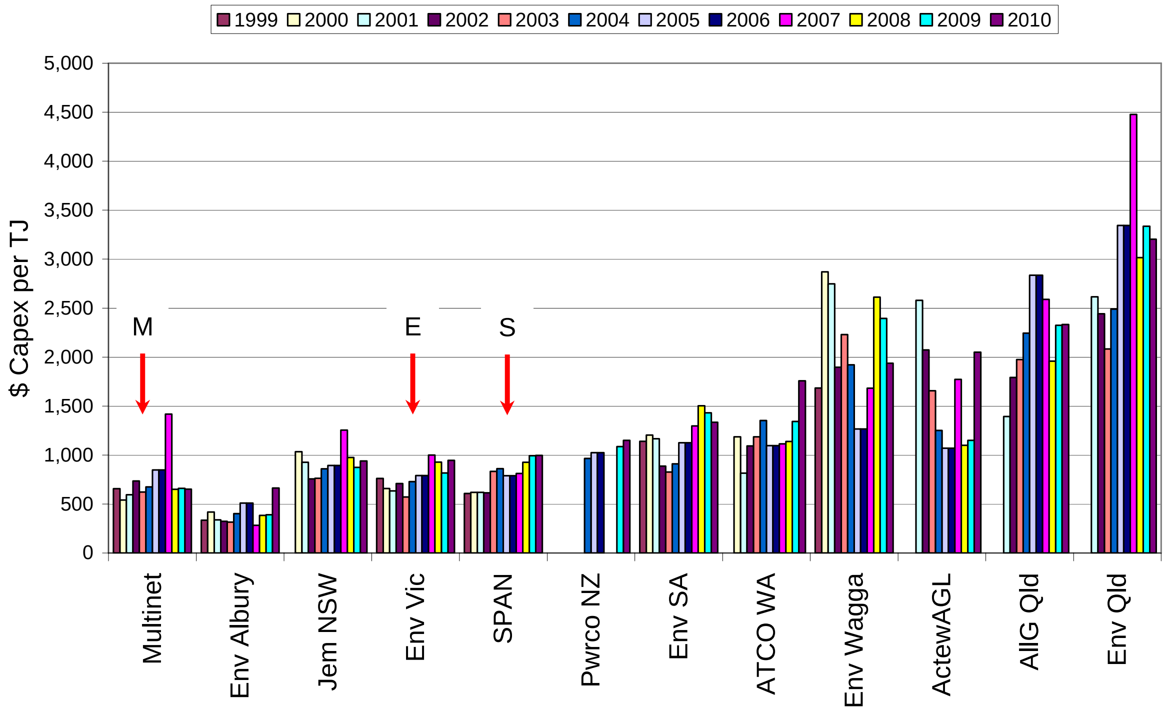
- meeting demand growth (new connections and increased consumption per customer);
- replacement of depreciated and damaged assets;
- initiatives to improve the reliability and quality of performance;
- compliance with new regulations, including environmental requirements; and
- demand management initiatives.

Comparisons of capital expenditure are generally more difficult to interpret than either operating expenditure or capital asset value comparisons as different GDBs will face different demand growth rates, have systems of differing age and construction with older systems requiring more replacement capital expenditure, and have different reliability performances which may or may not be considered adequate to meet customer expectations and valuations. Given these considerations, comparisons of capex need to be interpreted with caution.

For the purposes of this exercise we normalise GDB capex on the same bases as used for our opex and capital asset value comparisons. The results of comparing capex using these normalisations are presented in Figures 9 to 13 and Table 1. The estimates of capex are in $A 2010. Recent New Zealand GDB capex data are only available for Powerco so the other two New Zealand GDBs – GasNet and Vector – are not included in these comparisons.

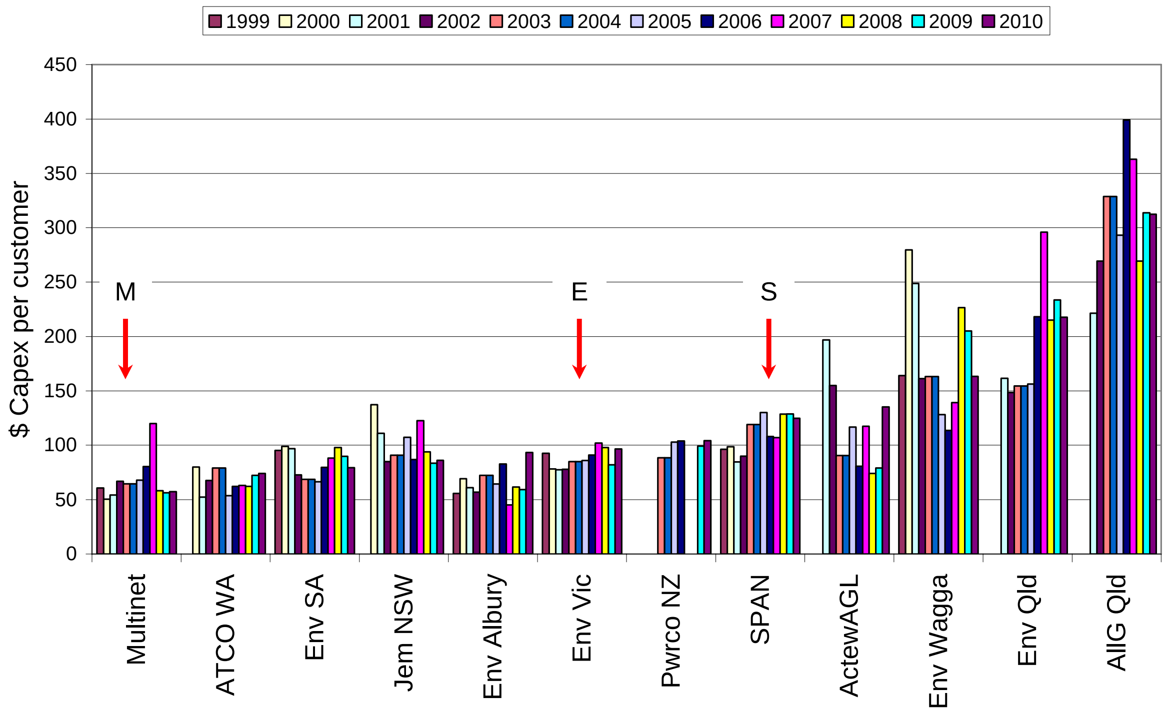
The three Victorian GDBs have below average capex per TJ (Figure 9 and Table 1). In 2010 Multinet, Envestra Victoria and SP AusNet ranked first, fourth and fifth with capex per TJ of $663, $945 and $996, respectively, compared to an average of $1,497 for the sample. Multinet's capex per TJ was around the same level in 2010 as it was in 1999, despite some volatility around 2007, while those for Envestra Victoria and SP AusNet have trended upwards somewhat over the period after having started from relatively low bases in the 2000–02 period.

Figure 9: **Capex per TJ, 1999–2010**



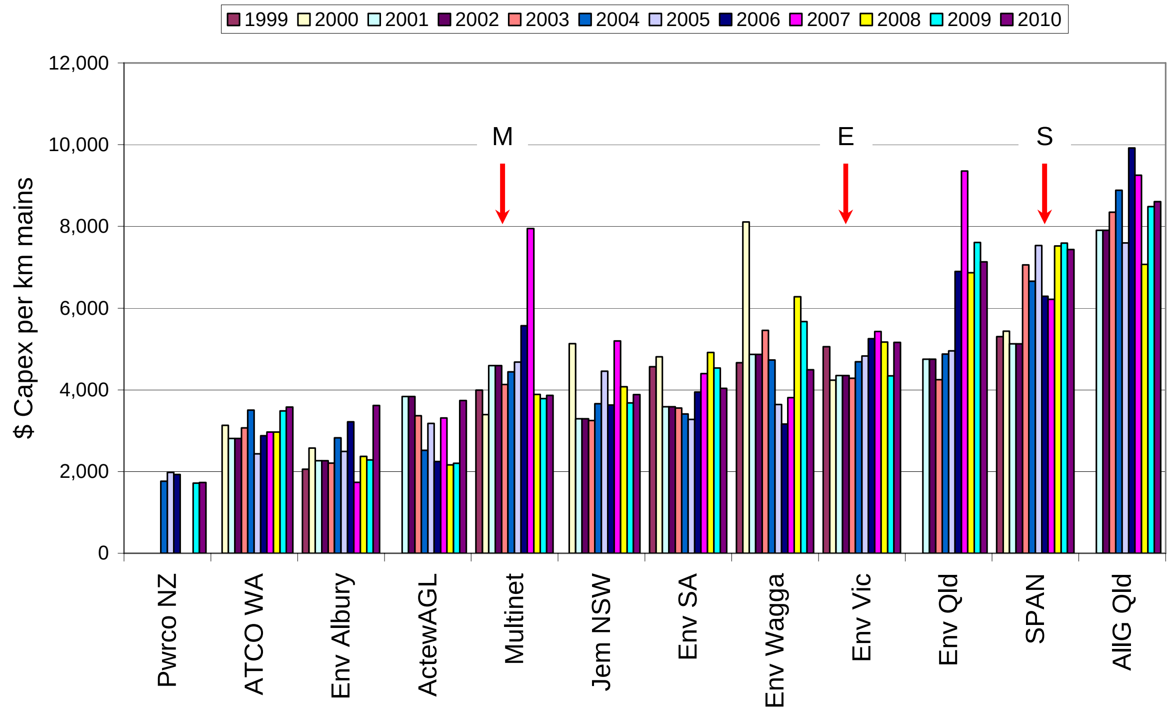
Source: Economic Insights gas utility database

Figure 10: **Capex per customer, 1999–2010**



Source: Economic Insights gas utility database

Figure 11: **Capex per kilometre, 1999–2010**



Source: Economic Insights gas utility database

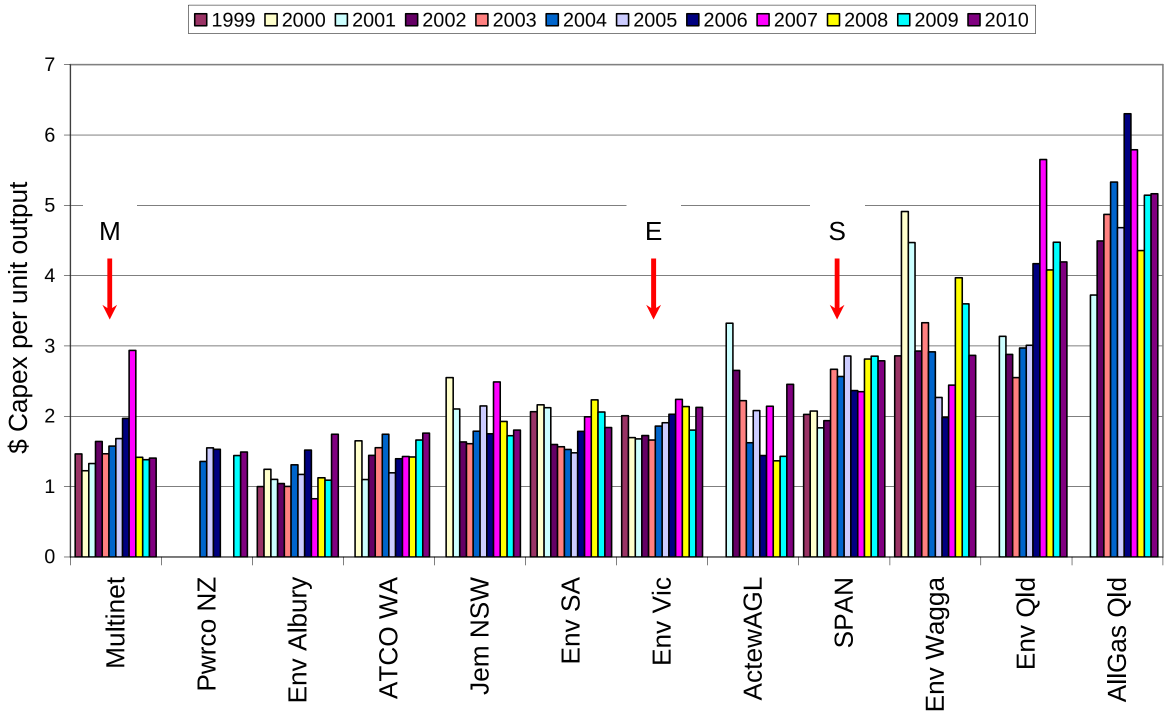
The three Victorian GDBs also have below average capex per customer (Figure 10 and Table 1). In 2010 Multinet, Envestra Victoria and SP AusNet ranked first, sixth and eighth with capex per customer of $57, $97 and $125, respectively, compared to an average of $129 for the sample. While Multinet's relatively high customer density will advantage it on this measure, its capex per customer (along with Envestra Victoria's) was around the same level in 2010 as it was in 1999, despite some volatility around 2007, at the same time that average capex per customer for GDBs in the sample has tended to rise.

Two of the three Victorian GDBs have above average capital expenditure per kilometre as is to be expected from their relatively high customer densities (Figure 11 and Table 1). The Victorian distribution systems are also generally older than those found in the other States and have a relatively high proportion of residual low pressure mains which require ongoing replacement. In 2010 Multinet, Envestra Victoria and SP AusNet ranked fifth, ninth and eleventh with capex per kilometre of $3,864, $5,160 and $7,432, respectively, compared to an average of $4,772 for the sample. Multinet's and Envestra Victoria's capex per kilometre were around the same in 2010 as they were in 1999, while SP AusNet's capex per kilometre was flat until 2002 from which point it has increased markedly.

We again form an objective measure of GDB output which incorporates the three cost drivers examined so far – energy throughput, customer numbers and kilometres of mains – using multilateral index number methods which will allow us to form an overall summary capex performance indicator. Because capital costs constitute the majority of total costs, we use the overall output cost shares estimated in Lawrence, Fallon and Kain (2007b) of 13 per cent for throughput, 49 per cent for customer numbers and 38 per cent for kilometres of mains.

Capex per unit output is presented in Figure 12 where Multinet performed best in 2010 of the sample of 12 GDBs, reflecting its first rankings in capex per customer and capex per TJ. Envestra Victoria ranked seventh on the capex per unit output indicator while SP AusNet ranked ninth. Again, Multinet's 2010 capex per unit output level was slightly below its 1999 level, while Envestra Victoria's 2010 level was around the same as its 1999 level. SP AusNet's capex per unit output was higher in the period from 2003 onwards compared to the preceding years.

Figure 12: **Capex per unit output, 1999–2010**



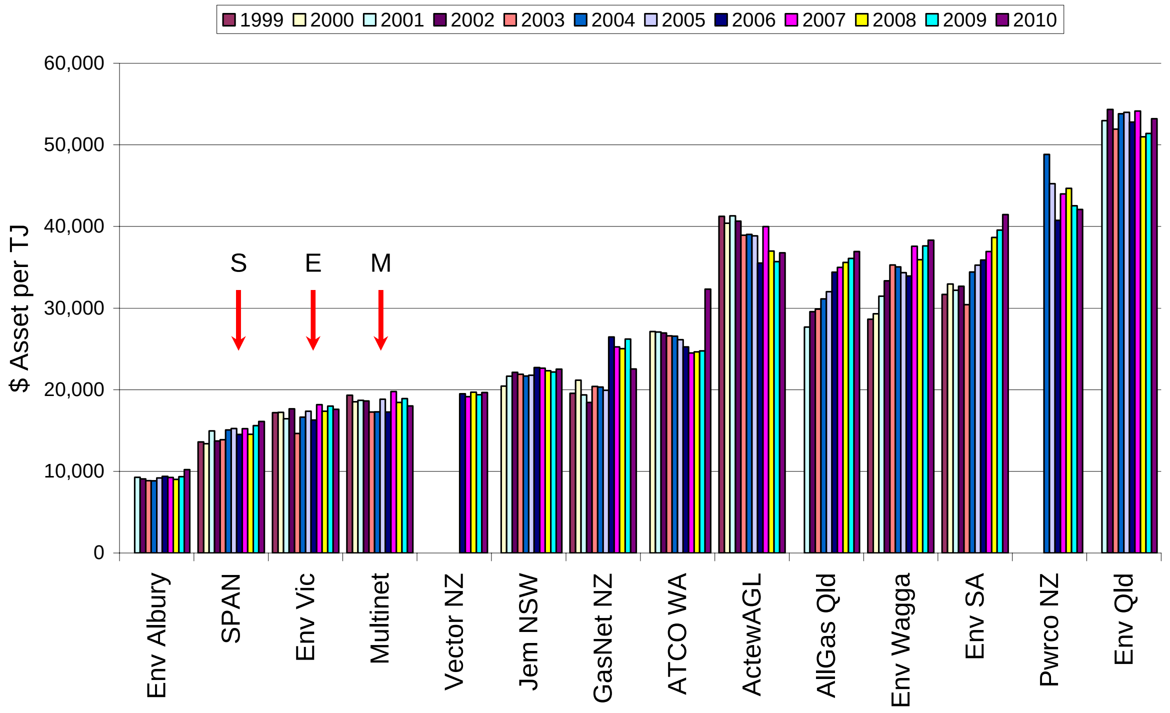
Source: Economic Insights gas utility database

3.4 Capital asset efficiency

The estimates of capital assets used in this section are based on depreciated asset values for regulatory purposes or those calculated using the same approach as used in regulatory accounts in $A 2010. While it would be preferable to use an undepreciated asset value measure to abstract from differences in average asset age, undepreciated asset value data are generally not available in the public domain. Consequently, differences in average asset age will play a role in the resulting capital asset efficiency comparisons.

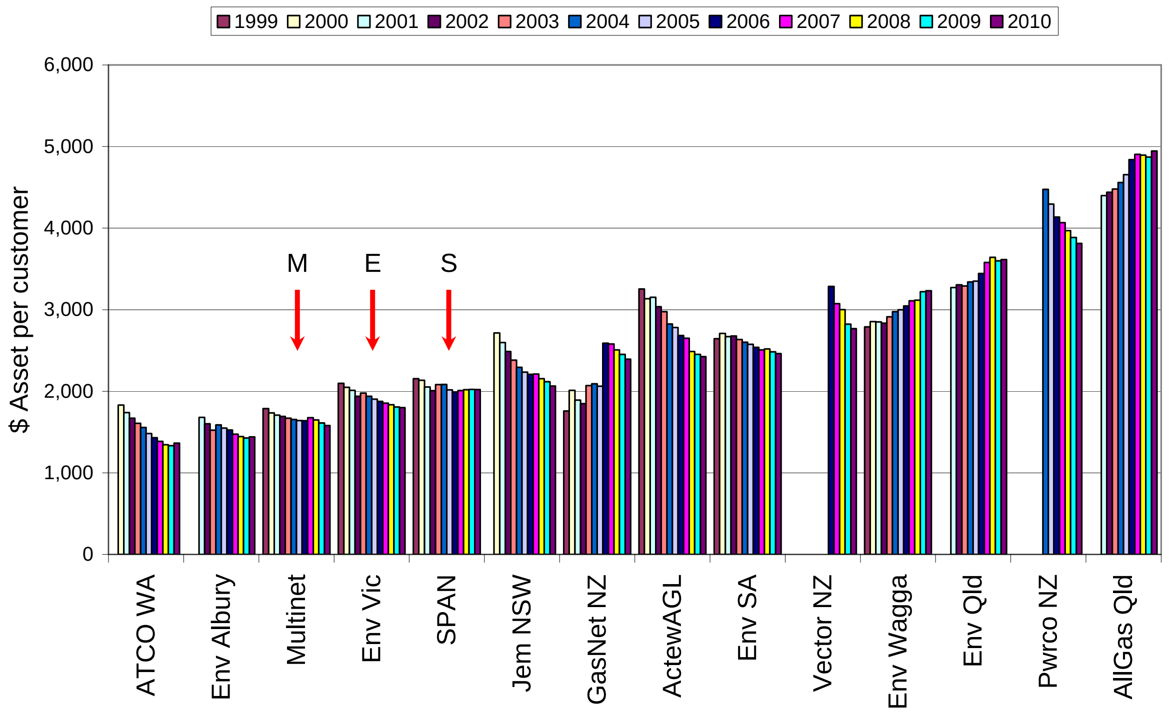
Just as there are a number of ways of looking at opex and capex efficiency, the efficiency of the use of the capital stock can also be examined in analogous ways, with the method chosen to normalise capital stock values again having an important bearing on the relative performance of GDBs. We look at the same four bases for normalising capital asset values as used for opex and capex in Figures 13 to 16.

Figure 13: **Capital asset values per TJ, 1999–2010**



Source: Economic Insights gas utility database

Figure 14: **Capital asset values per customer, 1999–2010**

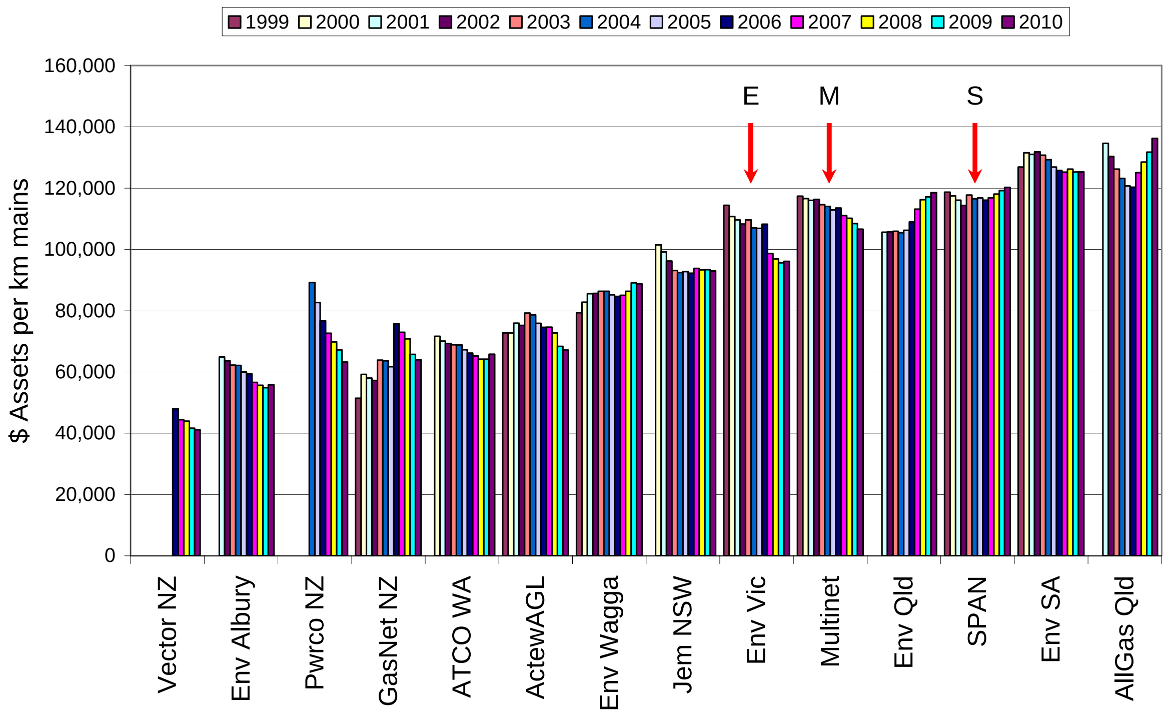


Source: Economic Insights gas utility database

The three Victorian GDBs have relatively low capital asset values per TJ (Figure 13 and Table 1). SP AusNet's, Envestra Victoria's and Multinet's capital asset values per TJ ranked second, third and fourth in 2010 with values of $16,123, $17,602 and $18,006, respectively, compared to a sample average of $29,127. While the Victorian GDBs' relatively high customer densities and energy densities per kilometre will advantage them on this measure, their around average energy densities per customer will not. Multinet's capital asset values per TJ experienced a small reduction over the period while Envestra Victoria's remained relatively flat. This contrasted with an average increase for the sample of just under 1 per cent per annum. SP AusNet's capital asset value per TJ increased at 1.6 per cent per annum over the period.

Multinet, Envestra Victoria and SP AusNet also have relatively low capital asset values per customer (Figure 14 and Table 1), ranking third, fourth and fifth on this measure with values of $1,581, $1,800 and $2,021, respectively, compared to a sample average of $2,566 in 2010. Again, the Victorian GDBs' relatively high customer densities will tend to advantage them on this measure. Multinet's and Envestra Victoria's capital asset values per customer decreased over the period with growth rates of –1.4 per cent and –1.1 per cent annually, respectively. This compares to a sample average growth rate of –1.0 per cent and a growth rate of –0.6 per cent annually for SP AusNet.

Figure 15: **Capital asset values per kilometre, 1999–2010**

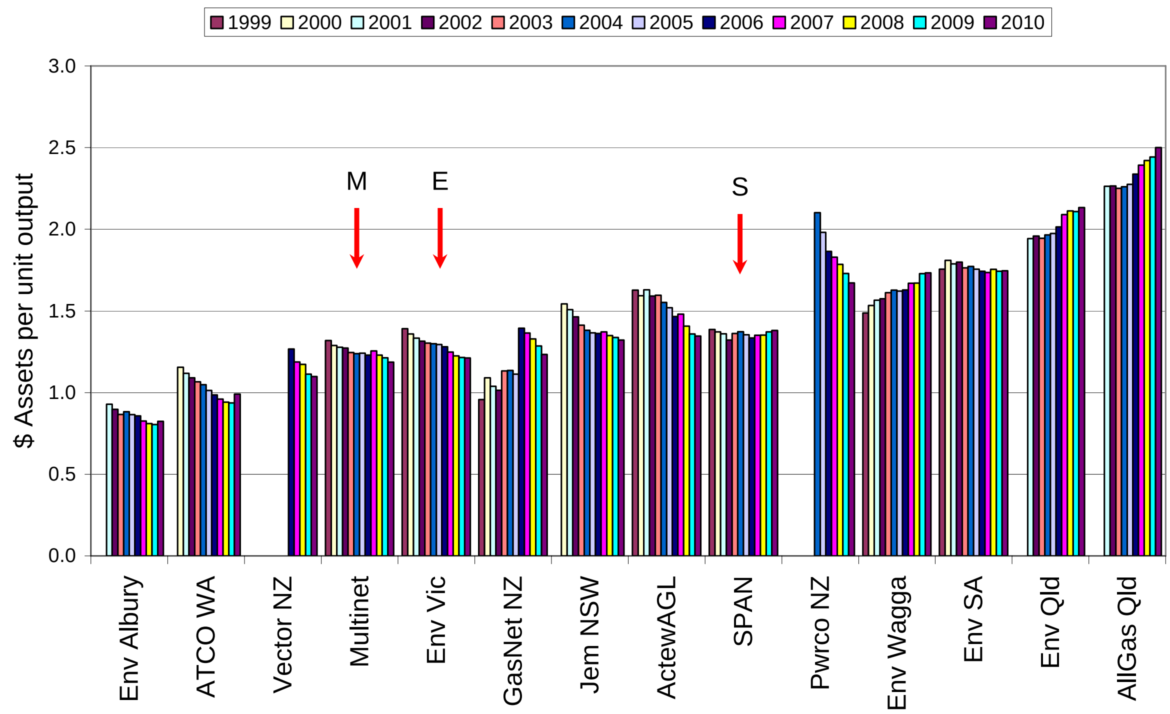


Source: Economic Insights gas utility database

As expected, the rural based and less dense urban based GDBs dominate the capital asset values per kilometre series presented in Figure 15 and Table 1. Envestra Victoria, Multinet and SP AusNet have above average capital asset values per kilometre in line with their high customer densities, ranking ninth, tenth and twelfth on this measure, respectively. The respective capital asset values per kilometre were $96,074, $106,629 and $120,255 compared to a sample average of $88,698 in 2010.

Capital asset value per unit output is presented in Figure 16 where the unit output index is again formed using the overall output cost shares estimated in Lawrence, Fallon and Kain (2007b) of 13 per cent for throughput, 49 per cent for customer numbers and 38 per cent for kilometres of mains. Multinet and Envestra Victoria rank fourth and fifth, respectively, on this measure in 2010 while SP AusNet ranks ninth in the sample of 14 GDBs. Envestra Victoria's capital asset value per unit output reduced over the period with a growth rate of –1.3 per cent while Multinet had a growth rate of –1.0 per cent. SP AusNet's capital asset value per unit output remained relatively flat over the period.

Figure 16: **Capital asset values per unit output, 1999–2010**



Source: Economic Insights gas utility database

3.5 Summary

The three Victorian GDBs' operating environment characteristics can be summarised as follows:

- the highest customer densities per kilometre in the sample;
- relatively high energy densities per kilometre; and,
- mid–ranking energy densities per customer.

The three Victorian GDBs' efficiency performance in 2010 can be summarised as follows:

- the second, third and fourth lowest opex per TJ, with well above average improvement over the 12 year period;
- the first, third and fifth lowest opex per customer, with significant improvement over the period;

- while SP AusNet has shown the second highest rate of reduction in opex per customer over the last five years, the other two Victorian GDBs have had rates of reduction less than the overall sample average;
- sixth, ninth and twelfth rankings on opex per kilometre reflecting their high customer densities but with a substantial reduction over the period well in excess of the average;
- the second, third and fourth most efficient Australasian GDBs when the three principal opex drivers are combined into a comprehensive output measure;
- the first, fourth and fifth lowest capex per TJ;
- the first, sixth and eighth lowest capex per customer;
- fifth, ninth and eleventh rankings on capex per kilometre reflecting their high customer densities;
- the first, seventh and ninth best rankings on capex per unit of comprehensive output;
- Multinet had the lowest unit capex for three of the four driver normalisations and its real assets were around the same level in 2010 as they were in 1999 giving it a considerably lower than average capex indicator growth rate;
- Envestra’s capex indicator growth rates were around average while SP AusNet’s were higher than average;
- the second, third and fourth lowest capital asset values per TJ;
- the third, fourth and fifth lowest capital asset values per customer;
- ninth, tenth and twelfth rankings on capital asset values per kilometre reflecting their high customer densities;
- fourth, fifth and ninth rankings on capital asset values per unit of comprehensive output;
- Multinet had below average growth in its capital asset value indicators, Envestra Victoria had around average growth and SP AusNet had above average growth.

Based on these indicators and recognising the nature of their networks, the Victorian GDBs have performed well on most indicators. Opex efficiency has been particularly strong, considering that the Victorian GDBs have older systems and higher proportions of cast iron and other low pressure mains.

Some of the indicator growth rates observed in the first half of the period in the immediate aftermath of reform and ownership changes have slowed in the second half of the period as cost reductions become progressively harder to achieve after these initial gains were made. Future growth rates of key indicators are more likely to reflect, at best, the generally lower average growth rates of the more recent period (shown in Table 2) due to the ‘convergence’ effect.

APPENDIX A: MULTILATERAL OUTPUT INDEX METHODOLOGY

Caves, Christensen and Diewert (1982) developed the multilateral translog output index measure to allow comparisons of the absolute levels as well as growth rates of total output where firms produce multiple outputs. It satisfies the technical properties of transitivity and characteristicity which are required to accurately compare total output levels within panel data.

The Caves, Christensen and Diewert (CCD) multilateral translog index is given by:

$$\text{(A1)} \qquad \log (Y_m/Y_n) = \sum_i (R_{im}+R_i^*) (\log Y_{im} - \log Y_i^*)/2 - \sum_i (R_{in}+R_i^*) (\log Y_{in} - \log Y_i^*)/2$$

where Y is output quantity, m and n are observations in the panel data, i refers to an output component, R_{im} is the revenue share of output i in total revenue for observation m, R_i^* is the revenue share averaged over all utilities and time periods and $\log Y_i^*$ is the average of the log of output i.

The formula in (A1) gives the proportional change in total output quantity between two adjacent observations (denoted m and n). An index is formed by setting some observation (usually the first in the database) equal to one and then multiplying through by the proportional changes between all subsequent observations in the database to form a full set of indexes. The index for any observation then expresses its total output level relative to the observation that was set equal to one. However, this is merely an expositional convenience as, given the invariant nature of the comparisons, the result of a comparison between any two observations will be independent of which observation in the database was set equal to one.

This means that using equation (A1) comparisons between any two observations m and n will be both base–GDB and base–year independent. Transitivity is satisfied since comparisons between the two GDBs for 2010 will be the same regardless of whether they are compared directly or via, say, one of the GDBs in 2002. An alternative interpretation of this index is that it compares each observation to a hypothetical average GDB with output vector $\log Y_i^*$ and revenue shares R_i^*.

APPENDIX B: DERIVING OUTPUT COST SHARE WEIGHTS

This study uses multi–output Leontief cost function method applied in Lawrence (2007) to derive output cost share weights. These weights are then used as the revenue shares in forming the multilateral output index outlined in appendix A. This multi–output Leontief functional form essentially assumes that GDBs use inputs in fixed proportions for each output and is given by:

(B1) $$C(y^t, w^t, t) = \sum_{i=1}^{M} w_i^t \, [\sum_{j=1}^{N} (a_{ij})^2 \, y_j^t \, (1+b_i t)]$$

where there are M inputs and N outputs, w_i is an input price, y_j is an output and t is a time trend representing technological change. The input/output coefficients a_{ij} are squared to ensure the non–negativity requirement is satisfied, ie increasing the quantity of any output cannot be achieved by reducing an input quantity. This requires the use of non–linear regression methods. To conserve degrees of freedom a common rate of technological change for each input across the three outputs was imposed but this can be either positive or negative.

The estimating equations were the M input demand equations:

(B2) $$x_i^t = \sum_{j=1}^{N} (a_{ij})^2 \, y_j^t \, (1+b_i t)$$

where the i's represent the M inputs, the j's the N outputs and t is a time trend representing the nine years, 1998 to 2006.

The input demand equations were estimated separately for each of the three GDBs using the non–linear regression facility in Shazam (White 1997) and data for the years 1998 to 2006. Given the limited number of observations and the absence of cross equation restrictions, each input demand equation is estimated separately.

Lawrence (2007) then derived the output cost shares for each output and each observation as follows:

(B3) $$h_j^t = \{\sum_{i=1}^{M} w_i^t \, [(a_{ij})^2 \, y_j^t \, (1+b_i t)]\} / \{\sum_{i=1}^{M} w_i^t \, [\sum_{j=1}^{N} (a_{ij})^2 \, y_j^t \, (1+b_i t)]\} .$$

Lawrence (2007) then formed a weighted average of the estimated output cost shares for each observation to form an overall estimated output cost share where the weight for each observation, b, is given by:

(B4) $$s_b^t = C(b, y_b^t, w_b^t, t) / \sum_{b,t} C(b, y_b^t, w_b^t, t) .$$

ATTACHMENT A: LETTER OF RETAINER

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Doc ID:	62036263.1

23 March 2012

Dr Denis Lawrence
Economic Insights Pty Ltd
6 Kurundi Place
HAWKER ACT 2614

Dear Dr Lawrence

Victorian Gas Access Arrangement Review 2013 – 2017: Envestra, Multinet and SP AusNet

We act for Envestra Limited (**Envestra**), Multinet Gas (DB No. 1) Pty Ltd and Multinet Gas (DB No. 2) Pty Ltd (together, **Multinet**) and SPI Networks (Gas) Pty Ltd (**SP AusNet**) in relation to the AER's review of each of Envestra's, Multinet's and SP AusNet's Access Arrangements for Victoria.

Envestra, Multinet and SP AusNet (**the Distributors**) wish to jointly engage you to prepare expert reports in connection with the AER's review of the Victorian Access Arrangements.

This letter sets out the matters which the Distributors wish you to address in your reports and the requirements with which the reports must comply.

Terms of Reference

The terms and conditions upon which each of the Distributors provides access to their respective networks are subject to five yearly reviews by the AER.

The AER undertakes that review by considering the terms and conditions proposed by each of the Distributors against criteria set out in the National Gas Law and National Gas Rules.

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The Distributors wish to engage you to prepare two expert reports, which reports are described below.

TFP and PFP Report

The Distributors wish to engage you to prepare an expert report which assesses:

(a) the total factor productivity and partial factor productivity of the Distributors' networks; and

(b) how this compares against the levels of total factor productivity and partial factor productivity for Envestra's South Australian and Queensland networks and the Jemena New South Wales gas distribution network.

Cost Benchmarking

The Distributors wish to engage you to prepare an expert report which considers, using partial productivity indicators, the efficiency of each Distributor's performance by comparing their cost outcomes against the cost outcomes achieved by other equivalent Australian and New Zealand gas distribution network operators.

In preparing those aspects of your reports which relate to the making of forecasts or estimates, you should have regard to the relevant requirements of Rule 74(2) of the National Gas Rules which provides:

"A forecast or estimate:

(a) must be arrived at on a reasonable basis; and

(b) must represent the best forecast or estimate possible in the circumstances."

Use of Report

It is intended that your reports will be included by each of the Distributors in their respective access arrangement revision proposals for their Victorian networks for the access arrangement period from 1 January 2013 to 31 December 2017. The reports may be provided by the AER to its own advisers. The reports must be expressed so that they may be relied upon both by the Distributors and by the AER.

The AER may ask queries in respect of the reports and you will be required to assist each of the Distributors in answering these queries. The AER may choose to interview you and if so, you will be required to participate in any such interviews.

The reports will be reviewed by the Distributors' legal advisers and will be used by them to provide legal advice to the Distributors as to their respective rights and obligations under the National Gas Law and National Gas Rules. You will be required to work with these legal advisers and the Distributors' personnel to assist them to prepare the Distributors' respective access arrangement revision proposals and submissions in response to the draft and final decisions made by the AER.

If any of the Distributors choose to challenge any decision made by the AER, that appeal will be made to the Australian Competition Tribunal and the reports will be considered by the Tribunal. The Distributors may also seek review by a court and the reports would be subject to consideration by such court. You should therefore be conscious that the reports may be used in the resolution of a dispute between the AER and any or all of the Distributors as to the appropriate level of the respective Distributor's distribution tariffs. Due to this, the reports will need to comply with the Federal Court requirements for expert reports, which are outlined below.

You must ensure you are available to assist the Distributors until such time as the Access Arrangement Review and any subsequent appeal is finalised.

Time Frame

Each of the Distributors' access arrangement revision proposals is due by 30 March 2012. We request that you provide your reports to us or to each of the Distributors by 28 March 2012 so that the Distributors may finalise their submissions in advance of the due date.

Compliance with the Code of Conduct for Expert Witnesses

Attached is a copy of the Federal Court's Practice Note CM 7, entitled "Expert Witnesses in Proceedings in the Federal Court of Australia", which comprises the code of conduct for expert witnesses in the Federal Court of Australia (**the Code of Conduct**).

Please read and familiarise yourself with the Code of Conduct and comply with it at all times in the course of your engagement by the Distributors.

In particular, your reports prepared for the Distributors should contain a statement at the beginning of the reports to the effect that the author of the report has read, understood and complied with the Code of Conduct.

Your reports must also:

(a) contain particulars of the training, study or experience by which the expert has acquired specialised knowledge;

(b) identify the questions that the expert has been asked to address;

(c) set out separately each of the factual findings or assumptions on which the expert's opinion is based;

(d) set out each of the expert's opinions separately from the factual findings or assumptions;

(e) set out the reasons for each of the expert's opinions; and

(f) otherwise comply with the Code of Conduct.

The expert is also required to state that each of the expert's opinions is wholly or substantially based on the expert's specialised knowledge.

It is also a requirement that the reports be signed by the expert and include a declaration that *"[the expert] has made all the inquiries which [the expert] believes are desirable and appropriate and that no matters of significance which [the expert] regards as relevant have, to [the expert's] knowledge, been withheld from the report."*

The Distributors may request the principal author of the reports to sign a statutory declaration to the effect that the Code of Conduct has been complied with. This is to ensure that the reports carry maximum weight and probative value and will be suitable to rely upon in any subsequent court proceedings.

Please also attach a copy of these terms of reference to the reports.

Terms of Engagement

Your contract for the provision of the reports will be directly with the Distributors. You should forward to each of the Distributors any terms you propose govern that contract as well as your fee proposal.

Please sign a counterpart of this letter and forward it to us or to each of the Distributors to confirm your acceptance of the engagement by the Distributors.

Yours faithfully

Johnson Winter & Slattery

Enc: Federal Court of Australia Practice Note CM 7, "Expert Witnesses in Proceedings in the Federal Court of Australia"

D.A. Lawrence

....
Signed and acknowledged by Dr Denis Lawrence

Date 26 March 2012

ATTACHMENT B: CURRICULA VITAE

Dr Denis Lawrence

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Qualifications

Doctor of Philosophy (Economics), University of British Columbia, Canada, 1987.

Bachelor of Economics (Honours), Australian National University, 1977.

Key Skills and Experience

For the past 20 years Dr Denis Lawrence has played a leading role in the regulation, benchmarking and performance measurement of infrastructure enterprises. He has advised Australian and overseas regulators and utilities on a wide range of quantitative and strategic issues in the energy, telecommunications, post and transport sectors. Denis has been a consultant on energy regulation since 1996. Recent key energy network projects include:

- Assisting the AEMC with its review of total factor productivity-based regulation including advice on data requirements and specification issues, constructing a detailed model comparing outcomes under productivity-based and building block regulation and drafting and review of sections of AEMC reports (2008-2011).
- Advice to the New Zealand Commerce Commission on asset valuation and total factor productivity measurement in the presence of sunk costs and incorporating the principle of financial capital maintenance (2008–09).
- Advice to the Northern Territory Utilities Commission on the setting of key price control parameters for electricity distribution (2008–09).
- Advice to the Commerce Commission on using the comparative or benchmarking option for resetting the price path threshold for electricity transmission and distribution businesses using total factor productivity and econometric techniques (2003–09).
- Advised ENMAX Corporation (Alberta, Canada) on developing the case for moving from cost–of–service to formula–based regulation (2006–09).
- Advice to the Commerce Commission on key aspects of its inquiry into whether the distributor Unison Networks should be subject to price control for having breached price thresholds (2006–07).
- Benchmarked the productivity, operating and capital expenditure, reliability and price performance of 13 of Australia's 15 electricity distributors for a consortium of distribution businesses (2004).
- Reviewed total factor productivity modelling of electricity distribution in Victoria

undertaken for the Essential Services Commission (2005).

- Econometric modelling of operating and maintenance expenditure efficiency based on a sample of electricity distributors and taking operating environment differences into account (2005).
- Presented commentaries on the principles behind incentive regulation and the implementation of total factor productivity measurement to support incentive regulation for a Utility Regulators' Forum workshop on future electricity networks regulation (2003).
- Examined the relative efficiency performance of Australian State electricity supply industries in response to energy reforms from 1975 to 2001 for the Parer Review of Energy Market Reform (2001).
- Prepared case studies for the Ontario Energy Board of international best practice in distribution pricing structures, allowing for distributed generation, incorporating energy conservation and demand management incentives (2006).
- Advised the Australian Energy Networks Association on development of a nationally consistent suite of service quality performance indicators and assisted with developing the ENA's position on service quality incentive regulation (2006).
- Advised CitiPower and Powercor on developing a robust and defendable case for a revised Service Incentive Scheme for their 2006 Price Review submissions (2005).
- Assisting the Commerce Commission with reviewing the regulated gas distribution businesses' pricing principles and quantitative cost of service models (2007–09).
- Studies of the comparative efficiency performance of gas distribution for the Victorian gas distribution businesses (2006–07).
- Benchmarking of the efficiency of gas transmission and distribution pipelines in Australia and New Zealand for the Commerce Commission (2004).
- Advised the Commerce Commission on the allocation of joint costs in firms supplying electricity and gas (2007–08).

Selected Publications

Coelli, T.J. and D. Lawrence (eds.) (2006), *Performance Measurement and Regulation of Network Utilities*, Edward Elgar Publishing, Cheltenham, UK.

Lawrence, D., W.E. Diewert and K.J. Fox (2006), "The Contribution of Productivity, Price Changes and Firm Size to Profitability", *Journal of Productivity Analysis* 26, 1–13.

Zeitsch, J. and D. Lawrence (1996), "Decomposing Economic Inefficiency in Base Load Power Plants", *Journal of Productivity Analysis* 7(4), 359-378.

Zeitsch, J., D. Lawrence and J. Salerian (1994), "Comparing Like With Like in Productivity Studies - Apples, Oranges and Electricity", *Economic Record* 70(209), 162-70.

Lawrence, D., P. Swan and J. Zeitsch (1991), 'The Comparative Efficiency of State Electricity Authorities', in P. Kriesler (ed.), *Contemporary Issues in Australian Economics*, MacMillan.

John Kain

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Qualifications

BSc, Sydney University

BE (1st Class Hons), Sydney University

Key Skills and Experience

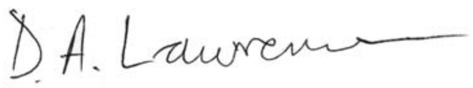
Prior to becoming a consultant John Kain was Chief Engineer and General Manager Engineering with ACT Electricity and Water (ACTEW) and its predecessor organisations. John has extensive experience in electricity distribution engineering including underground and overhead mains, transmission circuits, zone and distribution substations, protection design, setting and commissioning, system planning and system operations. He also acquired experience in supply cost analysis and tariff formulation as well as bulk–supply purchases. Since leaving ACTEW, John has operated as an independent consultant specialising in the analysis of electricity network costs and tariffs. John was a Board Member of the former National Electricity Code Administrator (NECA). Recent key projects include:

- Advice to the AEMC on the data and other requirements for the implementation of productivity–based regulation.
- Constructed a database for total factor productivity and econometric analyses for the New Zealand Commerce Commission's resetting of price regulation parameters for electricity distribution businesses for the period 2009–2014.
- Constructed detailed database of US gas business outputs and inputs for efficiency analysis.
- Advised the ENA on development of a nationally consistent suite of service quality performance indicators and assisted with developing the ENA's position on incentive regulation and embedded generation issues.
- Benchmarked the operating and capital expenditure performance of the two Queensland distributors, Energex and Ergon Energy, against Australian and US distributors.
- Reviewed proposals for a Network Access Regime in the Northern Territory including asset valuation, analysis of retail tariffs and revenues.
- Examination of higher voltage network elements of New South Wales distributors likely to be regarded as "Transmission Elements" under the National Electricity Code, and advice as to their relevance for regulatory inclusion.
- Provided Cost and Tariff analysis and advice to the Network arms of Electricity Trust of South Australia in anticipation of market operations in that state.

- Assisted NorthPower in the examination of network costs, and the development of an allocation methodology for determining network charges. Assistance in negotiations with neighbouring network operators over disputed charges.
- Assistance to TransGrid as the then NSW market and system operator in a review of the National Grid Metering Code requirements associated with the extension of contestability to the 160-750 MWh customer tranche.
- Assistance to TransGrid as then NSW market and system operator at the time in a review for IPART of the methodologies used by the New South Wales Network operators in the determination of loss factors, and the results of those determinations.
- Prepared a report on Electricity Distributors' Costs and Cost Allocation Methodology and Analysis of Suppliers' Responses. This study confirmed and better quantified the cross-subsidy as well as highlighting the difference between Tariff formats, and the format of allocated costs, particularly for the 'simple' energy only tariffs.
- Assisted the Pricing Oversight Commission in understanding of the Electricity Supply Industry Cost and Tariff Structures, and in the understanding, analysis and questioning of the Cost and Tariff Proposals of the Hydro Electric Commission of Tasmania.
- Advised on cost and tariff analysis and the preparation of Integral Energy Networks Division's Submission to IPART and undertook subsequent analysis of tariff separation on various potentially contestable customers.
- Reviewed Electricity Distributors Retail and Network Costs and Allocations, including separation of the 'wires' and 'retail' operations of distributors with indications of appropriate directions and amounts of change.
- Identified cross subsidies in electricity distribution for various clients.

ATTACHMENT C: DECLARATION

I, Denis Anthony Lawrence, Director of Economic Insights Pty Ltd, declare that I have read the Federal Court Guidelines for Expert Witnesses and that I have made all inquiries I believe are desirable and appropriate and that no matters of significance which I regard as relevant have, to the best of my knowledge, been withheld.



Denis Anthony Lawrence

26 March 2012

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