# Ergon Energy Expenditure Benchmarking

## Partial productivity and cost driver analysis and comparisons

huegin

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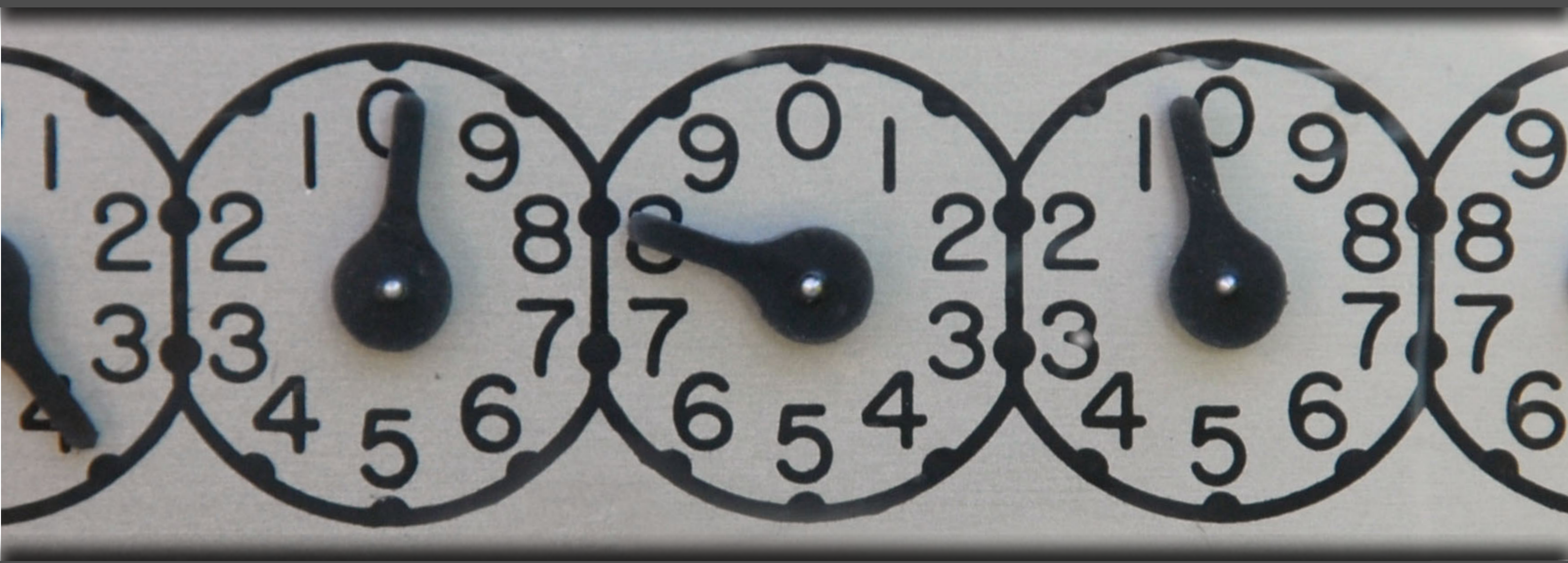

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# Executive Summary

## Benchmarking Ergon Energy Expenditure

### All networks are different

In response to changes in the National Electricity Rules, the Australian Energy Regulator will produce an annual benchmarking report outlining the relative efficiency of DNSPs within the National Electricity Market. These efficiency estimates will be considered by the AER when examining the proposed expenditure of DNSPs. One of the risks of the approach is the assumption that a single cost function can represent the cost structure of all industry participants. In reality, the networks are very different.

### Understanding cost drivers

Putting the differences of the networks into perspective is an ongoing challenge for benchmarking practitioners. Understanding the drivers of cost and understanding the magnitude of the influence is difficult - particular across large regions where conditions vary and are not easily described by a single measure.

A number of cost drivers exist on an electricity business. Several of them are presented in this report, demonstrating how different the networks are and how unique Ergon Energy's operating conditions are.

### Partial productivity analysis

Partial productivity analysis is a common benchmarking technique, but it carries its own inherent limitations. Substitution of costs between categories can be erroneously classified as efficiency differences and the assumption that all networks can achieve cost ratios similar to the "lowest" cost business has lead in the past to unrealistic expenditure targets. Understanding the influence of cost drivers on these partial productivity indicators is important, as is understanding that direct comparisons across different types of networks will not yield defensible results.

# Contents

# Introduction

This benchmarking study is a review of major category expenditure across the National Electricity Market for distribution businesses, focusing on comparisons of Ergon Energy's costs with industry peers. The study aims to identify and highlight drivers of category expenditure where possible.

## Analysis Techniques

Most of the analysis in this report uses partial productivity indices - individual ratios of a single output and single input.

Partial productivity indices become more relevant as cost data is disaggregated, but only if adequate explanatory variables can be found for the denominator. At the opex and capex level, partial productivity indices still exhibit limitations for efficiency analysis as a single cost driver rarely carries the same weighting for cost outcomes of different businesses.

Costs are divided into major functional activities and cost drivers are presented in a framework that depicts the variation in the influence of the drivers on costs and the ability of businesses to control those cost drivers.

## Data Sources

The data used in the analysis contained within this report has been sourced predominately from:

- Category Analysis Regulatory Information Notices (RIN);
- Economic Benchmarking Regulatory Information Notices;
- Annual Financial and Non-FInancial Regulatory Information Notices; and
- Other publicly available data, such as regulatory reports, Network Management Plans, Annual Reports and company websites.

The period represented by the data in this report is from financial year 2009 to financial year 2013. Huegin makes no warranty for the accuracy of the data as reported in RINs, and whilst every effort is made to accurately reflect the costs and attributes of each business, Huegin is not responsible for errors or omissions in the RINs submitted by the businesses. Readers should also refer to the Basis of Preparation document that accompanies the RINs - this document highlights some of the different interpretations, data collection methods and estimation techniques employed by the businesses.

# DNSP Summary

Distribution Network Service Providers (DNSPs) in Australia operate in a broad range of environmental, legislative and socio-demographic conditions. The size and location of businesses varies greatly across the country. This chapter presents an overview of the variation

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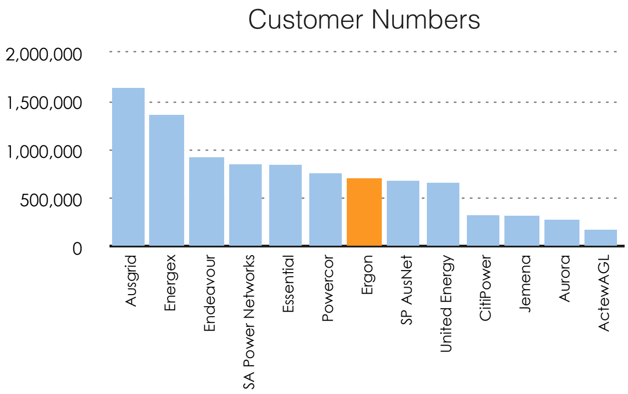
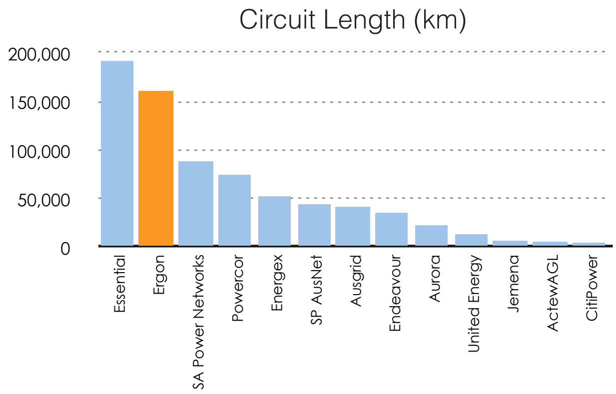
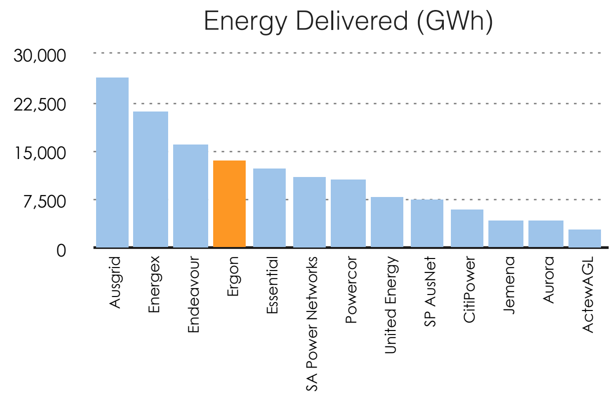
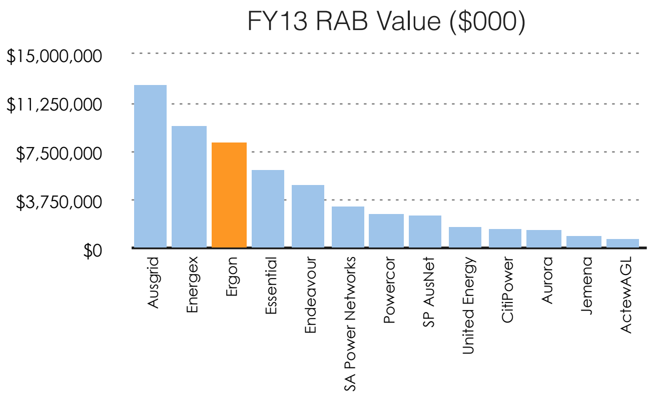
# Ergon Energy has few peers in the electricity distribution industry

Most of the benchmarking approaches adopted in the Australian regulatory environment take the lead from northern hemisphere jurisdictions, in particular Great Britain. The diversity of network attributes in Australia, however, compared to northern hemisphere jurisdictions presents significant challenges in identification of peer distribution businesses in benchmarking studies. On single measurements, such as below, it might be possible to identify a number of businesses that share an attribute with Ergon Energy (or close to it), however finding one business that shares several attributes is impossible.



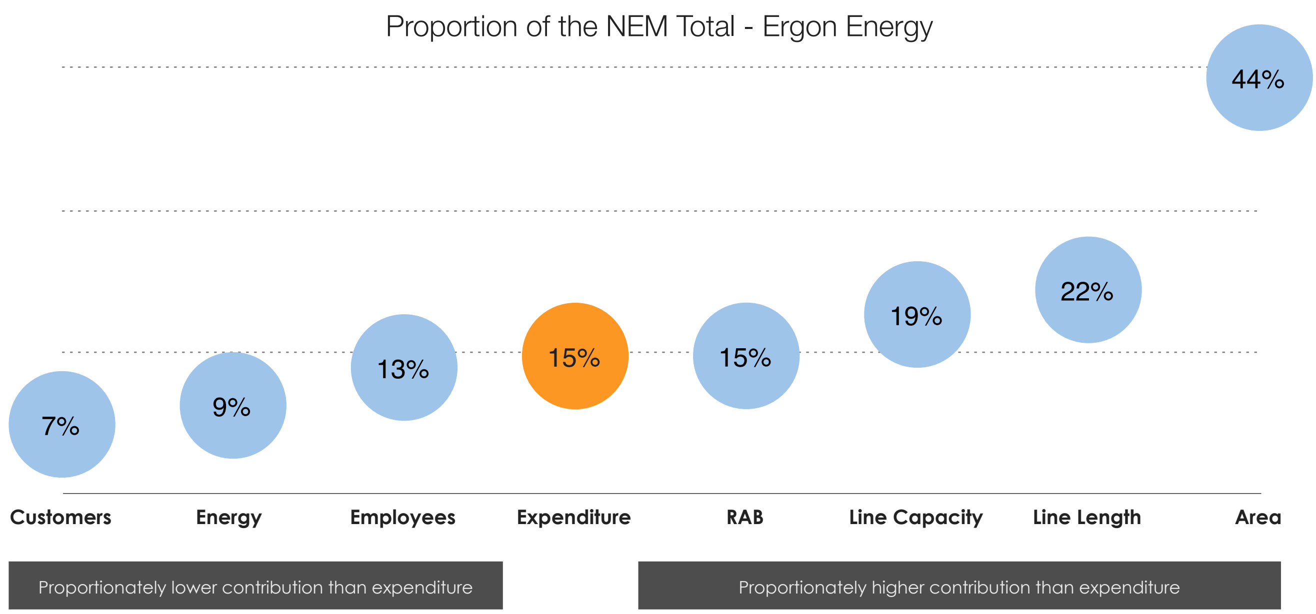

Most benchmarking studies of Australian businesses use customers per kilometre of network, or some other combination of customer numbers and network length in an attempt to normalise cost data, however these single attributes are limited in ability to describe all of the influences on individual activity costs. Attempts to normalise the businesses often fail due to the sheer magnitude of the differences between the businesses at the extreme ends of the spectrum - and Ergon Energy is at one end of the spectrum on most measures. The following table comparing the Great Britain Distribution Network Operators (DNOs) and the NEM DNSPs highlights the issue.

| Ratio | GB DNOs | NEM DNSPs |
|---|---|---|
| Difference in scale between the **longest network to the shortest** | 3 times the size | 39 times the size |
| Difference in scale between the **maximum network customers and the minimum** | 5 times the size | 10 times the size |
| Difference in customer density between the **most dense and least dense network** | 4 times the density | 21 times the density |

As shown, the physical attributes of the businesses in Australia are significantly more varied than the 14 DNOs in Great Britain.

# Network attributes in the context of the NEM

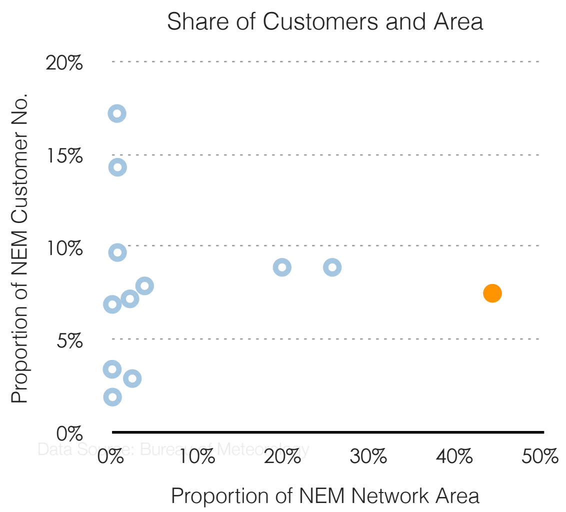
To put the differences between networks into perspective, network attributes can be analysed on the basis of their contribution to the National Electricity Market (NEM) totals. With 13 businesses in the NEM, a network that was of average scale would contribute just under 8% to the total on all network attributes. The Ergon Energy profile (measured over 2009-2013) is shown below.




Ergon Energy is larger than what would be an average size business on all of the selected attributes, other than customer numbers. Intuitively, Ergon Energy will likely perform better than some DNSPs when measuring against attributes to the right of its expenditure measure above and will perform worse than most DNSPs when comparing against attributes to the left. Further, relative to the contribution of Ergon Energy's expenditure to the NEM total:

- The contribution of Ergon Energy's customer numbers and energy delivered is somewhat lower than the contribution of expenditure;
- The contribution of Ergon Energy's employee numbers and Regulated Asset Base (RAB) value is roughly equivalent to the expenditure contribution;
- The contribution of Ergon Energy's line capacity (MVA-kms) and line length are somewhat greater than the contribution of expenditure; and
- The contribution of Ergon Energy's network area is significantly greater than the contribution of expenditure - to the extent that it constitutes almost half the NEM area.

The differential between contribution of customer numbers and network area is greater than for any other business in the NEM, even for those businesses that are closest to Ergon Energy in customer density. This indicator is largely dismissed or ignored in most of the analysis we have seen to date.



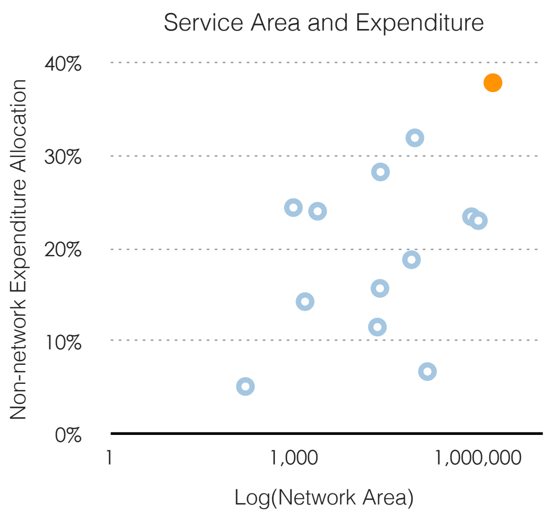

### Customer Density by Area

Customer density is often measured by the number of customers per kilometre of network in electricity network benchmarking. Whilst the customers per kilometre of network measure provides an indication of the concentration of customers and assets along a linear length of network, understanding the area that those customers and network lines are distributed across reveals the challenges faced by the businesses in accessing the customers and assets. Given a significant proportion of network costs are driven by access to the assets (pole inspections, vegetation management, etc), the distance required to travel to the asset (or place resources close to assets) is relevant to costs. As shown, Ergon Energy services the single greatest proportion of the NEM by area - this has impacts on non-network costs such as property and fleet expenditure, but this impact is hidden when measuring against customers per km of line on its own.

# Differences in cost allocation reflect differences in operating conditions

Comparing costs directly between networks is challenging due to the variation in the physical attributes and operating conditions. However understanding the composition of costs for an individual business compared to the industry average can highlight the influence of the various cost drivers. The composition of Ergon Energy's direct costs (excluding overheads) compared to the industry average composition is shown below.


As shown, the balance of Ergon Energy's costs is skewed less toward replacement and augmentation capex (and vegetation management, to a lesser extent) than industry averages, with a higher contribution from non-network opex and capex than industry averages. This is reflective of the significant difference in the network area serviced highlighted in the previous analysis. The graph below shows that as network area serviced increases, the proportion of expenditure dedicated to non-network expenditure also generally increases.




### Non-network Expenditure and Service Area

As service area increases, the proportional allocation of expenditure to non-network capex and opex also generally rises. One outlier to this relationship is Powercor - a business that services a large area, but shares ownership with CitiPower.

Note: Ergon Energy utilised a 50% owned subsidiary, SPARQ Solutions, to supply ICT services. The costs to Ergon Energy for these services are reflected predominately in opex rather than capex leading to a large proportion of ICT investment "off balance sheet". This will attribute to higher amounts of operating expenditure compared to DNSPs who invest in-house.

# Drivers of DNSP Costs

The range of operating conditions present across Australia's electricity distribution networks is broader than most other countries. The boundaries between the businesses - which is much less uniform than many other countries - exacerbates the problem of heterogeneity between networks.

This chapter explains some of the more relevant cost drivers for electricity networks.

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# Understanding differences between networks is imperative

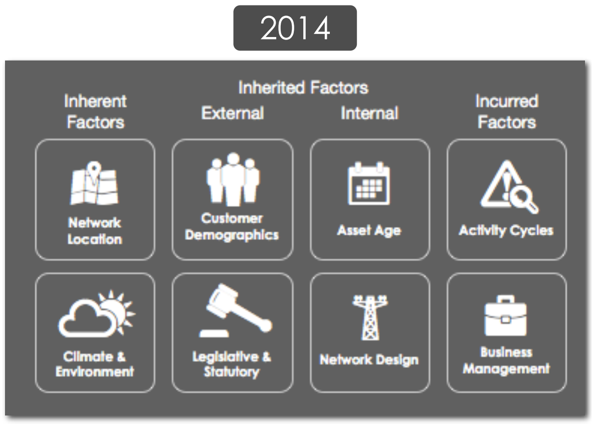
The most common error in analysing and making conclusions from partial productivity analysis is concluding that differences in simple cost ratios across businesses are due to differences in efficiency without considering:

1. Substitution of costs between categories;
2. The impact of exogenous variables and different operating conditions on the cost; and
3. The ability to control those variables and costs through management decisions.

These issues have been raised by Huegin and many others, for example:

> ***Comparing the costs between businesses in different jurisdictions without accounting for factors outside the control of the business could provide misleading indicators of managerial efficiency. If used in incentive regulation, this could lead to underinvestment or unwarranted transfers from consumers to the businesses.***
>
> - Productivity Commission, "Electricity Network Regulatory Frameworks", 26 June 2013, p.163
>
> ***A direct comparison of firms' costs without accounting for the implications of their relevant individual circumstances would render such comparison meaningless for assessing efficiency.***
>
> - NERA, "Economic Interpretation of Clauses 6.5.6 and 6.5.7 of the National Electricity Rules", 8 May 2014, p.9

It is often difficult to determine the component factors in any residual present when comparing data, but at the very least the differences in networks should be understood. The following pages provide information on the significant exogenous and endogenous factors that influence network costs (and present a challenge to the comparison of network performance). These factors can be arranged in a framework of categories and types. In 2012 Huegin presented a framework of twelve categories of cost drivers; for this report, the framework has been refined to eight categories. The two frameworks are shown below, with more detail on the nature of the factors shown on the next page.


### Changes made

The major changes in the framework include:

- Splitting of Policy, Regulation and Legislation into internal (Business Management) and external (Legislative and Statutory) categories;
- Movement of Voltage into Network Design;
- Removal of Reliability Standards - as these change over time;
- Removal of Utilisation - as this is an outcome of Design and Customer Demographics;
- Removal of Scale;
- Removal of Accessibility - as this varies too much across a single network to be measured meaningfully;
- Addition of the incurred factor of Activity Cycles - as this impacts maintenance costs materially.

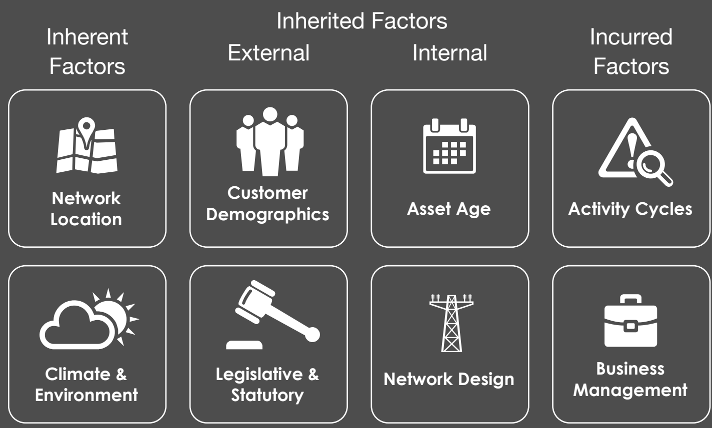
# Understanding network cost drivers

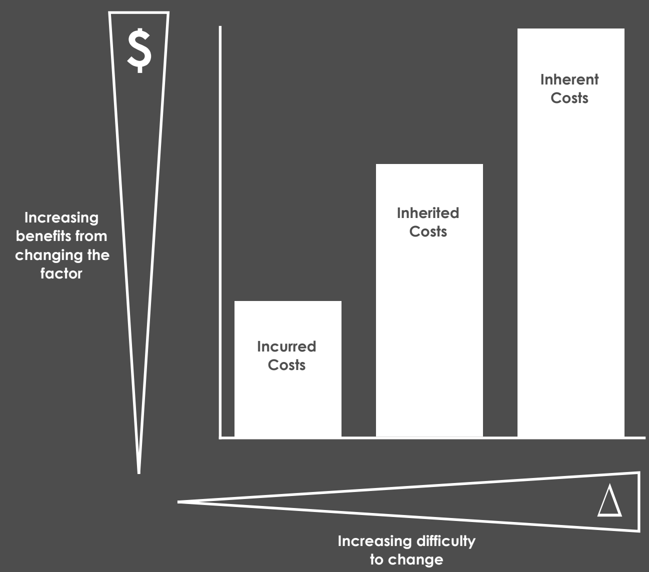
In previous benchmarking studies, Huegin has posited that a number of cost drivers exist that influence costs and the presence and influence varies across networks. We have refined the list to eight important cost drivers shown to the right and categorised as follows:

- Inherent factors - these are beyond the control of the distribution business.
- Inherited factors (external) - these can be influenced by the distribution business, but not controlled. The level of influence is not usually significant.
- Inherited factors (internal) - these can be directly influenced by the distribution business, but any material change in these factors generally takes much longer than a regulatory period to take effect.
- Incurred factors - these are mostly the outcome of management decisions, and are more readily influenced, although the changes may not be significant.

There is often an inverse relationship between the level of control management has for each category and the magnitude of impact that results from changes in the factors. That is, those factors that are hardest to influence or control are generally those that would deliver the most benefit if change were possible.

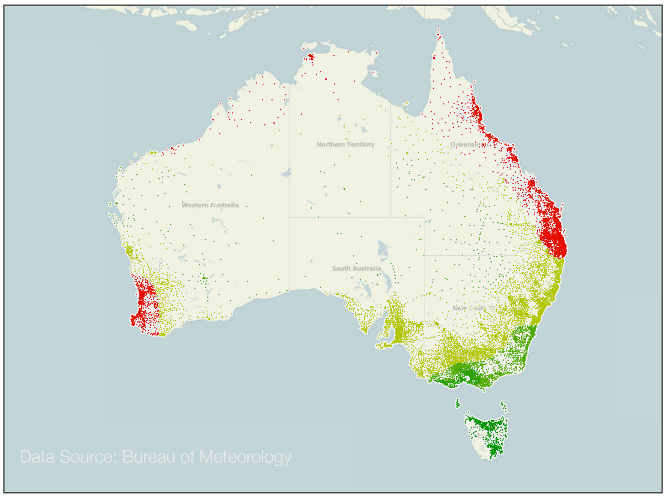
Each of these factors can be represented by certain network or environmental attributes. Some of these are presented in the following pages.



# Network location

There are many reasons a network's location will influence costs, some physical, some logistical. The graphs below show some of the important locational differences for factors that influence network costs.



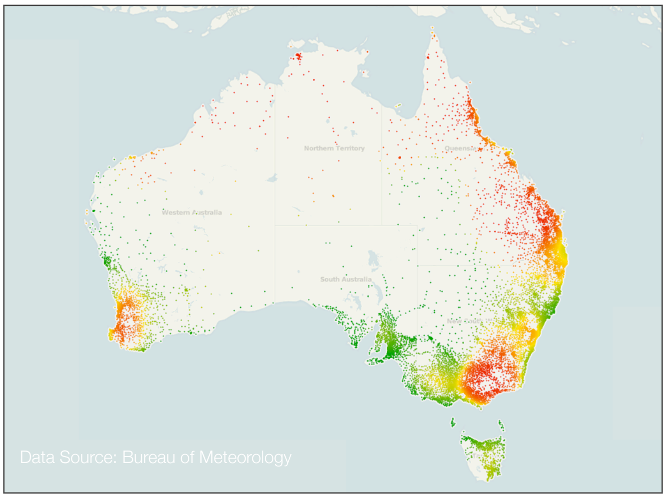

## Termite Exposure

The graphic to the left shows the variation in termite risk zones across Australia by post code. As shown all of the east coast of Queensland and the South West of Western Australia are highest risk areas. Of course this risk factor combines with climate risk factors to pose specific degradation issues for wooden poles.

Activities impacted by this cost driver:

Maintenance Opex

Replacement Capex




## Bushfire Risk

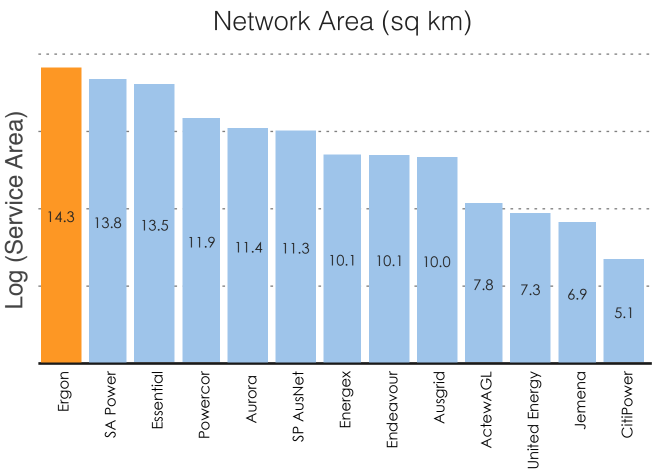
The graphic to the left shows the variation in bushfire risk across Australia by post code. This is an issue for fire starts through contact with electricity assets. Vegetation management and pole inspection costs are influenced most significantly by this factor.

Activities impacted by this cost driver:

Maintenance Opex

Replacement Capex

Vegetation Management




## Service Area

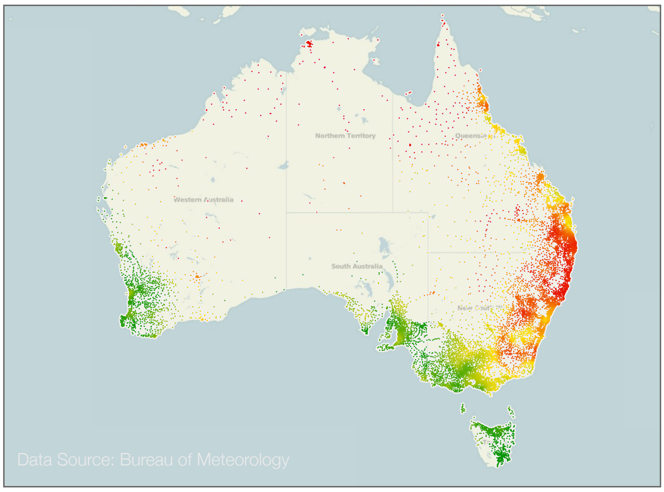
The graphic to the left shows the variation in network area serviced. A logarithmic scale is required to illustrate the comparison due to the significant range between the smallest (CitiPower, 157 sq km) and largest (Ergon Energy, 1,700,000 sq km). Property, fleet and other corporate overhead costs increase with increasing service area.

Activities impacted by this cost driver:

Non-network Expenditure

# Climate and Environment Impacts

The impacts of climate and environment vary broadly across Australia. In larger networks they vary broadly across a single distribution business also.

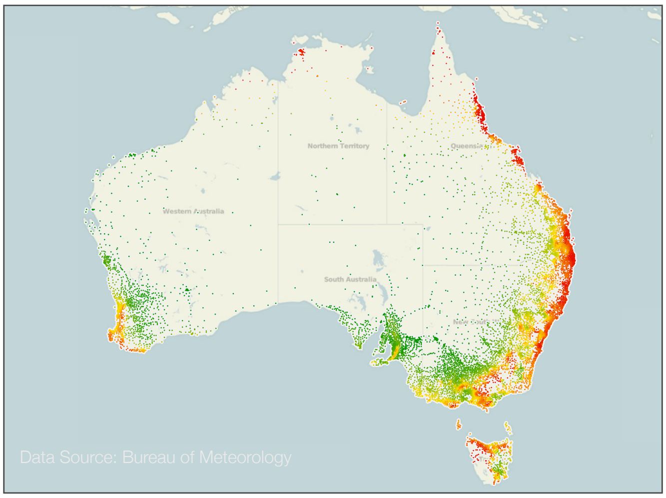



### Severe Storms (thunder days)

The graphic to the left shows the range in number of thunder days per annum by post code across Australia. As shown, South East Queensland and the north coast of New South Wales have the most storm activity in Australia. High storm activity indicates areas that are more prone to weather related outages, increasing network switching and emergency response operations.

Activities impacted by this cost driver:

Emergency Response | Network Control | Customer Service

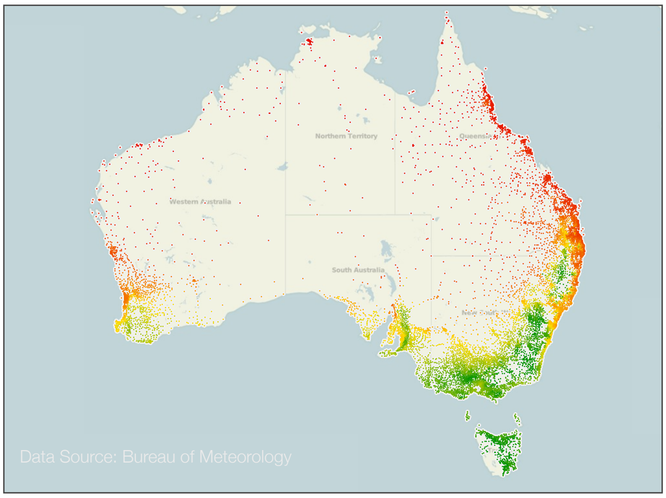



### Rainfall (mm)

The graphic to the left shows the variation in annual mm of rain by postcode across Australia. As shown, the east coast of Australia and north west Tasmania have the highest falls. High rain fall accelerates the degradation of wooden poles - particularly in the presence of high temperatures - which increases the maintenance and replacement rates of poles.

Activities impacted by this cost driver:

Maintenance Opex | Replacement Capex




### Maximum Temperature (degrees)

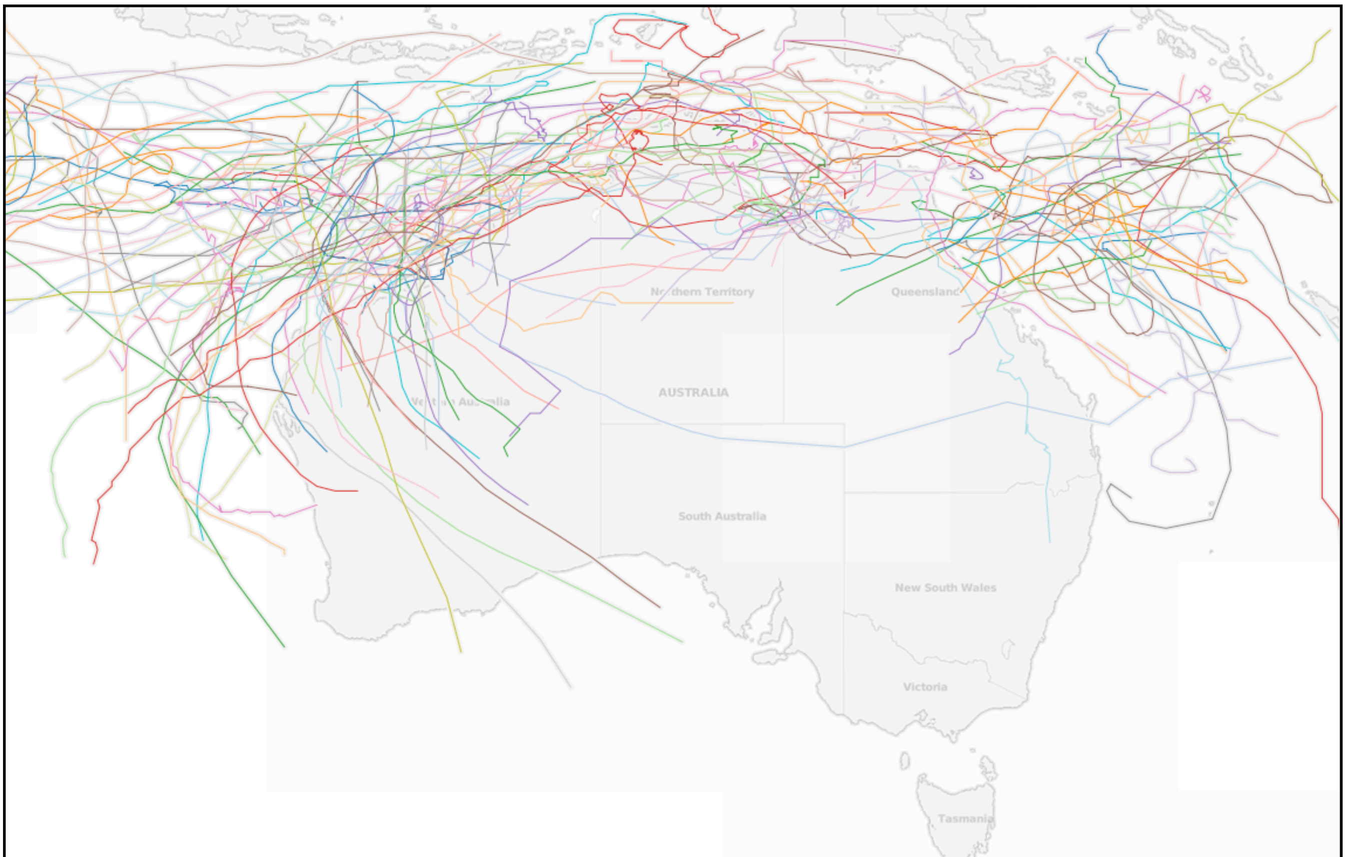
The graphic to the left shows the variation in maximum recorded temperatures by postcode across Australia. The north east coast and north west coast of Australia experience the highest temperatures. High temperatures place pressure on networks through customer demand, but also the sag on overhead lines. Both of these factors increase the likelihood of outages.

Activities impacted by this cost driver:

Emergency Response | Network Control Opex | Customer Service | Augmentation Capex

# Climate and Environment Impacts

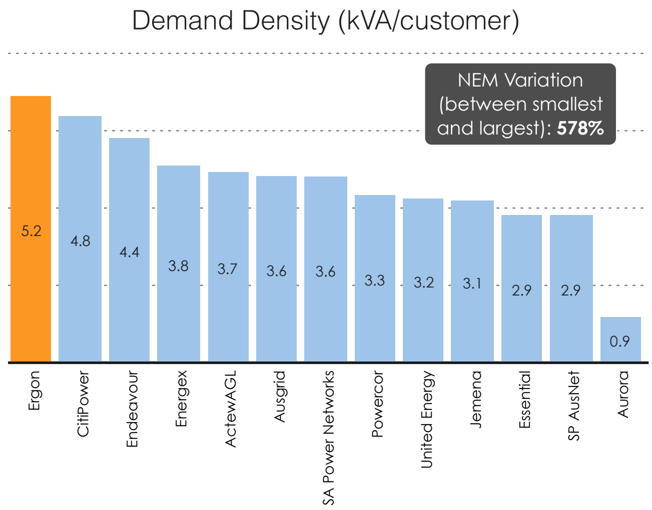
The previous page shows that Queensland experiences some of the most extreme weather and climate conditions in Australia. In the NEM, it is relatively unique in terms of the exposure to cyclones. The graphic below depicts the last 20 years of cyclonic paths around Australia.



Data Source: Bureau of Meteorology

# Customer Demography Impacts

Consumer behaviour and statistics vary across the NEM. These behaviours place different pressures on the networks in terms of demand management and network control.

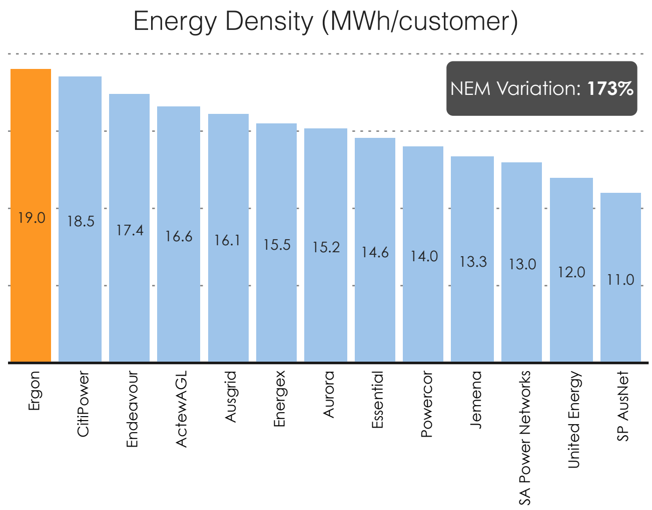



## Demand Density (kVA/customer)

The graphic to the left shows the variation in demand density - calculated by the peak demand on the system divided by customer numbers. As shown, despite having a smaller customer base than many of the larger businesses and a much lower customer density, Ergon Energy's demand density is higher than any of the urban and CBD businesses. This is particularly relevant as it highlights the significant cost pressure for Ergon of high demand and low density - that is, less customers demanding more energy.

Activities impacted by this cost driver:

Network Control Augmentation Capex




## Energy Density (MWh/customer)

The graphic to the left shows the variation in energy density - calculated by dividing total energy delivered by the number of customers. Like demand density, Ergon Energy's energy density is the highest of all businesses. And like demand density, the energy density demonstrate the juxtaposition of Ergon Energy's high demand and usage relative to its dispersed customer base, placing significant pressure on costs.

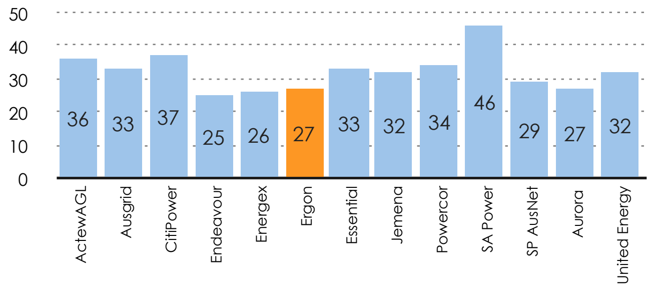
Activities impacted by this cost driver:

Network Control Augmentation Capex

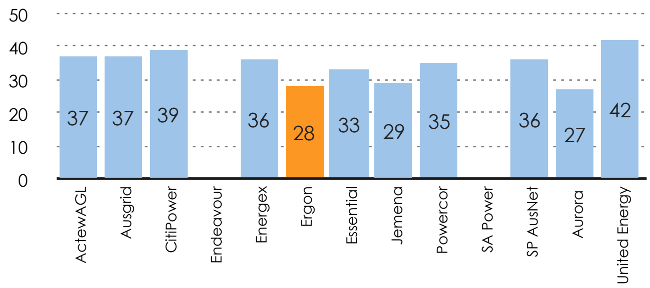
# Asset Age

The growth of networks across Australia occurred at various periods in the past and have been replaced at various rates. The result is a broad range of age profiles across networks, which impacts replacement and maintenance costs.

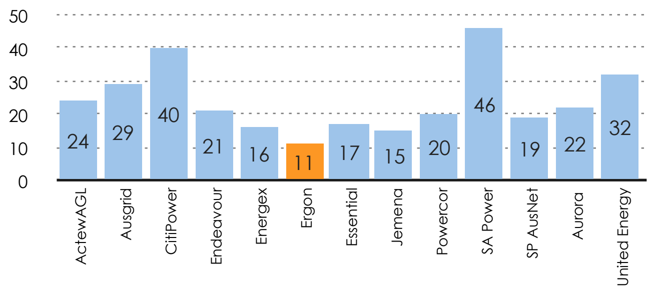
Average Pole Age



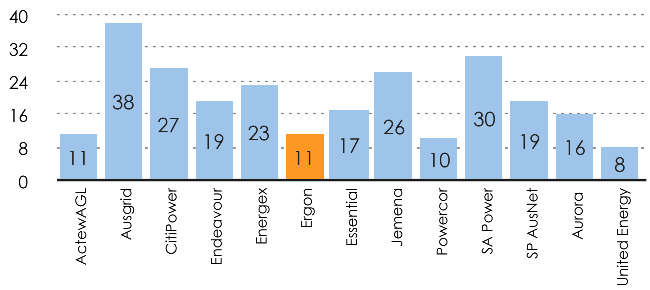

Average OH Asset Age



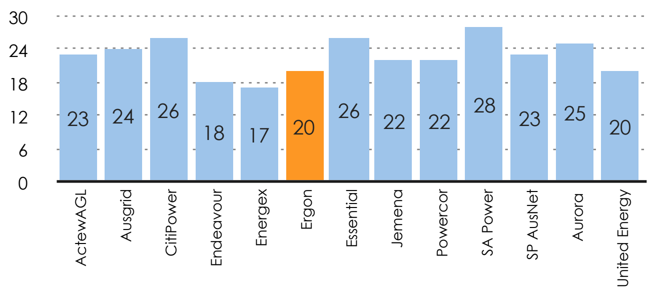

Average LV UG Age




Average HV UG Age




Average Transformer Age




**Average Age (years)**

The graphs to the left show average ages of various asset classes. Whilst the individual age profiles - the distribution of the population of an asset across the age range - reveals more about the need to replace assets than the average does, average age provides a high level comparison of the immediate pressures on asset replacement for an asset class.

Note: several businesses, including Ergon Energy have reported difficulties in providing accurate asset age data.

Activities impacted by this cost driver:

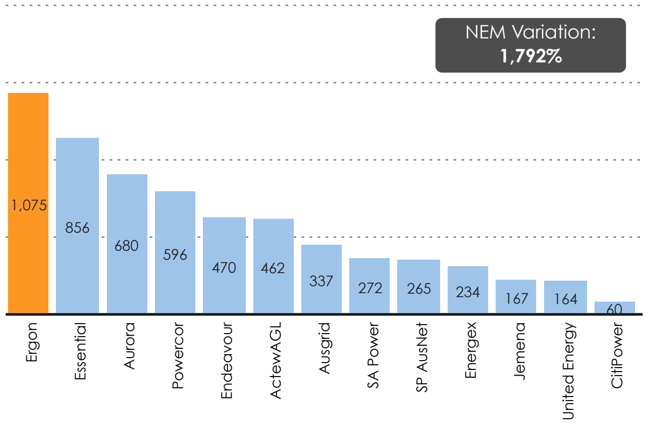
Maintenance Opex

Replacement Capex

# Network Design Factors

Network design is perhaps the single largest influence on costs. Variations in line capacity, undergrounding and network redundancy all impact construction and maintenance costs.

Line Capacity (kVA-kms) per Customer



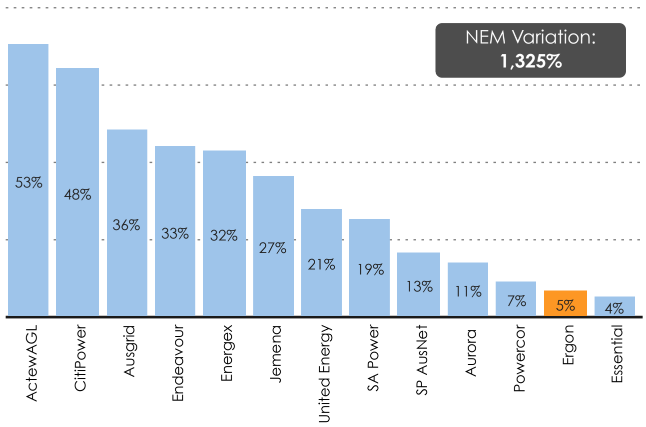

## Line Capacity per Customer

The graphic to the left shows the variation in line capacity per customer of each of the businesses. The line capacity (the length of feeders multiplied by their capacity) per customer provides an indication of both the length and design voltage required to deliver energy to end users. DNSPs with a higher line capacity per customer are likely to have a higher cost of transport given that infrastructure of higher voltages are normally more expensive than those of lower voltages.

Activities impacted by this cost driver:

Maintenance Opex | Replacement Capex | Augmentation Capex

Network Underground (%)



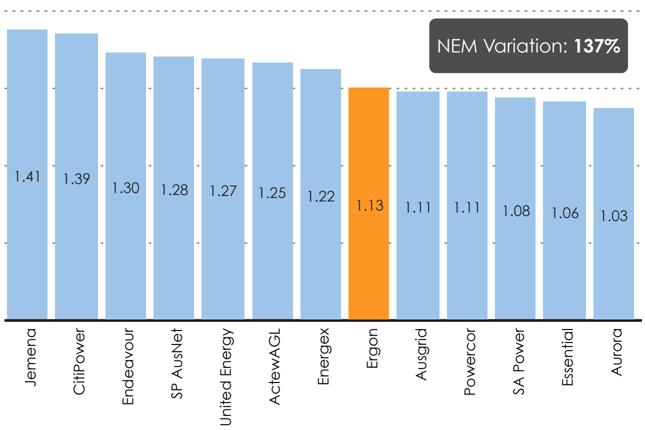

## Proportion of Underground

The graphic to the left shows the proportion of the network that is underground by circuit length. Undergrounding assets is generally more expensive during construction than overhead assets, however underground assets are more resilient and generally have lower total lifecycle costs due to the lower maintenance requirements.

Activities impacted by this cost driver:

Maintenance Opex | Emergency Response | Vegetation Management

Circuit Density (times)




## Circuit Density (circuit km vs route km)

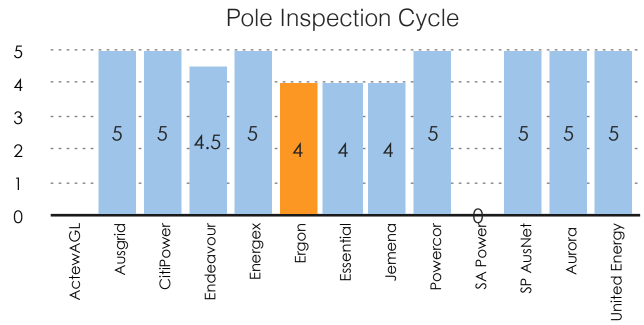
The graphic to the left shows the variation in circuit density - the length of network circuit divided by the route length. This measure gives an indication of the radial nature of lines and also the redundancy within routes. Whilst only a high level indicator, it does provide information about the variation in this aspect of network design.

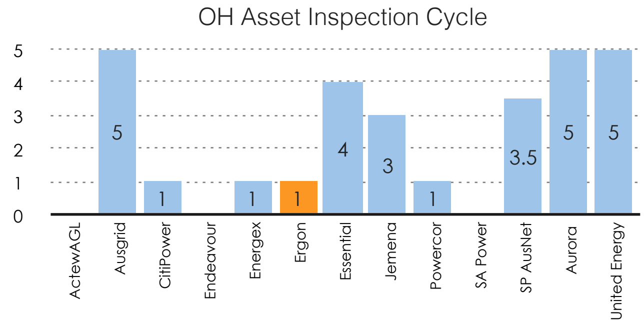
Activities impacted by this cost driver:

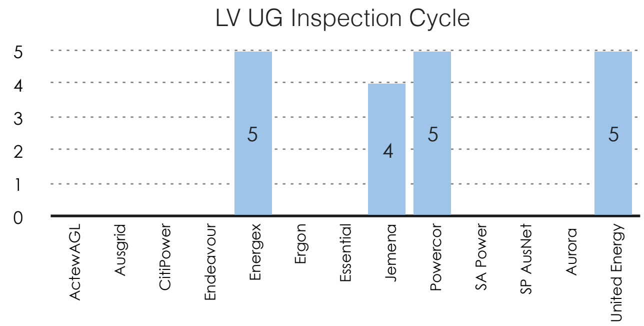
Maintenance Opex | Network Control

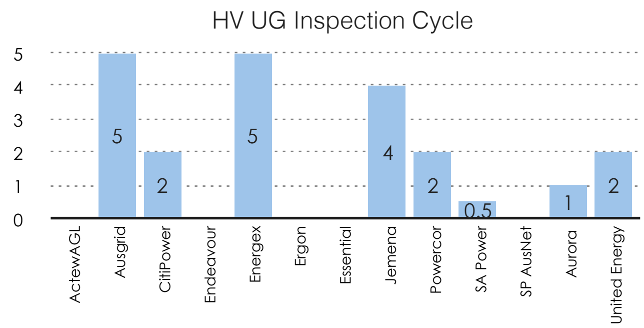
# Activity Scheduling

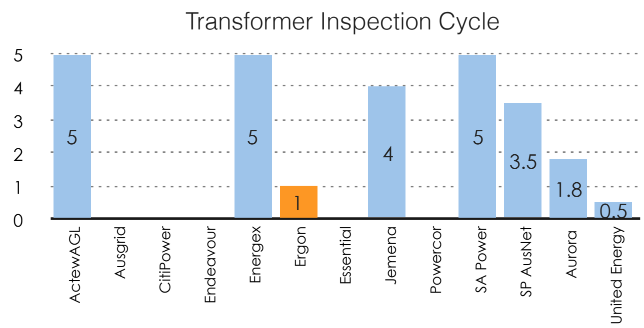
Inspection cycles have a significant impact on maintenance costs. A high degree of maintenance costs for an electricity network are preventative activities such as inspections, and the period for inspection by asset class will determine the workload, and therefore costs.




## inspection Cycles (years)

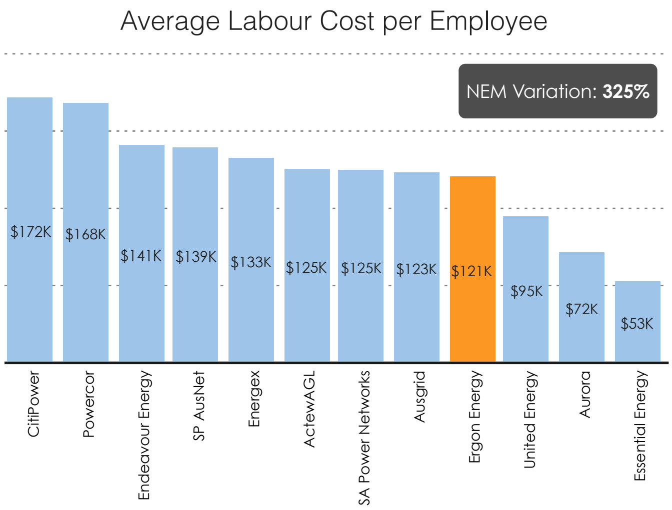
The graphs to the left show inspection cycles of various asset classes. These cycles have a direct influence on the amount of expenditure over time spent on conducting preventative maintenance on the assets. Where some of the fields are blank, the DNSP may not have provided the data in the RIN or may have a run-to-failure maintenance strategy.

Activities impacted by this cost driver:

Maintenance Opex

# Business Management Factors

Management decisions such as ownership options (buy vs lease), capitalisation policies and wages negotiated all impact on total costs.

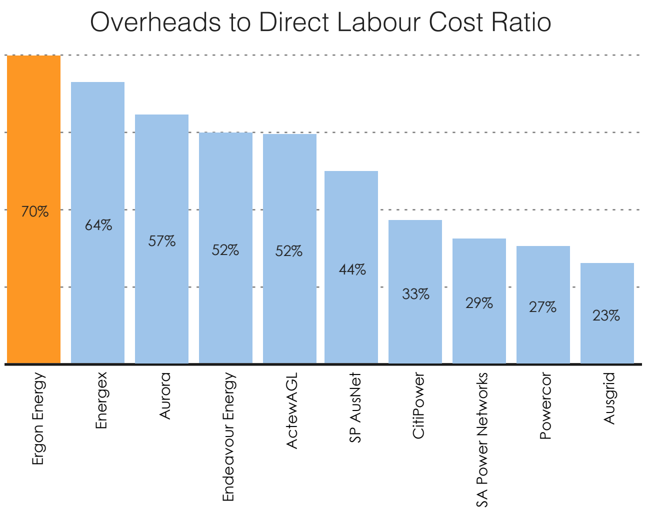



## Labour Costs

The graphic to the left shows the average labour cost per employee. This value will be impacted by organisational structures and skills mix, seniority, outsourcing, location and negotiated conditions. However this may also be influenced by variations in accounting treatment of labour costs.

Activities impacted by this cost driver:

All Costs




## Overheads

The graphic to the relationship between overhead labour costs (network and corporate) and direct labour costs. Whilst this information says more about the differences in cost allocation methodologies between businesses than anything else, it does provide a view of how differently the businesses treat the split between indirect and direct cost activities.

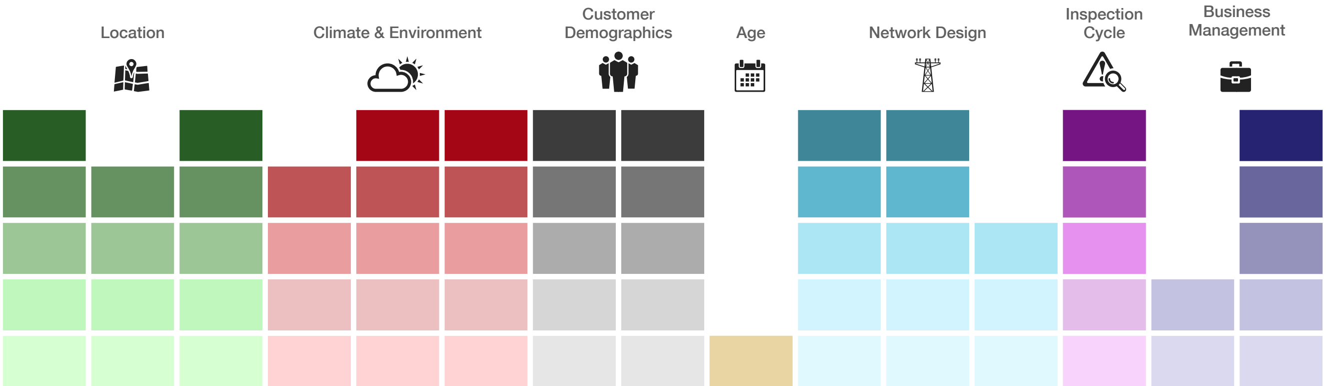
Activities impacted by this cost driver:

All Costs

# Profiling electricity networks

The range of operating conditions across Australia is broad, and many factors influence network costs to varying degrees. Quantifying these different influences is challenging, particularly where networks such as Ergon Energy, Essential Energy and SA Power Networks operate in a broad spectrum of environments within a single network. The framework introduced in this chapter is one of many that could be used to construct a profile of an electricity network based on the most important cost factors that exist in its operating environment. Using this framework - and the measures presented on previous pages - we can visualise the relative impact of the cost driver categories on an individual network.

Using assessments of relative impact* of each of the factors identified on Ergon Energy's cost outcomes, we can construct a profile for Ergon Energy's network cost drivers as shown below. Each column represents a ranking on the measures identified with each level representing the quintile ranking. The more "filled" the column, the more influence that factor has relative to other businesses for the individual measure. DNSPs with high ranking across all columns are going to be at the greatest disadvantage if comparisons are made on cost benchmarks alone.




** Relative impact is measured by ranking the individual business within the range of NEM business for each individual factor. A higher ranking (top quintile) indicates a greater degree of impact of the factor on the business - and therefore a greater relative cost disadvantage.*

As shown, Ergon Energy has a significant number of cost disadvantages, particularly at the inherent and inherited end of the cost driver scale. Comparison with the profiles of the other networks (next page) shows how diverse the cost drivers are across the NEM.

# Comparative Profiles

Ergon Energy's cost driver influence profile was shown on the previous page. The diversity of conditions can be depicted using the same profiling process for the other networks (below).

# Partial Productivity Analysis

Using data available across the NEM, business can compare common partial productivity indicators (cost ratios of disaggregated cost categories) against other business, over time and in relation to environmental or other explanatory variables.

This chapter provides a range of indicators of cost performance for Ergon Energy relative to other DNSPs.

3

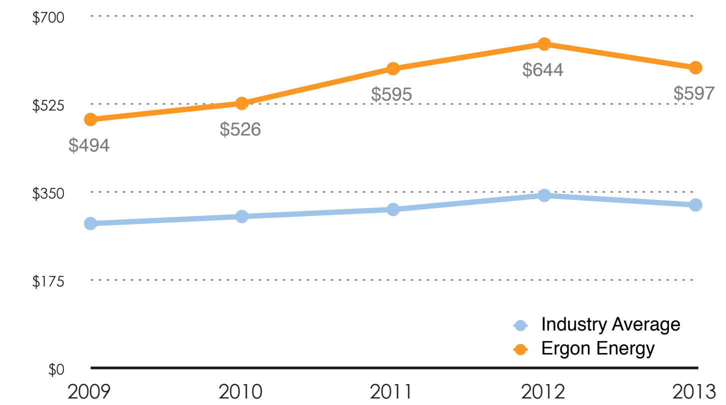
# Assessing partial productivity at the functional level

To gain further insight into Ergon Energy's current and recent performance, as well as forecast performance, partial productivity analysis can provide signals of productivity and efficiency at the functional level of costs - albeit with the same inherent challenge of normalisation. The following sections provide some common measures of partial productivity, comparing Ergon Energy over time and against industry peers.

## High level trends provide a guide to relative performance

Direct comparisons of partial productivity indicators are misleading when the influence of an omitted variable is not considered. That is, partial productivity generally relies on one simple denominator to normalise costs across business, however as detailed in the previous chapter there are many more than one in reality. Further the relationship between cost drivers is also complex and varies by business. Trends over time of the partial productivity indicator at least show relative improvement or otherwise against peer and industry trends. There may still be legitimate reasons for a change in spend over time, however at the very least understanding the trend provides the opportunity to explore the conditions driving that change. At the highest level, opex per customer and capex per km are common partial productivity indices. However, comparing businesses on just opex per customer will favour more densely populated networks and disadvantage rural networks, such as Ergon Energy, meaning limited information is available from the comparison. Viewing the trend of the index over time, however, provides a view as to the relative directions that individual and industry are trending in.

Operating Expenditure per Customer, $FY14



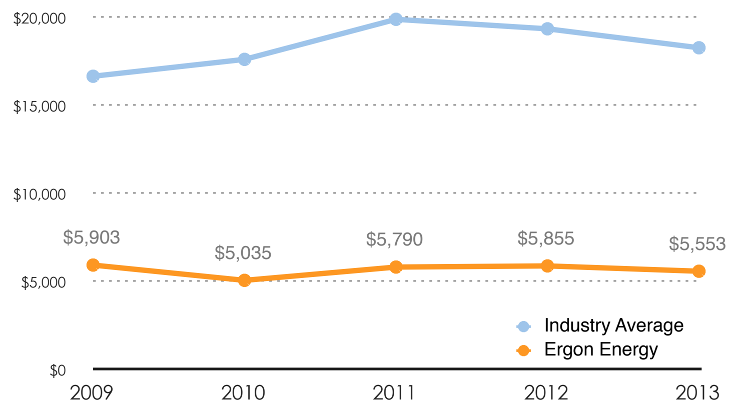

**2.5%**
Industry Annual Growth Rate

**3.9%**
Ergon Growth Rate FY09-FY13

### Opex Partial Productivity

As shown, Ergon Energy's opex per customer value - which we expect to be higher than the industry average given its low customer density - was trending relatively in sync with the industry value with the exception of a divergence away in 2011 and 2012. Breaking opex costs down further will allow analysis of the categories that contribute to this.

Capital Expenditure per Network km, $FY14




**1.9%**
Industry Annual Growth Rate

**-1.2%**
Ergon Growth Rate FY09-FY13

### Capex Partial Productivity

Conversely for capex, Ergon Energy's value is lower than the industry average - which again we expect, given the long, radial nature of its network. Whilst the industry trend shows a decline since FY11, overall the industry trend exhibits a small positive compound annual growth rate whilst Ergon Energy displays a small negative growth rate.

The analysis in the rest of this chapter shows partial productivity and trend analysis at lower levels of detail.

# System Capital Expenditure

## Partial Productivity Analysis

System capital expenditure is predominately comprised of replacement and augmentation expenditure. These costs make up to 50% of industry expenditure across the NEM, however for Ergon Energy they account for around 35% of expenditure.

## Replacement Capex

Replacement capex is driven by age and condition. Age profiles vary across to the NEM as do operating conditions that deteriorate assets. Replacement capex can be measured relative to the asset size or value, but normalisation is generally required. Average unit costs per item replaced by asset class can also be measured.

## Augmentation Capex

Augmentation is difficult to benchmark, as there is no system level indicator that appropriately reflects the need to invest in new assets. Single year partial productivity measures for augmentation capex are significantly flawed - not just for this reason, but also because projects often run over multiple years and the capacity and expenditure do not necessarily occur in the same financial year.

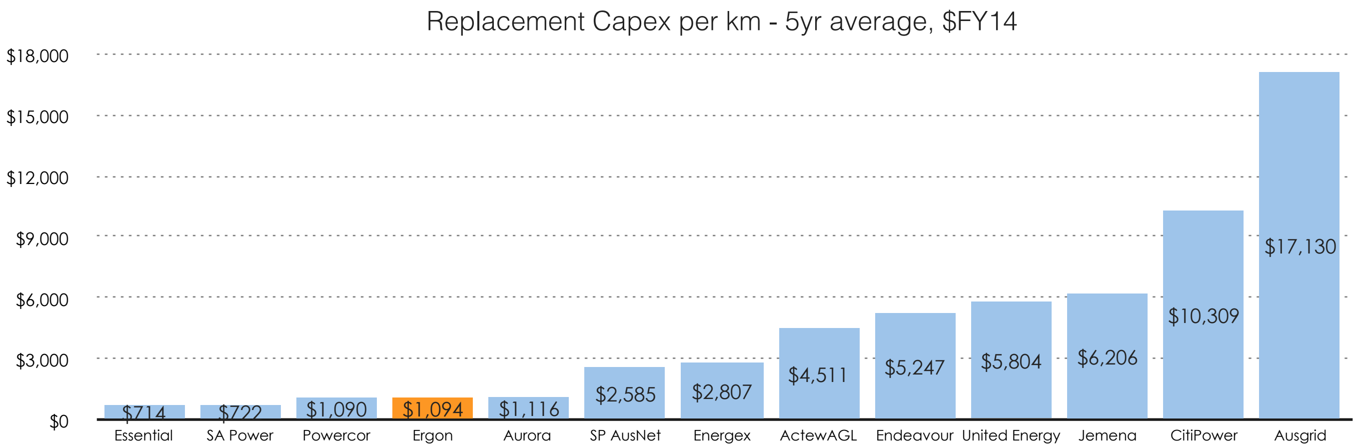
## Benchmarking analysis and measures

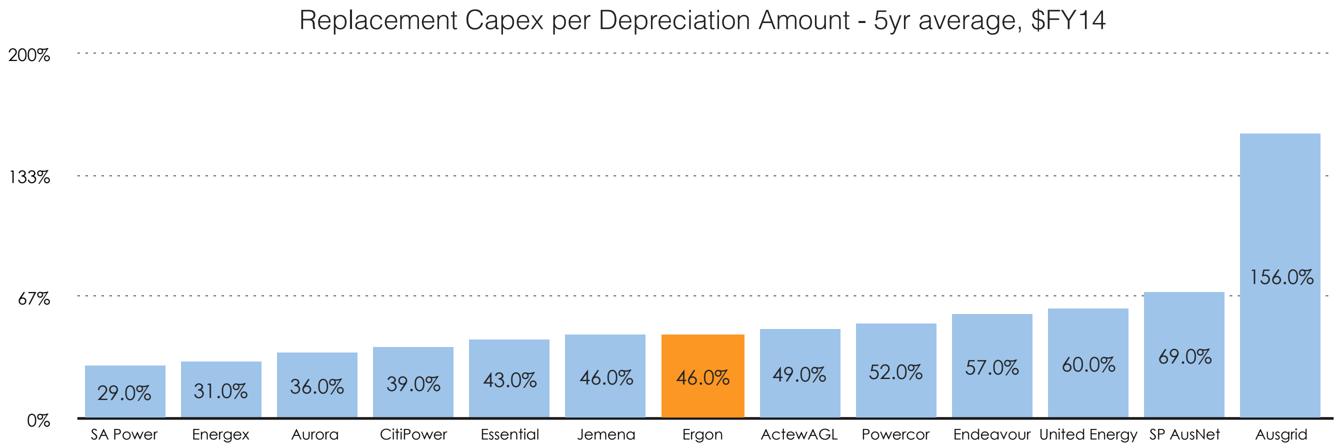
The table below shows the benchmarking analysis and measures included in this section.

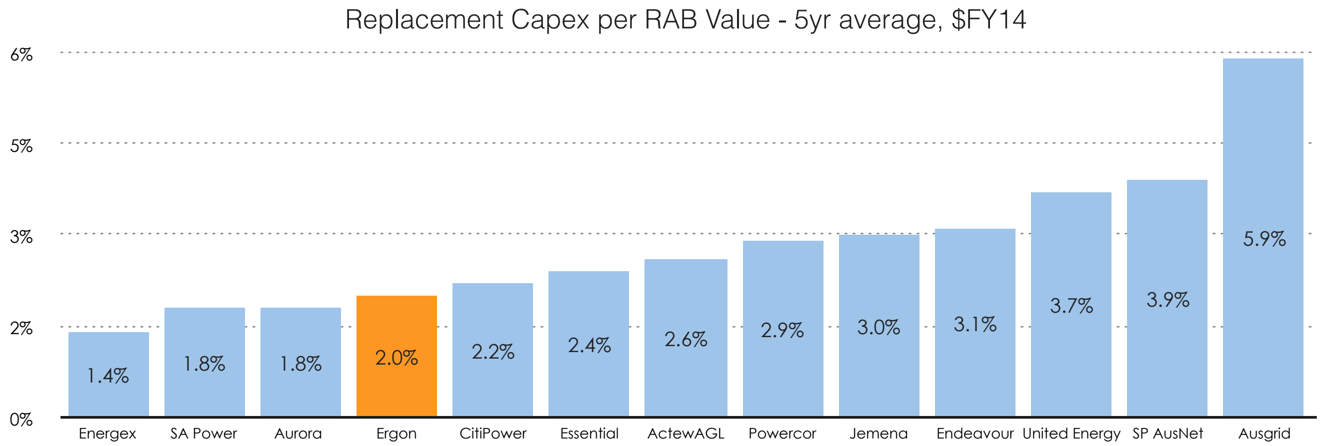
| Category | Measure | Type |
|---|---|---|
| Replacement Expenditure | Repex per km | Comparison |
| | Repex per $ Depreciation | Comparison |
| | Repex per $RAB | Comparison |
| | Repex per km | Trend |
| | Repex per km Growth Rate | Comparison |
| | Average Replacement Costs | Comparison |
| Augmentation Expenditure | Total Augmentation per MVA Zone Substation Capacity Added | Comparison |
| | Total Augmentation per MVA Line Capacity Added | Comparison |
| | Total Augmentation per MVA-kms of System Capacity Added | Comparison |

# Replacement capital expenditure

There are many common replacement partial productivity indicators - using size or value of the asset, or some other physical measurement - as the denominator to allow for scale differences. Unfortunately with electricity networks, comparison complexity is complicated by several other factors that influence replacement costs. The following pages provide comparison of common maintenance partial productivity measures - showing direct comparisons, trends and the relationship with several explanatory variables.



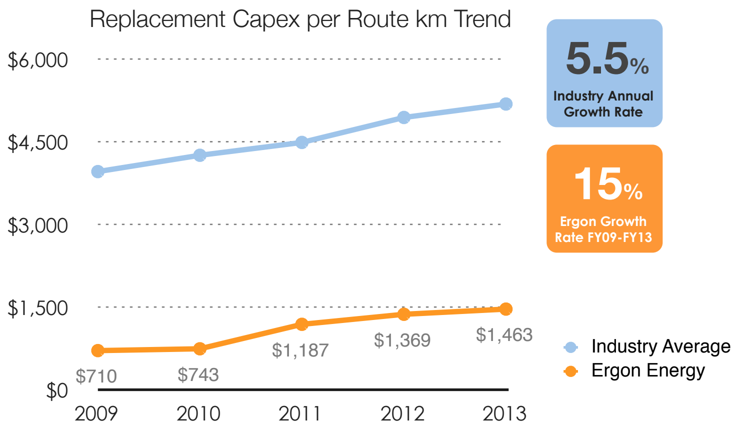



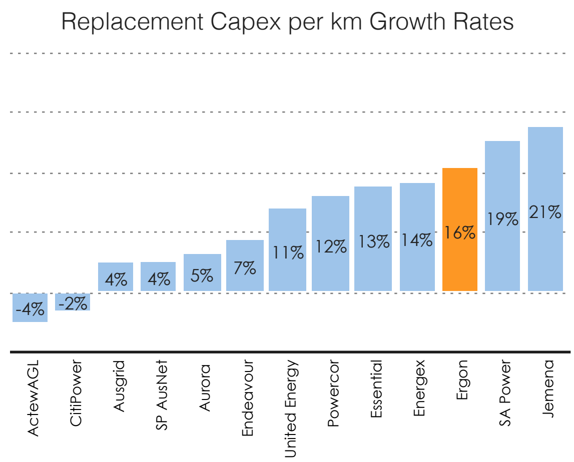
# Replacement capex trends show performance relative to industry

Whilst absolute comparisons are difficult to draw conclusions from due to the differences in networks, rates of growth of the partial productivity factor can at least indicate relative performance of an individual DNSP against the industry trends.

## Replacement Capex (partial productivity trend)

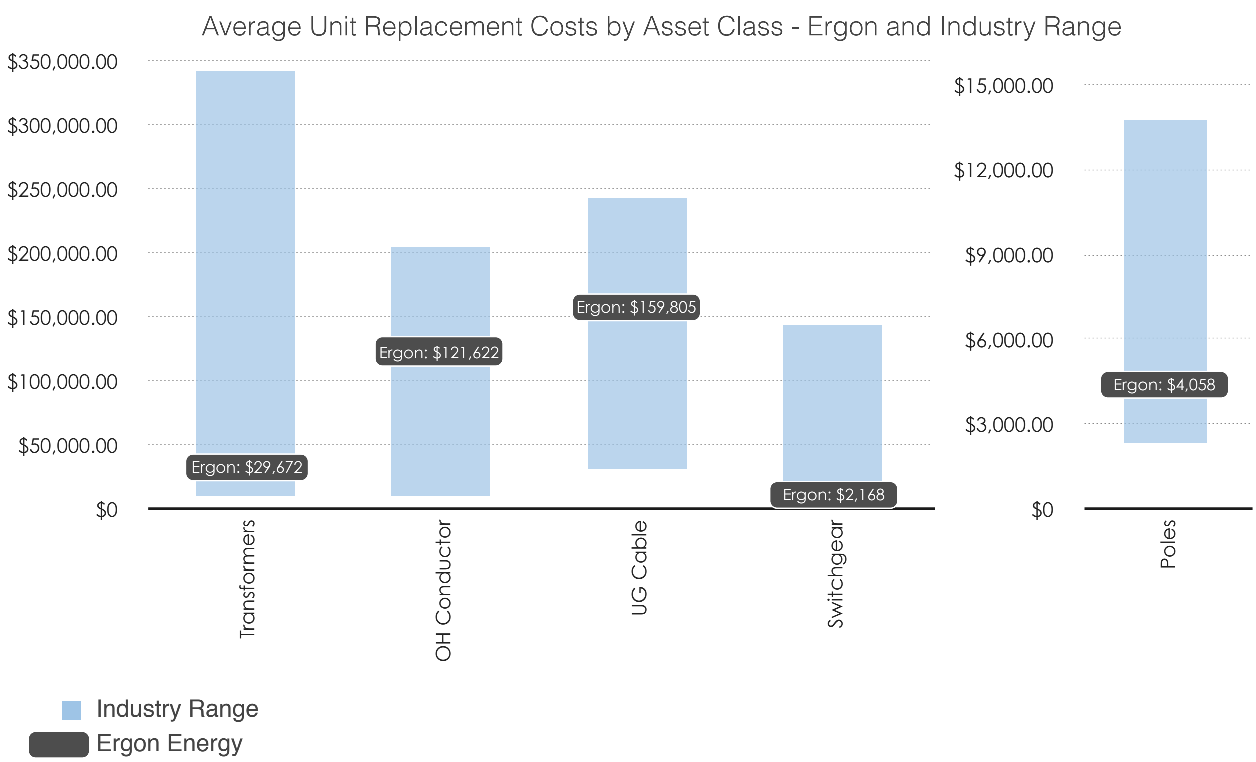
The graphs below show replacement capex partial productivity indicator trends compared to individual and industry average rates of growth for the indicator.



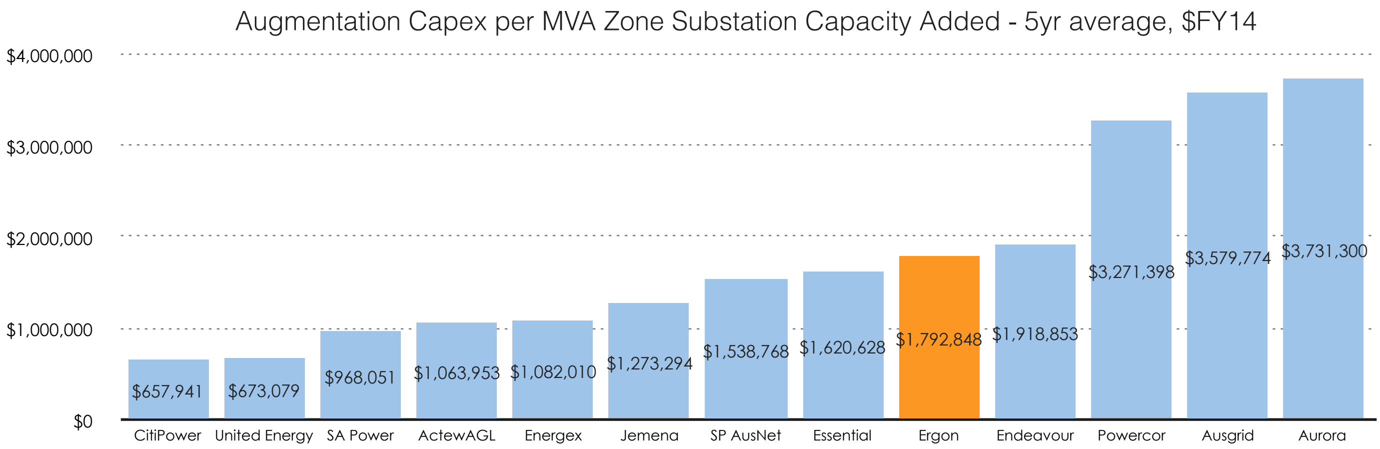

## Replacement Capex (average replacement costs)

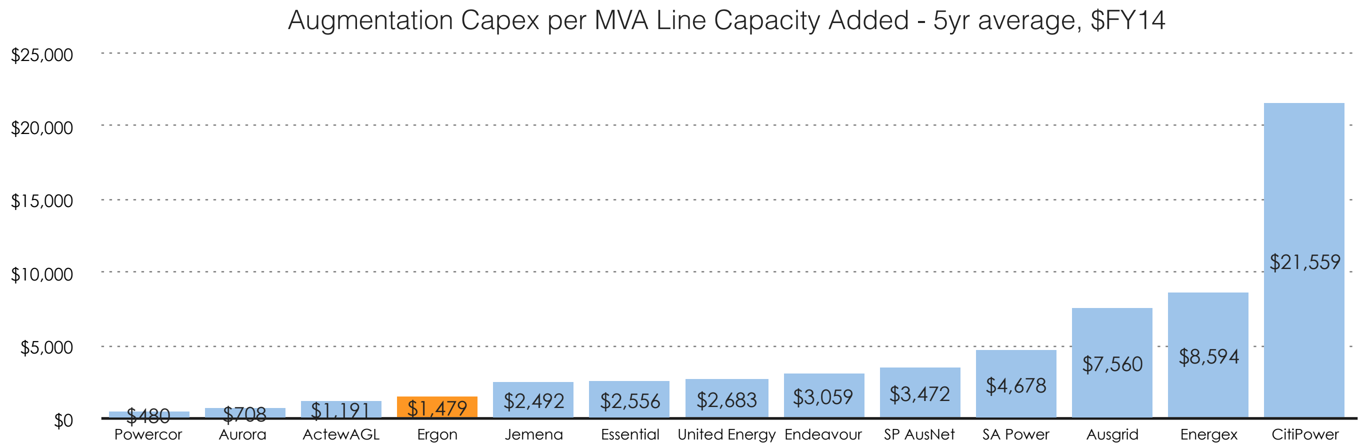
To compare the replacement cost of individual asset types, the total replacement expenditure can be divided by the assets replaced for an average item replacement cost by asset class. Even at this level, however, cost factors remain unaccounted for - assets in dense urban areas often attract more access costs and different voltage and ampere ratings influence unit costs significantly. So differences in costs at this level may simply reflect location and design influences.

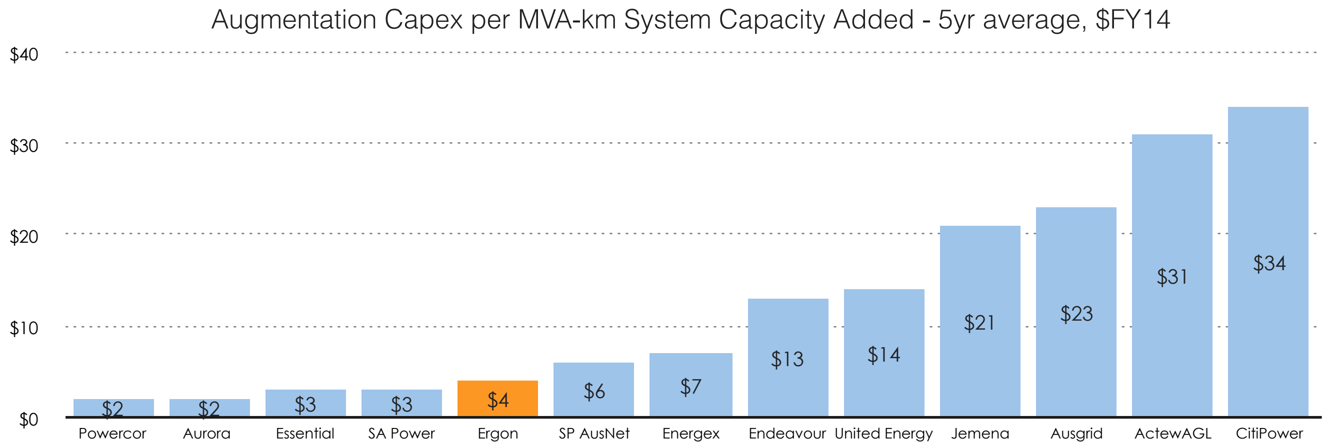


# Augmentation capital expenditure

Augmentation capital expenditure is difficult to benchmark due to manner in which it is triggered (by localised demand constraints) and the means by which it is accounted for (capitalisation of the expenditure versus commissioning of the capacity). The latter can be somewhat mitigated by measuring over a longer time period, but the measures at a system level will always be difficult to compare without knowledge of the constraints and types of projects undertaken



# Maintenance & Vegetation Opex

## Partial Productivity Analysis

Around 18% of Ergon Energy's expenditure is allocated to maintenance, emergency response and vegetation management opex.

### Maintenance Opex

Maintenance opex is driven primarily by inspection cycles, asset condition and work practices. A large amount of network maintenance is preventative actions such as inspections, although inspections often lead to discovery of defects that trigger corrective maintenance.

### Emergency Response Opex

Emergency response maintenance is generally driven by network design and environmental factors but will also be influenced by the condition and resilience of the asset. It can fluctuate with long term weather patterns.

### Vegetation Management Opex

Vegetation management opex is influenced by design and environmental factors through exposure of overhead assets and types and growth rates of local vegetation.

### Benchmarking analysis and measures

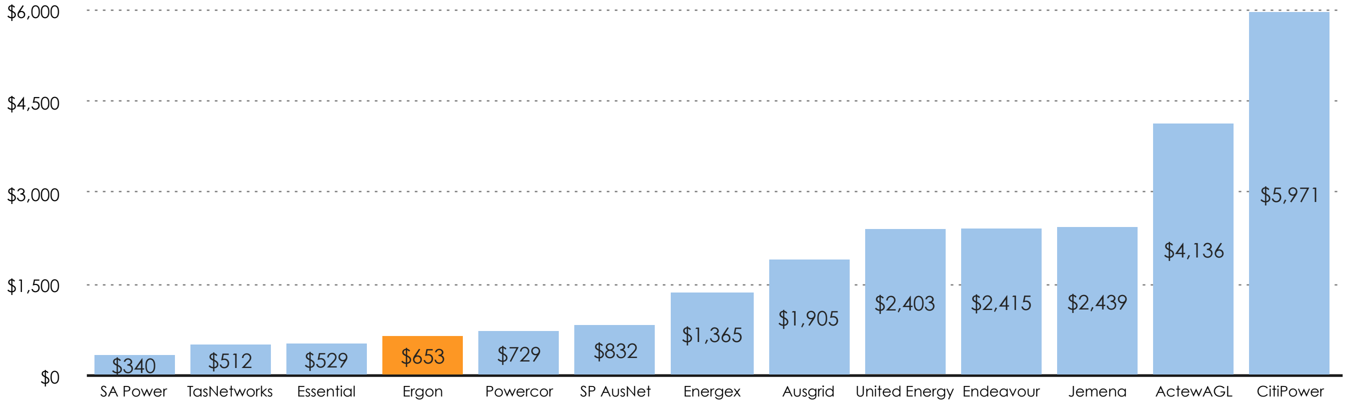
The table below shows the benchmarking analysis and measures included in this section.

| Category | Measure | Type |
|---|---|---|
| Maintenance Expenditure | Maintenance per km | Comparison |
| | Maintenance per System Capacity | Comparison |
| | Maintenance per $RAB | Comparison |
| | Maintenance per km | Trend |
| | Maintenance per km Growth Rate | Comparison |
| | Maintenance per km and Line Capacity Density | Relationship |
| | Maintenance per km and Circuit km per Route km | Relationship |
| Emergency Response Expenditure | Emergency Response per Maintenance Dollar | Comparison |
| | Emergency Response per km | Trend |
| | Emergency Response per km Growth Rate | Comparison |
| Vegetation Management Expenditure | Vegetation Management per Overhead km | Comparison |
| | Vegetation Management per Overhead km | Trend |
| | Vegetation Management per Overhead km Growth Rate | Comparison |

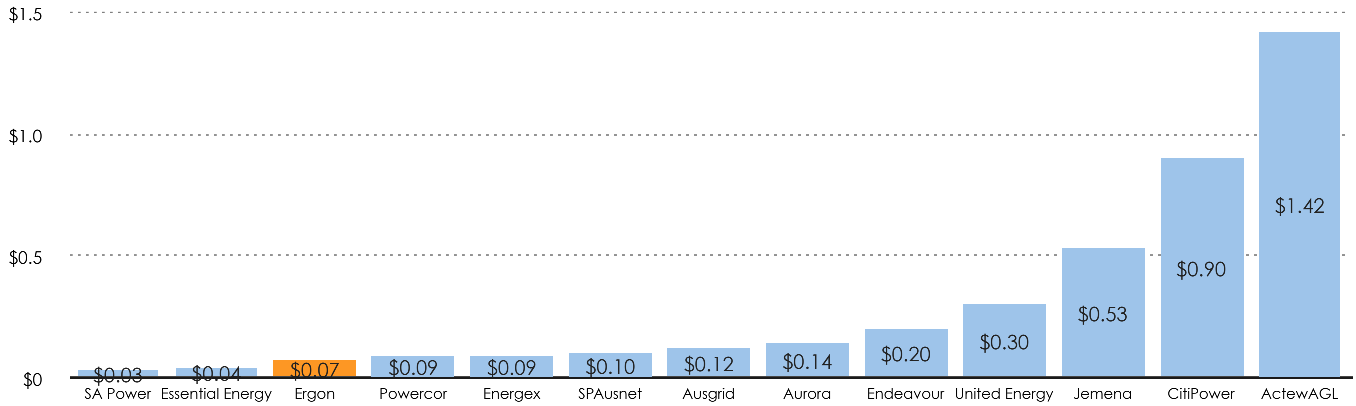
# Maintenance opex is more readily compared than many other cost categories

There are many common maintenance partial productivity indicators - using size or value of the asset, or some other physical measurement - as the denominator to allow for scale differences. Unfortunately with electricity networks, comparison complexity is complicated by several other factors that influence maintenance costs. The following pages provide comparison of common maintenance partial productivity measures - showing direct comparisons, trends and the relationship with several explanatory variables.

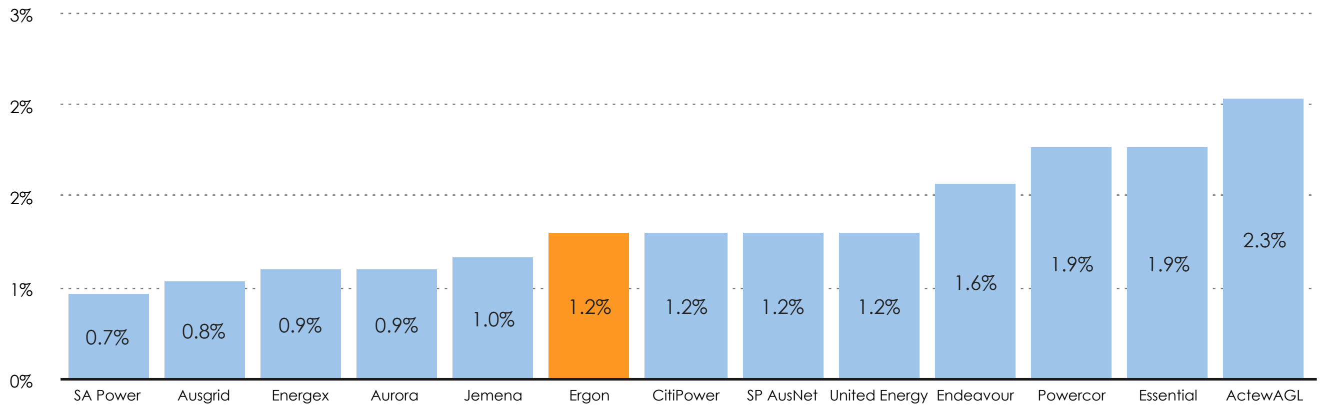
Maintenance Opex per Route km - 5yr average, $FY14




Maintenance Opex per 000 MVA-kms System Capacity - 5yr average, $FY14




Maintenance Opex per RAB Value - 5yr average, $FY14

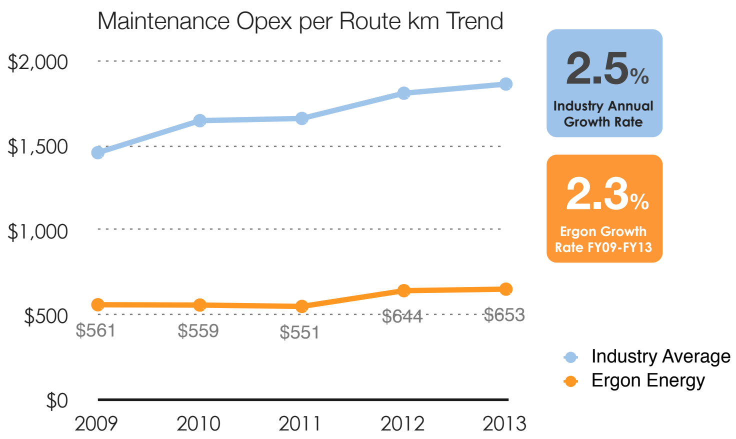


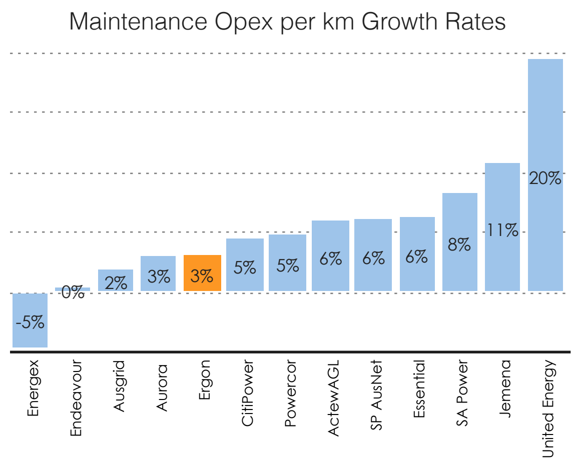
# Maintenance opex trends show performance relative to industry

Whilst absolute comparisons are difficult to draw conclusions from due to the differences in networks, rates of growth of the partial productivity factor can at least indicate relative performance of an individual DNSP against the industry trends.

## Maintenance Opex (partial productivity trend)

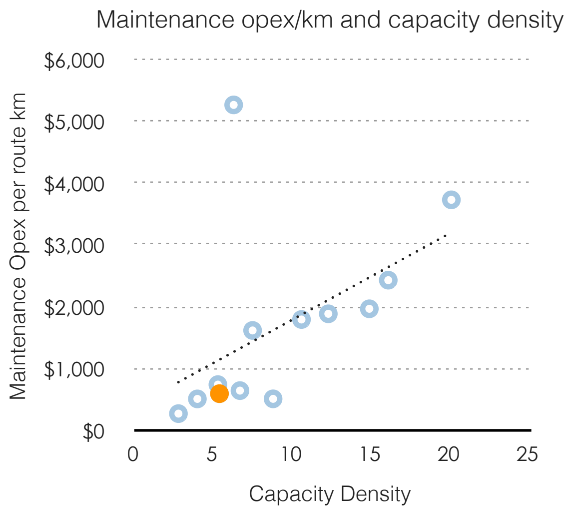
The graphs below show maintenance partial productivity indicator trends compared to individual and industry average rates of growth for the indicator.

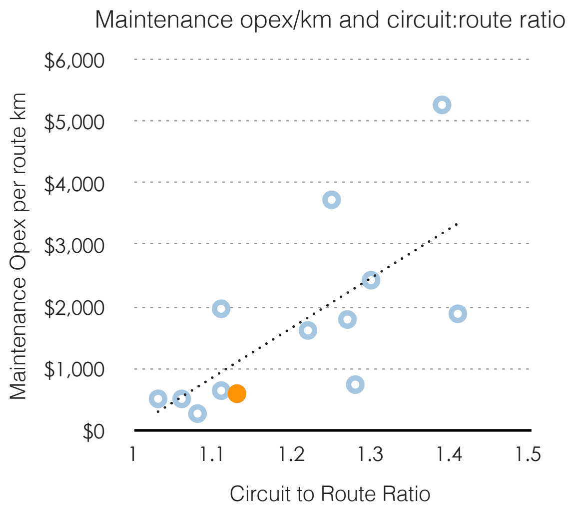



## Maintenance Opex (explanatory variables)

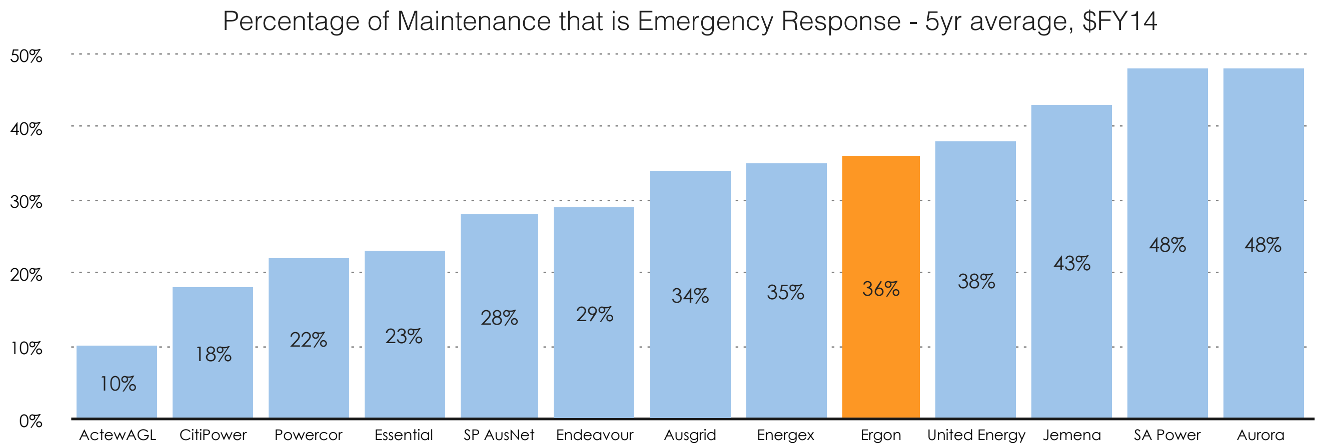
The graphs below show relationships between maintenance indices and two explanatory variables. As shown, capacity density (measured as MVA-kms of line per km network length) is reasonably strongly correlated with the maintenance costs per km of line with the exception of one outlier. There is some relationship between maintenance opex per km and the number of circuit kilometres per route kilometre, but other factors are influencing the result.



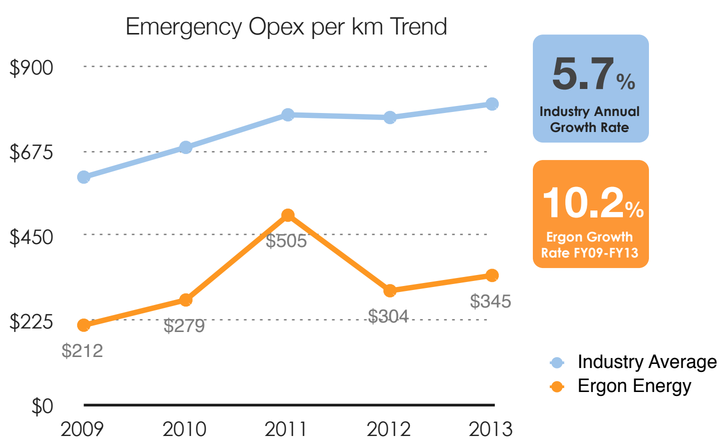
# Emergency response

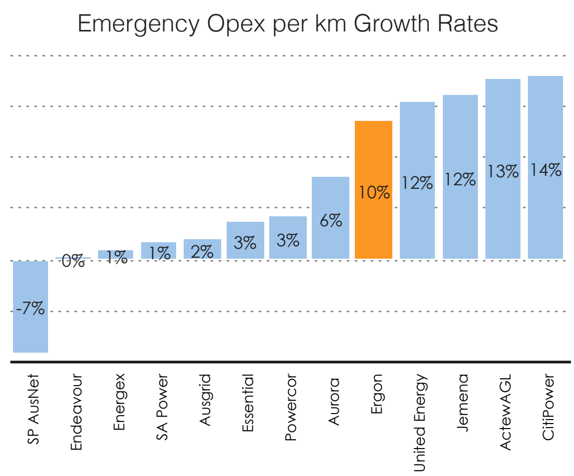
Network design and environmental and weather patterns all influence emergency response opex, but as a measure it is difficult to benchmark. Without an understanding of the nature of the events that trigger the response it is difficult to understand if a business is spending the appropriate amount on emergency response. Ideally, all maintenance would be planned, but that is impossible for an electricity network. The percentage of maintenance that is emergency response related is shown below.




**Emergency Response (partial productivity trends)**

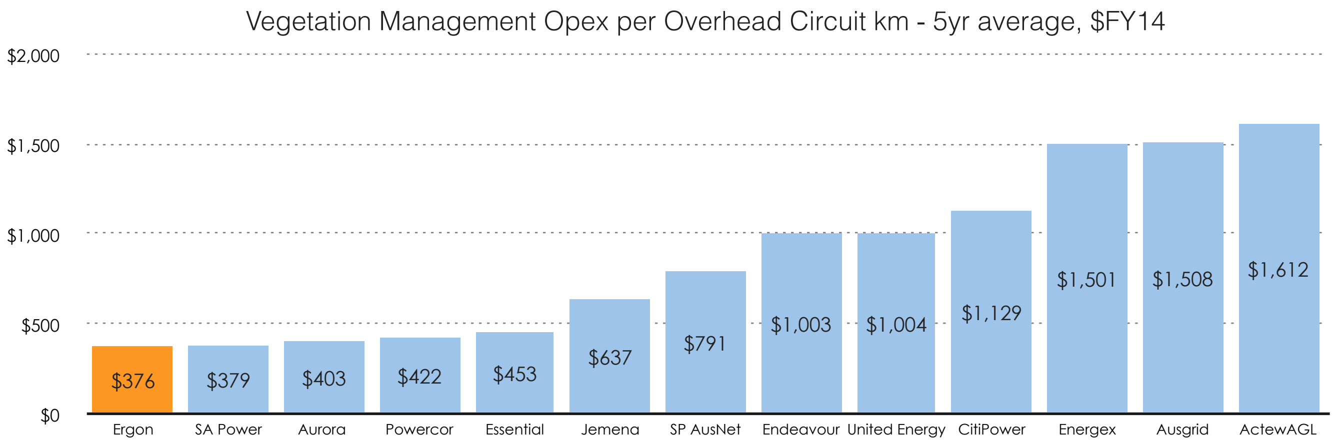
Looking at emergency response opex per km of network is not particularly useful from a comparison point of view, however trending the proportion of emergency response opex over time is likely only to show seasonal variations. To provide some illustration of the emergency response impost over time, response opex per km is shown below.



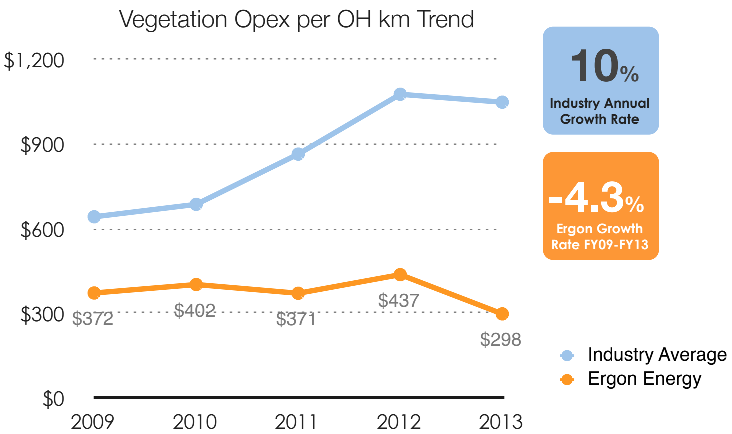
# Vegetation management costs have not increased in QLD as much as other states

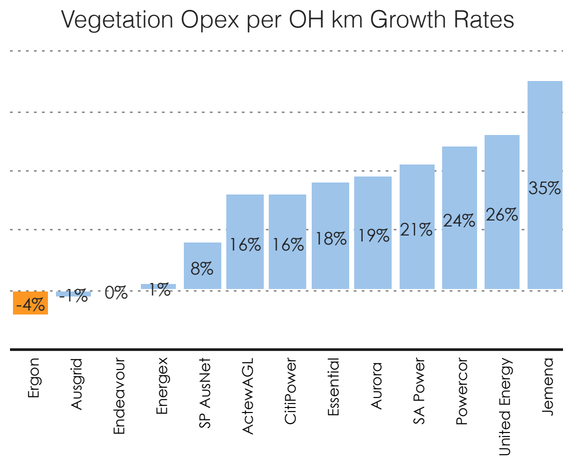
Vegetation management costs per overhead kilometre of network are reasonably comparable, but differences in scope between businesses exist, different standards apply and the cost of cutting trees in dense urban areas carries a cost premium.




**Vegetation Management Opex (partial productivity trends)**

The graphs below show vegetation management partial productivity indicator trends compared to individual and industry average rates of growth for the indicator.



# Non-network Expenditure

## Partial Productivity Analysis

A significant proportion of Ergon Energy's costs are dedicated to non-network expenditure based on the direct costs reported in the RINs. Fleet management, IT and property are three major components of this spend category that can be benchmarked across businesses.

### Fleet Management

Capital and operating expenditure associated with the management of cars, light and heavy commercial vehicles are driven by the location of the network and management policies.

### Information Technology

Generally there are no physical network factors that should affect information technology expenditure. Rather, differences in IT spend will occur through business model differences and nature of non-recurrent expenditure.

### Property Management

Capital and operating expenditure associated with the management of land and buildings are driven by the location of the network and management policies.

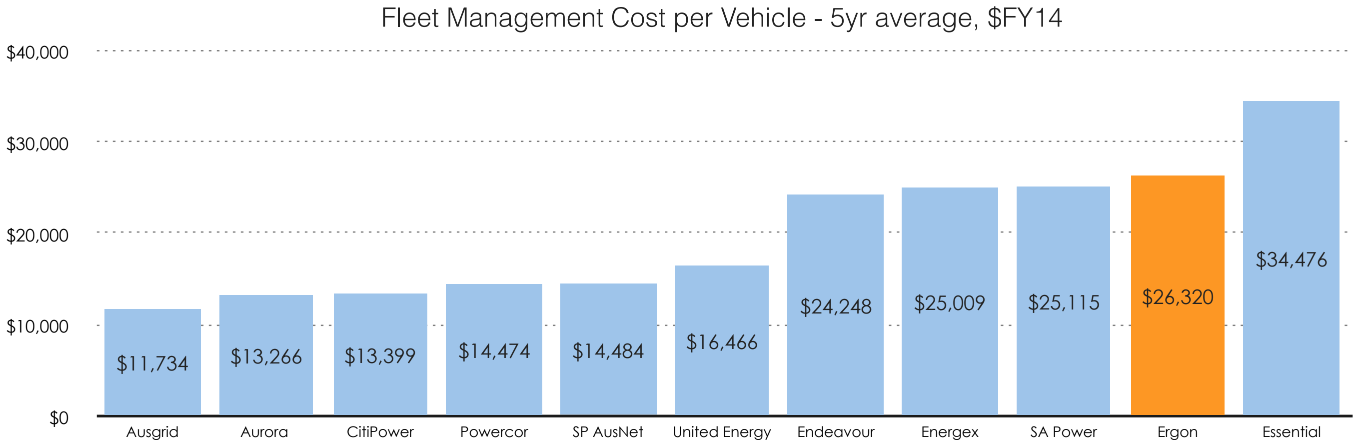
### Benchmarking analysis and measures

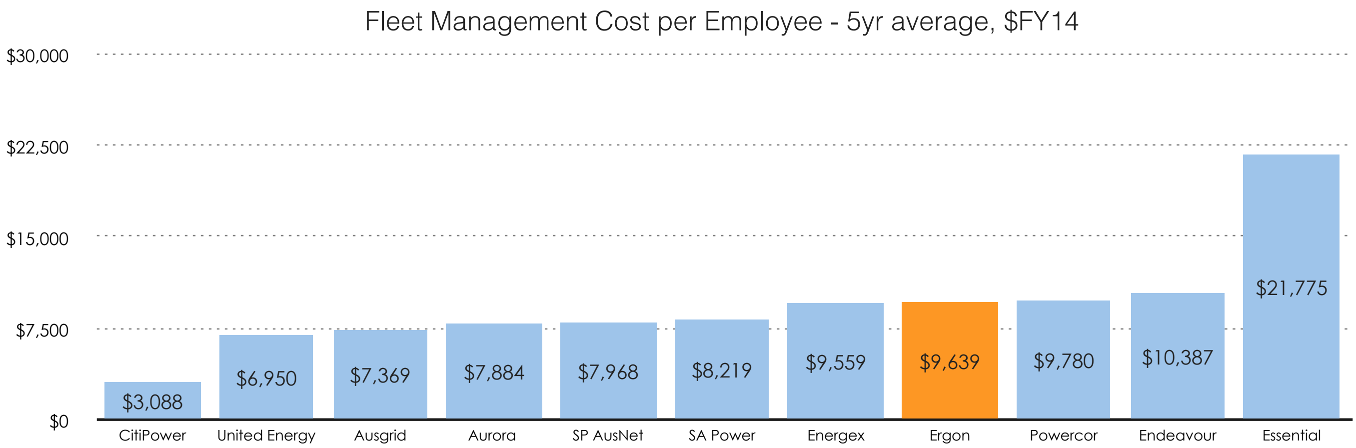
The table below shows the benchmarking analysis and measures included in this section.

| Category | Measure | Type |
|---|---|---|
| Fleet Management | Fleet Expenditure per Vehicle | Comparison |
| | Fleet Expenditure per FTE | Comparison |
| | Fleet Expenditure per Vehicle | Trend |
| | Fleet Expenditure per Vehicle Growth Rate | Comparison |
| Information Technology Expenditure | Emergency Response per Maintenance Dollar | Comparison |
| | Emergency Response per km | Trend |
| | Emergency Response per km Growth Rate | Comparison |
| Property Management Expenditure | Property Management per Employee | Comparison |
| | Property Management per Employee | Trend |
| | Property Management per Employee Growth Rate | Comparison |

# Fleet management costs

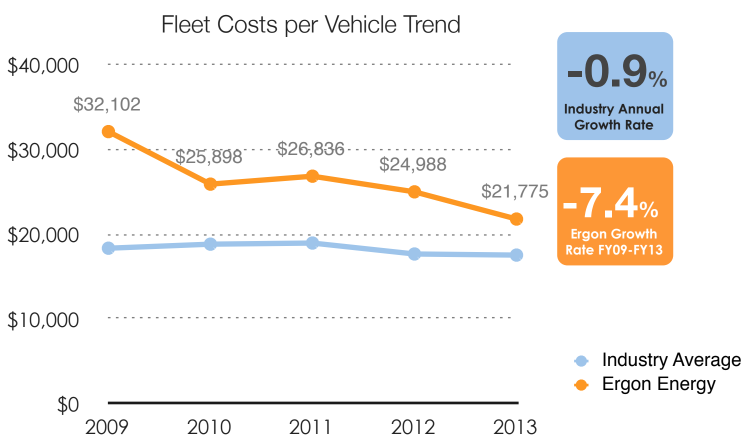
Fleet management is a significant non-system expense for most electricity networks. The fleet expenditure reported in the analysis here is for cars, light commercial and heavy commercial vehicles only - that is, it excludes trailers, cranes, EWPs, etc.

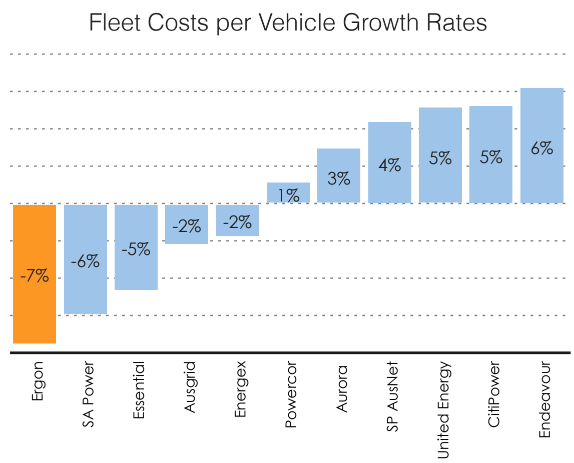



**Fleet Management Expenditure (partial productivity trends)**

Fleet costs per vehicle depend on location, fleet type, distances travelled and ownership policies, making direct comparison challenging. Trends over time for fleet expenditure per vehicle are shown below.

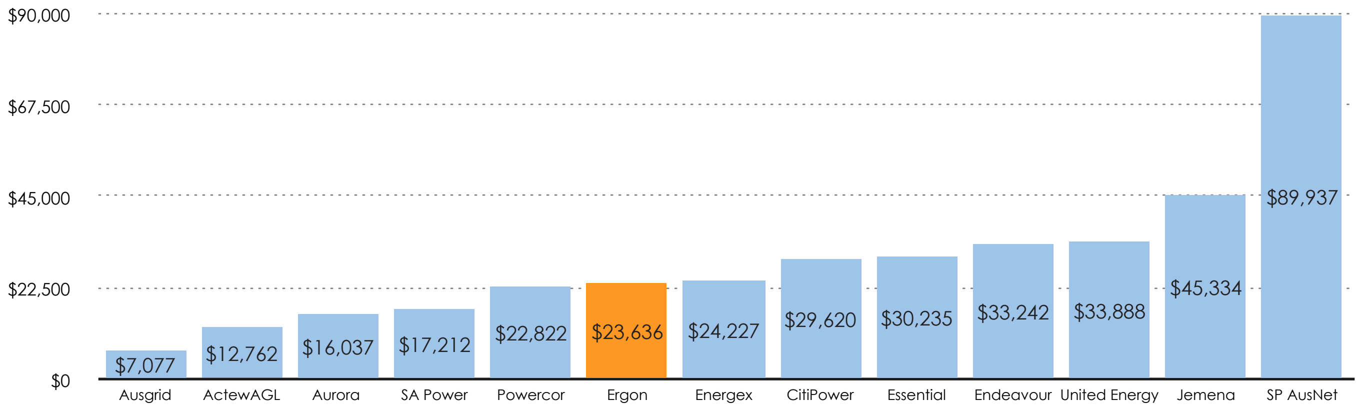


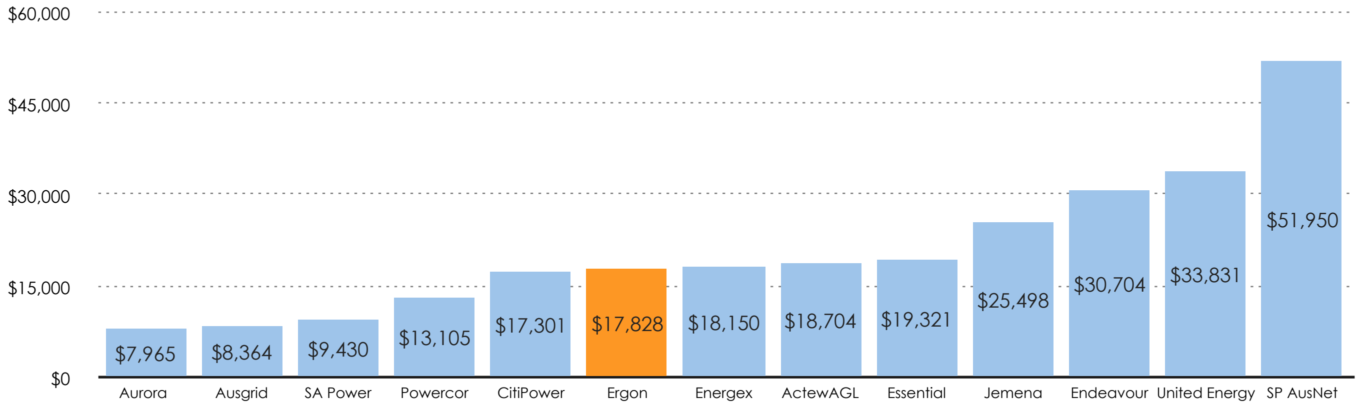
# Information technology costs

Business models for IT service delivery vary across the NEM. In particular, Ergon Energy and Energex have a shared IT service provider, Sparq Solutions and many of the privatised businesses have shared corporate services. IT costs can be reported by user or device, but it must be considered that these costs may include large, discrete IT projects.

Information Technology Costs (Opex and Capex) per User - 5yr average, $FY14



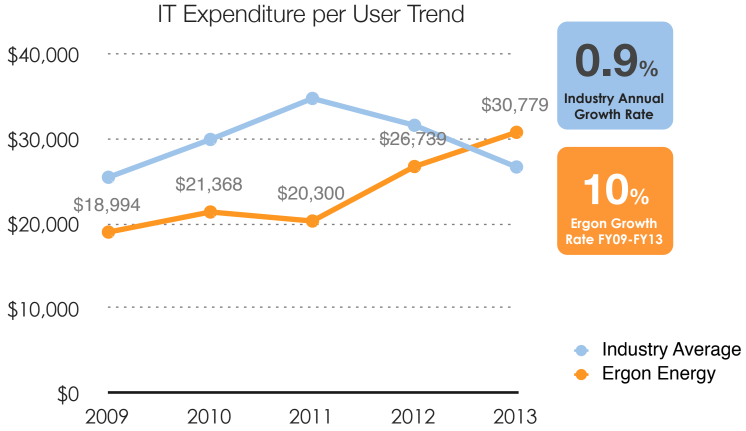

Information Technology Costs per Device - 5yr average, $FY14



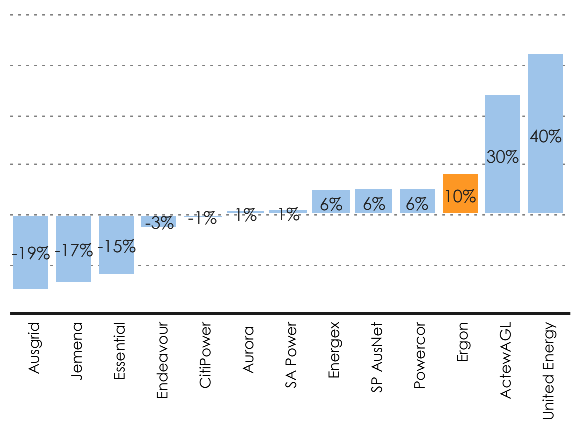

**IT Expenditure (partial productivity trends)**

Total IT expenditure per user can be misleading as it includes non-recurrent expenditure which will often be large system upgrades and therefore not driven by user numbers. Trends over time for IT expenditure per user are shown below.

IT Expenditure per User Trend

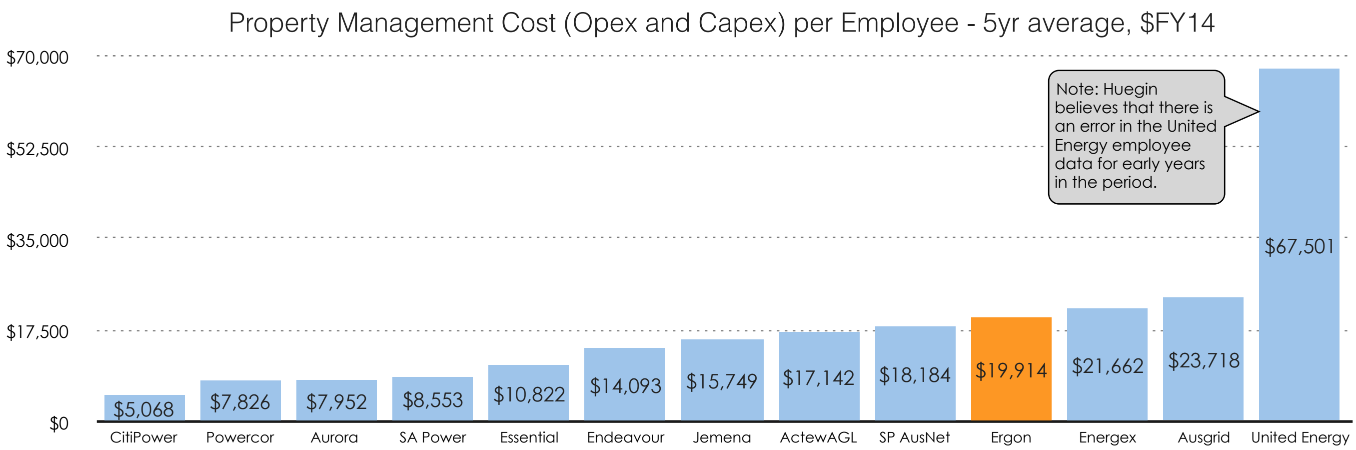



IT Expenditure per User Growth Rates



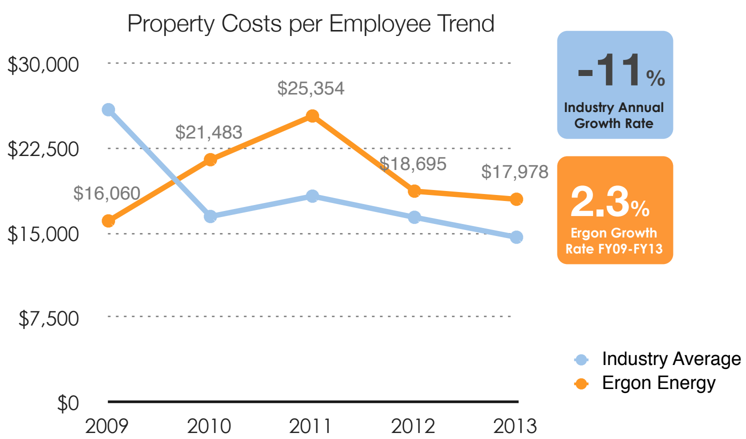
# Property management costs

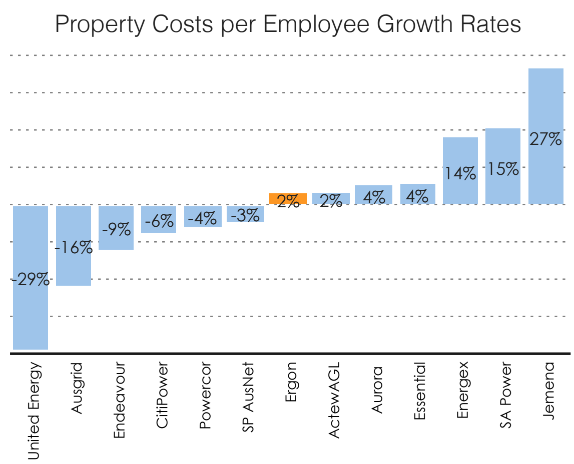
Property management costs can carry a premium for both CBD businesses and large, rural businesses - through either cost per square metre or quantity of buildings required respectively.




**Property Management Expenditure (partial productivity trends)**

Property costs per employee depend on location, and ownership policies. Single construction projects in a period can skew these measures when taken over a short period. Trends over time for property expenditure per employee are shown below.



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