Huegin: Benchmarking of Transend's operating costs

Appendix 5

Tasmanian Networks Pty Ltd

Transend Networks Pty Ltd

Transmission Benchmarking Study

2013

Transend Networks
Pty Ltd

Transend Benchmarking Study

An investigation of cost and performance conducted by Huegin Consulting Group

Benchmarking of electricity industry capital and operating costs is a topic of increasing scrutiny under the evolving regulatory frameworks across the world. In Australia, the challenge remains to find suitable techniques to compare businesses which are few in number and diverse in nature.

This study aims to analyse Transend's costs from two perspectives:

1. In relation to the drivers of those costs; and
2. Compared to other electricity businesses in Australia and New Zealand.

Understanding the drivers of costs in particular puts benchmarking into context - illustrating how the unique circumstances under which each business operates can significantly influence benchmarking results. Specifically, the analysis of cost driver impacts can demonstrate how high-level, so called "top-down" economic models can provide false signals of relative efficiency amongst a small group of very different businesses.

What To Expect?

Key points arising from this study

Transend is the smallest traditional Transmission Network Service Provider (TNSP) in the National Electricity Market (NEM). As such, Transend will always be subject to scale bias in any traditional benchmarking method. Compounding this, Transend also operates in a unique environment where economic, demographic, topographical and other exogenous factors combine to present conditions that drive higher costs than would be experienced in more benign operating conditions. Whilst all electricity businesses in Australia - with its vast changes in environmental conditions and legislative and economic jurisdictions - are subject to unique circumstances that drive some costs higher or lower, Transend appears to have more drivers that cause cost premiums than cost efficiencies. Specifically, this study found:

- Transend has had the least volatile operating expenditure over time; maintaining a relatively flat profile whilst others have increased - some significantly.
- Scale is Transend's most influential cost driver, with Corporate and Operations costs in particular subject to certain fixed costs of business that cannot be spread over a larger scope of activity.
- The scale influence leads to seemingly unfavourable benchmarking results when using traditional benchmarks based on network length and load - factors of scale. Using benchmarks that are more suited to Transend's operating circumstances provide far more favourable results.
- The unique market structure that exists in Tasmania drives higher levels of network complexity, which leads to high planning and operations costs. In particular, the large number of generators and significant spread of end users across the network requires a more complex network with more spurs of down to distribution-level assets than those states with fewer, larger generators and concentration of end users in major metropolitan areas.
- Despite the scale and complexity issues, Transend's maintenance costs (its major opex category) rate amongst the best in the NEM. In particular, Transend is the only business to keep maintenance costs from increasing as the Regulated Asset Base (RAB) has grown.
- Whilst some of the smaller costs that are more susceptible to scale effects have exhibited a level of variation over time, there is nothing to suggest that Transend is inefficient compared to its peers. Using changes in the cost base over time, one can argue that Transend has managed to keep costs contained to a greater degree than its peers whilst experiencing a greater array of exogenous factors.

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About the Report

This report represents an analysis of Transend's historical costs in the context of its peers in the Australian electricity transmission industry. Where possible, Transend has been benchmarked against the other Transmission Network Service Providers (TNSPs); where appropriate, data from Distribution Network Service Providers (DNSPs) has also been included to expand the sample size. Data from the New Zealand transmission company, TransPower, has also been used where appropriate.

The predominate source of data in this report for the businesses other than Transend is:

- Public sources, such as Regulatory Determinations and Performance Reports, for the other Australian and New Zealand TNSPs; and
- Huegin's own database of historical data, particularly for the analysis including DNSPs.

Any other information sourced from published literature is referenced within the report.

Current Status

This report is in final status, released on 18th March 2014.

1. The Changing Landscape of Benchmarking

Benchmarking in the Electricity Industry

The Australian Energy Regulator (AER) regulate the revenues and expenditures of Australia's electricity businesses that operate within the National Electricity Market (NEM). For electricity distribution, this includes the fourteen Distribution Network Service Providers (DNSPs) in all states and territories except for the Northern Territory and Western Australia. These DNSPs are connected to the NEM transmission network, which is operated by the following Transmission Network Service Providers (TNSPs):

- Powerlink (Qld)
- TransGrid (NSW)
- SP AusNet (Vic)
- ElectraNet (SA)
- Transend (Tas)

and the state inter-connectors:

- Directlink (Qld-NSW)
- Murraylink (Vic-SA)
- Basslink (Vic-Tas)

DNSPs and TNSPs are regulated in accordance with the National Electricity Law (NEL) and National Electricity Rules (NER), the latter of which has a number of capital expenditure (capex) and operating expenditure (opex) objectives. The AER is required to consider its own benchmarking report in deciding whether the forecast expenditure of a business satisfies those objectives. The challenge for the AER is to find a suitable benchmarking methodology in a market that operates as a natural monopoly.

Electricity price rises have increased media exposure

When the AER commenced regulation of the NSPs, taking over from the state based regulators, many of those NSPs significantly increased their capital and operating expenditure proposals. The reasons for the increases varied, but the majority of increases were tied to significant demand forecasts, ageing assets and increasing commodity prices. Whatever the reasons, the outcome of the increases was an annual series of price rises. As the financial crisis hit and electricity demand plateaued, the annual price rises for customers caused a groundswell of political backlash fanned by the media. Influence came from several government bodies (Treasuries, the Productivity Commission and state and federal ministers) resulting in industry reform in most states. Regulatory changes have also been made and benchmarking has been given increased exposure as a mechanism for finding efficiencies when evaluating network expenditure. The changes will impact all TNSPs and DNSPs.

The regulator's view of benchmarking is evolving

The AER has recently released guidelines for how it intends to benchmark electricity transmission and distribution businesses. The guidelines follow recent rule changes which strengthen the requirement to consider benchmarking in the evaluation of electricity network expenditure, including the obligation to publish annual benchmarking reports. The guidelines followed an extensive consultation period, however there remains significant uncertainty in the expected outcomes of the approach. The framework consists of both economic (top-down) and engineering (bottom-up) approaches, both of which have issues and have fallen in and out of favour over time in jurisdictions across the world.

Economic approaches avoid the issue of information asymmetry between network businesses and the regulator, however they require assumptions about the production function of an electricity supply business. This is not a trivial challenge, given that even fundamental questions, such as what constitutes an input and output of an electricity business remain subject to discussion and debate in the literature. The lower level category benchmarking technique adopted by the AER as a supplementary method pose a different challenge; one of normalisation across a diverse range of operating conditions faced by each network. The amount of data and assumptions required for this normalisation is significant - and rarely recorded uniformly or consistently across different businesses.

Regulatory signals herald upcoming changes

The compounding effect of increased political pressure on prices, industry reform and rule changes have resulted in significant activity by the AER in exploring options for addressing the benchmarking objective for electricity businesses. From the 2012 release of its own research papers on benchmarking to the more recent issues papers and expenditure guidelines, the AER has invested considerably in solving the benchmarking issue over the last 12 to 24 months. This investment of time and effort signals changes in the way the regulator will collect data, conduct analysis and make decisions about the efficiency of electricity network expenditure.

Regardless of the intent, there remain fundamental flaws in the application of common benchmarking techniques in the Australian context - flaws which will not be solved by more sophisticated economic benchmarking techniques. These flaws are amplified for business such as Transend. Due to its scale and unique circumstances, Transend is a statistical outlier in a small data sample. When data samples are small, and outliers exist, then many economic models will represent those businesses as inefficient (or efficient) simply because they cannot explain the variation in inputs and outputs.

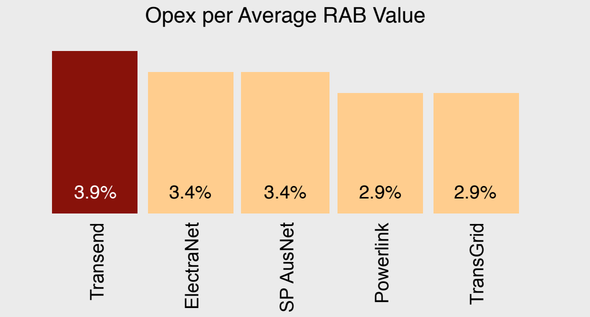
Examples of recent regulatory benchmarking efforts that may provide misleading information about the relative efficiency of Transend's network business are provided on the following page.

A matter of perspective

The following graphs show a reproduction of benchmarking analysis from regulatory sources on the left and an alternative perspective of the same analysis on the right.

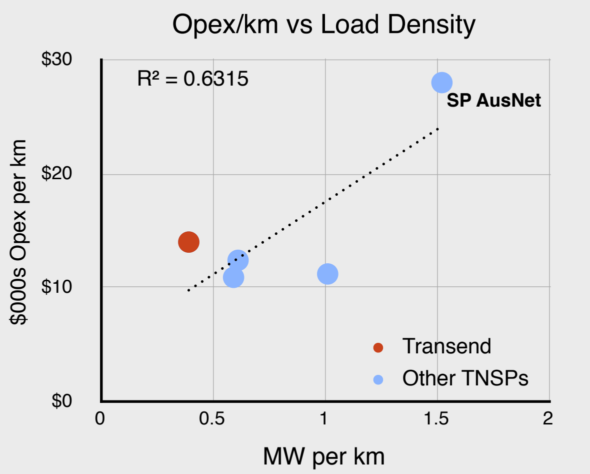
Original

From the 2010-11 TNSP Electricity Performance Report:



The AER performance report used operating expenditure over the average RAB for the 2010-11 year, showing Transend's expenditure to be considerably higher than other TNSPs on this ratio.

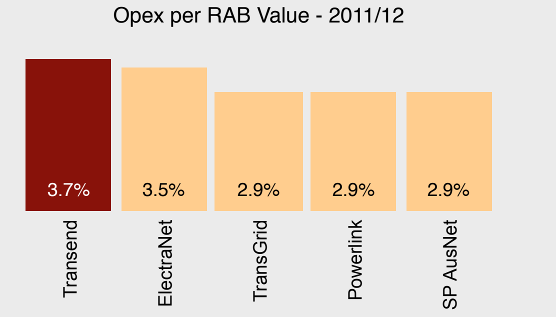
From the 2013 ElectraNet regulatory draft decision:



In this analysis, the AER included easement tax in the SP AusNet opex, which distorts the trend line - which would clearly display a negative gradient but for the outlier created by including this anomalous cost for SP AusNet. Further, the analysis uses a five year average of opex, which favours networks such as Powerlink which has had a significant rise in opex and disadvantages Transend, which has incurred negligible opex growth.

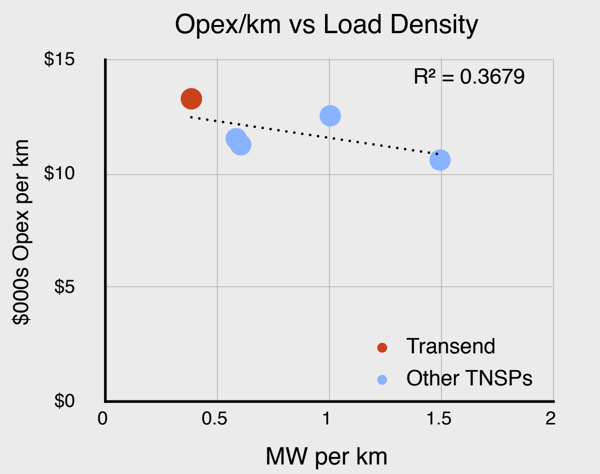
Alternative

Huegin analysis of regulatory accounts:



Using actual opex over closing RAB for the most recent financial year shows that the TNSPs are much closer in performance on this ratio. This is a function of both the sensitivity of this measure and also the fact that all other businesses other than Transend have increased their opex over the current regulatory period. Furthermore, with the exception of SP AusNet, there is a high correlation between this measure and the value of the RAB - i.e. smaller networks naturally have a higher opex to RAB ratio.

Huegin analysis of regulatory accounts:



Adjusting for the exclusion of the SP AusNet easement tax and using the most recent opex illustrates that the per kilometre spend across the businesses is much closer than represented in the ElectraNet draft determination. Further, the load density is a poor explanatory variable for this cost ratio - as would be expected, given the small proportion of opex that is a function of the peak demand on the network. Note that SP AusNet also does not include Network Planning opex in its reported opex, which makes it inappropriate to compare opex ratios with other TNSPs.

2. Benchmarking Approaches and Challenges

Overview

Benchmarking as a mechanism for efficiency incentives is present in many of the regulatory frameworks for natural monopoly businesses around the world. The form that it takes has varied over the years, and the application of benchmarking in the context of setting prices and expenditure allowances has been the subject of much debate. There are several quantitative techniques that have been used during attempts to benchmark electricity distribution and transmission businesses; the most common of these techniques are presented over the following pages.

Econometric Approaches

Econometric benchmarking relies upon the identification of an efficient frontier through the production of a plot of data points using a cost function said to represent the efficient level of expenditure for the sample firms. Econometric approaches can be either:

- Deterministic, where the distance away from the frontier is assumed to be related to that firm's inefficiency relative to sample frontier members; or
- Stochastic, where a level of statistical error or noise is assumed to contribute to the total distance to the frontier.

Whilst not explicitly stated, much of the benchmarking conducted using regression analysis in the Australian regulatory environment over recent years represents a form of deterministic frontier analysis. That is, there has been no attempt to quantify the statistical error inherent in applying a common cost function to a small sample of heterogenous businesses.

The types of variables and conditions that can contribute to statistical error in frontier approaches includes:

- Exogenous shocks, such as severe weather events, which increase costs but would contribute to inferences of inefficiency if not accounted for;
- Differences in accounting methods which contribute to the heterogeneity of the sample data; and
- Clusters of data points at the extreme ends of the data range, which can combine to provide disproportionate weight on the slope of regression lines that represent the frontier.

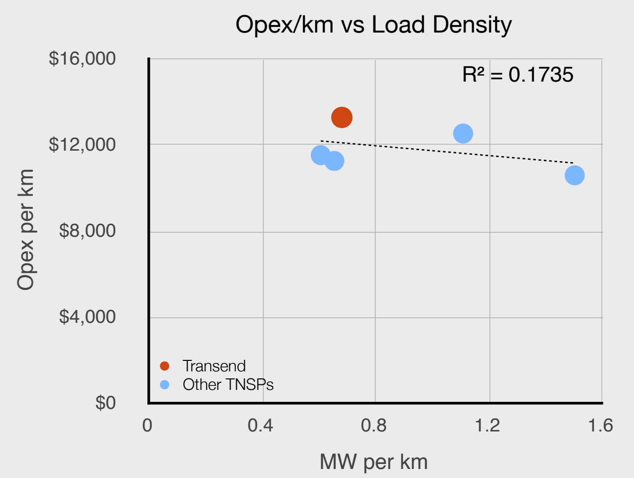
Recent examples of regression analysis conducted during regulatory determinations in the Australasian context show a preference of the regulator to use aggregate (i.e. total opex or capex) cost ratios as a function of a single explanatory variable (such as load density). No specific frontier is cited in these examples, however the Ordinary Least-Squares (OLS) regression line, or "line of best fit" is plotted on the graphs. The position of each business on the graphs relative to the regression line and other distributors in the sample are used to infer relative efficiency.

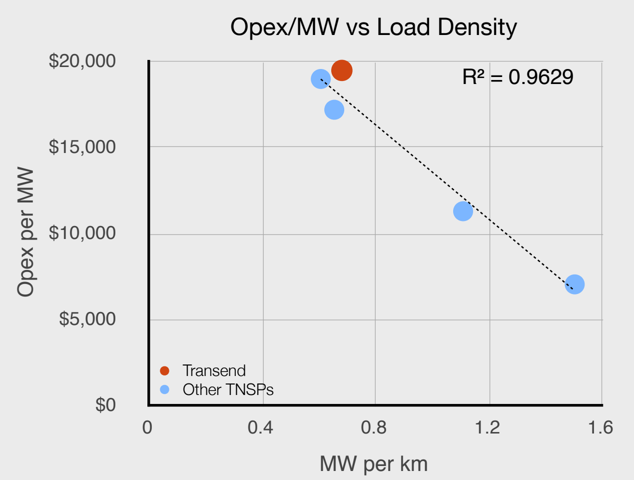
Examples of this type of analysis previously conducted by the AER are shown on the following page.

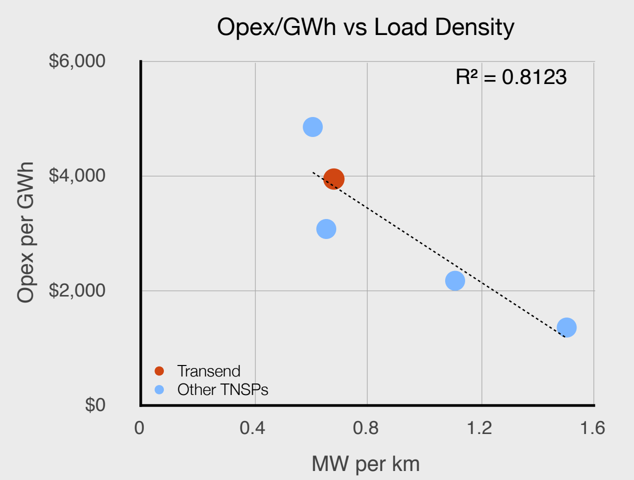
Regression Analyses

The following graphs show the most commonly used regressions for NEM TNSPs. Note, Huegin does not suggest that this analysis is robust or significant enough for benchmarking - in particular, we believe that load density is a poor explanatory variable for most high level cost ratios - however the analysis is reproduced here as an illustration of the common methods used.

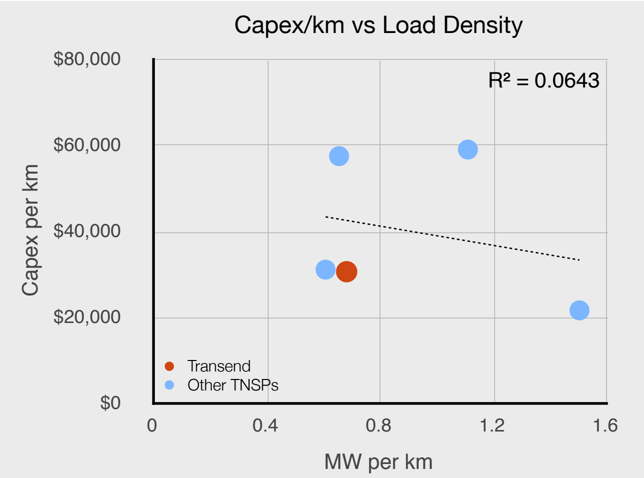
Opex

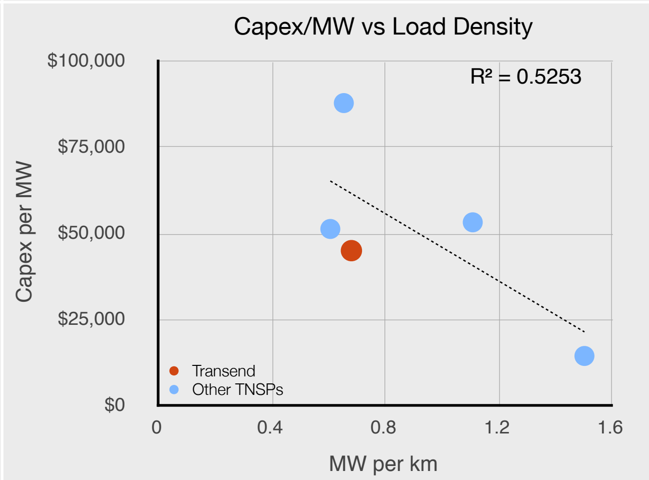


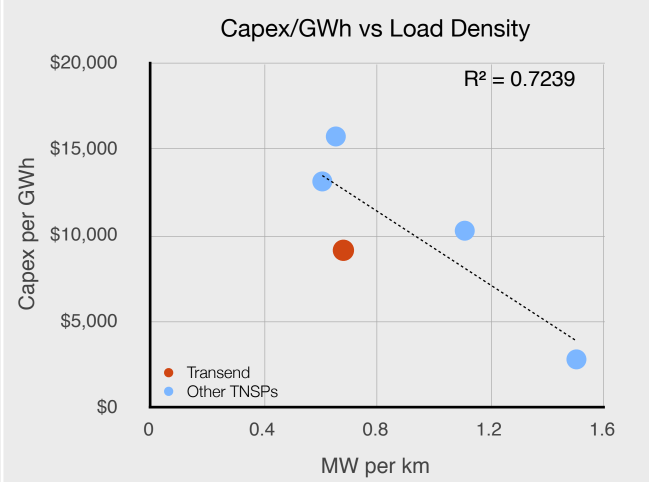




Capex







Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) is a linear programming technique for measuring efficiency of Decision Making Units (DMUs). DEA allows the inclusion of multiple inputs and multiple outputs and it identifies:

- The DMUs that are considered efficient amongst the set; and
- The magnitude of non-efficiency of the other DMUs based on the distance from the efficient frontier.

Unlike econometric approaches, no assumptions are made regarding the form of the cost function. The linear program places DMUs on the frontier (or otherwise) based on a ratio of a linear combination of outputs over a linear combination of inputs, with weights set to maximise the efficiency ratio for each DMU.

The advantage of DEA is that the production function does not need to be known, the disadvantages include that the method is sensitive to the selection of the input and output variables and the sample size.

Productivity Indices

Productivity indices are the ratio of output to input and can take the form of:

- Total Factor Productivity (TFP) indices, a ratio of multiple outputs to multiple inputs; or
- Partial Productivity indices, individual ratios of 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. They do however provide a useful starting point for deeper level analysis - although data restrictions often prohibit the exploration of performance at lower levels of detail. The most common productivity indices used in TNSP benchmarking are shown on the following page. Of note:

- The two smallest networks - Transend and ElectraNet - are consistently above the median for the opex ratios and below the median for the capex ratios, suggesting that smaller businesses have higher relative opex, but lower capex;
- SP AusNet is consistently the lowest on all opex and capex ratios[1];
- Powerlink and TransGrid's cost indices are reasonably close together on most indices, with the exception of those with Peak Demand as the denominator; and
- The indices of ElectraNet and Transend are similar across most categories.

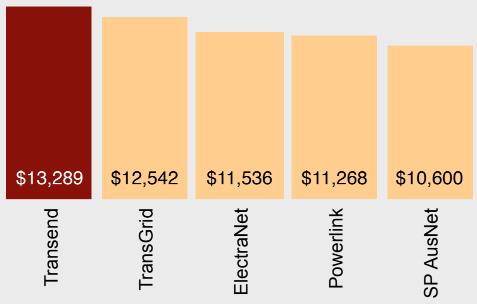
[1] Note: SP AusNet's regulatory accounting structure excludes Network Planning opex and Augmentation capex.

Productivity Indices

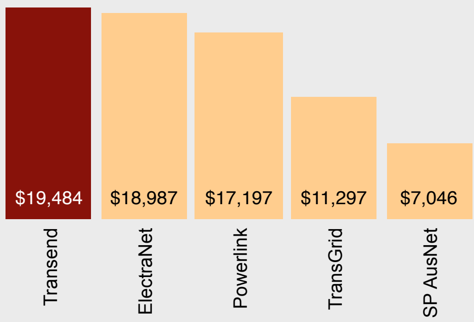
The following graphs show the most commonly reported productivity indices for NEM TNSPs. The data is for the 2011/12 financial year and has been sourced from Regulatory Accounts and the AER State of the Market report.

Opex

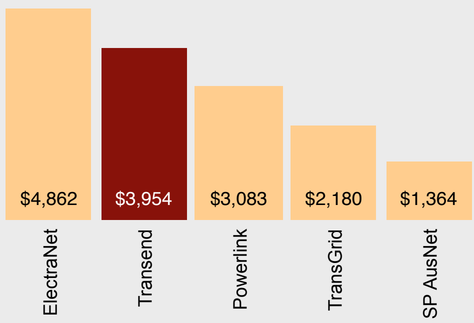
Opex per Circuit km



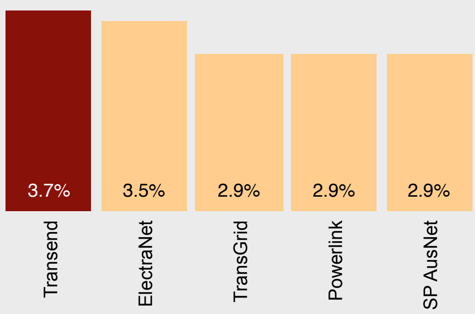
Opex per MW Demand



Opex per GWh Transmitted

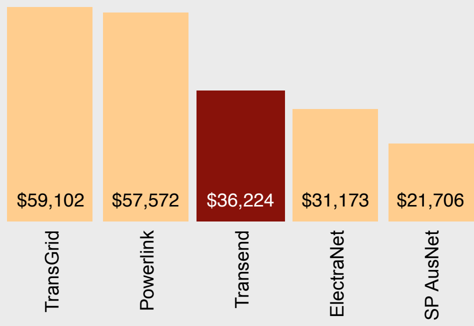


Opex per RAB Value

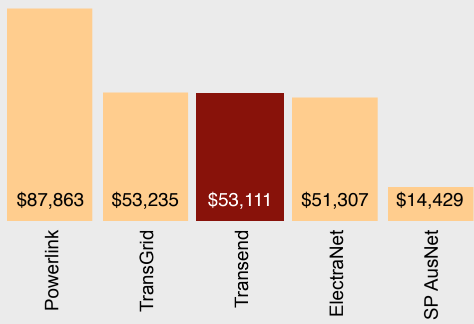


Capex

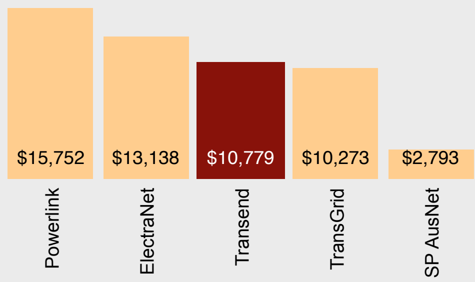
Capex per Circuit km



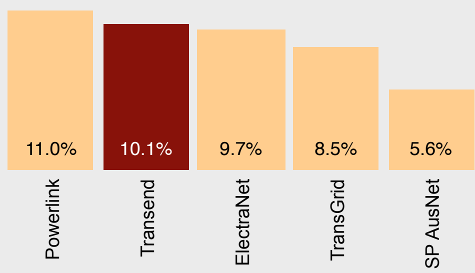
Capex per MW Demand



Capex per GWh Transmitted

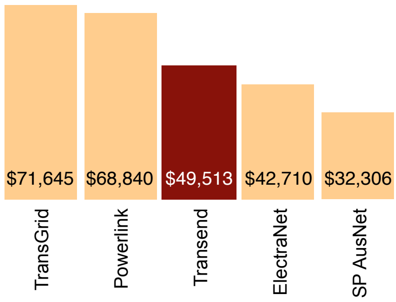


Capex per RAB Value



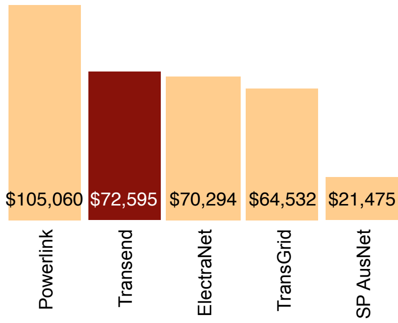
The observation on the previous pages that, with the exception of SP AusNet, the size of the business dictates a shift in the relative ranking by productivity index between opex and capex suggests that the total expenditure by network variable should be reasonably similar across TNSPs. As shown below this is the case for the four non-Victorian businesses - with Transend close to the average on all ratios.

Totex per Circuit km



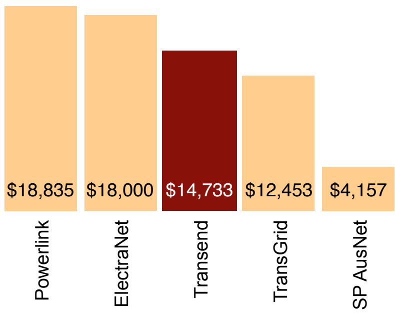
Median	$49,513
Average	$53,003
Std Dev	$15,132

Totex per MW



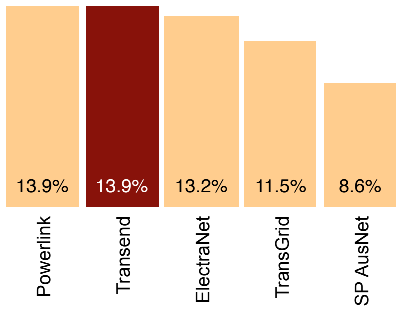
Median	$70,294
Average	$66,791
Std Dev	$26,718

Totex per GWh



Median	$14,733
Average	$13,636
Std Dev	$5,264

Totex per RAB



Median	13.2%
Average	12.1%
Std Dev	2.1%

As already mentioned, productivity indices are limited in what they can reveal as a benchmark of efficient expenditure, but the analysis in this section illustrates that using a capex or opex ratio in isolation can be misleading.

The Challenge of a Heterogeneous Data Sample

Many of the most common benchmarking techniques applied around the world today are tested and refined in Europe and North America. These jurisdictions have electricity networks of similar size and density, spread evenly across the geography. Australia, conversely, is a sparse land mass with boundaries between electricity networks that drive fundamental differences in their composition and characteristics. This makes benchmarking particularly challenging. 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.

After several years of attempting to find top-down models that simplify the benchmarking approach, the electricity and gas markets regulator in Great Britain, Ofgem, have acknowledged that top-down analysis is limited in its ability to explain costs and therefore relative efficiencies amongst the businesses. Ofgem has introduced the concept of adjustment for cost driver variation across businesses.

This recognition that top down approaches do not adequately identify differing circumstances amongst businesses is significant given that the consideration of such circumstances is a requirement of the Australian National Electricity Rules (NER).

Simple cost driver models utilise network parameters that are very poor explanatory variables for certain types of costs; they also assume that outliers exhibit exceptional (either very good or very poor) performance without due consideration of statistical error and data noise.

Disaggregating costs into categories of activities and identifying the variables that drive those activities (and therefore costs) is a significantly more meaningful benchmarking approach. The complexity of the businesses, however, often means that the analysis of data at these lower levels raise more questions than answers about the next levels down.

Identifying the existence and nature of cost drivers is a valuable practice in benchmarking approaches, but it should always be practiced with consideration of management's ability to change or influence these cost drivers - which will differ by type and business.

“

Our view is that the top down approach combines costs to a degree that relatively simple cost drivers are unable to identify and differentiate between the differing circumstances of the DNOs.

Ofgem
DPCR IP - Cost Assessment
August 2009

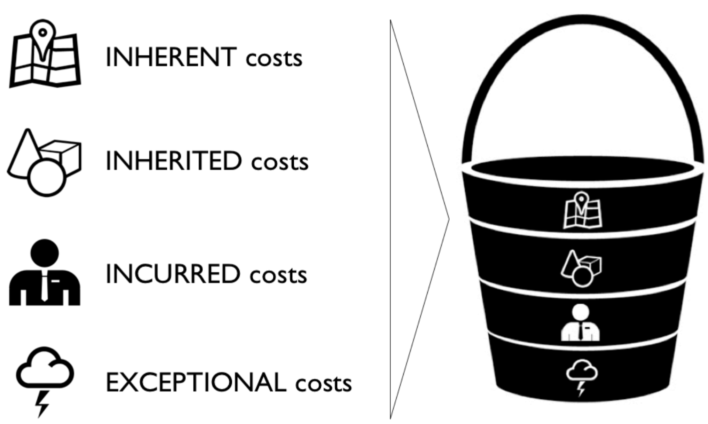
Addressing Cost Controllability

The level of control that each business has on changing cost outcomes through management decisions depends upon the operating conditions and exogenous factors that influence the businesses cost drivers - and these are not common across the diverse group of businesses.

Previous benchmarking studies conducted by Huegin have utilised a framework to assess the ability of the businesses to influence specific cost drivers. In Great Britain, Ofgem has also recognised that individual business outcomes must account for differences between the operating conditions. Ofgem has primarily used the framework in the setting of reliability and Quality of Service benchmarks, but a similar framework has been adopted previously by Huegin to categorise drivers of cost and the ability to influence them. The categories are:

- **Inherent** - these are cost drivers that are the result of the network location, such as geography, customer base and the environment. These are cost drivers that have a significant influence on costs, but are outside of the control of the business.
- **Inherited** - these are cost drivers that are the result of the legacy of decisions made by the owners, operators and regulators of the network in the past, such as network design and configuration and asset age. These are cost drivers that can have a significant impact on costs, but are difficult to change, particularly over a short timeframe.
- **Incurred** - these are cost drivers that are a direct result of management decisions on the maintenance and operation of the network. These are cost drivers that are within the control of the business, but often do not have the potential to fundamentally impact the cost structure of the business like inherent and inherited cost drivers do.
- **Exceptional** - these are cost drivers that are purely exogenous, often unforeseeable events. Businesses have no control over these cost drivers, but there are generally mechanisms in place to exclude the influence on costs from manifesting in the permanent cost structure of the business.

Each individual cost category for a business will be the sum product of the influence of the above drivers on activities. The proportion of the total cost that each category represents will vary across cost categories and businesses.



3. The Influence of Cost Drivers

Isolating the Impact of Drivers

To overcome the limitations inherent in benchmarking amongst a small but diverse sample, a more granular assessment of the drivers of cost is required. Such assessments present other challenges, in particular the lack of data in a consistent format, but an understanding of the underlying drivers of costs is essential to support inferences of relative efficiency of peer distribution businesses.

Most costs can be described as a unit cost multiplied by an activity rate. These two variables are each comprised of a number of lower level variables, each with their own set of drivers that eventually impact the overall cost. This level of data is unlikely to ever be completely available for sufficient number of businesses for a thorough and comparative cost breakdown analysis, but the examination of the few, most significant drivers can provide valuable insight into performance.

Despite the challenge of data availability and veracity, this approach has significant advantages over purely top-down cost benchmarking approaches. Top-down models make too many assumptions about the ability of a few simple cost drivers to explain the expected cost outcomes for any business. This is particularly the case with the small and diverse group of businesses that exist in Australia.

Huegin has found through several years of study into cost drivers for electricity businesses in Australia that there are a common set of the most prevalent and influential drivers that are significant for benchmarking. The twelve most significant drivers of cost for electricity businesses are shown on the following page; the rest of this chapter explores the drivers that are most relevant for Transend’s circumstances.

Every business has drivers which advantage and disadvantage them from a cost perspective, the relative impact of the collective influences will either be a net positive or net negative effect. As will be shown on the following pages Transend has a disproportionate amount of negative cost driver influences, including:

- The highest number of power stations per MW demand in the NEM;
- The lowest number of end user customers per kilometre of line in the NEM;
- The highest penetration of renewable generation sources in the NEM;
- Amongst the lowest load density in the NEM;
- The second highest number of substations per kilometre of line in the NEM; and
- The highest proportion of the population living outside the capital city of all NEM states.

Many of these cost drivers combine to cause the others, for example the low customer density, low load density and high number of generators and large spread of population outside the major centre combine to necessitate an asset dense network.

Inherent and Inherited Cost Drivers

Asset Age

Older assets are generally less reliable. An older age profile will also drive of high replacement rate.

Design

The design of electricity assets varies by state and network; this variation has significant impact on costs.

Voltage

Higher voltage assets are more expensive to construct, maintain and repair due to increased material and labour costs.

Location

The location of the network and the resources that build, operate, maintain and support it drive significant cost differences.

Density

Customer and asset density can contribute to scale economy and productivity through travel reduction, but can also drive certain costs higher.

Accessibility

Networks with assets in CBD and highly urbanised areas will incur traffic management costs. Remote and rugged terrain will also increase access costs.

Demographics

Behaviour of the wider market in terms of electricity production and consumption affect the costs of the networks transporting the electricity.

Utilisation

High utilisation of the existing assets will make a network more sensitive to changes in demand. It may also reduce switching options for outage management.

Environment

Harsh environments (wind, flood, dust, humidity, lightning, heat) cause assets to degrade more rapidly and increase outages.

Scale

Larger companies have the benefit of economies of scale, particularly for fixed costs associated with certain functions.

Policy, Regulation and Legislation

Different jurisdictions impose different statutory requirements on businesses. Even in a national system there are state based legacies.

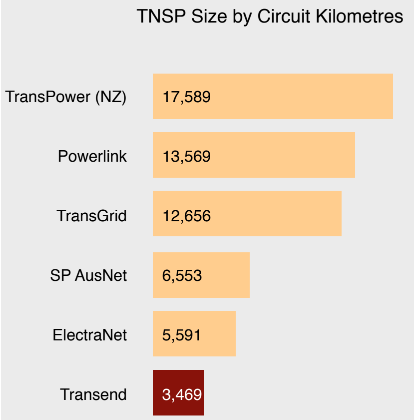
Performance Standards

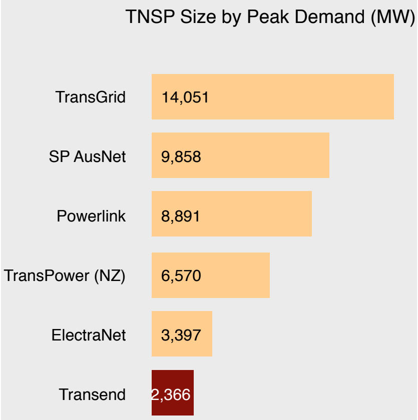
More stringent targets will drive higher operations and maintenance costs due to shorter response time requirements.

Scale

Excluding the interconnectors and Ausgrid's transmission assets, Transend is the smallest transmission company in the NEM based on most measurement variables.

Measuring Scale





In the Literature

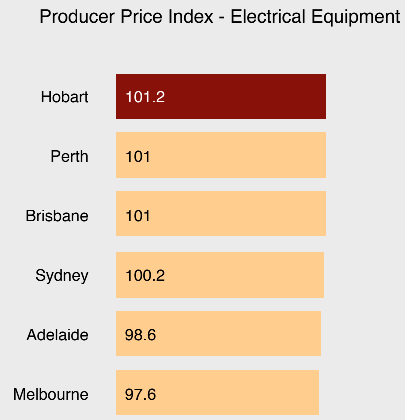
"We find strong economies over all relevant ranges of capacity and across all regions of the USA."

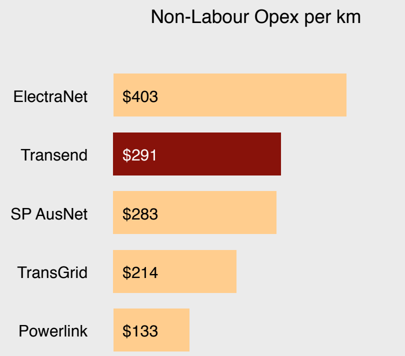
Dismukes, Cope and Mesyanhinov *"Capacity and economies of scale in electric power transmission."*

Location

As a small island location, Tasmania incurs extra shipping costs and specific skills shortages.

Measuring Locational Factors





Higher locational costs manifest themselves in the non-labour component of opex per kilometre, with Transend's non-labour costs much higher than in QLD and NSW.

In the Literature

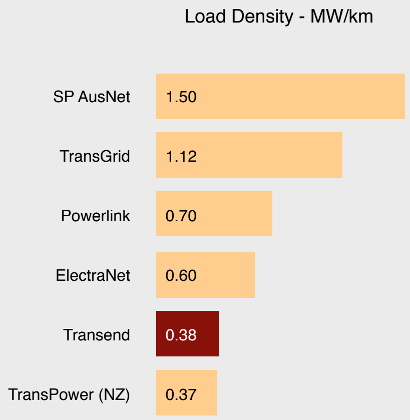
"Tasmanian producers rely heavily on shipping to access mainland markets - the cost of shipping a container across Bass Strait can be more than double the cost of road transport for a similar distance on the mainland."

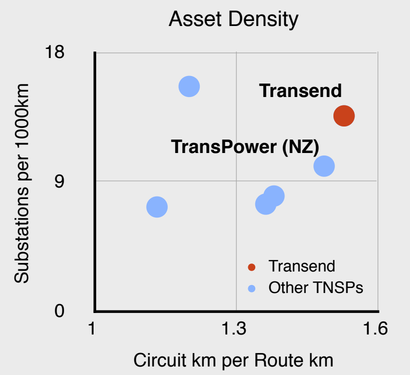
Productivity Commission, 2006

Density

Transend has low load density but high asset density - driving higher costs of construction, maintenance and operation.

Measuring Density





TransPower and Transend - the two island based transmission businesses with many small, hydro generators - have the lowest load densities and highest asset densities (measured by substations and circuit km).

In the Literature

"...it is more expensive to supply customers in areas of low load density than in areas of high load density."

Energy Policy and Planning Office, Thailand

"As load density increases, the cost per customer and the cost per transmitted electric energy decreases."

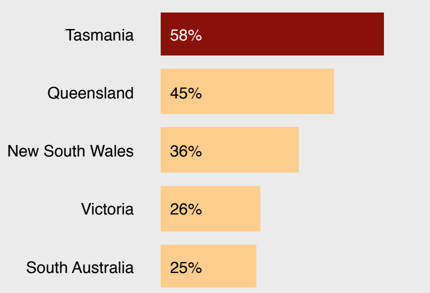
Hyvärinen, M. *"Electrical networks and economies of load density."*

Demographic

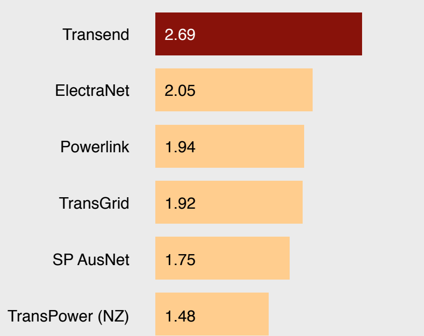
Transend has the most residents outside the capital of all NEM states. Further the peak and energy usage per customer is higher, given the high relative proportion of industrial customers.

Measuring Demographic Factors

State Population Outside Capital City



Peak Demand/Population (kW/person)



Tasmania has more of its population outside the capital than in it and its customers are spread more broadly than other states - both of which drive higher costs.

In the Literature

…"Other states have considerably more customers outside of their capital cities. Tasmania has the largest with 58 per cent outside of Hobart, while 45 per cent of Queenslanders live outside of Brisbane and 37 per cent of people in NSW live outside of Sydney."

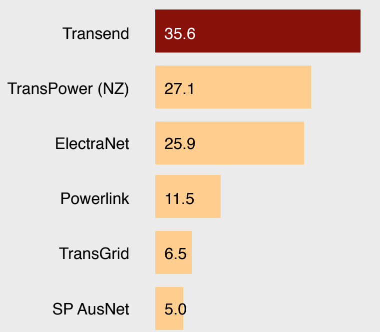
Grid Australia

Design

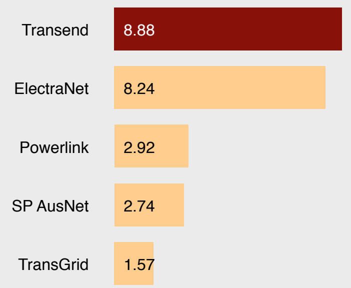
Transend's network requires more substations and more generators to produce the capacity to meet demand than any other network given the small capacity of its numerous small generation sources and extension into the distribution level of the network.

Measuring Design Factors

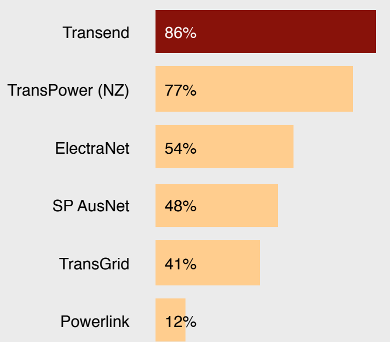
Substations per 1000 MW



Power Stations per 1000 MW



Renewable Energy Generation



Voltage Levels within Networks

	Transend	ElectraNet	Powerlink	TransGrid	SP AusNet
220 kV and higher	✓	✓	✓	✓	✓
110 to 132 kV	✓	✓	✓	✓	
66 kV	✓	✓	✓		✓
22, 33 & 44 kV	✓				
11 kV and lower	✓				

The number and spread of Transend's generation sources, the spread and demand of the load and the reliance on numerous small hydro generation sources increase the complexity of the network and place unique constraints on the design of the assets. This is further compounded by the presence of distribution level assets in the network.

In the Literature

"Due to the majority of Tasmania's generation being hydro-electricity and variations involved in generation output, Transend may encounter additional costs in providing transmission services relative to other TNSPs."

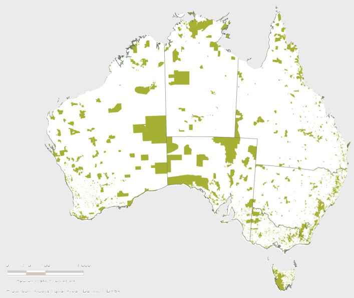
Australian Energy Regulator
TNSP Electricity Performance Report 2009-10

Other Cost Drivers

The other cost drivers that influence Transend's costs are less readily measured than those presented on the previous page - namely the environment and accessibility. There are measures of the effects of these drivers, but no single index or measure that can be used to explain cost variations at the level required for this report; as such, acknowledgement of their existence is more contextual than analytical.

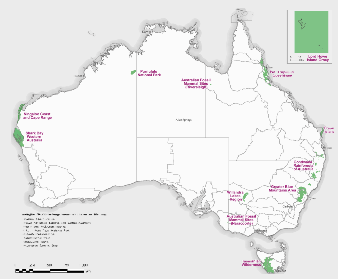
Accessibility

Illustrating Accessibility Differences



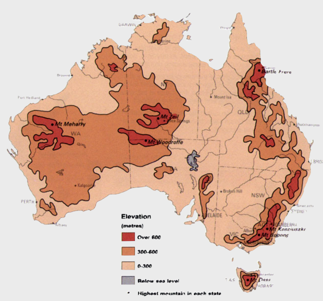
National Reserves

Transend has the highest proportion of protected reserve land in its state in Australia.



World Heritage

Transend has the highest proportion of World Heritage land in its state in Australia.

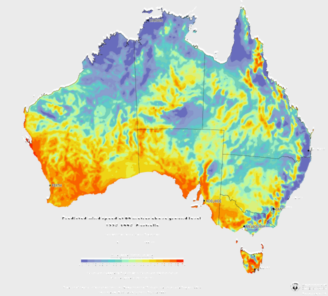


Elevation

Tasmania has the highest proportion of land over 600 metres above sea level in Australia.

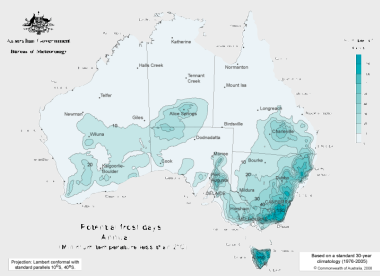
Environment

Illustrating Environment Differences



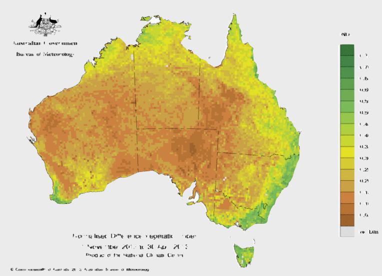
Wind Speed

A leading failure mode for network cables is failure under wind load. Tasmania has some of the highest average wind speeds in Australia.



Frost

Tasmania has a high number of potential frost days per annum, increasing the likelihood for icing of assets.



Vegetation

Tasmania has the highest coverage of vegetation relative to total land area.

In the Literature

"Metropolitan areas that are dominated by high hills and mountains are about 10% more costly."

Gyourko and Saiz
CONSTRUCTION COSTS AND THE SUPPLY OF HOUSING STRUCTURE

"For both 380kV and 220kV we have assumed a premium of 20 percent for hilly ground and a premium of 50 percent for high mountainous land"

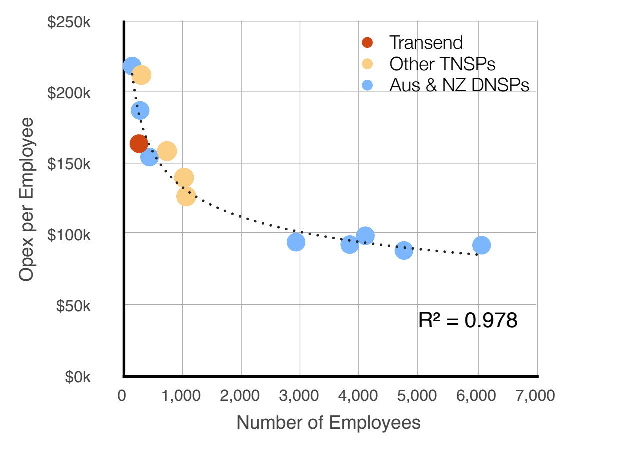
ICF Consulting
Unit Costs of constructing new transmission assets at 380kV within the European Union, Norway and Switzerland

Map sources: National Reserves map - Department of Sustainability, Environment, Water, Population and Communities: World Heritage map - Caring for our Country; Windspeed map - Windlab; Elevation map - Geoscience Australia; Frost and Vegetation maps - Bureau of Meteorology.

The Impact of Cost Drivers

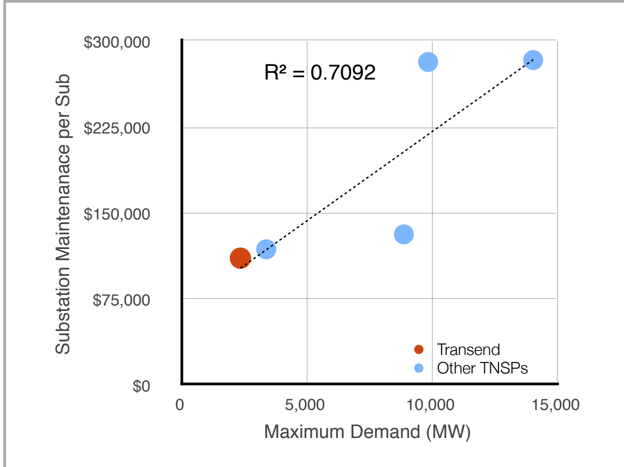
The cost measures used by the regulator and others, some of which were included in the previous chapter, are generally represented on a per kilometre or per MW peak demand basis. This oversimplifies the relationship between cost drivers and costs and renders benchmarking analysis limited in suitability. Disaggregating costs provides the opportunity to isolate the primary driver of the costs at a more suitable level. Below are some examples of the relationship between true cost drivers and the cost categories where they manifest.

Opex and Scale (by employee numbers)



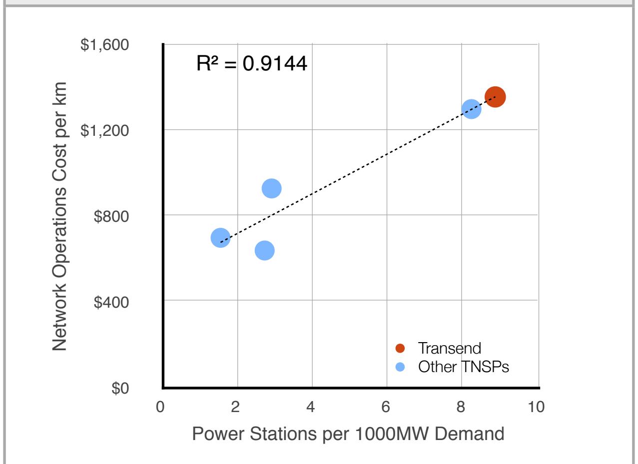
There is a strong, non-linear relationship between opex/employee and number of employees - an indication of the influence of scale on a business.

Substation Maintenance Costs and Demand



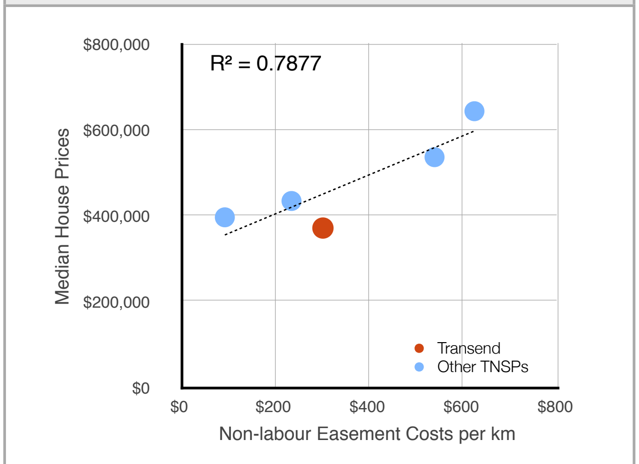
There is a linear relationship between maintenance costs per substation and the demand on the network, inferring that smaller loads are handled by lower voltage (and cost) substations.

Generation Complexity and Network Operations



Network Operations cost generally increase with the increasing number of generators required to produce a standard unit of load.

Median Land Value* and Non-Labour Easement Costs



The median land value in the network area naturally influences easement costs; Transend is an outlier in this relationship - driven by easements within World Heritage and National Parks locations.

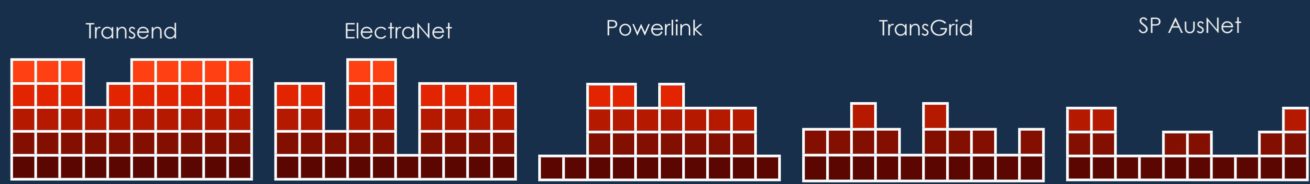
* Median house prices have been used as a proxy for land value

Cost Driver Profiles

Transend has some of the most challenging operating circumstances in the NEM. The combination of many of the cost drivers that emerge from those circumstances place a premium on costs. The ranking of Transend on many of the cost drivers represented in this chapter are shown below, with the higher ranking indicating less favourable cost outcomes based on the specific measure.

Network Length	Maximum Demand	Producer Price Index	Load Density	Asset Density	Population Outside Capital	Peak per Capita	MW per Substation	Generators per 1000 MW	Reliance on Renewables
Transend	**Transend**	**Transend**	ElectraNet	ElectraNet	**Transend**	**Transend**	**Transend**	**Transend**	**Transend**
ElectraNet	ElectraNet	Powerlink	Powerlink	**Transend**	Powerlink	ElectraNet	ElectraNet	ElectraNet	ElectraNet
SP AusNet	SP AusNet	TransGrid	**Transend**	Powerlink	TransGrid	Powerlink	Powerlink	Powerlink	SP AusNet
TransGrid	TransGrid	ElectraNet	TransGrid	SP AusNet	SP AusNet	TransGrid	TransGrid	SP AusNet	TransGrid
Powerlink	Powerlink	SP AusNet	SP AusNet	TransGrid	ElectraNet	SP AusNet	SP AusNet	TransGrid	Powerlink

The table above can be translated into a series of graphical representations of the ranking profile of each business across the ten drivers listed - providing the relative intensities of the cost drivers on each individual business as shown below.



Recognition of Transend's cost drivers

"Due to the majority of Tasmania's generation being hydro-electricity and variations involved in generation output, Transend may encounter additional costs in providing transmission services relative to other TNSPs."

"World heritage status in some areas contributes to increased transmission costs."

Australian Energy Regulator
TNSP Electricity Performance Report 2009-10

"The differences between utilisation calculated at individual circuit level during winter and that calculated at the winter maximum demand "snapshot" are extraordinary in this state, driven by dispatch patterns from generators (outside Transend's control)."

Evans and Peck
Response to AEMO Position Paper - August 2012

4. Operating Expenditure

Overview

This chapter looks at the main components of operating expenditure, providing analysis on the disaggregated level of costs from a comparative perspective. The disaggregated costs are also analysed against the cost drivers of significance identified in the previous chapter where possible.

Materiality of Opex Costs

When studying costs from a benchmarking perspective, it is useful to examine the most material of costs in terms of spend relative to the total and over time. The plot below shows Transend's average opex over the four year period between FY2009 and FY2012 broken down into cost categories and cumulatively. The graphic on the following page shows the cost categories within the accounting structure hierarchy. As shown:

- Field Operations and Maintenance (total) represents a third of Transend's total opex;
- Customer and Asset Management has contributed the highest amount of the disaggregated costs;
- Over 50% of Transend's opex has been allocated to four cost categories (Customer & Asset Management, Substation Maintenance, Business Services and Engineering Services).

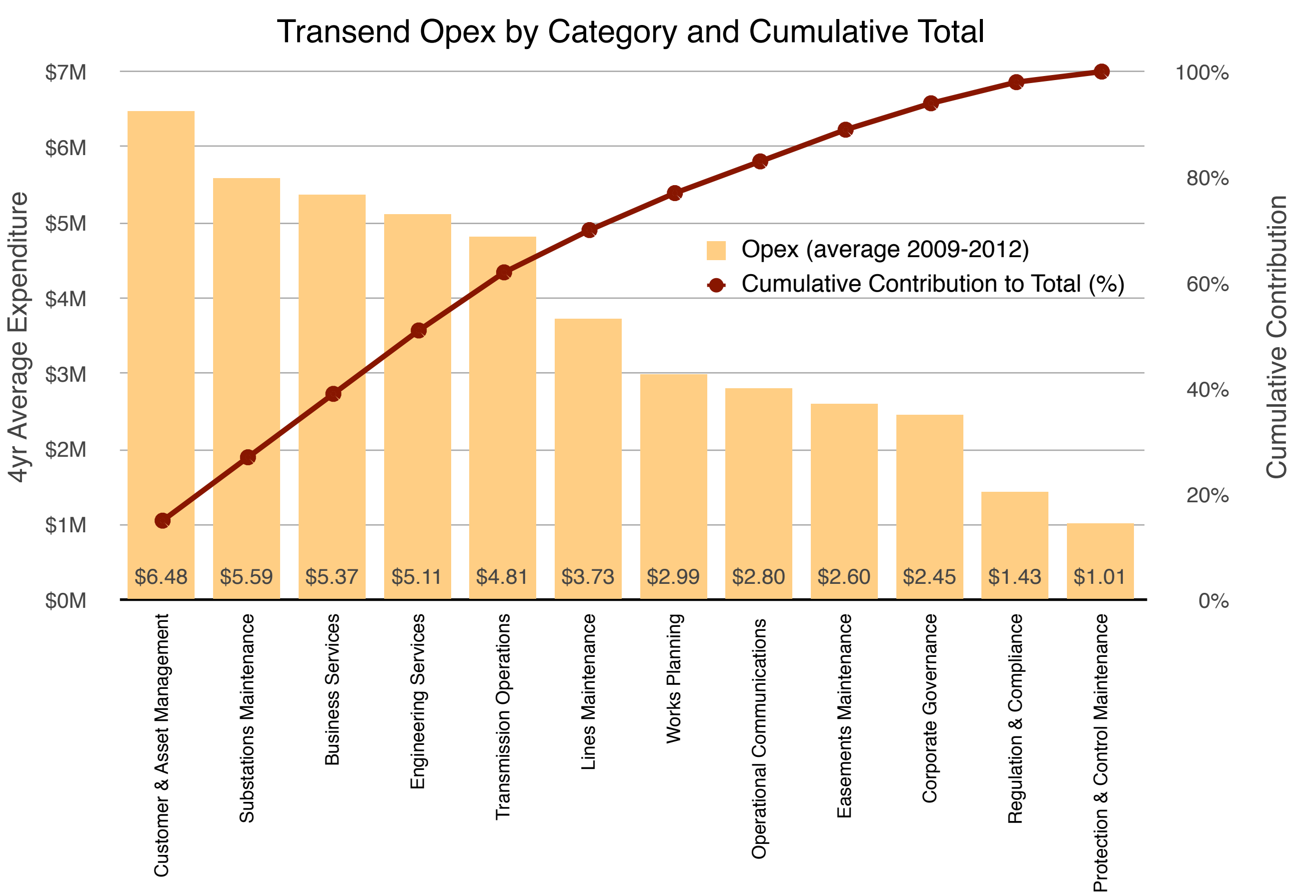
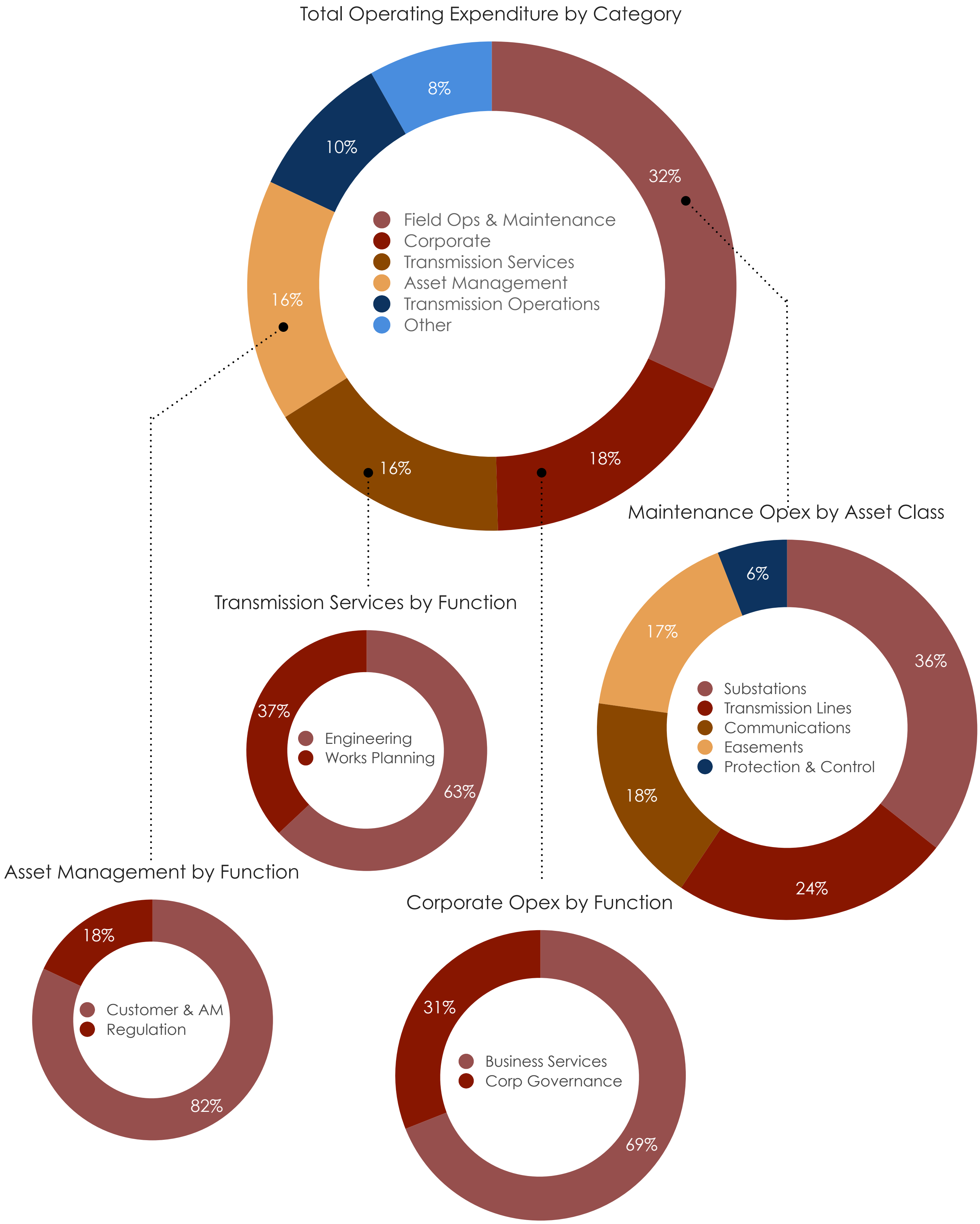
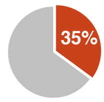


Figure: Opex by category and cumulatively



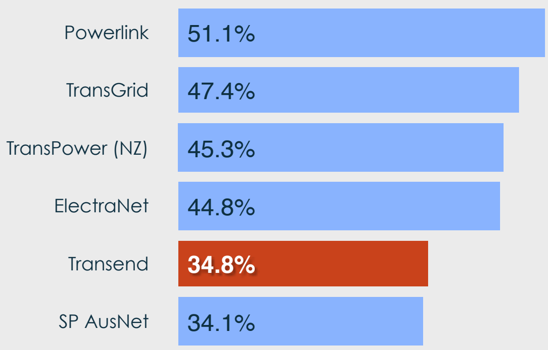
Each of the major cost categories are analysed in more detail on the following pages.

Field Operations & Maintenance

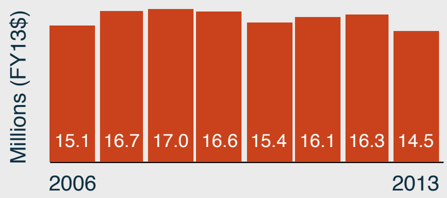


Field Operations & Maintenance costs are Transend's largest opex category. Benchmarking of maintenance costs is generally more informative than other cost categories due to the commonality of work practices across the industry. Comparisons, growth rates and key partial productivity ratios are shown below.

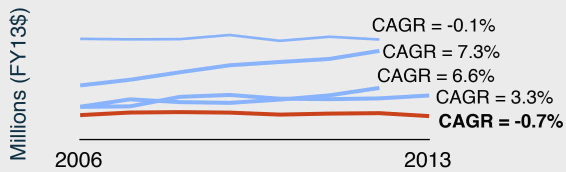
Proportional Allocation (4yr average)



Change over Time



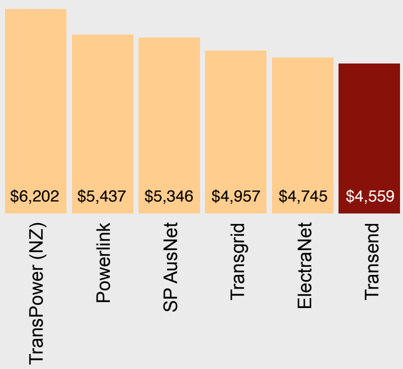
The compound annual growth rate of Transend maintenance opex is **-0.7%** since 2006.



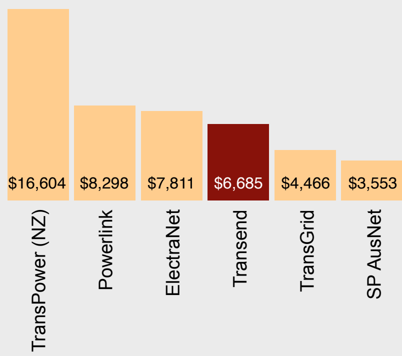
Transend's proportional allocation to maintenance costs is at the lower end of the group, driven by its small scale and the associated impact of other, largely fixed, non-maintenance costs. Transend's maintenance costs have remained remarkably stable over time, with no real increase (8 year CAGR of -0.7%) in costs since 2006 - the lowest rate of all NEM TNSPs.

Partial Productivity Indicators

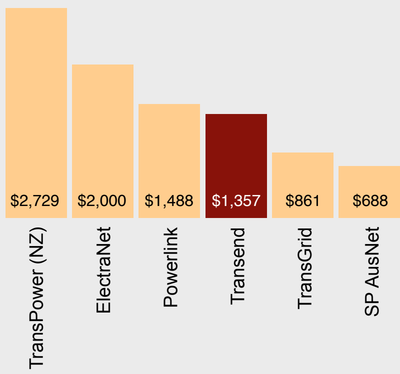
Maintenance Opex per Circuit km



Maintenance Opex per MW Peak Demand



Maintenance Opex per GWh Throughput



With Transend's small scale, small peak demand and low throughput, maintenance costs as a ratio of these variables is expected to be at the higher end of the group; however the data shows the opposite. Despite the disadvantages of scale,Transend achieves relatively lower maintenance costs than most of its peers.

Primary Maintenance Cost Drivers

The **location** of the asset, through a combination of factors, influences maintenance costs.

Higher **asset density** drives lower maintenance costs.

Poor **accessibility** drives higher maintenance costs.

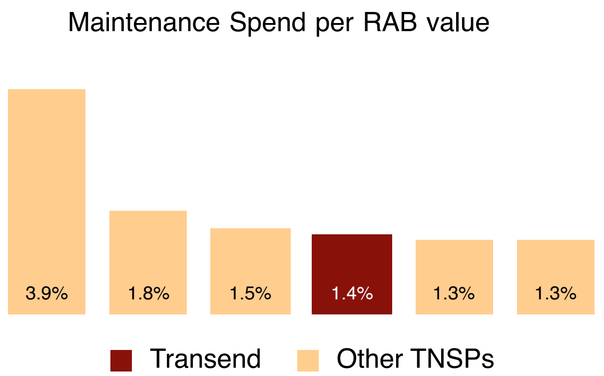
The asset **design** has a strong influence on maintenance costs.

The effect of some of these cost drivers on maintenance costs are explored further on the following pages.

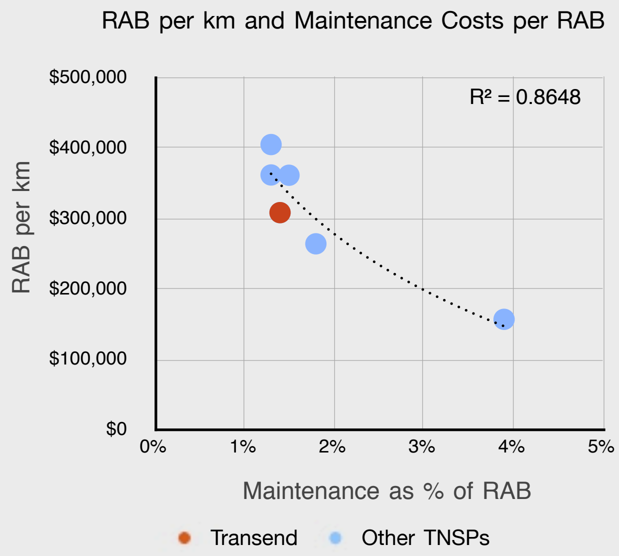
Maintenance costs and the asset base

Much of the maintenance cost for an electricity network is planned. That is, the majority of maintenance activities are scheduled, known inspections and services, with proportionally much lower costs associated with unforeseen corrective maintenance activities. This is particularly the case for TNSPs, which generally don't have the same number of failures as the much more asset intense, lower rated components of a distribution network. A recent study by Huegin showed that DNSPs spend between 40 and 70% of their maintenance budget on corrective maintenance. In comparison, Transend's average proportion of maintenance that is corrective over the last four years is **8.7%**.

With so much of a TNSPs maintenance being planned, the cost of maintenance relative to the asset value should provide a reasonable comparison basis (notwithstanding the limitations of comparing RAB values across businesses). Maintenance as a percentage of RAB is presented below for Australian and NZ TNSPs.



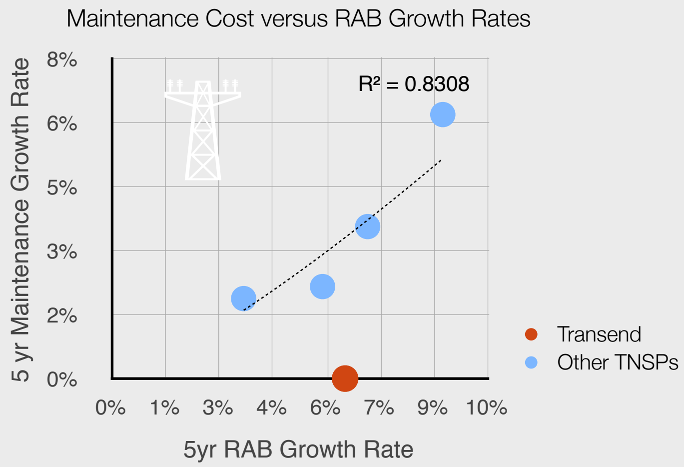
The RAB by itself as a comparator (aside from accounting differences) is unable to normalise for maintenance spend as it does not consider the inherent differences in location, topography and design between networks. Long rural networks generally have higher maintenance costs, but the RAB does not increase at the same rate. To account for these differences, the above ratios have been normalised by the RAB value per kilometre. The plot below shows a relationship between the asset value per kilometre of network and the maintenance costs as a percentage of asset value for Australian TNSPs.



The plot shows that the relationship between RAB value per kilometre of network and the maintenance spend as a percentage of the RAB value is strong and non-linear.

Transend is very close to the regression line. Circumstances that would lead to a high RAB per kilometre include network design (for example, higher voltage assets) and/or asset density (that is, more assets over a smaller area) - Transend has a high asset density, but low load density.

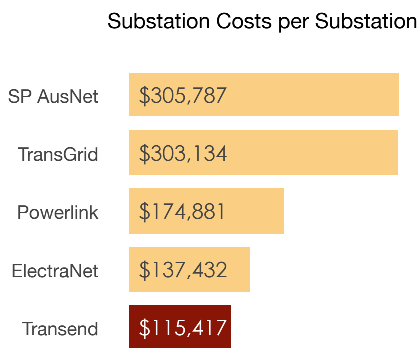
The asset base itself is undoubtedly a major driver of maintenance spend. For many industries, a maintenance spend of 1.8 to 2% is a benchmark. Naturally then, as the asset base grows so would the maintenance spend. As illustrated previously, Transend has held maintenance spend relatively constant over a long period. To provide context, the plot below shows the growth in maintenance costs relative to the growth in the asset value. Whilst RAB is not a perfect indicator of change in asset value, it does provide a useful reference point for maintenance costs.

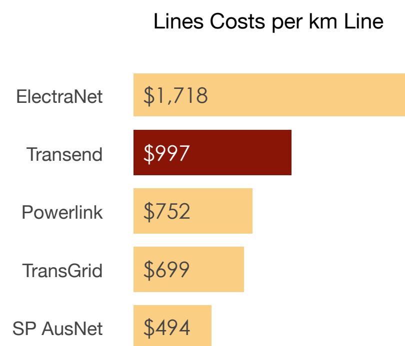


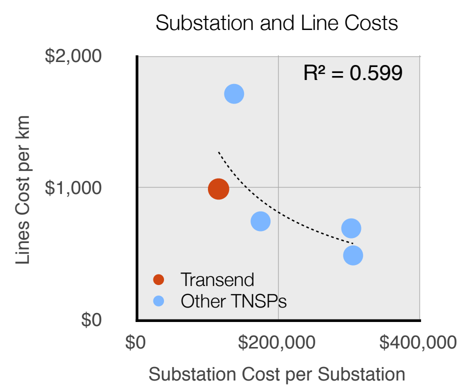
The plot shows that whilst Transend's RAB has grown at a rate (6.2% 5yr CAGR) in the same range as the other TNSPs, its maintenance costs have remained flat.

Maintenance costs and density

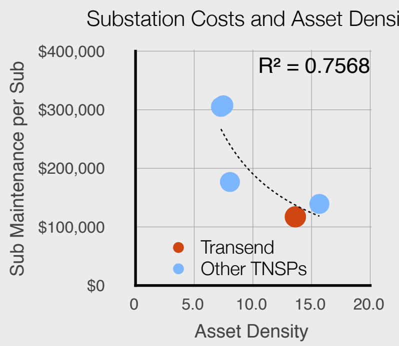
The partial productivity factors shown at the start of this section indicate that Transend's maintenance costs are relatively low when compared to other TNSPs. Scale factors do not, however, account for asset design or density (which can be measured as asset, load or end customer density). Breaking the maintenance costs of each business down into the two major asset classes (substations and lines) reveals that Transend has relatively low substation maintenance costs and high lines costs. There is a relationship between high substation costs and low lines costs and vice versa, as shown on the plot on the right below.

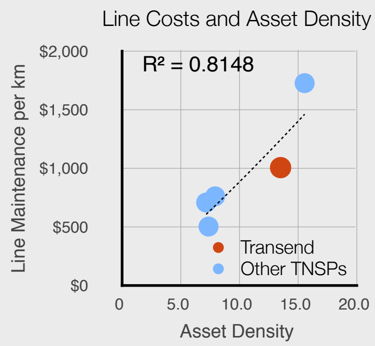






The relationship between substation and lines costs may be due to variations in the division of expenditure between the two asset types, but as shown on the next page, the analysis suggests that the density of the assets also influences where the costs are concentrated.

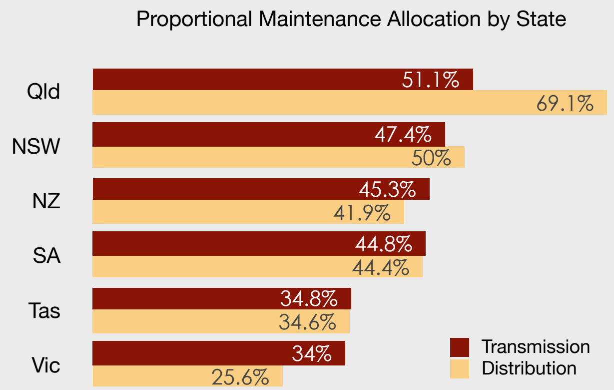


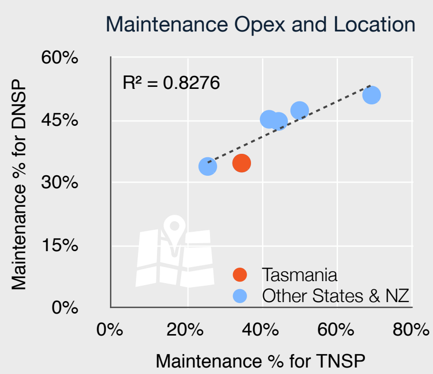


Asset dense networks (measured by the number of substations per 1000km network), such as Transend and ElectraNet have higher line maintenance unit costs and lower substation maintenance unit costs.

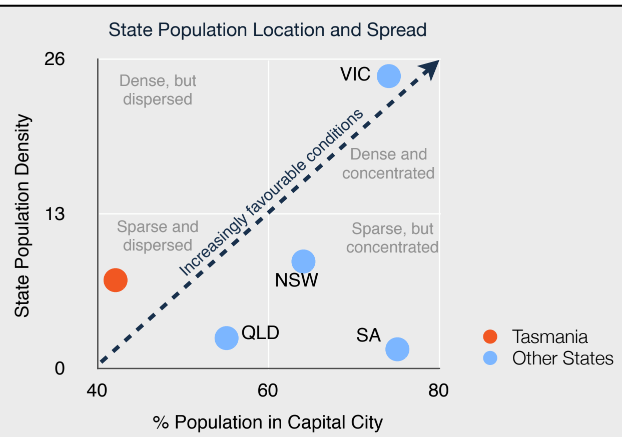
Maintenance costs and location

Whilst the relative proportion of opex allocated to maintenance tasks is primarily a factor of scale, the ranking of that proportional allocation for Australian TNSPs by state is identical to the ranking of proportional maintenance allocation for Australian DNSPs by state (calculated by summing the DNSP spend in each state); see below.



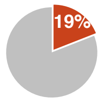


The relationship above might still be explained by scale (one would expect that the distribution networks in a state with a larger transmission network would also be larger than its counterparts), but the diversity of conditions across the Australian states suggests that inherent demographic and geographic factors would also influence maintenance (and other) costs. The spread and density of the population is one signficant difference across states which would influence costs.



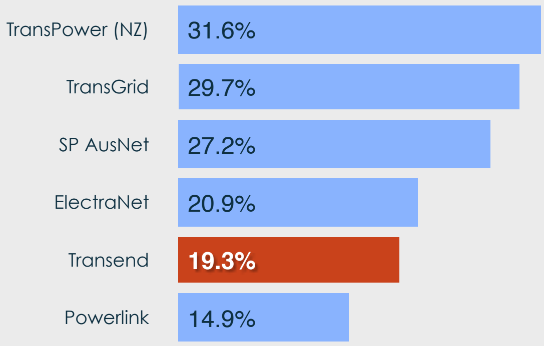
The costs of any networked business will increase with the distance between 'nodes' or customers and the distribution of its customer base. Victoria is a small, highly populated land mass with most of its population residing in the capital. Tasmanian and Queensland, on the other hand, have low population densities and a large proportion of the population living outside the capital.

Corporate Costs

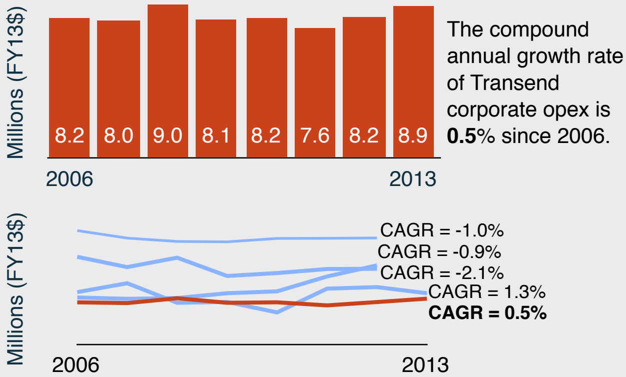


Corporate costs are Transend's second largest opex category. Corporate costs are predominately driven by scale, with many fixed costs associated with operating a transmission business. Comparisons, growth rates and key partial productivity ratios are shown below.

Proportional Allocation (4yr average)

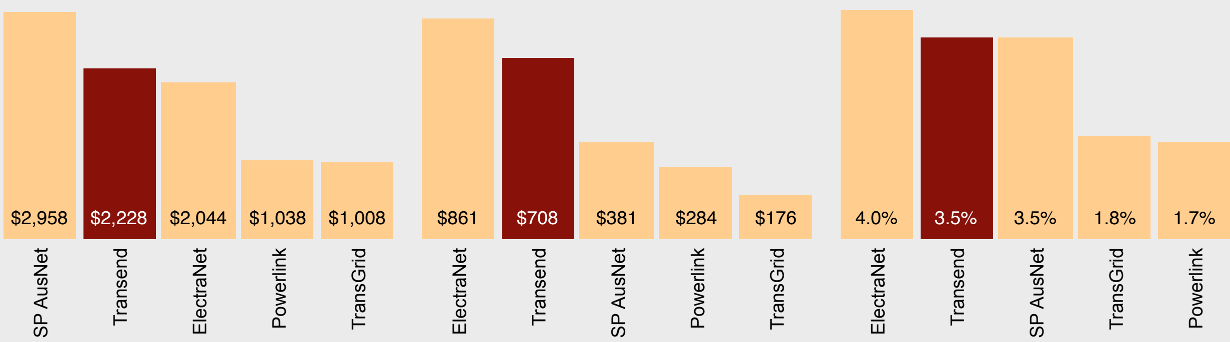


Change over Time



Transend's proportional allocation to corporate costs is at the lower end of the group range; somewhat surprising given its small scale. Transend's corporate costs have remained reasonably consistent over time, with only a small increase (8 year CAGR of 3.2%) in costs since 2005 - attributable to the first year of that period.

Partial Productivity Indicators



With Transend's small scale its position at the higher end of the scale for the above simple ratios is to be expected. The scale relationship is validated further by the positioning of ElectraNet at the higher end also.

Primary Corporate Cost Drivers

The scale of the business is the primary driver of corporate costs. Smaller TNSPs will have proportionally higher corporate costs. Most of the functions that come under this category have a fixed minimum size, which disadvantages the smaller TNSPs.

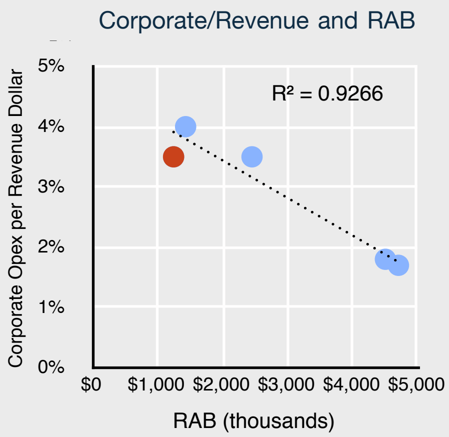
The effect of these cost drivers on corporate costs are explored further on the following pages.

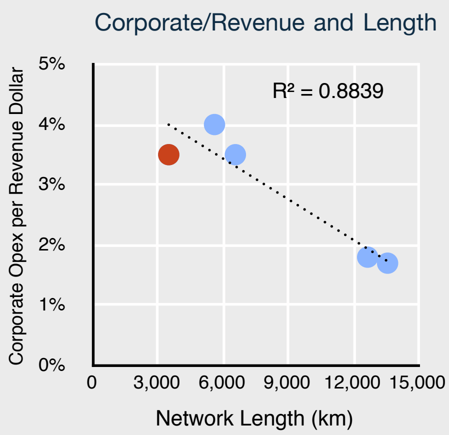
Corporate costs and scale

Corporate costs are undoubtedly a function of business scale. The smaller the business, the more affected it is by the fixed component of corporate costs associated with the minimum activity required for particular functions. Corporate costs for Transend comprise the activities of the Business Services and Corporate Governance and Compliance business groups. The major functions under these groups include:

- Strategy
- Legal Services and Governance
- Human Resources and Payroll
- Finance and Commercial
- Corporate IT

The predominate drivers of these corporate costs are not related to the asset, rather they are related to operating a business. Finding appropriate cost ratios for these costs is difficult due to the natural monopoly status of the industry (and therefore lack of comparable businesses in the same location) and the uncontrollable factors of business size and location. Corporate costs to revenue ratios are used in many industries to indicate the level of administrative overhead associated with earning income from the core operations of the business. As shown below, there is a strong relationship between TNSP corporate cost to revenue ratio and scale.





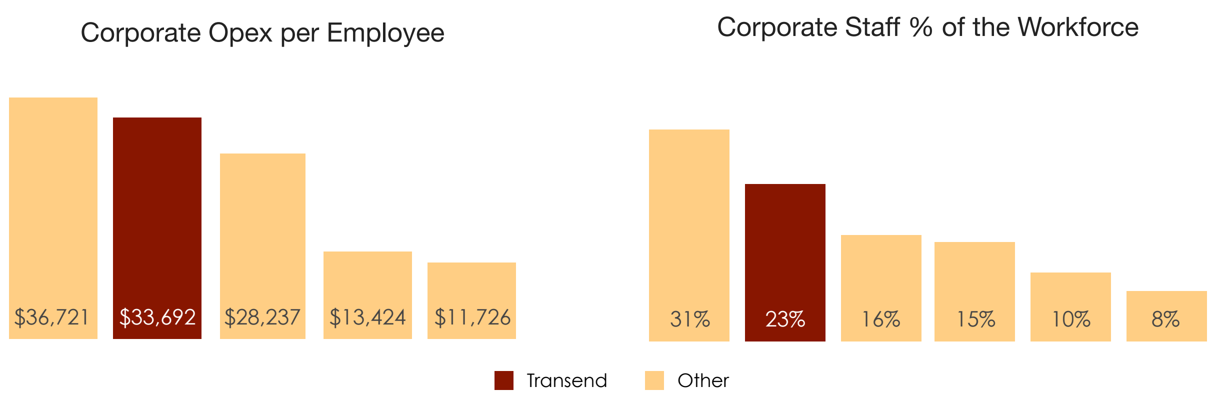
The plots show the relationship between the corporate cost to revenue ratio and the RAB value and Network Length respectively as indicators of business size.

The relationship between this ratio and these scale factors is very strong. What it shows is that there is a clear relationship between the corporate cost of earning a dollar of revenue and the size of the business - the difference between the largest and the smallest (Transend) being a factor of just under three.

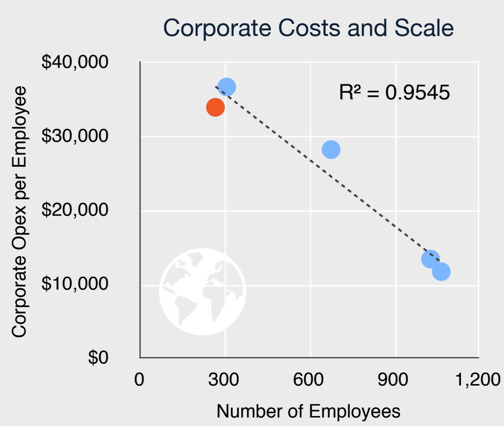
That is, the general and administrative costs of earning a dollars worth of revenue for a very small TNSP is about three times higher than it is for a very large TNSP.

- Transend
- Other TNSPs

As shown below, Transend's corporate costs per employee and the ratio of corporate to total employees are the second highest in the group.



There is, once again, a strong relationship between these costs and scale. The corporate opex required per employee for the very smallest TNSPs is around three times the amount required per employee for the largest - a similar relationship to the corporate cost per revenue dollar and scale analysis on the previous page. The plot below shows the relationship between corporate opex per employee and the number of employees for the Australian TNSPs.

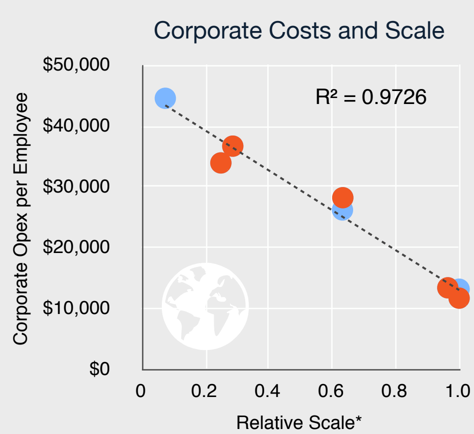


Corporate costs per total business employee can be seen as the administrative cost of operating a business. These are the costs associated with managing people, finance, IT and other enablers of the network operations. Naturally the cost of these functions per employee decreases with increasing business size.

That is, the general and administrative costs of earning a dollar of revenue for a very small TNSP is about three times higher than it is for a very large TNSP.

Transend   Other TNSPs

The ratios and relationships between corporate costs and scale are similar for Australian DNSPs - only with higher costs. That is, the corporate cost per employee for DNSPs decreases at a similar rate with scale as that shown above, with the smallest DNSP having corporate costs per employee of around 3 times greater than the largest DNSP.

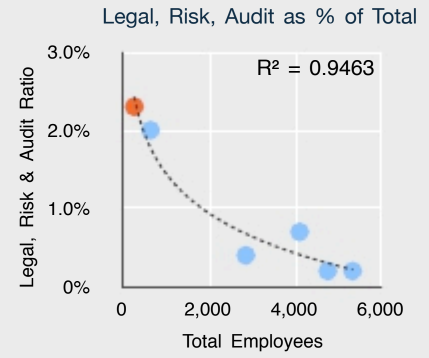


Adding a number of DNSPs to the plot above using a relative scale (*Total number of employees have been normalised to a percentage of the largest business to allow a single plot for both TNSPs and DNSPs) shows that the relationship between corporate costs per employee and the number of employees holds across both transmission and distribution.

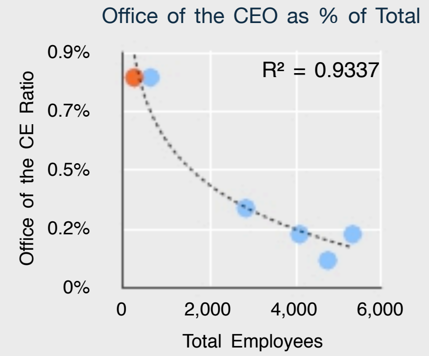
TNSPs   DNSPs

The reason that corporate costs are so significantly impacted by scale is the existence of functions that must be conducted regardless of scale; there is a minimum fixed cost associated with these functions driven by both infrastructure and staff. The simplest example of this is the CEO; each business has a CEO regardless of size. The cost of having a CEO manifests in corporate opex, and for a smaller company is obviously a higher proportional contributor than for a larger company.

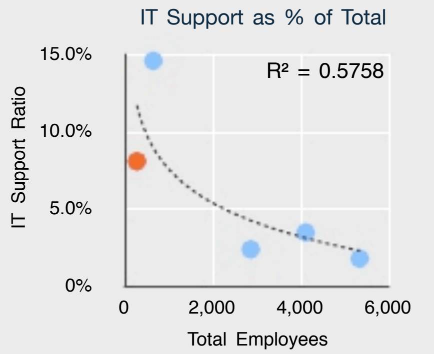
To investigate the impact of scale on common corporate costs, the ratios of staff in certain corporate positions to the total workforce size are shown below for a number of electricity businesses.



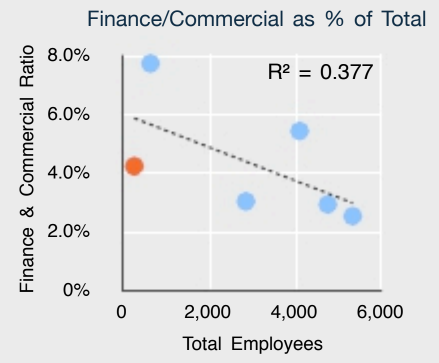
The number of staff employed in Legal, Risk and Audit roles decreases rapidly from around 2% of the workforce for small NSPs to around 0.2% for the largest. This equates to approximately five employees for the smallest NSPs up to approximately ten for the largest.



For the smaller businesses, the office of the CEO constitutes two staff, presumably the CEO and an Executive Assistant. For the larger businesses, the office of the CEO is staffed by up to five employees.



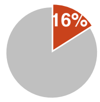
The relationship between IT support and scale is not as strong as for other functions; this is mainly due to both the variability of the scope of services falling under this category across the businesses and the division of responsibility between network and non-network IT.



The relationship between Finance/Commercial and scale is not strong at all. The ownership structure, scope of activities for each business and differences in staff categorisation between this function and Human Resources are the key reasons for the level of variation.

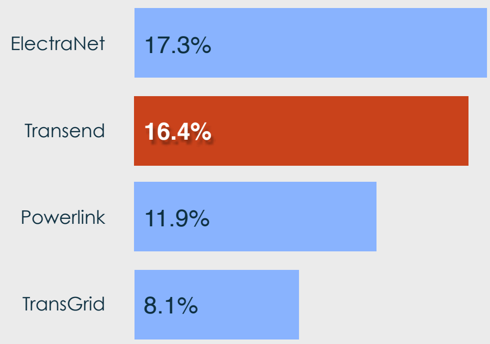
● Transend ● Other NSPs

Transmission Services

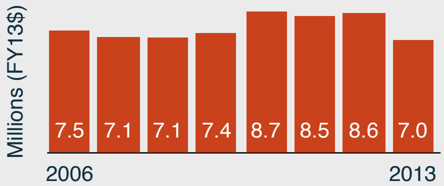


Transmission Services are predominately driven by scale, with many fixed costs associated with the activities included in this cost category. Accounting differences across this category and Asset Management make benchmarking difficult. Comparisons, growth rates and key partial productivity ratios are shown below.

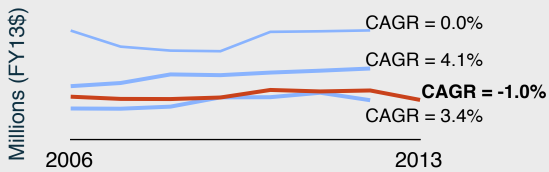
Proportional Allocation (4yr average)



Change over Time



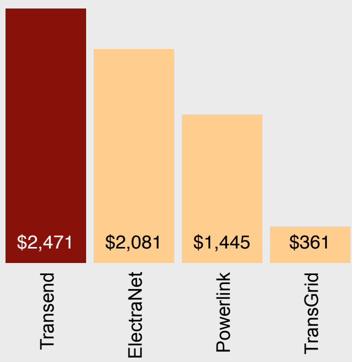
The compound annual growth rate of Transend transmission services is **-1.0**% since 2006.



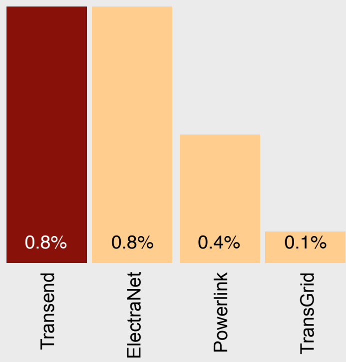
Transend's proportional allocation to transmission services costs is at the higher end of the small group that report these costs (SP AusNet does not). Transend's transmission services costs have fallen since 2006 (8 year CAGR of -1.0%). TransGrid reports some of the costs that are in this category for other businesses in the Asset Management category.

Partial Productivity Indicators

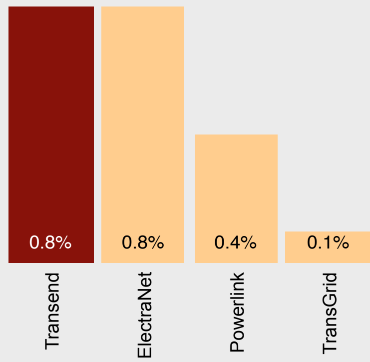
Transmission Services Opex per Network km



Transmission Services Opex per RAB



Transmission Services Opex per Total Expenditure



With Transend's small scale, it has the highest transmission services cost ratios, along with the other small network in South Australia. Transmission services are generally driven by the network assets and the size of the works program and therefore subject to economies of scale.

Primary Transmission Services Cost Drivers

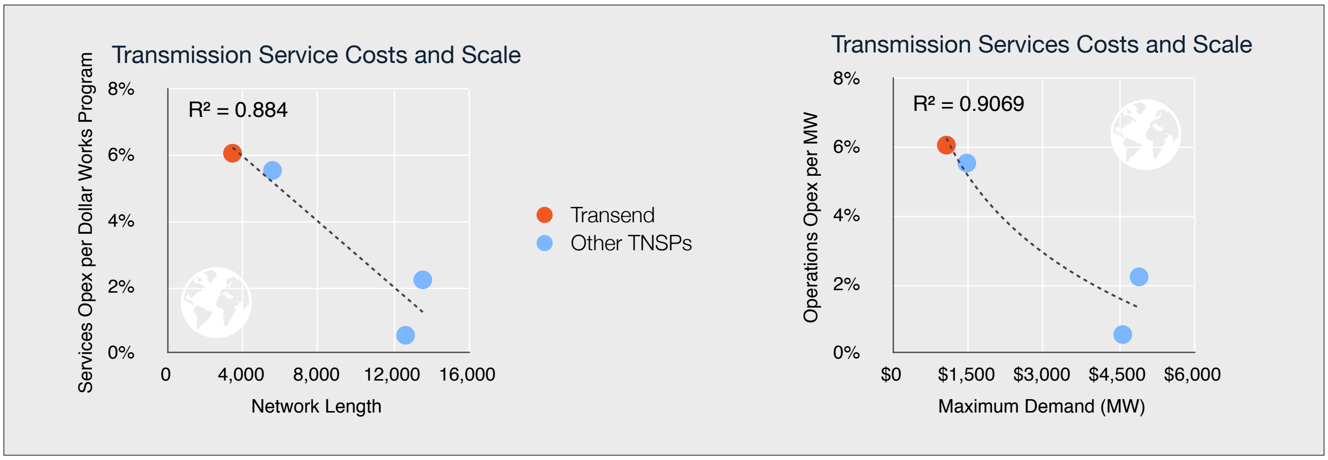
The **scale** of the business is the primary driver of transmission services costs. Smaller TNSPs will have proportionally higher transmission services costs.

The **demographics** of the network area will also influence costs, as the planning and coordination of work is affected by the characteristics of the network environment.

The effect of these cost drivers on transmission services costs are explored further on the following pages.

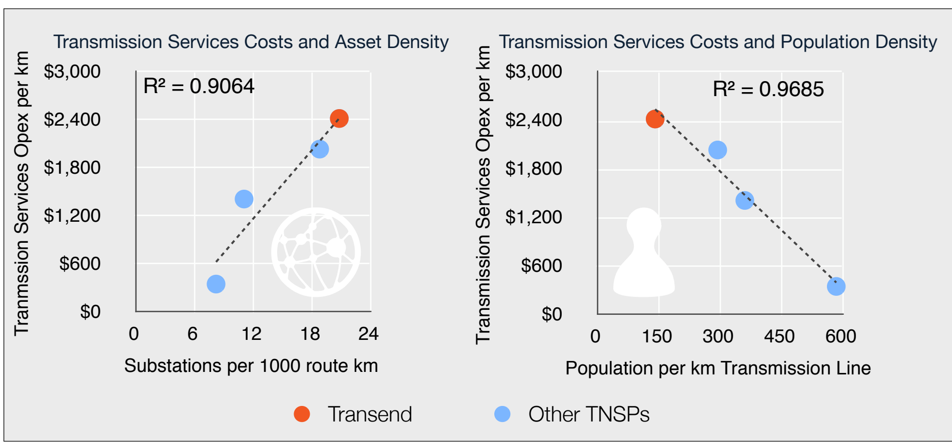
Transmission services costs and scale

Scale undoubtedly influences this cost category; with only four TNSPs reporting these costs, relationships between drivers and costs are difficult to quantify, but as shown below the two smaller TNSPs have higher cost ratios than the larger two. Transmission services costs are shown using the ratio to the total maintenance and capital expenditure amount, as the size of both the maintenance and capital programs drives these costs.

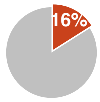


Transmission services costs and complexity

As transmission services includes the engineering and works planning and coordination functions, it stands to reason that an increase in the complexity of the design and network environment would influence these costs. As shown below, with the limited data available, there is a relationship between transmission services costs and the demographics and asset density of the network. The transmission services cost per kilometre increase with increasing number of substations per route kilometre and decrease with increasing population density.

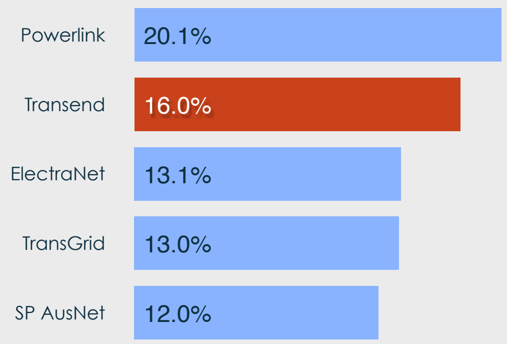


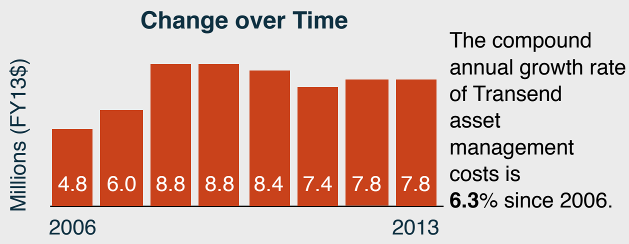
The plots show the relationship between the transmission services cost per kilometre and the asset and population densities of the network - measured by the density of substations per route kilometre and state population per circuit kilometre respectively.

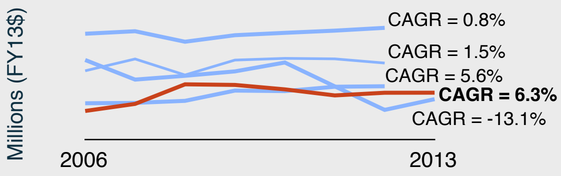


Asset Management

Asset Management costs are Transend's most volatile costs over time - a function of the small scale of Transend and the cyclical nature of regulatory support activity. As shown below, Transend's costs for this category increased around the time of the last regulatory determination, as it did for many other TNSPs.

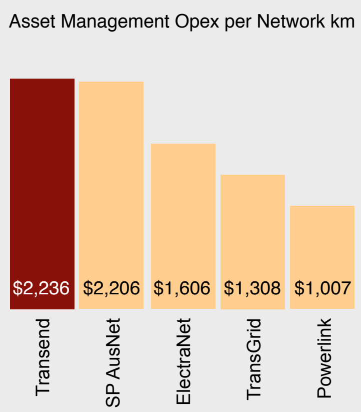


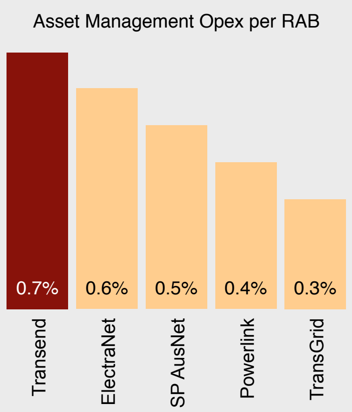


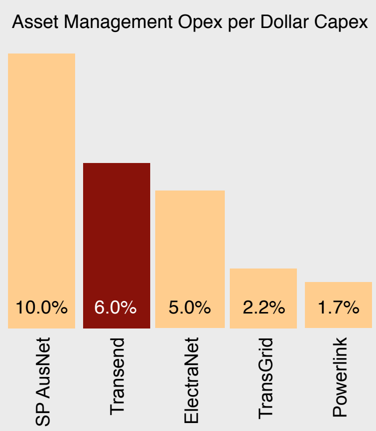


Presumably, asset management opex is affected by the size of the capital works program, with increases in the size, value or number of projects requiring greater levels of support. As the regulatory function is also included in this category, fluctuations around the regulatory submission timeframe would be expected and are indeed evident in the cost over time for this function shown above. As Transend includes customer management in this category, its costs are driven higher still; particularly given the high number of directly connected customers compared to its larger peers.

Partial Productivity Indicators







Transend's asset management costs as a ratio of these variables is at the higher end of the group, as expected due to its small scale. SP AusNet is a slight outlier in this analysis due to accounting differences, with SP AusNet recording some costs that other businesses record as Transmission Services in this category.

Primary Asset Management Cost Drivers

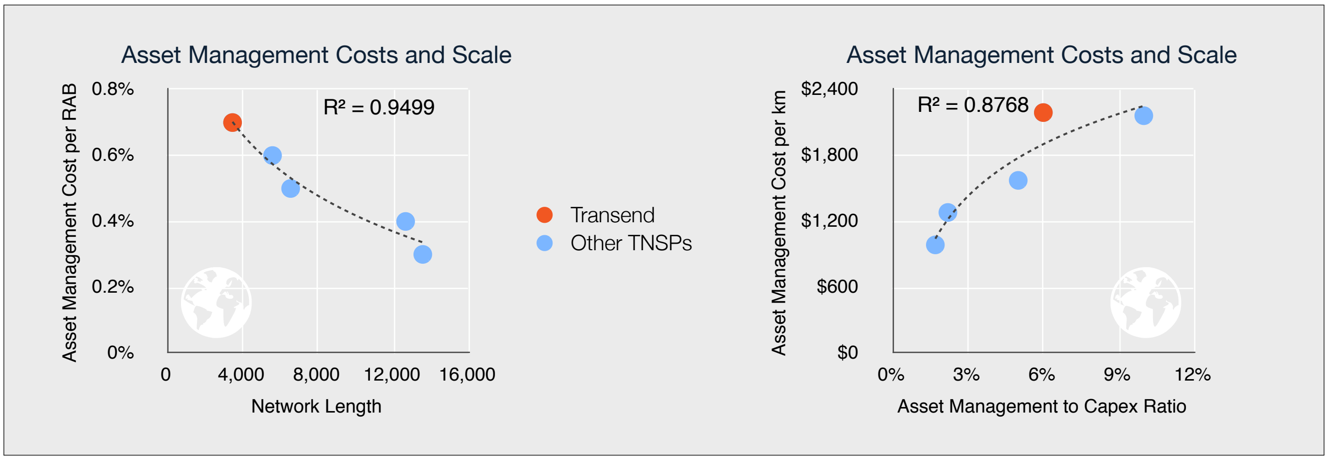
The **scale** of the business is the primary driver of asset management costs. Smaller TNSPs will have proportionally higher asset management costs.

The **design** of the network will also affect asset management costs. More complex networks require increased planning efforts. Transend's high number of directly connected customers also increases costs.

The effect of these cost drivers on asset management costs are explored further on the following pages.

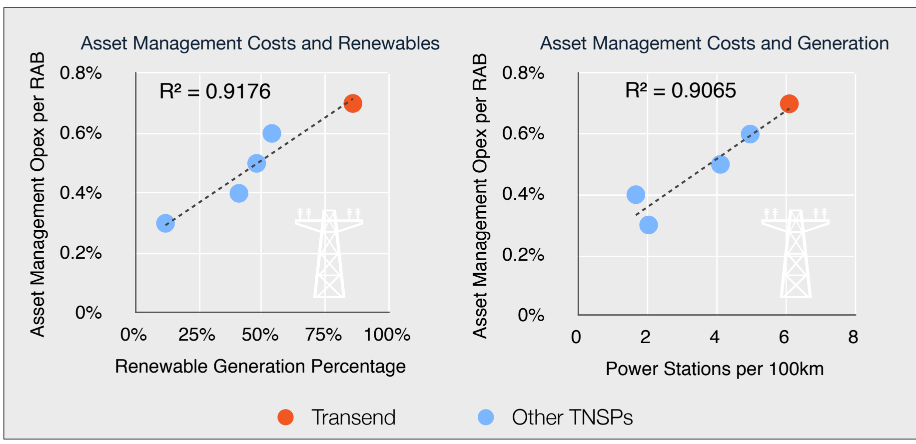
Asset management costs and scale

As shown below there is a correlation between the ratio of asset management costs to RAB value and to network length and the scale of the business. The influence of scale on asset management costs will be exacerbated by the existence of the regulatory management function - which has a finite minimum size - in this cost category.



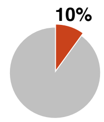
Asset management costs and complexity

Just as transmission services costs increase with increasing complexity of the market and network design, asset management costs can be expected to do the same. As shown below, asset management costs as a percentage of the network value increase with an increase in the proportion of supply that comes from renewable sources and the number of power stations for every unit of network length.



The plots show the relationship between the asset management cost to RAB value ratio and proportion of renewable energy source and number of power stations respectively - both of which cause costs to increase.

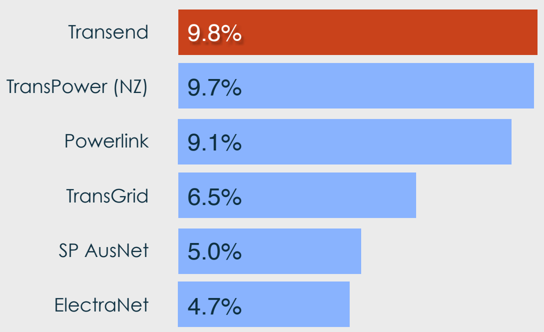
As a small TNSP with a large number of renewable source power stations providing generation, Transend has higher asset management cost ratios than its peers. The size and complexity of the network are both shown to be drivers of these cost ratios.



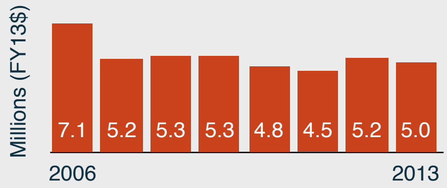
Transmission Operations

Transmission Operations costs are one of the smallest of Transend's cost categories. Scale is one factor in the costs, with a minimum level of infrastructure (e.g. a control room) required for any size business. Comparisons, growth rates and key partial productivity ratios are shown below.

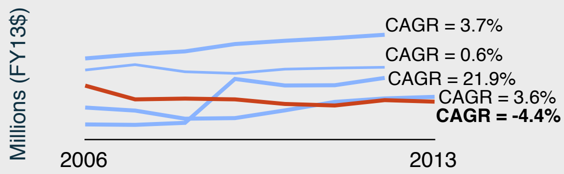
Proportional Allocation (4yr average)



Change over Time

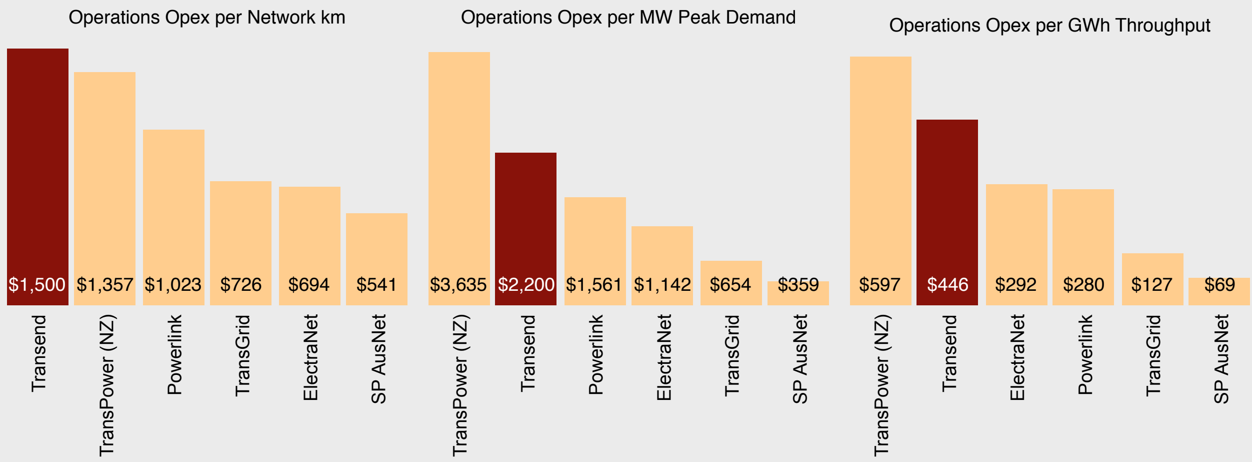


The compound annual growth rate of Transend transmission operations is **-4.4**% since 2006.



Transend's proportional allocation to Transmission Operations is the highest in the group. The compound annual growth rate of this category of costs is -4.4%. Interestingly, the two businesses that had significantly lower Transmission Operations costs than Transend through this period now have similar costs - one just above and one just below.

Partial Productivity Indicators



With Transend's small scale it is not surprising that it has the highest operations costs per kilometre. Whilst scale is one driver of these costs, other operating conditions associated with the network and the generation and distribution markets it connects also influence the relative costs for this category.

Primary Transmission Operations Cost Drivers

The **scale** of the business is the primary driver of operations costs. Smaller TNSPs will have proportionally higher transmission operations costs.

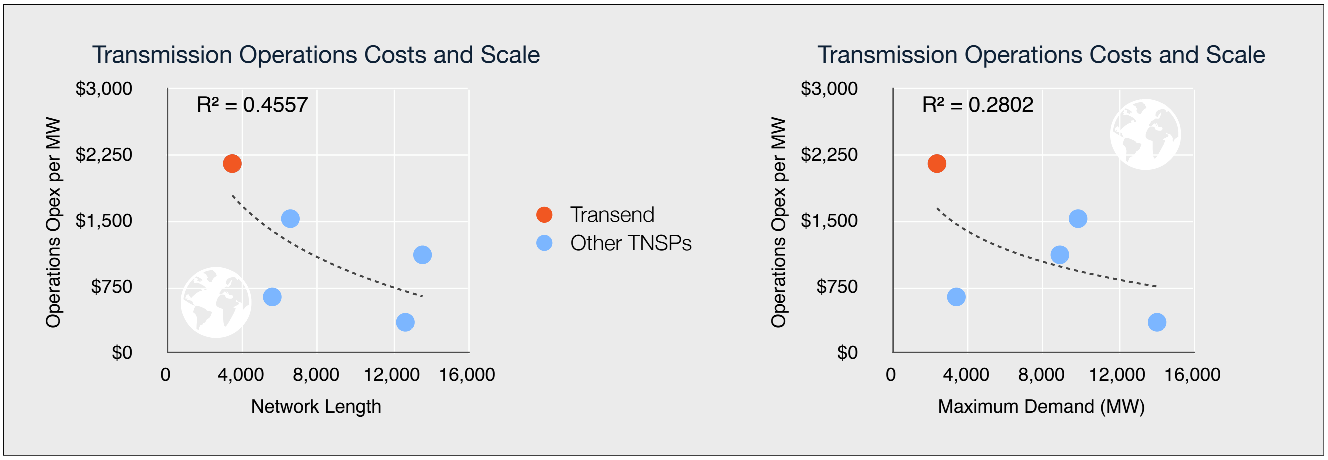
The **density** of the business drives operations costs through greater complexity of the network, but also more switching options.

The **demographic** of the customer/market on both the generation and distribution side influence operations opex.

The effect of these cost drivers on transmission operations costs are explored further on the following pages.

Transmission operations costs and scale

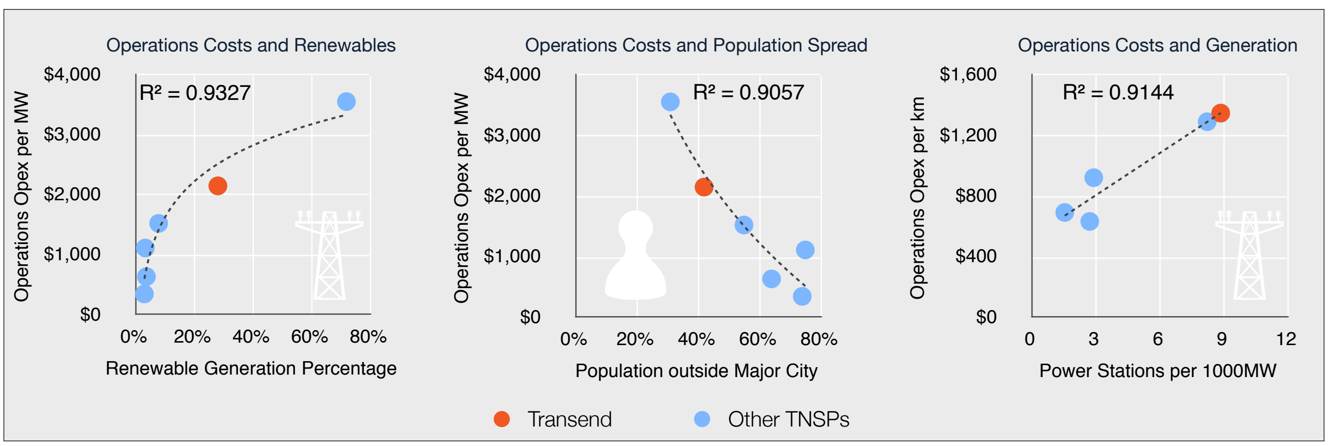
Whilst scale undoubtedly influences this cost category, the correlations between these costs and scale are not strong, as shown below.



Transmission operations costs and complexity

The weak correlations above and the absence of ElectraNet from the higher cost positions on the ratios shown on the previous page suggest that scale is not the only driver of Operations costs. The consistent positioning of Transend and TransPower in the two highest cost positions suggests that Transmissions Operations costs could depend on the complexity and diversity of the generation and distribution markets; both of these jurisdictions have significant hydro-electric generation capacity and broadly spread population.

To test the relationship between Transmission Operations costs and generation market composition (as a proxy for operational complexity) and end customer location, the plots below show the relationship between Transmission Operations costs per MW of peak demand of the system and the percentage of the generation from renewable sources[2] by jurisdiction and the percentage of the population outside the capital city (Auckland is used in the case of TransPower rather than Wellington, as it is the major population centre). The costs per kilometre are also shown as a function of the number of power stations required to generate 1000MW of the network maximum demand. The plots show that costs increase with all three variables.

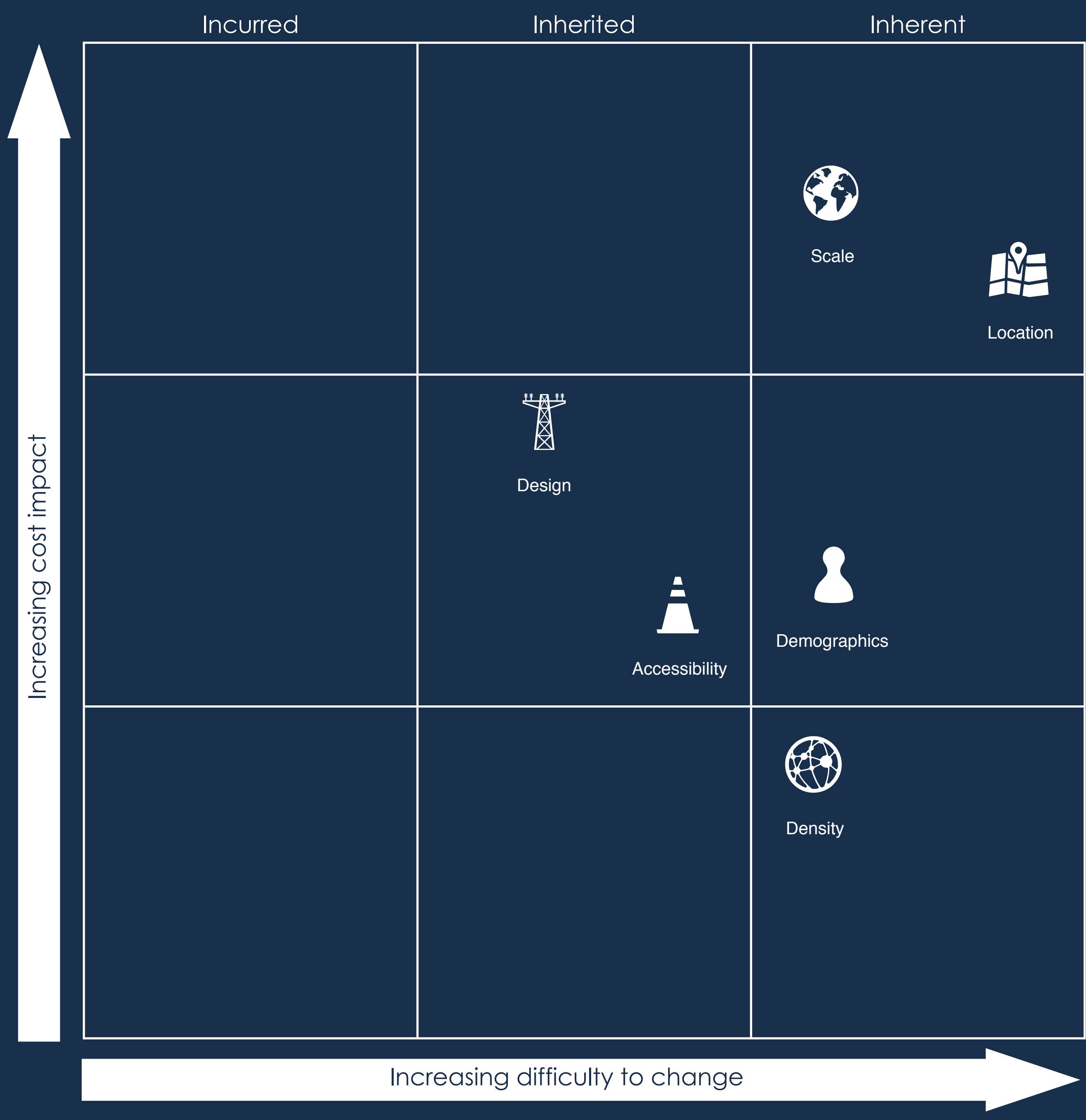


[2] Includes hydro, geothermal and biomass sources, but excludes solar and wind (which are both included in the total).

Opex Cost Drivers Impact and Controllability

The most influential cost drivers for Transend's opex are those that are hardest to change through management decisions - that is, they are inherent and inherited cost drivers. The graphic below illustrates the relative position of the major cost drivers in terms of ability to change (controllability) and significance (cost impact).

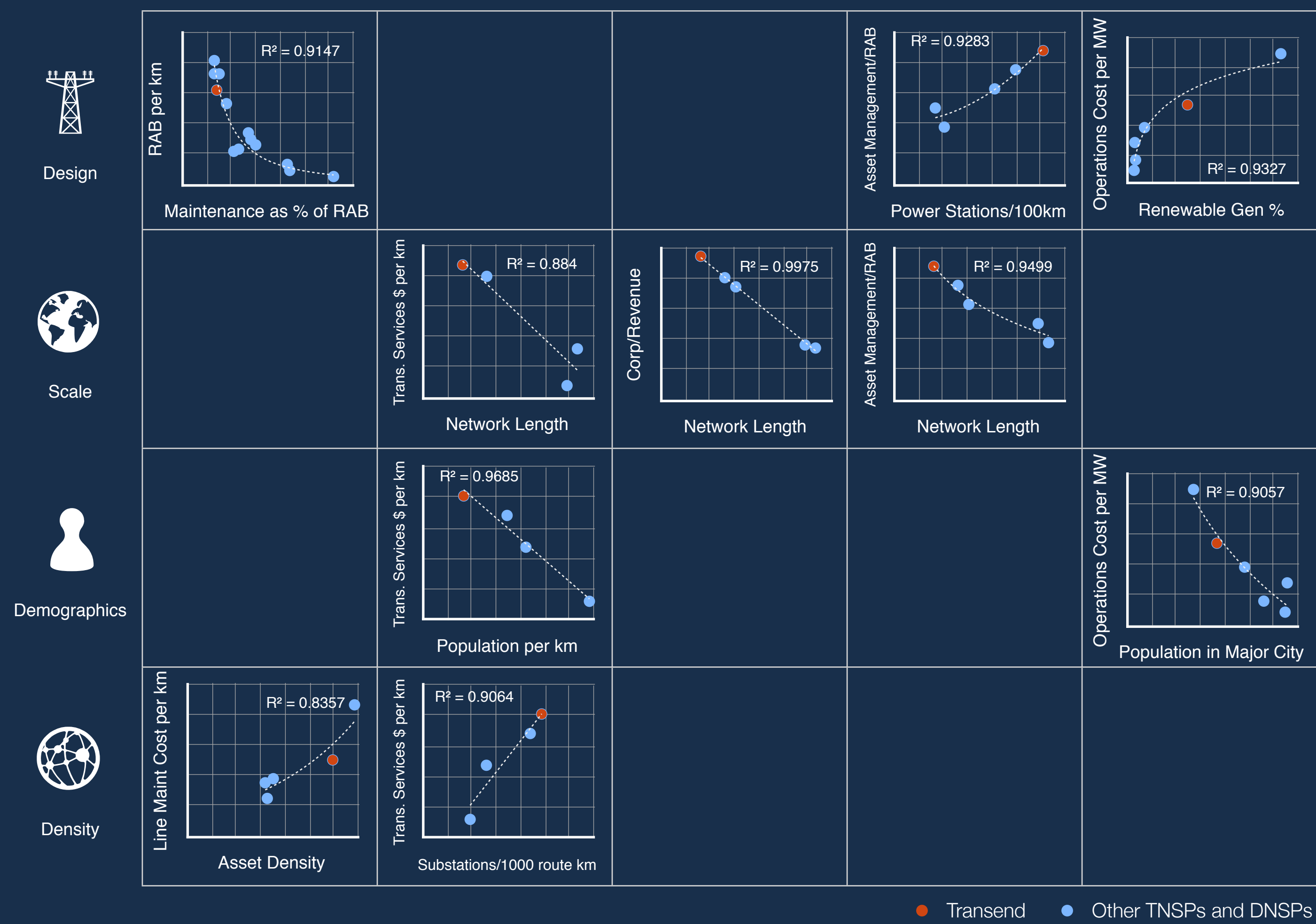
The following page presents a matrix of the opex cost categories, the major cost drivers and plots of those costs against the cost drivers to illustrate the relationship between the two.



Opex Cost Drivers by Category

Scale, the network design, the generation market structure and the population characteristics in Tasmania are the major cost drivers for Transend's operating expenditure categories. As shown below, each influence the cost categories in specific ways, but each represent a strong argument for the influence of these drivers on costs at this level of aggregation and the illustration of the impact that they have on Transend's cost outcomes.

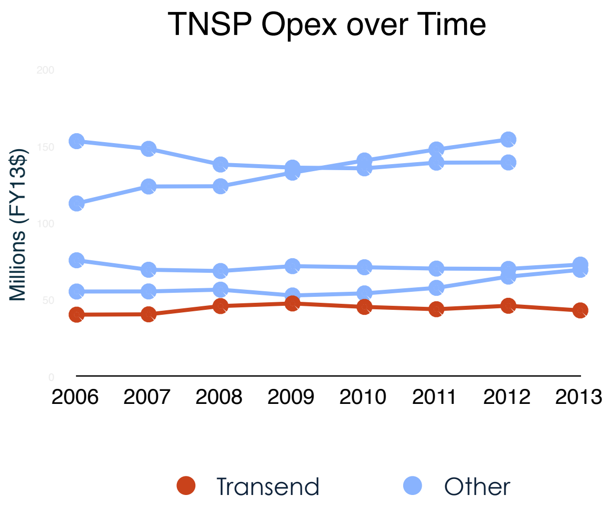
Maintenance $15.94 m	Transmission Services $8.42 m	Corporate $8.03 m	Asset Management $7.63 m	Transmission Operations $5.08 m
The value of the asset, and the distribution of that value across the network, is the primary driver of maintenance spend.	*Scale is a consideration, but the operating environment - population and network density - is a strong influence.*	*Scale is the single largest driver of Corporate Opex costs; fixed costs inherent in this category inflate Transend cost ratios.*	*Scale and network design complexity both impact the level of asset management expenditure relative to network value.*	*Scale and complexity both influence the relative costs for this category, pushing Transend's cost ratios higher than larger peers.*



Opex Summary

Transend undoubtedly faces many challenges in the cost drivers present in its operating environment. The significantly smaller scale, island location and the characteristics of its generation and distribution markets drive costs which appear higher relative to peer networks in some cost categories, in particular Corporate Opex and Transmission Operations.

The variability in conditions in Australia and small sample size makes benchmarking through straight, in-year comparison difficult. However with the increasing costs right across the electricity industry over the last decade, Transend's ability to keep its operating costs relatively flat over time is an indication that it is performing well with respect to overall industry cost efficiency.



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Victoria has a very concentrated energy source with virtually all its power being generated in the Latrobe Valley about 150km east of Melbourne. Other NEM jurisdictions, however, have considerably more dispersed and distant generation sources. This means it is far simpler to plan the network in Victoria and also means that the needs of load can be met largely through a single core corridor of transmission line.

Electricity Network Regulation
Supplementary Submission in Response to the
Productivity Commission Issues Paper, August 2012

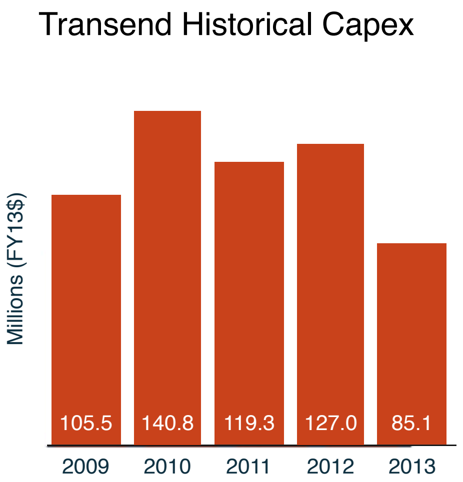
5. Capital Expenditure

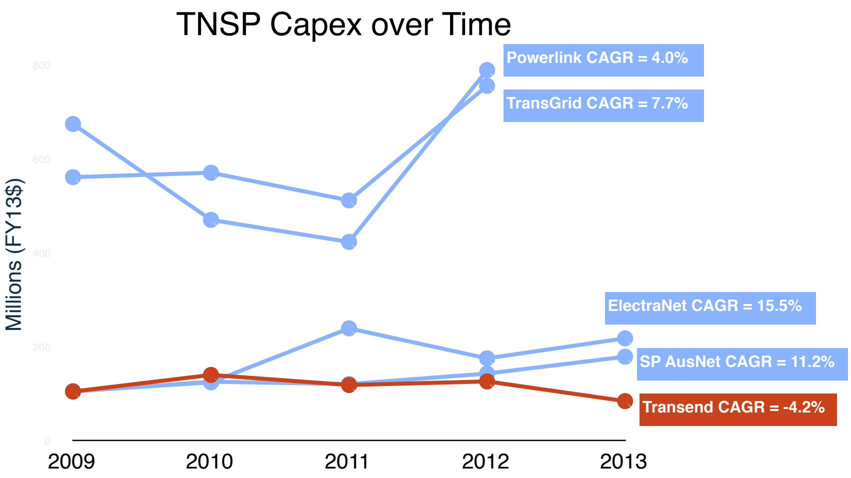
Overview

Capital expenditure is significantly more challenging to benchmark due to the nature of how and when it accumulates - that is, unlike operating expenditure, capital is not the outcome of a continuous process of activities, rather it accumulates through projects which arise through needs triggered by the either the capacity limitations or condition of the network. As such, it is both unique to each business and incomparable within a given time period. This chapter deals with capex, therefore, at a high level only due to the lack of information available.

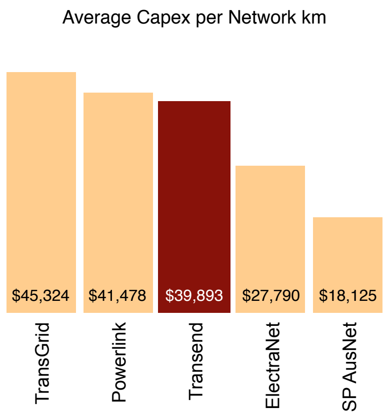
Capital Expenditure Analysis

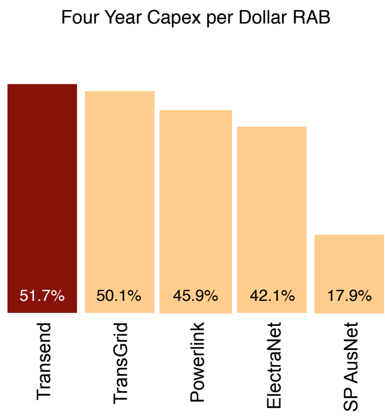
A four year period of capital expenditure has been analysed to account to the extent possible for the "lumpy" nature of a capital program. As shown below, Transend currently has the lowest capex of the TNSPs; it also has the second lowest growth rate over the period, with a decrease in the most recent year of analysis. SP AusNet has the lowest average capex over this time period, followed by Transend, however SP AusNet does not include augmentation capex in its regulatory financial reports - a major cost category for the other businesses.

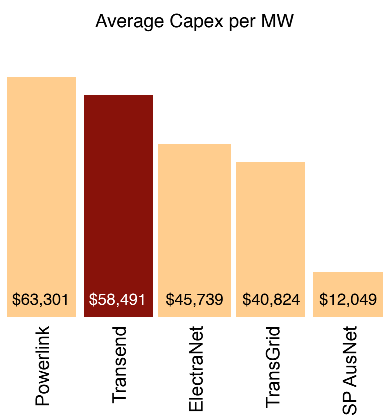




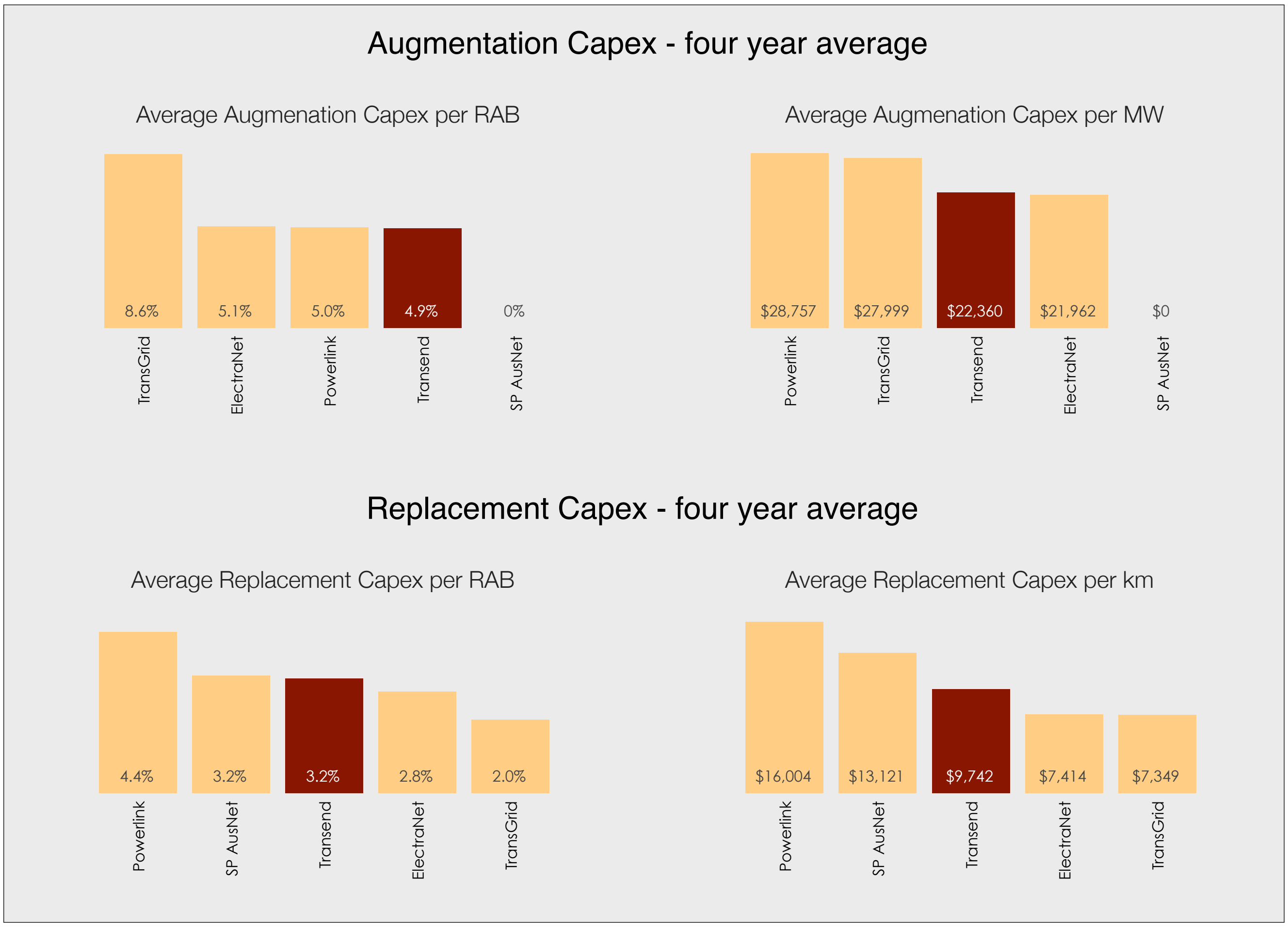
High level capex ratios for the four year period are shown below; excluding SP AusNet (which does not include augmentation capex in its total), the ranges of expenditure are relatively similar.



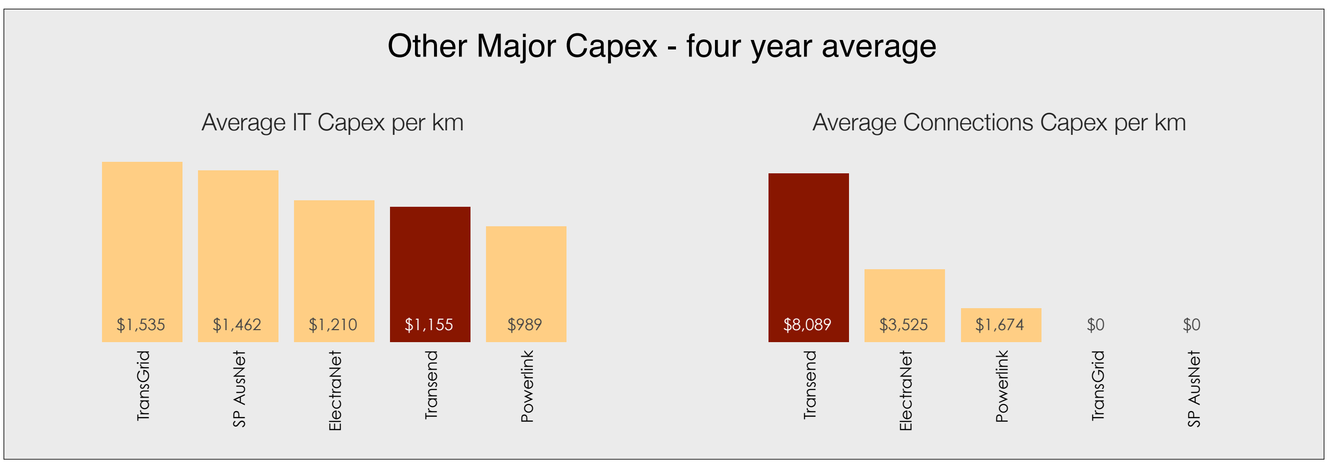




Due to the limitations outlined on the previous page - that is, the nature of capital expenditure and the accounting difference of SP AusNet - detailed driver analysis is limited in utility. To provide a summary view of relative performance however, the analysis below shows there is very little difference between the businesses in terms of major capital cost ratios.



The two capex categories above, Augmentation and Replacement, contribute between 60% and 80% of total capex for all TNSPs. The other drivers of capex include connections, easements, IT and other non-system categories (such as facilities, vehicles and buildings). Of these, connections and IT are two that are subject to economies of scale. The greater connection density (at both ends of the network) and grandfathered assets in Transend's network will also drive connection capex higher; however only three businesses report this category of spend. IT and connections capex as ratios of the network length are shown below where data is available.



KEY POINTS IN BRIEF

Field Operations & Maintenance Opex

Transend's largest opex category has also been its most consistently stable.

Transend's maintenance costs are relatively low compared to its peers and have remained constant over a long period.

Despite the challenges of high densities of low voltage (down to distribution level) assets in mountainous and environmentally protected areas, Transend has managed to maintain low maintenance costs ratios consistently over a long period of time.

Corporate Support Opex

The predominate driver of corporate opex is scale, and its influence is significant.

Transend is in the top two TNSPs for maximum corporate costs on a number of cost ratios due to its small scale.

Analysis of corporate costs and scale shows a remarkably strong relationship that holds true for both transmission and distribution entities. This indicates that whilst Transend's corporate costs are relatively high amongst its peers when compared on a straight cost ratio, its costs in this category are exactly where one expects they should be based on scale.

Scale, of course, is an inherited (if not inherent) cost driver that influences Transend's corporate costs and its overall opex.

Transmission Services Opex

Transmission services are primarily driven by scale; Transend and ElectraNet - the smallest networks - each have the highest cost ratios for this category.

Transend's transmission services costs are very similar to the other small network in Australia, ElectraNet. As the smallest network, Transend has the highest costs as a ratio of its RAB, length and total expenditure.

This cost category is a function of the size of the works program and the scale of the network itself. The complexity of Transend's network would also contribute to a cost premium in this cost category.

Customer & Asset Management Opex

Scale and network complexity drive this category of costs - both of which are challenges for Transend.

The primary functions under this category are regulatory support and asset management. Regulatory support is strongly influenced by scale and timing (due to regulatory submission cycles); as a small TNSP, the cyclical nature of this influence is amplified for Transend.

Asset management is also a function of scale, but the complexity of Transend's network provides a compounding effect on the influence of the cost drivers. Specifically, Transend's reliance on numerous power stations that use renewable energy sources, along with its ownership of distribution voltage assets and grandfathering of certain assets all have an upwards influence on asset management costs.

Transend also has a very high number of directly connected customers compared to its much larger peers.

Transmission Operations Opex

Like Corporate Opex, Transmission Opex is influenced by scale. The complexity of the electricity supply chain in Tasmania, however, adds more to the costs of Transend.

Transend has the highest or second-highest cost ratios across the industry in the Transmission Operations category. The fixed costs of operating a control room contribute to this position, however the complexity of the network also contributes to higher costs.

Tasmanian has more power stations per kilometre, MW and GWh of the transmission network than any other state. It also has the highest percentage of renewable generation sources in Australia.

The AER, Grid Australia and the Productivity Commission have all acknowledged the likely increased costs for Transend due to the composition and complexity of the Tasmanian generation supply.

Capital Expenditure

Capital Expenditure is difficult to benchmark; however there is nothing in the high level analysis to suggest that Transend's capital program is less efficient than its peers.

In terms of expenditure over time and as a ratio of major network variables, Transend's capital expenditure is similar to its peers (with the exception of SP AusNet, which does not report augmentation capex).

Many of the drivers that influence opex costs have negligible, or only a minor effect, on the capital expenditure program. Locational and environmental factors - such as the shipping premium and hilly, inaccessible landscape in Tasmania - have a greater influence on capital than the opex drivers, however these drivers are also more difficult to quantify.

What is evident in the analysis is that the two small, complex networks spend more proportionally on connections than the other businesses.

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