APPENDIX 23

Unit rate review
AECOM

Energex Unit Rate Review
Energex Ltd
08-Aug-2014

Energex Unit Rate Review

Final Report

Energex Unit Rate Review

Energex Unit Rate Review

Final Report

Client: Energex Ltd

ABN: N/A

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Energex Unit Rate Review

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			Name/Position	Signature
0	08-Aug-2014	Final Report	Nick Sunman Associate	

Energex Unit Rate Review

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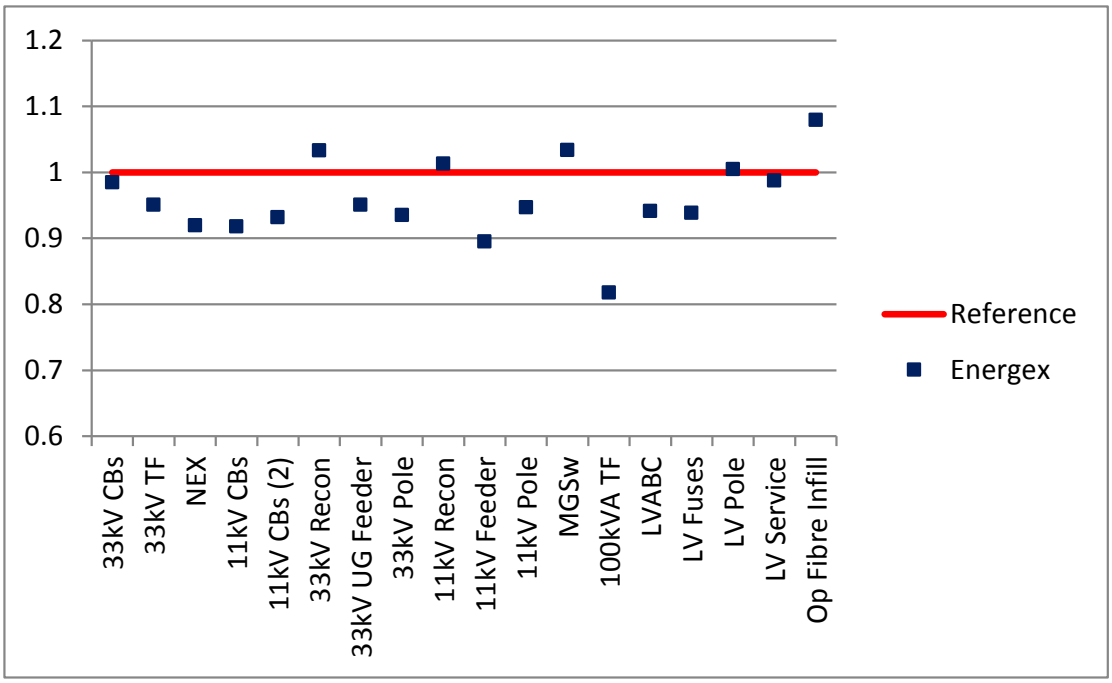
Executive Summary

AECOM has been engaged by Energex Ltd to review eighteen unit rates that are being used to compile their funding requirements for the next financial period.

Energex provided a scope statement, detailed estimates and a selection of relevant drawings to provide a basis for the review.

Davis Langdon, an AECOM company, has reviewed the unit rates by developing reference pricing based on the Energex unit scope, standards and specifications using our database and pricing templates. The rates were then reviewed with the experience that Davis Langdon has obtained from working within Australia and internationally to determine how the Energex rates compare to the reference price and in comparison to similar activities performed by other Australian providers.

The comparison of reference estimate and Energex unit rates shows the following where the reference estimate is the unit (1):



The reference estimates were produced using market rates as at 31st July 2014 with no escalation or contingency.

Energex on-costs have not been included in the rates reviewed.

We have reviewed the Energex estimates provided and found reasonable correlation with the reference estimates.

The largest deviation is 18% below the reference estimate for the 100kVA transformer. This is principally due to the low value of the unit and the market rate assumptions used by Davis Langdon.

All other values are within ±10% of the reference value which corresponds with the expected outcomes taking into consideration the basis of estimate.

1.0 Introduction

AECOM has been engaged by Energex Ltd to review eighteen unit rates that are being used to compile their funding requirements for the next financial period.

Energex provided a scope statement, detailed estimates and a selection of relevant drawings to provide a basis for the review.

Davis Langdon, an AECOM company, has reviewed the unit rates by developing reference pricing based on the Energex unit scope, standards and specifications using our database and pricing templates. The rates were then reviewed with the experience that Davis Langdon has obtained from working within Australia and internationally to determine how the Energex rates compare to the reference price and in comparison to similar activities performed by other Australian providers.

The unit costs exclude Energex on-costs.

The unit rates requested are:

- Replacement of 4 off 33kV Outdoor Dead Tank Circuit Breakers;
- Replacement of 33/11kV, 25MVA Transformer;
- Replacement of NER with NEX;
- Replace 6 off 11kV Indoor Circuit Breakers, excluding cable connections;
- Replace 5 off 11kV Circuit Breakers with RMU transfer;
- Reconductor 6km of 33kV Line including pole & cross-arm replacement;
- Replace 33kV Underground Feeder, 1.35km;
- Replace 33kV pole;
- Reconductor 2,8km of 11kV overhead line including pole and cross-arm replacement;
- New 11kV underground feeder;
- Replace HV pole;
- Replace and 11kV air break switch with a manual gas switch;
- Replace pole mounted 100kVA transformer;
- Install LV fuses;
- Replace LV pole;
- Replace a service cable;
- Reconductor open wire LV with LVABC, 1km;
- Optical fibre infill, 5.5km.

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2.0 Scope of Work

The following scope has been identified based on the Energex Scope Statements, Estimate Details and reference drawings provided:

2.1 Replacement of 4 off 33kV Outdoor Dead Tank Circuit Breakers:

- Demolition of four existing dead tank circuit breakers including primary and secondary connections, retaining the existing footings;
- Demolition of four adjacent hook type disconnects including primary connections, retaining the existing footings;
- Replacement of secondary connections from the circuit breakers to the control building;
- Replacement of relays, rework and retermination of cables on existing relay panels for four lines;
- Supply and installation of four 33kV, 2,000A dead tank circuit breakers, four 2,000A three phase hook type disconnects and primary connections on existing footings;
- Make good switchyard surface;
- Connection of relays to SCADA System and reconfiguration of SCADA system;
- Network switching;
- Testing and commissioning.

2.2 Replacement of 33/11kV, 25MVA Transformer:

- Demolition and removal of an existing 33/11kV transformer including footings, primary and secondary connections;
- Construction of a new transformer enclosure including footings, oil containment, drainage, earthing, etc;
- Replacement of secondary connections from the transformer to the control building;
- Replacement of the transformer protection and control panel;
- Supply and installation of a 33/11kV 25MVA Transformer including earthing and 33kV primary connections.
- Supply and installation of new 11kV cables and termination to existing 11kV switchgear;
- Make good switchyard surface;
- Connection of relays to SCADA System and reconfiguration of SCADA system;
- Network switching;
- Testing and commissioning.

2.3 Replacement of 33/11kV Transformer NER with NEX:

- Demolition and removal of an existing Neutral Earthing Resistor including footings, primary and secondary connections;
- Construction of a new footing, earthing connection to grid, etc;
- Replacement of secondary connections to the control building;
- Retermination of cables on existing relay panel;
- Supply and installation of an 11kV, single phase neutral earthing reactor, 19.1mH, 1kA, pedestal mount.
- Supply and installation of a new 11kV cable and termination to an existing transformer;
- Make good switchyard surface;
- Network switching;

- Testing and commissioning.

2.4 Replacement of 6 off 11kV Indoor Circuit Breakers:

- Demolition and removal of six existing indoor circuit breakers including primary and secondary connections, retaining the existing footings;
- Replacement of secondary connections from the circuit breakers to the protection panels;
- Replacement of relays, rework and retermination of cables on existing relay panels for each circuit breaker;
- Supply and installation of six 11kV, 1,250A circuit breakers and reconnection of existing primary connections on existing footings;
- Connection of relays to SCADA System and reconfiguration of SCADA system;
- Network switching;
- Testing and commissioning.

2.5 Replacement of 5 off 11kV Indoor Circuit Breakers in C&I Sub:

- Installation of temporary Ring Main Unit;
- Extension and retermination of incoming feeder and four outgoing 11kV feeder cables to the RMU;
- Recommissioning of the RMU to temporarily supply the facility;
- Demolition and removal of five existing indoor circuit breakers including primary and secondary connections, retaining the existing footings;
- Replacement of secondary connections from the circuit breakers to the protection panels;
- Replacement of relays, rework and retermination of cables on existing relay panels for each circuit breaker;
- Supply and installation of five 11kV, 1,250A circuit breakers on existing footings;
- Rework and reconnection of 11kV cables to new circuit breakers;
- Connection of relays to SCADA System and reconfiguration of SCADA system;
- Network Switching;
- Testing and Commissioning;
- Removal of temporary RMU.

2.6 Reconductor 6km of 33kV Line:

- Replacement of 48 wood poles;
- Reconductor of 6km of Pluto AAC conductor including recovery of existing conductor;
- Replacement of 50 LV services;
- Reconnection of 50 LV services;
- Traffic control;
- Network switching.

2.7 New 33kV Double Circuit Underground Line:

- Supply and installation of 1km of two circuits of 3 x 1 core 640mm^2 XLPE cable, direct buried in soil;
- Supply and installation of 0.35km of two circuits of 3 x 1 core 640mm^2 XLPE cable, installed in conduit in friable rock;
- Supply and installation of 0.06km of two circuits of 3 x 1 core 640mm^2 XLPE cable, installed in conduit in soil;

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- Supply and installation of 1.4 km, 2 off 24 core fibre cables in conduit;
- Supply and installation of 1.4 km, 2 off 70mm^2 bare earth cables;
- Cutting and reinstatement of 1.4km of asphalt, general road;
- Termination to existing 33kV switchgear;
- Traffic control;
- Network switching.

2.8 Replacement of 33kV Pole:

- Removal of the existing pole;
- Installation of 33kV tension pole including 11kV subsidiary;
- Traffic control;
- Network Switching.

2.9 Reconductor 2.8km of 11kV Line:

- Replacement of 36 wood poles including LV subsidiary;
- Replacement of 14 additional HV cross arms on existing poles;
- Replacement of 28, 250W HPS luminaires on existing poles;
- Reconductor of 2.4km of Moon AAC conductor including recovery of existing conductor;
- Reconductor of 0.4km of CCT, 120mm^2 AAC conductor including recovery of existing conductor;
- Replacement of 36 LV services;
- Reconnection of 48 LV services;
- Traffic control;
- Network switching.

2.10 New 11kV Underground Feeder:

- Supply and installation of 2.4km of 400mm^2 3 core XLPE cable, installed in conduit direct buried in soil including an allowance for 10% friable rock;
- Supply and installation of 0.5km of 240mm^2 3 core XLPE cable, installed in conduit direct buried in soil including an allowance for 10% friable rock;
- Cutting and reinstatement of 0.5km of asphalt, general road;
- Termination to two new 11kV termination poles;
- Termination to RMUs;
- Supply and installation of two kiosk type RMU stations;
- Supply and installation of a cable jointing pit;
- Replacement of an existing pole mounted air break with a manual gas switch;
- Reconductor with 200m of Moon AAC conductor;
- Replacement of 2, 250W HPS luminaires on existing poles;
- Replacement of 3 LV services;
- Reconnection of 4 LV services;
- Replacement of 1 x 11kV Cross arm on an existing pole;

- LV Generator, 1 week;
- Traffic control;
- Network Switching.

2.11 Replacement of 11kV Pole:

- Removal of the existing pole;
- Supply and installation of 11kV tension pole including LV subsidiary and services;
- Traffic control;
- Local switching.

2.12 Replacement of 11kV Air Break Switch with Manual Gas Switch:

- Removal of the existing air break assembly;
- Supply and installation of an 11kV manual gas switch including cross arm and HV connections;
- Traffic control;
- Local switching.

2.13 Replacement of 11/0.4kV 100kVA Transformer, Simple Arrangement:

- Removal of the existing transformer;
- Supply and installation of an 11kV 100kVA transformer including cross arm, HV & LV connections;
- Retains existing HV & LV fuses and / or switchgear.
- Traffic control;
- Local Switching.

2.14 Reconductor 1km of open wire LV Line with LVABC:

- Replacement of 7 low voltage wood poles;
- Removal of 33 existing cross-arms;
- Reconductor of 1km of open wire LV conductor with 4 x 95mm2 LVABC conductor including fittings and line hardware including recovery of existing conductor;
- Replacement of 2, 250W HPS luminaires on existing poles;
- Replacement of 21 LV services;
- Reconnection of 54 LV services;
- Traffic control;
- Local switching.

2.15 Replacement of existing LV fuses:

- Removal of the existing LV fuse assembly on existing pole top transformer;
- Supply and installation of 2 x 3 phase LV fuse arrangements and elements;
- Supply and installation of pole mounted smart meter in enclosure;
- Replacement of HV fuses;
- Testing and commissioning;
- Local traffic control;
- Local switching.

2.16 Replacement of LV Pole:

- Removal of the existing pole;
- Supply and installation of low voltage simple pole;
- Replacement of two services and transfer of two services;
- Transfer of street light;
- Traffic control;
- Local switching.

2.17 Replacement of LV Service:

- Removal of the existing single phase LV service;
- Supply and installation of low voltage single phase services, 25mm2, up to 30 m long;
- Pole and facia clamps and allowance for riser bracket;
- Local traffic control.

2.18 Infill of 5.5km of Optical Fibre Cable:

- Supply and installation of 4km of 72 core ADSS cable on existing poles;
- Supply and installation of 1.3km of 72 core single mode optical fibre cable in existing conduits;
- Under-bore of existing rail crossing and installation of 2 x 125mm underground conduits and associated junction pits.
- Supply and installation of two substation entries comprising 50m of 72 core fibre installed in conduit and a cable pit.
- Supply and installation of fibre termination panels, wall mounted or in existing cubicles.
- Traffic control;
- Termination and testing of 72 core fibre.

3.0 Drawings & Information Used

The following documentation was used in compiling this estimate:

- Energex Scope Statements and Detailed Estimates est 429633, 429645, 429654, 429666, 429713, 429731, 429736, 429756, 429787, 429791, 429878, 429879, 429880, 429881, 429882, 429883, 429884, 429885 all dated 13th July 2014.
- Various Energex General Arrangement drawings.

4.0 Comparison of Unit Costs

The following diagrams represent the reference unit cost, Energex unit cost and the expected range of costs based on various factors. The report considers the unit costs in logical groups as indicated below:

4.1 Substation Equipment

The substation equipment includes units for the replacement of:

- 4 off 33kV outdoor dead tank circuit breakers (33kV CBs);
- 1 off 33/11kV, 25MVA transformer (33kV TF);
- Transformer Neutral Earthing Resistor with a Neutral Earthing Reactor (NEX);
- 6 off 11kV indoor circuit breakers, excluding cable relocation or retermination (11kV CBs);
- 5 off 11kV indoor circuit breaker, including temporary RMU, cable extensions, rework and retermination (11kV CBs (2).

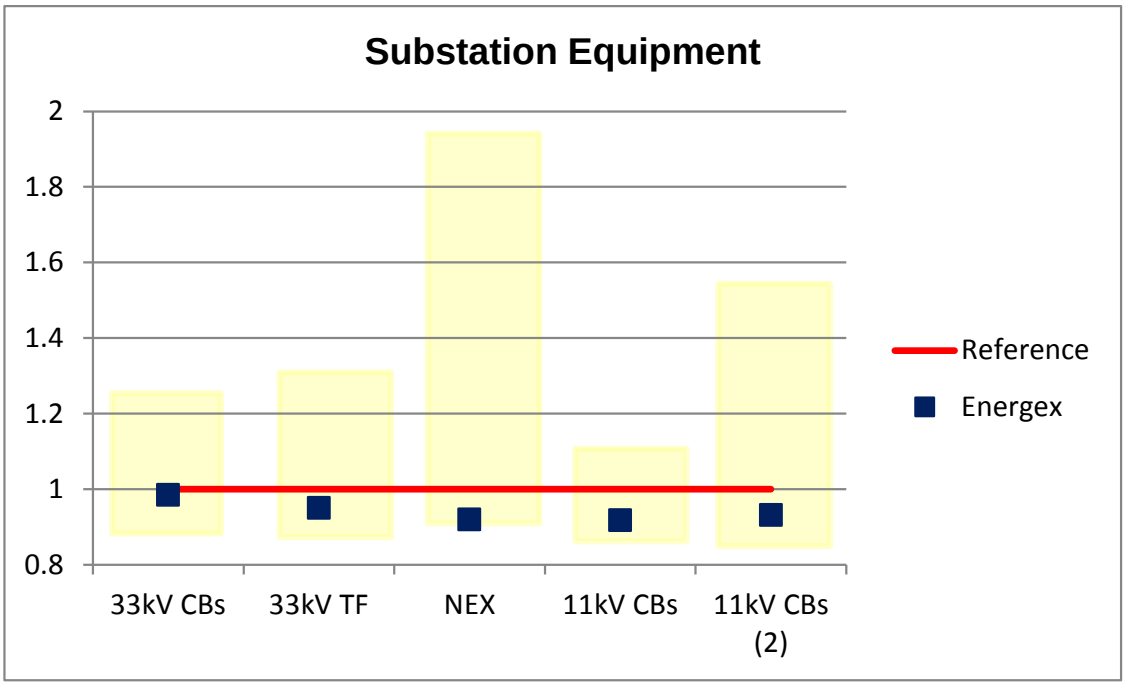

Figure 4-1, Substation Equipment

The reference estimate is represented as the unit figure (1).

The diagram shows that the Energex Unit Rate is approximately 2% to 8% below the reference estimate based on a similar scope of work.

The yellow areas indicate the approximate range of costs for the supply and installation of similar equipment assessed across the distribution industry in Australia. These ranges are based on the understanding and experience of Davis Langdon in the distribution industry and while these ranges are not able to be absolutely quantified due to differences between the various networks they give an order of comparison based on the information below.

Basis of Ranges

33kV Circuit Breakers

The cost of replacement of the 33kV circuit breakers can vary due to several factors:

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- A reduction in current rating and current transformer requirements may reduce the cost of the purchase of the circuit breaker by up to 15%.
- The unit cost provided by Energex includes replacement of relays that may not be included in the scope of circuit breaker replacements for other distribution companies.
- These combine to produce a potential reduction of approximately 10% of the reference cost.
- Increases in cost can be associated with the need to replace the footings, undertake temporary works and / or transfer the line connection.
- The cost of these works has been assessed as conservatively adding approximately 25% to the reference cost.

33kV Transformer

The cost of replacement of the 33kV transformer can vary due to several factors:

- The cost used by Energex for the transformer is competitive due to recent purchases and procurement strategies. A minor reduction in cost may be possible but the purchase cost appears to be at the lower end of expected costs.
- It may be possible to replace the transformer on the existing footings or augment the existing footings for the new transformer. This would contribute to a 5% reduction in cost.
- Similarly the replacement of relays may not be included in the scope of work, or the low voltage cable may not require replacement. These contribute approximately another 5% of the replacement cost.
- These combine to produce a potential reduction of approximately 10% of the reference cost.
- Increases in cost can be associated with a higher specification for the transformers, an upturn in the international demand for transformers and other market based factors. Transformers are very subject to the cost of specialist materials and show high volatility of pricing during periods of international growth. Other distribution companies have a much higher overload requirement for their transformers that can contribute substantially to the cost. Similarly, different testing requirements can contribute to a higher price for the units.
- Other increases in cost may be incurred due to additional secondary cable requirements, fire walls and / or noise enclosures. These are a normal requirement for transformers in urban areas and are often included in unit transformer installation prices. These add to the cost of installation.
- In many installations, replacement in the existing location of the transformer is not able to be undertaken due to the access to the location and the need to maintain the existing transformers in service due to system loading or redundancy issues. In this case new areas in the substation may be required to be established at additional cost.
- The cost of these works has been assessed as conservatively adding approximately 30% to the reference cost.

33kV Transformer, NER to NEX Replacement

The neutral reactor rating used by Energex is lower than some providers within Australia. Values experienced by Davis Langdon have been in the order of twice the cost of supply and installation of the unit specified by Energex. This is reflected in the ranges indicated in Figure 4-1 above

11kV Circuit Breaker Replacement

- Reductions of up to 10 to 15% may be achieved by removing components of the relay replacement and other secondary works from this unit. These could be allocated to other units.
- The likely increase in costs is similar to the discussion on the 33kV units.
- An additional increase in costs may be experienced with the C & I stations based on our experience with other distribution companies. The methodology used by Energex is a very cost effective method to provide temporary supply which also provides timely changeover to the permanent replacement. Other providers use a variety of methods to avert large outages for these clients that contribute to the higher costs indicated in Figure 4-1.

4.2 33kV Line Works

The 33kV Line Works includes the following units:

- Reconductoring of 6km of 33kV overhead line (33kV Recon);
- A new double circuit 33kV underground feeder (33kV UG Feeder);
- The replacement of a 33kV pole (33kV Pole).

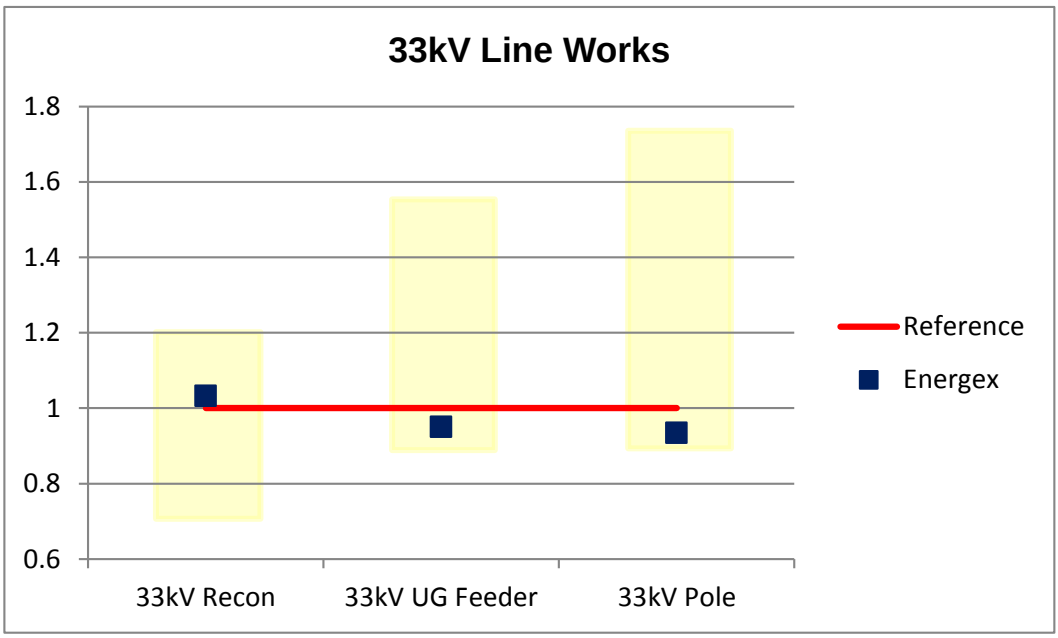

Figure 4-2, 33kV Line Works

The diagram shows that the Energex Unit Rate ranges from -7% to +3% compared to the reference estimate.

33kV Reconductoring

- Energex has included the replacement of eight poles per km in their costs. Other providers use a different basis for latent asset condition or treat these replacements as separate units. This has an impact on the cost of this unit.
- Other contributing factors to the cost of the unit include the amount of traffic management and restrictive productivity issues due to work time restrictions and out of hours work requirements.
- It has been assessed that due to these factors that the cost for these works could vary from -30% to +20%.

33kV Underground Feeder

The cost of the underground feeder costs can vary widely due to latent conditions.

- Energex has nominated to install the feeder along existing roads with road cutting, asphalt replacement and traffic management along the entire length.
- Reductions in costs may be achieved by utilising existing easements, road reserves, parkland or other routes.
- Traffic management costs may also be reduced by using routes on minor streets where complete closure or road sectors may be possible.
- These provide a marginal reduction in costs in the order of 10% possible where conditions allow.

Alternatively, higher costs may be incurred due to other latent conditions including installation:

- Along high traffic and busy commercial areas where works hours are restricted and temporary works need to be undertaken daily to return access;
- Along elevated road sections, across rail easements and busy intersections where different installation methods are required;
- Along high volume, high load roads such as freeways where the cost of restoration of the roadway is higher.
- Where contaminated soils, hard rock, etc add to the cost of excavation and restoration.
- Where the route changes due to various issues that increase the length of the cables.

Several scenarios have been undertaken to show elevated costs of up to 57% above the reference cost for various combinations of the above issues.

33kV Poles

The cost of replacement of a 33kV pole varies substantially depending on the pole size, type, footing requirements and pole top arrangements. The cost range above reflects the cost difference between a simple wood pole and a complex concrete pole in varying traffic and network conditions.

4.3 11kV Line Works

The 11kV Line Works includes the following units:

- Reconductoring of 2.8km of 11kV overhead line (11kV Recon);
- A new 11kV underground feeder (11kV Feeder);
- Replacement of an 11kV pole (11kV Pole);
- Replacement of a pole top air break switch with a manual gas switch;
- Replacement of a 100kVA Transformer.

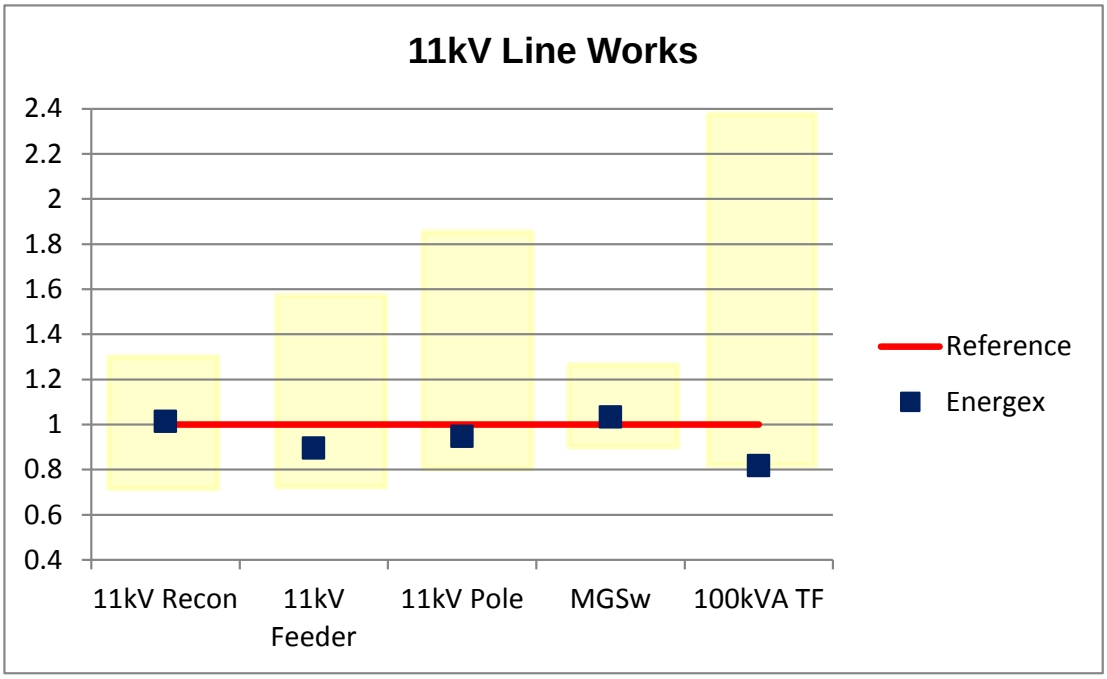

Figure 4-3, 11kV Line Works

The diagram shows that the Energex Unit Rate ranges from -18% to +3% compared to the reference estimate.

11kV Reconductoring

- Energex has included the replacement of 36 poles and 14 additional cross arms along the 2.8km route in their unit scope. Other providers use a different basis for latent asset condition or treat these replacements as separate units. This has an impact on the cost of this unit.
- Other contributing factors to the cost of the unit include the amount of traffic management and restrictive productivity issues due to work time restrictions and out of hours work requirements.
- It has been assessed that due to these factors that the cost for these works could vary from -30% to +20%.

11kV Underground Feeder

The basis for the 11kV feeder is similar to the 33kV feeder with a similar range allocated.

Replacement of 11kV Poles

The cost of replacement of an 11kV pole varies substantially depending on the pole size, type, footing requirements and pole top arrangements. The cost range above reflects the cost difference between a simple pole and a complex pole in varying traffic and network conditions.

Replacement of an 11kV Air Break Switch with a Manual Gas Switch

The cost of replacement of an 11kV air break switch with a manual gas switch is relatively stable. This is a simple task and excludes other asset replacements such as poles and cross arms. The cost may vary due to local conditions, traffic management requirements and the need to modify the pole top to enable installation of the gas switch. The cost of replacement has been assessed in the range of -10% to +25% of the reference value.

Replacement of a 100kVA Pole Top Transformer

The unit scope for this item is a minimum requirement for the replacement of the transformer, excluding all HV and LV associated equipment. Specifications for pole top transformers vary widely across the various providers from the minimal scope undertaken here to the more complex arrangements including multiple low voltage circuits, HV fusing, etc. The cost range above reflects the cost difference between a simple transformer replacement and a complex rebuild including additional HV and LV primary connections, protection and control equipment.

4.4 Low Voltage Line Works

The Low Voltage Line Works includes the following units:

- Reconductoring of 1km of low voltage overhead line with LVABC (LVABC);
- Installation of LV fuses (LV Fuses);
- Replacement of a low voltage pole (LV Pole);
- Replacement of a single phase service;
- Installation of 5.5km of optical fibre cable.

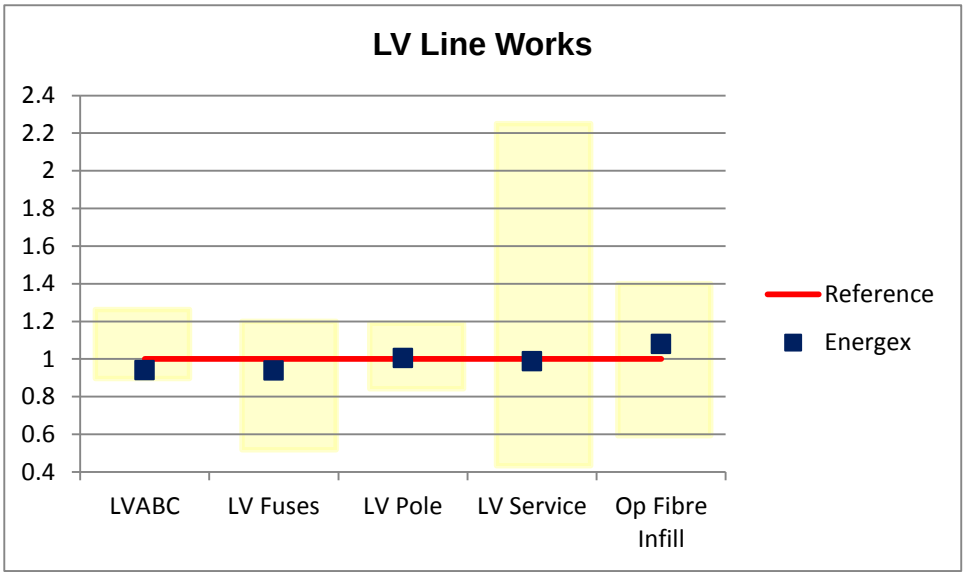

Figure 4-4, Low Voltage Line Works

The diagram shows that the Energex Unit Rate ranges from -6% to +8% compared to the reference estimate.

LVABC

- Energex has included the replacement of seven poles along the 1km route in their unit scope. Other providers use a different basis for latent asset condition or treat these replacements as separate units. At low voltage this has a minor impact on the cost of this unit.
- Other contributing factors to the cost of the unit include the amount of traffic management and restrictive productivity issues due to work time restrictions and out of hours work requirements.
- Vegetation clearance is a major issue for the installation of LVABC and this could add cost to any installation.
- It has been assessed that due to these factors that the cost for these works could likely vary from -10% to +25%.

LV Fuses Installation

The unit scope for this item includes the installation of a smart meter on the LV side of an existing pole top transformer. The basis for the range on this unit is the removal of the smart meter from the scope and additional costs due to existing equipment removal or relocation, additional traffic management, etc.

Replacement of LV Poles

The cost of replacement of an 11kV pole varies substantially depending on the pole size, type and pole top arrangements. The cost range above reflects the cost difference between a simple pole and a complex pole in varying traffic and network conditions.

Replacement of a Low Voltage Service

- The cost of replacement of a low voltage overhead service varies considerably between a simple single phase and more complex three phase arrangements.
- The costs also vary considerably due to the logistics of travel to the work site, set-up of traffic management, notification of residents, etc.
- If the services are grouped so that multiple similar tasks are undertaken in the same or a similar set-up the costs can be reduced.
- Based on these factors and information across multiple service providers, we have assessed the range as -50% to +120%.

Optical Fibre Infill

The unit scope for this item includes 4km of overhead fibre installation, 1.5km of installation in existing conduit, a rail easement crossing and connection into two substations.

- Removal of the substation entries and rail easement crossing can reduce the cost substantially, whereas installation of conduit underground, rather than using existing conduit increases costs.
- Based on these factors plus increased traffic management, vegetation clearance, the need to modify clearance from other pole services, etc, costs could vary considerably.
- We have assessed a conservative envelope of ±40% based on these issues.

5.0 Basis of Reference Estimate:

- The scope is based on the scope statements provided by Energex, reference drawings and an appreciation of industry standards and practices to provide a generic specification with no specific design, site or network arrangements provided.
- The estimate has been prepared using historical information from similar projects, adjusted to reflect the requirements of the proposed unit scope and current market conditions.
- The costs are based on current market rates as at 31st July 2014. No allowances for price escalations or potential exchange rate fluctuations have been included.
- The unit costs include Energex costs for design and management.
- The labour rates used have been adjusted to reflect the use of a mixture of Energex personnel and contract workers.
- Energex on-costs have not been included in the rates reviewed.
- No contingency or risk allowance has been allocated to these values.

6.0 Reference to Unit Cost Data on AER Web Site

A brief review of relevant information on the AER website http://www.aer.gov.au/node/26287 was undertaken. No relevant information was found to make comparisons to the Energex unit costs.

Based on a brief analysis of relevant information on the site we believe that the reference estimates provided comply with the AER requirements.

7.0 Conclusions

Based on the development of the reference estimates and our experience across Australia and internationally we have reviewed the Energex estimates provided and found reasonable correlation.

The largest deviation is 18% below the reference estimate for the 100kVA transformer. This is principally due to the low value of the unit and the impact of the market rate assumptions by Davis Langdon.

All other values are within ±10% of the reference value which is in alignment with the methods used to compile the reference estimate and within the expected range of variation for the units selected.