Assessment of Efficiency of Unit Rates for Selected Activities

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SINCLAIR KNIGHT MERZ

SKM

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Prepared by:	Jeff Butler
Approved by:	Andreas Laubi

Sinclair Knight Merz
ABN 37 001 024 095
32 Cordelia Street
PO Box 3848
South Brisbane QLD 4101 Australia
T +61 7 3026 7100
F +61 7 3026 7300
www.globalskm.com

Contents

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The sole purpose of this report and the associated services performed by Sinclair Knight Merz ("SKM") is to review the efficiency of the unit costs associated with electricity distribution network capital costs in accordance with the scope of services set out in the contract between SKM and ActewAGL ("the Client"). That scope of services, as described in this report, was developed with the Client.

In preparing this report, SKM has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, SKM has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

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1. Executive summary

ActewAGL is currently preparing its regulatory submission for the period 2014/19 to the Australian Energy Regulator (AER). As part of that process, ActewAGL requested Sinclair Knight Merz (SKM) to undertake a comparative review of a unit rates for a selection of activities that are included in ActewAGL's expenditure programs.

In addition, SKM was requested to review the development of 3 project estimates for zone substation works.

1.1 Activity estimates review

For each comparison, the variance has been calculated as the variance of the SKM comparative estimate from the ActewAGL estimate value. The summary of these comparisons are shown in Table 1. Values shaded in green are within the nominal ±15% range for the assessment of the reasonableness/efficiency of the ActewAGL estimate.

Table 1 Summary of comparisons

Asset Category	Activity	ActewAGL estimate	SKM estimate	Variance
Pole replacement/refurbishment	Transmission pole replacement	[redacted]	[redacted]	-7.21%
	HV concrete pole replacement			-10.36%
	LV concrete pole replacement			-14.52%
	LV fibreglass pole replacement			-5.45%
	Pole reinforcement			-2.44%
	Pole neutral bonding			-1.51%
Switchgear maintenance	Hazemeyer RMU maintenance			11.25%
Transformer replacement	500kVA pad mount transformer replacement			-4.59%
	Two-pole substation rebuild into one-pole configuration			-2.78%
	Pole mount transformer replacement			-7.63%
Cable replacement	HV mains cable replacement			-11.39%
	LV CONSAC cable replacement			-12.78%
Services	New greenfields UG service			-4.00%
	Replacement of existing OH service			13.39%
	Domestic LV pillar replacement			4.95%
Metering	Type 6 meter replacement			2.80%
	Domestic meter testing			-0.92%
	Type 5 meter testing			11.16%
Inspection	Pole inspection			7.49%
	Zone Substation thermographic inspection			7.73%
	Thermographic inspection by feeder			-19.01%
	Urban inspection program			-7.46%

In conducting the comparisons, SKM adjusted its reference estimates to more closely align with ActewAGL work descriptions where these were provided. There were several examples - transformer replacement, cable replacement and inspection tasks - where the ActewAGL activity estimate did not fully specify the scope of cost elements, and SKM has relied upon its reference assets.

There are 21 ActewAGL estimates that are considered reasonable, with 14 higher than the comparative SKM estimate, and 7 that are lower, whilst there is 1 which is outside the nominal ±15% range for assessment of reasonableness. For the 1 estimate outside of the nominal reasonableness range, SKM accepts the ActewAGL estimate as being based on historical costs, and the variance is due to a difference in the scopes of the SKM and ActewAGL estimates.

Overall, SKM is of the view that the ActewAGL activity unit rate estimates for the selected activities are reasonable and efficient, subject to the observations and qualifications detailed within this report.

1.2 Substation estimates review

SKM has reviewed the 3 zone substation project cost estimates that ActewAGL provided. All 3 have used an estimate prepared by SKM for substation works in Molonglo Zone Substation as the base, and adjusted this for additional concept design costs, ActewAGL overheads, access road costs, and operational and maintenance costs.

For the Molonglo and Mitchell substation project estimates, SKM considers that ActewAGL has appropriately considered the inclusions and exclusions of the original Molonglo substation works estimate, and applied reasonable additional allowances for land acquisition, concept design, access road, overhead costs and an owner's contingency allowance for project uncertainties and risks outside of the project scope. SKM is satisfied that there is no duplication in contingency allowances.

For the Belconnen substation project estimate, SKM considers that whilst the ActewAGL estimate has adequately considered the scope of works for Belconnen Zone Substation and included a reasonable allowance from the original Molonglo substation works estimate for the electrical primary works, SKM is of the opinion that ActewAGL may not have included sufficient allocations for EPCM, contractor and contingency sums. SKM recommends that ActewAGL review its project cost estimate to clarify and verify that the estimate adequately considers all elements of expected cost.

2. Scope and methodology

ActewAGL required an assessment of the efficiency of 23 standard estimates used in the development of the capital works forecast as part of their AER regulatory submission, and a review of 3 zone substation augmentation projects to assess the reasonableness of the development of the project estimates. SKM was requested to:

- conduct a comparative analysis between the SKM reference asset unit rates and the activity estimates provided to the SKM by ActewAGL, including any differences in scope, assumptions, inclusions and exclusions which might affect the comparison
- provide a report on the reasonableness of ActewAGL's proposed estimates. As part of this review, SKM was requested to provide an overview of the approach and key assumptions used to prepare the estimates, and why these rates should be considered efficient
- make an overall statement as to the reasonableness or otherwise of ActewAGL's estimates and any adjustments that are recommended

SKM adopted the following approach in undertaking the assignment.

- The estimates provided by ActewAGL were separated into seven headings based on the different asset category related activities
- The scope of work for the ActewAGL estimates were compared with the scope of the SKM reference asset estimates to ensure that there was a comparison of like-for-like. Where significant differences were identified, appropriate adjustments were made to the SKM estimates for a valid comparison with the ActewAGL estimates.
- The variance between the ActewAGL estimate and SKM comparative estimate was calculated:
  - where there was agreement within ±15%, SKM would consider the ActewAGL estimates reasonable and no further detailed assessment was undertaken
  - where the estimates differed by more than ±15%, SKM carried out more detailed assessments in an attempt to identify the reasons for the differences
- An assessment was made of the ActewAGL estimates,
  - SKM made an assessment of individual estimates provided by ActewAGL commenting on the efficiency as appropriate
  - SKM undertook a global assessment of the results of the work undertaken to reach general conclusions regarding efficiency of the ActewAGL estimates. SKM looked for trends in the ActewAGL estimating process that may have influenced the outcomes. The global assessment also provided a basis for forming an opinion about the efficiency of the ActewAGL estimates where SKM did not have comparable reference asset estimates
- For the review of the 3 zone substation augmentation projects, SKM has reviewed the scope of the Molonglo zone substation estimate prepared by SKM Sydney previously for ActewAGL to understand the scope of works included, and assessed its use in developing project estimates for Molonglo, Mitchell and Belconnen zone substation works.

3. Assumptions

SKM has based its comparative estimates on the standard reference assets used by SKM for asset valuation and project estimate purposes. Where there is an identifiable difference in the ActewAGL estimate (such as a pole size and/or type, cable size or transformer rating) to the SKM reference asset, SKM has adjusted its estimate to suit so as to allow for a reasonable comparison.

For each of the 23 ActewAGL unit rates provided, SKM prepared a comparative bottom-up estimate based on the data available.

3.1 Data sources

The unit rates for this valuation were developed using a variety of sources, including:

- procurement studies of transmission and distribution asset costs involving the collecting, collating and analysing actual contract prices from seven Australian electricity distributors and four transmission companies for primary items such as circuit breakers, current transformers, voltage transformers, disconnectors, power transformers and conductor
- contract and procurement costs incurred by utilities on recent projects
- recent asset valuations by SKM
- SKM market price surveys of material costs and construction and maintenance activities - activity man-hours used in comparative estimates considered responses to a market price survey of construction and maintenance activities in the electricity distribution system, conducted by SKM over the period June 2001 to May 2003.[1] The surveys included a wide range of capital and operating activities, and attracted between 10 and 15 participants to each survey. Survey participants included government owned utilities, privately owned utilities and private contracting businesses
- SKM valuation database

These data sources represent the reference asset database used by SKM primarily for asset valuation purposes, as well as supporting project specific estimates. All of this input data is based on what SKM believes the cost of these goods and services would be in a reasonably mature competitive marketplace.

As such, these costs may not necessarily reflect the actual costs incurred by ActewAGL.

3.2 Labour rate

SKM has previously conducted surveys with utilities, service providers and contractors to review labour costs associated with a selected range of electricity construction and maintenance activities. As part of these surveys, SKM was able to establish average allocations allowed for overhead and on-cost provisions within labour rates across a sample of the Australian market.

[1] SKM has considered the estimated labour hours only for the various activities from the market surveys; not the labour costs as these costs are considered dated

SKM developed labour hourly rates for this unit rate review was based on the following parameters:

- Basic hourly rates and allowances[2] were based on the Power and Energy Industry Electrical, Electronic and Engineering Employees (EEEE) Award
- Market average values for on-costs including:
  - Payroll tax
  - Superannuation
  - Annual, Long Service and Sick leave
  - Workers Compensation
  - Public holidays

The labour rate adopted for the SKM estimates was based on the assumption that ActewAGL will be utilising their own field personnel; the standard technician rate was used for the development of the substation, metering and thermographic inspection unit rates, whilst the overhead line and underground cable unit rates considered the standard linesman labour rate.

The standard hourly rates used by SKM for 2012/13 were:

- Engineer - [redacted] per hour
- Technician - [redacted] per hour
- Linesman - [redacted] per hour

These labour rates have no provisions for either profit or GST.

It should be noted that the SKM hourly rates do not include any allowances for corporate overheads, so as to provide an equitable comparison with the ActewAGL estimates.

The hourly rates used in the SKM comparative estimates have been used in the standard reference assets developed by SKM, and were not intended to directly reflect the various skill levels and associated hourly rates used by ActewAGL in its unit rates.

3.3 Work practices

While SKM has independently estimated the unit rate costs for the nominated list of capital and maintenance works from its own data sources, SKM recognises that ActewAGL has particular design requirements and work practices due to the nature of its network and the specific issues that network presents.

For example, the majority of underground distribution feeders laid by ActewAGL and its service providers are installed by directional boring techniques as opposed to more conventional trenching, backfilling and reinstatement methods. Where possible, SKM has adjusted its comparative estimate to suit the ActewAGL construction requirements; otherwise, SKM has reviewed the variance in the comparative estimate to identify the difference in construction allowances between the two estimates.

[2] Rates and allowances for a linesman are based on Band 4 Step 3 and a technician on Band 5 Step 2 of EEEE Award (section 10.1 of award AP793302)

3.4 Level of accuracy

In establishing a criterion for assessing the reasonableness of the ActewAGL unit rates, SKM is of the opinion that consideration must be given to the level of accuracy that can be achieved.

The graph shown in Appendix A indicates the levels of accuracy that can be expected for estimates prepared for capital works at various stages of a project development. Due to the different levels of engineering input, and completeness in the design, there are various levels of accuracy that can be reasonably expected in forecasts.

Most of the ActewAGL activity estimates have been provided to a level of detail, including allowance for overtime and engineering/supervisory support, and have in some instances been based on historic actual project costs or contracted service costs. Therefore, SKM would consider the estimates to be within the Preliminary Study phase, but towards the top end of the range.

Based on these estimate classifications and considering ActewAGL has relied upon historic cost data, SKM has adopted a criterion of ±15% as the first pass for comparing the ActewAGL estimates with the SKM reference estimates. For those ActewAGL estimates where the variation is outside this range, SKM has reviewed the underpinning assumptions to identify the potential reasons.

4. Review of unit rates

SKM separated the estimates for the selected activities into asset category related groups.

For each comparison, the variance has been calculated as the variance of the SKM comparative estimate from the ActewAGL estimate value. Table values shaded in green are within the nominal ±15% range and are considered reasonable. Variances outside of this range are shaded in red, and the associated commentary will highlight the differences that have been identified as contributing factors.

For each activity, the description shown is the ActewAGL task description unless otherwise indicated.

4.1 Pole replacement/refurbishment

Table 2 shows a summary of the comparison between the ActewAGL unit rates for pole replacement and/or refurbishment activities and the comparative SKM estimates.

Table 2 Pole replacement/refurbishment estimates

Activity	Description	ActewAGL estimate	SKM estimate	Variance
Transmission pole replacement	Replacement of transmission pole	[redacted]	[redacted]	-7.21%
HV concrete pole replacement	Replace old HV pole with 12.5m concrete pole			-10.36%
LV concrete pole replacement	Replace old LV pole with 9.5m concrete pole			-14.52%
LV fibreglass pole replacement	Replace old pole with 8kN fibreglass pole			-5.45%
Pole reinforcement	Pole nailing			-2.44%
Pole neutral bonding	To rectify missing neutral bonding on conductive poles			-1.51%

In contrast to some of the ActewAGL estimates, SKM has made no allowance for overtime costs in any of the pole replacement/refurbishment activity estimates.

4.1.1 Transmission pole replacement

As the ActewAGL estimate was not specific with regards to the type and size of the transmission pole, SKM has based its comparative estimate on a 22-24m steel pole with crossarm, including foundations and earthing. The material component of the ActewAGL estimate was [redacted] whilst the total material allocation in the SKM comparative estimate was [redacted].

The variance of approximately -7% is well within the nominal range, and therefore SKM considers the ActewAGL estimate to be reasonable. The main contributing factors to the relatively small variance is the allowance of some overtime for the lineworker crew, and plant hire for an air track drill in the ActewAGL activity estimate.

4.1.2 HV concrete pole replacement

The ActewAGL activity involves the replacement of an old HV pole with a 12.5m concrete pole complete with associated hardware. SKM has based its comparative estimate on a 12.5m concrete pole with crossarm, including an allocation for the fitting of an existing street light.

The material component of the ActewAGL estimate is [redacted] compared to the SKM allocation of [redacted]. However, in reviewing the scope of work included in the ActewAGL estimate, SKM noted that it included a

provision of [redacted] for a vacuum excavating machine which effectively accounts for the difference between the SKM and ActewAGL values.

The variance between the two estimates is -approximately -10%, which is within the nominal ±15% range and therefore considered reasonable.

4.1.3 LV concrete pole replacement

The SKM comparative estimate has included provisions for a 9.5m concrete pole and crossarm, together with plant hire and traffic control. Allocations have also been included for refitting a street light and the associated work planning, supervision and recording.

The variance between the SKM and ActewAGL estimates is approximately -15%, which is border-line with regards to the nominal range of ±15% for the assessment of reasonableness. However, as for the HV concrete pole replacement, SKM noted that it included a provision of [redacted] for a vacuum excavating machine which effectively accounts for the difference between the SKM and ActewAGL values.

Therefore, SKM considers that the ActewAGL estimate to be reasonable, particularly recognising the allowance for a site specific requirement for water boring as included in the ActewAGL activity scope.

4.1.4 LV fibreglass pole replacement

ActewAGL is utilizing RStandard(R) composite poles to replace degraded wood distribution poles located in difficult to access locations, such as homeowner backyards and alleys. These fibreglass poles are light enough for line crews to hand carry and erect the poles without the need for heavy lift cranes which cannot access the installation sites. These poles are engineered for an 80-year service life.

Information published by the supplier[3] suggests the poles use a slip joint system which allows the pole to be adjusted to the correct height on-site. The hole for the pole foundations are typically prepared using an excavator or an auger, with the backfill being soil, crushed aggregate or concrete.

SKM is not familiar with the material and labour costs associated with composite poles, nor the assembly and installation requirements for the poles on-site. In preparing the comparative estimate, SKM has relied upon the composite pole cost as provided by ActewAGL and assumed similar installation requirements as for a conventional LV pole. The variance in the estimates is approximately -5% which suggested that the total labour requirements are similar, albeit undertaking different tasks.

SKM considers that the specialised experience that ActewAGL has with the procurement and installation of composite poles would give ActewAGL an excellent knowledge of the costs involved. Therefore, SKM considers the ActewAGL estimate to be efficient.

4.1.5 Pole reinforcement

Pole nailing is a service that is almost exclusively undertaken by external contractors in Australia. SKM noted that the activity estimate provided by ActewAGL has been based on a contracted service provided by Pole Foundations.[4]

In developing a comparative estimate, SKM has relied information from a previous unit rate review for a Victorian electricity utility for typical material and installation requirements. The variance between the two estimates was approximately -2%, from which SKM has concluded that the ActewAGL cost is efficient and reasonable.

[3] RS Poles, www.rspoles.com

[4] Pole Foundations, www.polefoundations.com/index.htm

4.1.6 Pole neutral bonding

SKM has based its comparative estimate on the earthing allowance typically included in its HV distribution line reference estimates. The variance between the ActewAGL estimate and the SKM comparative estimate was approximately 2%, which means there is excellent agreement. SKM therefore considers that ActewAGL estimate to be efficient and reasonable.

4.2 Switchgear maintenance

Table 3 shows a summary of the comparison between the ActewAGL unit rates for switchgear replacement/maintenance activities and the comparative SKM estimates.

Table 3 Switchgear replacement/maintenance estimates

Activity	Description	ActewAGL estimate	SKM estimate	Variance
Hazemeyer RMU maintenance	On a 5-yearly basis, switch network, dismantle, clean, lubricate and replace if necessary, remake/top up cable termination and test operate, seal base	[redacted]	[redacted]	11.25%

In accordance with the ActewAGL estimates, SKM has made allowance for overtime costs in the RMU maintenance activity estimate.

4.2.1 Hazemeyer maintenance

This estimate relates to the cyclic maintenance of a ring main unit, including the remake of a cable termination and testing and commissioning.

In developing the comparative estimate, SKM has relied upon market data relating to the major overhaul of a HV oil switch combination, and cable testing as a proxy for the maintenance of a nominal ring main unit. This estimate included an allowance of 20% overtime for the maintenance and testing crews in line with the allowances in the ActewAGL estimate.

The variance between the ActewAGL and SKM estimates is approximately 11%. Given that the material cost in each estimate is minimal, the primary difference is that the SKM estimate has allowed marginally more time for planning and recording, and more time for cable testing than has been included by ActewAGL. SKM is not aware of any specific requirements for the maintenance of Hazemeyer equipment that may affect the estimate, nor any testing requirements that ActewAGL may specify for its switchgear and cable terminations.

The SKM estimate included a 5% contingency sum to reflect a similar allocation in the ActewAGL activity estimate.

As the variance is within the nominal ±15% range for the assessment of reasonableness, the ActewAGL estimate is considered reasonable.

4.3 Transformer replacement

Table 4 shows a summary of the comparison between the ActewAGL unit rates for distribution transformer replacement activities and the comparative SKM estimates.

Table 4 Transformer replacement estimates

Activity	Description	ActewAGL estimate	SKM estimate	Variance
500kVA pad mount transformer replacement	Replace like-for-like transformer due to failure/noise/tap changer/bad leak	[redacted]	[redacted]	-4.59%
Two-pole substation rebuild into one-pole configuration	Rebuild a two-pole substation into one-pole configuration	[redacted]	[redacted]	-2.78%
Pole mount transformer replacement	Replace the transformer on an existing pole substation	[redacted]	[redacted]	-7.63%

SKM has assumed that the installations are located in public areas that are readily accessible, and that all work is done during normal working hours.

It is noted that in a similar review of activity costs[5] in May 2008, SKM found that the ActewAGL estimate for the replacement of an existing 315kVA double pole mounted transformer with a single pole mounted substation of similar rating was approximately 33% higher than the SKM comparative estimate.

4.3.1 500kVA pad mount transformer replacement

The SKM comparative estimate includes all of the provisions identified in the ActewAGL estimate:

- provision of a 11kV 500kVA transformer with a 3-way RMU
- HV and LV termination and joint kits
- plinth mounting and earthing

The most dominant line item in the estimate is the material cost for the 500kVA transformer. SKM noted that the material cost included in the ActewAGL estimate for the transformer and RMU was [redacted] whilst the SKM allowance was [redacted]. This is considered a good match given the possible variations in price due to any existing supply contracts/agreements that a utility may have and price variations between manufacturers.

The ActewAGL estimate includes 2 provisional sums for miscellaneous materials and miscellaneous contract services that SKM was unable to clearly identify the scopes for. However, SKM has based its estimate of labour hours and plant hire on similar work for other Australian distribution electricity utilities.

The variance between the estimates was approximately -5%, which is well within the nominal range. Therefore, SKM considers the ActewAGL estimate for the nominated activity to be efficient and reasonable.

4.3.2 Two-pole substation rebuild

This estimate relates to the replacement of an existing 11kV 3 phase double pole mounted distribution electricity transformer with a similarly rated single concrete pole mounted transformer.

[5] SKM, *Comparative Unit Rate Estimates for Selected Works/Activities*, 30 May 2008, section 4.9. p.12. In this review, SKM concluded that *"… it appears that ActewAGL may be paying marginally above the average market price for various materials for overhead construction activities. This may be expected due to the relatively low quantities contracted compared with other utilities, and remoteness from the major manufacturing centres "*

ActewAGL has included a material allocation in its activity estimate for materials of [redacted] for transformer, LVABC and miscellaneous materials. This allocation is an average of actual costs associated with 4 projects[6] completed between May and October 2013 under Project Nos. 7522307 and 7522308 related to distribution pole substation replacements. As the ActewAGL activity estimate has been based on average costs, there is no specific job scope. Therefore, SKM has modified its reference estimate to reflect the general nature of the ActewAGL activity using the 4 sample projects as a guide, and has been based on the following assumptions:

- removal of old substation and existing poles
- installation of a single 12.5m HV concrete pole
- installation of 11kV 315kVA pole mount distribution transformer together with associated switchgear
- installation of 500m of LV ABC 150mm^2 Al conductor
- refitting of an existing street light fitting
- substation in a public area with ready access, requiring some traffic control
- an allocation for 10% of installation work to be done outside of normal hours

The total material[7] and plant hire component of the SKM comparative estimate is approximately [redacted], and the total constructed cost is approximately [redacted].

The variance between the SKM comparative estimate and the ActewAGL activity estimate is -2.78%, which is well within the nominal ±15% range for reasonableness. Therefore, SKM considers the ActewAGL activity estimate is efficient and reasonable.

4.3.3 Pole mount transformer replacement

SKM has based its comparative estimate on the replacement of an 11kV 315kVA pole mounted transformer, including associated switchgear, on a replacement concrete pole that is located in a public area. The SKM estimate includes a provision for traffic control, but has assumed that all work will be done during normal hours. The costs associated with the replacement of the HV concrete pole are those included in the item in section 4.1.2.

ActewAGL advised that the activity estimate has been based on a 11kV 315kVA pole mounted transformer. The ActewAGL estimate includes a material allocation of [redacted] for transformer, LVABC and miscellaneous which has been based on an average of historic costs for this activity from 4 projects between May and October 2013 (refer section 4.3.2).

ActewAGL has made an adjustment for the work being undertaken occasionally on weekends, which accounts for approximately [redacted]. There are compensating differences between the SKM and ActewAGL estimates, as the material and services allocation in the SKM comparative estimate is approximately [redacted] compared to the [redacted] allowed by ActewAGL, but the SKM labour and services allocation is approximately [redacted] higher.

The overall variance between the two estimates is approximately -8%, which is well within the nominated range, and suggests that the assumptions regarding the scope of work made by SKM are likely valid. The ActewAGL estimate is considered reasonable.

[6] Work Pack numbers 47777 (completed 28 May 2013), 47974 (completed 5 Jul 2013), 47617 (completed 14 Oct 2013) and 47629 (completed 21 Oct 2013). Each of these projects involved the rebuilding of a pole mounted substation; most were 11kV 315kVA units with a new concrete pole and some LV ABC works, with WP 47974 including the replacement of a 500kVA distribution transformer.

[7] The material only estimate component is approximately [redacted] or within 6.5% of the ActewAGL average material cost

4.4 Cable replacement

Table 5 shows a summary of the comparison between the ActewAGL unit rates for HV and LV cable replacement activities and the comparative SKM estimates.

Table 5 Cable replacement estimates

Activity	Description	ActewAGL estimate	SKM estimate	Variance
HV mains cable replacement	Installation of 1.2km of 11kV cable (200 to 400 mm square) in an urban environment between 2 terminations, and including 2 joints	[redacted]	[redacted]	-11.39%
LV CONSAC cable replacement	Replacement of LV CONSAC cables: • 1.2km of cable (200 to 400mm square) • installation of 30 termination sets • install 20 new pillars (assuming existing 12 pillars are in serviceable condition)	[redacted]	[redacted]	-12.78%

For the purposes of the comparative estimate, SKM has based its costs on trenching and backfilling. SKM recognises that the standard construction technique for ActewAGL is based on directional boring and this will contribute to a variance between the two estimates.

4.4.1 HV mains cable replacement

The SKM estimate was based on the following:

- 1.2km length of 11kV 240mm^2 Al, 3-core XLPE cable
- Cable installed in conduit
- 2 joints per kilometre
- 2 terminations
- 2 pits
- re-instatement based on 70% grass and 30% bitumen
- traffic control for urban area
- 35% contingency sum to reflect a similar allowance in the ActewAGL activity estimate

The nominated cable size for the ActewAGL estimate is an 11kV cable with a cross-section between 200mm^2 and 400mm^2.

The SKM aggregated costs for trenching activities including conduit laying, backfill and re-instatement is approximately [redacted] whilst the ActewAGL allocation for contracted services associated with trenching is [redacted] SKM considers that the requirement for directional boring has contributed to this difference.

The variance between the estimates is approximately 11%, with the ActewAGL estimate being higher than the SKM comparative estimates. The difference in trenching costs is [redacted] which is almost the dollar difference in the estimate values. Therefore, as the variance is within the nominal range, SKM considers that the ActewAGL estimate is reasonable.

4.4.2 LV mains cable replacement

CONSAC (CON-centric S-olid A-luminium C-able) is a low voltage cable that is made up of 3 solid aluminium cores and an aluminium sheath that plays the role of the neutral and gives mechanical protection. It was

introduced in the 1970s as a replacement for lead sheathed cable. Because of the conductivity of aluminium, it is a larger diameter then the copper equivalent, even though there are only three cores.

For many electricity utilities in Australia and internationally, CONSAC is prematurely reaching the end of its operational life with functional or in-service failures, and is being replaced by utilities as part of asset management and reliability programs. The performance of CONSAC has proved very susceptible to poor ground conditions and also to apparently superficial mechanical damage. In unfavourable locations it is susceptible to failure in the aluminium sheath.

The SKM comparative estimate includes:

- removal of existing LV CONSAC cable
- installation of 1.2km of LV 300 mm^2 Al, 4 cores stranded XLPE cable
- 2 cable joints
- re-instatement based on 70% grass and 30% bitumen
- installation of 20 domestic LV pillars
- traffic control for urban area

As for the HV mains activity estimate, the largest single line cost item is contracted services for building of pillar bases, directional boring conduits and reinstatement. The SKM comparative estimate has been based on in-house labour rather than an external service provider, and has been based on trenching rather than the directional boring used by ActewAGL.

The ActewAGL activity description does not specify a cable size, but advice provided was that the nominated cable size is a LV cable with a cross-section between 200mm^2 and 400mm^2.

The SKM comparative estimate is approximately 13% lower than the ActewAGL value, which is likely due to the cost of directional boring over the 1.2km length. The variance is within the nominal ±15% range for the assessment of reasonableness, and therefore SKM considers the ActewAGL estimate to be reasonable.

4.5 Services

Table 6 shows a summary of the comparison between the ActewAGL unit rates for services and pillars, and the comparative SKM estimates.

Table 6 Services estimates

Activity	Description	ActewAGL estimate	SKM estimate	Variance
New greenfields UG service	New service installed in greenfields or new suburb development; which will typically be an UG service Each crew has 1 Leading Hand, 1 Trade Assistant and 1 Metering Fitter doing 4 sites per day	[redacted]	[redacted]	-4.00%
Replacement of existing OH service	Remove old OH service and run new OH service Each OH crew consists of 2 Lineworkers and 1 Metering Fitter doing 3 sites per day	[redacted]	[redacted]	13.39%
Domestic LV pillar replacement	Replacement of unmaintainable/damaged pillars or cabinets to comply with Tech Reg & Public Safety requirements	[redacted]	[redacted]	4.95%

For each activity, SKM has relied upon its reference estimates for the comparison. These estimates may not directly reflect the construction crews nominated by ActewAGL.

4.5.1 New greenfields service

The scope of work for the ActewAGL activity estimate is:

- 10m of underground service cable 25mm^2 Al XLPE
- cable pull through existing (customer provided) conduits
- service cable joint at the property boundary
- termination at the meter box
- meter and fuses installation

The variance between the SKM comparative estimate and the ActewAGL activity estimate is approximately 4%, which is well within the nominal ±15% range for the assessment of reasonableness.

SKM considers the ActewAGL estimate to be reasonable.

4.5.2 Service replacement

SKM has assumed the following for the development of its comparative estimate:

- existing overhead service disconnected from the mains box/meter and removed
- new 15m length of 25mm^2 ABC Al 2 core installed and terminated

The SKM estimate includes an allowance of [redacted] for an EPV, assuming that the service is located in the front yard of the premises. This allocation is the primary difference between the SKM and ActewAGL estimates.

Given that the variance is approximately 13% which is within the nominal ±15% range for the assessment of reasonableness, and the primary difference is the inclusion of an EPV in the SKM comparative estimate that may not be applicable in the ActewAGL environment, the ActewAGL estimate is considered efficient and reasonable.

4.5.3 Pillar replacement

In generating the comparative estimate, SKM has assumed the LV pillar to include:

- pillar cover
- panel - 6 fuse supply pillar
- 6 off cartridge fuse link 63A HRC
- service pit
- pillar MEN earth
- cable connections

The variance between the SKM and ActewAGL estimates is approximately 5%, which is well within the nominal range and therefore SKM considers the ActewAGL estimate to be efficient. However, the ActewAGL estimate includes an allowance of [redacted] for unassigned miscellaneous contract works (shown as 50% probability of [redacted]). SKM would recommend that this estimate is reviewed to clarify the purpose for this allocation to ensure that the SKM and ActewAGL estimates have similar scopes of work.

4.6 Metering

Table 7 shows a summary of the comparison between the ActewAGL unit rates for services and pillars, and the comparative SKM estimates.

Table 7 Metering estimates

Activity	Description	ActewAGL estimate	SKM estimate	Variance
Type 6 meter replacement	Replacement of Type 6 direct-connect meters regardless of customer type (residential or commercial) Scope is approximately 3,600 per year	[redacted]	[redacted]	2.80%
Domestic meter testing	Scope is approximately 1,500 per year	[redacted]	[redacted]	-0.92%
Type 5 meter testing	Scope is approximately 20 per year	[redacted]	[redacted]	11.16%

4.6.1 Type 6 meter replacement

The unit rate used by SKM for its comparative estimate was based on a basic type 6 accumulation meter as used by distribution electricity utilities in Australia. SKM has relied upon a meter price from a NSW utility as the basis for the comparative estimate.

The variance between the two estimates is approximately 3%, illustrating that the estimated costs are highly comparable. Therefore SKM considers the ActewAGL activity estimate to be efficient.

4.6.2 Domestic meter testing

SKM based its estimate for the testing of a basic type 6 accumulation meter on the hours allowed for the installation of the meter, which is comparable to the allocation in the ActewAGL estimate. SKM has assumed that an in-house metering technician undertakes the test, and that the results are recorded by ActewAGL staff.

The two estimates are approximately equivalent, and therefore SKM considers the ActewAGL estimate to be efficient.

4.6.3 Type 5 meter testing

For the testing of a type 5 meter, ActewAGL based its activity estimate on a contracted service from Ecowise Services[8], who are an accredited meter provider to the National Electricity Market.

In contrast, SKM has based its estimate on an in-house technician conducting the test, with the results recorded by ActewAGL staff. The SKM comparative estimate is approximately 11% higher, which is reasonable given that ActewAGL uses an external service provider and therefore cost efficiencies would be expected.

Given that the ActewAGL activity estimate is a contracted service price, and the variance to the SKM comparative estimate is within the nominal range, the ActewAGL estimate is considered efficient.

[8] www.ecowise-services.com.au

4.7 Inspection

Table 8 shows a summary of the comparison between the ActewAGL unit rates for selected inspection activities and the comparative SKM estimates.

Table 8 Inspection estimates

Activity	Description	ActewAGL estimate	SKM estimate	Variance
Pole inspection	Pole inspection by ActewAGL inspectors Different levels of pole inspections have been normalised into an equivalent "standard" inspection Costing is based on one "standard" inspection	[redacted]	[redacted]	7.49%
Zone Substation thermographic inspection	Thermographic inspection of zone substation on 6-monthly cycle	[redacted]	[redacted]	7.73%
Thermographic inspection by feeder	Thermographic survey of hot spot zones during winter and summer peak load seasons Survey is organised by feeder which includes both OH and UG/ground-mounted assets ActewAGL estimate is largely based on winter 2012 thermographic survey project for 63 feeders	[redacted]	[redacted]	-19.01%
Urban inspection program	First, second and helicopter inspection and support costs • 1st inspection of 38,738 poles • 2nd inspection of 7,748 poles (20% of 1st inspection)	[redacted]	[redacted]	-7.46%

4.7.1 Pole inspection

ActewAGL has published a Management System Work Instruction *FSW203: Pole and line inspection*[9] which defines the requirements, processes and responsibilities for pole and line inspection and data capture. SKM noted that there are several levels of inspection specified in the work instruction:

- level 1 - visual and asset inspection above ground of poles
- level 2 - below ground inspection of steel and stobie poles
- level 3 - partial below ground inspection of tanalith poles
- level 4 - full below ground inspection of wood poles
- level 5 - inspecting reinforced poles
- level 6 - inspecting reinforced splinted poles
- level 7 - visual inspection for bushfire mitigation

In generating the activity estimate, ActewAGL have normalised the different levels into an equivalent "standard" inspection level. The formula for normalising the various inspection types into a "standard" inspection essentially results in 1 standard inspection as approximately equalling 1 pole.

[9] www.actewagl.com.au/Help-and-advice/Safety-advice/Preventing-damage-to-utility-networks/~/media/ActewAGL/ActewAGL-Files/About-us/Publications/Safety%20PDFs/PoleLineInspectionInstructions.ashx

In recognising the provisions and levels of inspection detailed in the work instruction FSW203, SKM has used the labour content estimated by another Australian electricity utility for a pole inspection standard job. SKM considers that this standard job includes both above and below ground inspection activities, and therefore a reasonable proxy for the ActewAGL normalised task.

Whilst the variance is approximately -7%, with the SKM estimate being the higher estimate, the actual dollar variance is only $19. Therefore, with the variance well within the nominal range of ±15% for assessment of reasonableness and the minimal dollar difference, SKM is satisfied that the ActewAGL activity estimate is efficient and reasonable.

4.7.2 Zone substation thermographic inspection

Infrared thermography (IR) is widely used by utilities as part of a predictive maintenance program for inspection of a variety of plant mechanical and electrical components. The non-contact, remote inspection capabilities of this technology make it extremely appealing for on-line, in-service inspection applications. By observing and analysing the thermal signature of an operating component, the thermographer is able to provide valuable information about the continued operability of that component.

ActewAGL has appeared to base its activity estimate on a “standard” zone substation thermographic inspection using an internal protection technician with the analysis done by an Asset Strategy & Planning engineer. SKM has based its comparative estimate on the labour content for in-house technicians to conduct the thermographic inspection and the associated analysis and report on a standard job used by another Australian utility.

As for the ActewAGL estimate, SKM has included a 15% contingency sum.

The variance between the estimates is approximately 8%, which is well within the nominal range. As the SKM estimate has not considered the relative size and number of the ActewAGL zone substations compared with other Australian electricity utilities, SKM is satisfied that the ActewAGL activity estimate represents an efficient cost for a substation inspection.

4.7.3 Thermographic inspection

ActewAGL has based its activity estimate on the average cost per feeder from the winter 2012 thermographic survey, and included inspection of both overhead and ground mounted assets. Therefore, SKM is satisfied that the estimate represents actual costs incurred rather than a normalised inspection estimate as for the ActewAGL pole and zone substation inspection activities.

SKM based its comparative estimate on standard job labour content for overhead feeder infrared inspection, and assumed a similar labour requirement for ground mounted assets on the feeder. SKM has used a technician hourly labour rate with all of the work done on overtime rates to allow for the inspection to coincide with the evening peak load. The SKM comparative estimate also included an allowance for analysis and reporting.

The variance is approximately -19%, which is outside the nominal range. However, as the ActewAGL cost has been based on historic costs, SKM is satisfied that the average labour allowances in its comparative estimate likely do not address all of the costs, particularly in regards to any costs that may be incurred in gaining access to feeders on private sites.

Therefore, whilst the variance is outside the nominal range, SKM considers the ActewAGL estimate to be reasonable.

4.7.4 Urban inspection

This ActewAGL activity estimate related to an urban inspection program involving 38,738 poles. The program allowed for an initial visual only inspection of the total population, with a projected follow-up on 20% of the population for a more detailed inspection. Also, the estimate allowed for a contracted helicopter inspection service for HV feeders in urban and fringe areas.

In generating a comparative estimate, SKM has made the following assumptions:

- SKM has adopted the helicopter inspection cost as this is a contracted service, and SKM does not have an alternate view on such costs
- labour hours for the initial overhead line and ground level visual inspections of the total pole population of 38,738 in the program as per a standard inspection job for another Australian utility
- a more detailed inspection of 7,748 poles that have presumably been identified as having defects
- allowance for a program supervisor and administrator working full-time, and a works programmer part-time
- nominal allocations for miscellaneous subcontractor services and plant hire
- all field work based on a standard linesman hourly rate

The SKM comparative estimate is an approximation of the program requirements, and does not take any consideration of costs that may be associated with gaining access to poles on private land, or any restitution costs that ActewAGL has included as a provisional sum in its activity estimate.

The variance is approximately -7%, with the SKM estimate being the lower value. However, given the assumptions made for the SKM comparative estimate, and that the variance is within the nominal range, SKM considers that the ActewAGL activity estimate is reasonable and represents an efficient costing for the inspection works related to the urban inspection.

5. Review of selected projects

5.1 Molonglo Zone Substation

5.1.1 SKM substation estimate

The cost estimate for Molonglo Zone Substation has been based on a class 4 estimate provided by SKM in November 2012, with a nominated ±50% accuracy level. The primary characteristic to define the classification category is the degree of project definition.[10]

A class 4 estimate relates to a 1% to 15% level of project definition, and regarded as typically for a concept or feasibility study.

The original estimate was based on the following high level scope:

- 5 x 132kV switchgear bays (with provision for three additional bays)
- 2 x 132kV/11kV 55MVA power transformers (with provision for a third transformer)
- 2 x neutral earthing transformers (provision for a third transformer)
- 2 x auxiliary transformers
- 2 x 11kV switchboards (provision for a third switchboard)
- substation buildings and civil works
- substation security fence
- connection to the existing 132kV Woden to Civic transmission line

The total capital cost estimate for stage 1 of the substation based on GIS technologies was [redacted] and included for the following allowances:

- **Engineering, Procurement and Construction Management (EPCM) -** the contracting strategy has been assumed to be an EPCM arrangement. EPCM allowance of 17% has been applied to the estimated capital expenditure for the works.
- **Contingency -** an average 29% contingency for costs indeterminable at this phase of the project has been included, with a 31% allowance in stage 1 and 18% to stage 2. The contingency allowance covers any potential unforeseen items of work, that must be completed, or elements of cost that are incurred, within the defined scope of work but that cannot be explicitly foreseen or described at the time the estimate is being prepared.
- **Owner's Costs -** Owner's Costs are not included in the capital cost estimate, however for project approvals and budgets the Owner must take these costs into account. SKM advised that the Owner's budget estimate should include but not be limited to general management, additional consultants and service providers, insurance and fees, legal services, bonds and licences, office overheads, land acquisition, power supply and contingency.

[10] AACE International, *Recommended Practice 17R-97: Cost Estimate Classification System*, 12 Aug 1997, p.2

Table 9 Original SKM estimate (November 2012)[11]

Cost item	Stage 1	Stage 2	Stages 1 & 2
Civil/Structural works	[redacted]	[redacted]	
Electrical works (primary & secondary)	[redacted]	[redacted]	
Sub-total direct cost	[redacted]	[redacted]	
EPCM Allowance	[redacted]	[redacted]	
Contractor's Preliminaries Allowance	[redacted]	[redacted]	
Sub-total Direct & Indirect Cost	[redacted]	[redacted]	[redacted]
Contingency Allowance	[redacted]	[redacted]	[redacted]
Contingency Allowance as %	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]

5.1.2 SKM substation estimate exclusions

Excluded from the SKM estimate was:

- legal and financing costs
- costs associated with any Environmental Impact Statements
- land acquisition, permits, approvals and Right of Way
- geotechnical investigation and reports
- spare parts
- energy costs for commissioning
- growth
- unexpected and unidentified site conditions
- unforeseen labour requirements
- labour disputes
- Force Majeure
- allowance for any variation to scope
- project risk allowance
- foreign exchange variations
- escalation after the estimate base date
- customs duty
- Good and Services Tax (GST)

[11] There are some minor rounding off errors

5.1.3 ActewAGL project cost estimate

ActewAGL has prepared a project estimate[12] including:

- land acquisition
- concept design in two phases
- SKM capital works estimate for substation works, split across three years for detailed design & construct expenditure - 20% in year 1, 50% in year 2 and 30% in year 3
- access road costs
- operational and maintenance costs

In doing so, ActewAGL estimate has added 15% for overhead costs and included separate contingency sums on land acquisition, concept design, access road construction, and operational and maintenance costs. The ActewAGL estimate also includes a 30% owner's contingency allowance. This allowance would be expected to cover general uncertainties and risks outside of the scope of work of the project, such as scope changes, growth allowances, estimate errors and omissions, variations in labour productivity, pricing and quantity variations within the defined scope and delivery delays and other unexpected and unidentified considerations.

SKM considers that these additional allowances are appropriate, and address cost factors that were excluded from the original SKM estimate (refer section 5.1). The base estimate used by ActewAGL in its project cost estimate is the [redacted] total as shown in Table 9. The summary of the cost estimate for ActewAGL project cost estimate is set out in Table 10.

Table 10 Molonglo Zone Substation project cost estimate

Description	Estimated Cost
SKM estimate	
Civil and structural works	[redacted]
Electrical works	
Sub-total direct cost	
EPCM allowance (17%)	
Contractor's preliminaries allowance (9%)	
Sub-total direct & indirect cost	
Contingency allowance (31%)	
Total SKM estimate including allowances	
ActewAGL estimate	
Substation works (based on SKM estimate)	
11kV feeder line works	
Overheads (15%)	
Contingency (30%)	
Sub-total including allowances	
Land	
Concept design	
Access road	
Total ActewAGL estimate	

[12] ActewAGL, *Molonglo Zone Substation Cost Estimate Rev 1 0.xlsx*, 25 September 2013

5.2 Mitchell Zone Substation

The Mitchell Zone Substation estimate has been based on the Molonglo Zone Substation estimate, with added scope to include for 132kV line augmentation works.

The ActewAGL estimate uses the SKM estimate as a base and adds the following costs:

- overhead costs of 15%
- contingency of 30%
- land, concept design, road access, 132kV line augmentation costs

Table 11 sets out a summary of the ActewAGL project cost estimate for Mitchell Zone Substation.

Table 11 Mitchell Zone Substation project cost estimate

Description	Estimated Cost
SKM estimate	
Civil and structural works	
Electrical works	
Sub-total direct cost	
EPCM allowance (17%)	
Contractor's preliminaries allowance (9%)	
Sub-total direct & indirect cost	
Contingency allowance (31%)	
Total SKM estimate including allowances	
ActewAGL estimate	
Substation works (based on SKM estimate)	
132kV line augmentation allowance	
Overheads (15%)	
Contingency (30%)	
Sub-total including allowances	
Land	
Concept design	
Access road	
Total ActewAGL estimate	

As with the Molonglo Zone Substation estimate, the ActewAGL estimate has added 15% for overhead costs and included separate contingency sums on land acquisition, concept design, access road construction, and operational and maintenance costs. The ActewAGL estimate also includes a 30% owner's contingency allowance. This allowance would be expected to cover general uncertainties and risks outside of the scope of work of the project, such as scope changes, growth allowances, estimate errors and omissions, variations in labour productivity, pricing and quantity variations within the defined scope and delivery delays and other unexpected and unidentified considerations.

SKM considers that these additional allowances are appropriate, and address cost factors that were excluded from the original SKM estimate (refer section 5.1).

5.3 Belconnen Zone Substation augmentation

The Belconnen zone substation is being upgraded to increase the reliability of the substation and to meet the current and forecast demand.

It is noted that the Belconnen Zone substation scope of work include:

- install & commission 3 x 132kV switchgear bays (line bay, transformer bay & bus section)
- install & commission 1 x 132kV/11kV power transformer
- install & commission 1 x 11kV switchboard
- new 11kV switch room building
- commission all associated protection and control for the above assets

132kV line augmentation works

- towers and structures to connect 132kV subtransmission line to new substation line bay

Table 12 sets out a summary of the project cost estimate as prepared by ActewAGL for the Belconnen Zone Substation.

Table 12 Belconnen Zone Substation project cost estimate

Description	Estimated Cost
SKM estimate	
Civil and structural works	[redacted]
Electrical works (primary only)[13]	
Sub-total direct cost	
EPCM allowance	
Contractor's preliminaries allowance	
Sub-total direct & indirect cost	
Contingency allowance	
Total SKM estimate including allowances	
ActewAGL estimate	
Substation works (based on SKM estimate)[14]	
ActewAGL adjustment to SKM estimate[15]	
Overheads (15%)	
Contingency (20%)[16]	
Sub-total including allowances	
Concept design	
Total ActewAGL estimate	

[13] SKM estimate for Molonglo Zone Substation primary electrical work based on GIS switchgear was [redacted]

[14] ActewAGL activity estimate rounds this total allowance nominally to [redacted] in its Belconnen project estimate and split the contract services allowance as 30% in phase 1 and 70% in phase 2

[15] SKM noted that the values calculated by ActewAGL were based on a total value of [redacted], and therefore SKM has shown this variance as an adjustment in this table

[16] Percentage set by ActewAGL based on the level of engineering completed for the estimate

The ActewAGL cost estimate considers only the electrical primary system portion of the SKM estimate for Molonglo Zone Substation and excludes costs associated with civil & structural, secondary system, SCADA and communications, and any provisions for EPCM, contractor preliminaries and contingency. The ActewAGL activity estimate has added 15% for overhead costs and 20% contingency allowance, together with separate allocations for concept design, and operational and maintenance costs.

In the primary electrical works within the SKM Molonglo substation estimate, allowances are included for 132kV switchgear, 132/11kV power transformers, 11kV switchboard and associated test and commissioning costs. The SKM primary electrical works estimate also includes provisions for connecting the new substation bay to a 132kV transmission line. However, allocations [17] for an 11kV switchroom building are included in the civil/structural works of the SKM substation estimate, which has been excluded from the ActewAGL activity estimate.

ActewAGL has advised SKM that the Belconnen activity estimate has considered approximately [redacted] for the marginal SCADA and communication for the 3rd transformer bay as Belconnen Zone Substation already has an RTU and communication for the two transformer zone substation.

Although a contingency allowance of 20% has been made for general uncertainties and risks outside of the scope of work of the project, the allowance would generally not be expected to also cover project level allowances for EPCM, contractor preliminaries, and potential unforeseen items of work and elements of cost within the defined scope of work. SKM recommends that ActewAGL review its project cost estimate to clarify and verify that the estimate adequately considers all elements of expected cost.

[17] SKM included [redacted] for 11kV switchgear and secondary system building in the Molonglo substation works estimate

6. SKM findings

6.1 Activity estimate summary

Table 13 shows a summary of the comparisons between the ActewAGL activity estimate and the SKM comparative estimates for the 22 specified activities, grouped by the related asset categories.

Table 13 Summary of comparisons

Asset Category	Activity	ActewAGL estimate	SKM estimate	Variance
Pole replacement/refurbishment	Transmission pole replacement	[redacted]	[redacted]	-7.21%
	HV concrete pole replacement			-10.36%
	LV concrete pole replacement			-14.52%
	LV fibreglass pole replacement			-5.45%
	Pole reinforcement			-2.44%
	Pole neutral bonding			-1.51%
Switchgear maintenance	Hazemeyer RMU maintenance			11.25%
Transformer replacement	500kVA pad mount transformer replacement			-4.59%
	Two-pole substation rebuild into one-pole configuration			-2.78%
	Pole mount transformer replacement			-7.63%
Cable replacement	HV mains cable replacement			-11.39%
	LV CONSAC cable replacement			-12.78%
Services	New greenfields UG service			-4.00%
	Replacement of existing OH service			13.39%
	Domestic LV pillar replacement			4.95%
Metering	Type 6 meter replacement			2.80%
	Domestic meter testing			-0.92%
	Type 5 meter testing			11.16%
Inspection	Pole inspection			7.49%
	Zone Substation thermographic inspection			7.73%
	Thermographic inspection by feeder			-19.01%
	Urban inspection program			-7.46%

Therefore, in summary there are 21 ActewAGL estimates that are considered reasonable, with 14 higher than the comparative SKM estimate, and 7 that are lower, whilst there is 1 which is outside the nominal ±15% range for assessment of reasonableness.

6.2 Activity estimates within nominal variance

In reviewing the ActewAGL activity estimates, SKM has used a nominal ±15% variation as an assessment of the reasonable in comparison with reference estimates prepared by SKM for similar scope activities. For those activities with a variance within the nominal range, Table 14 shows the ActewAGL estimates that were lower than the SKM comparison estimate and Table 15 shows the ActewAGL estimates that are greater than the SKM estimate.

Table 14 Activity estimates lower than SKM comparative estimate

Asset Category	Activity	ActewAGL estimate	SKM estimate	Variance
Switchgear maintenance	Hazemeyer RMU maintenance	[redacted]	[redacted]	11.25%
Services	Replacement of existing OH service	[redacted]	[redacted]	13.39%
	Domestic LV pillar replacement	[redacted]	[redacted]	4.95%
Metering	Type 6 meter replacement	[redacted]	[redacted]	2.80%
	Type 5 meter testing	[redacted]	[redacted]	11.16%
Inspection	Pole inspection	[redacted]	[redacted]	7.49%
	Zone Substation thermographic inspection	[redacted]	[redacted]	7.73%

- For the switchgear activities, the variance was due to differences in the labour hours allowed in the ActewAGL and SKM estimates. The major difference in the RMU maintenance was the SKM allocation for testing; the difference for the replacement of switchgear was effectively less than ½ hour of a linesman time.
- For the services activities, SKM has included an EPV in the replacement of the overhead service which may not be applicable in the ActewAGL network where such services are often located in the backyard of private premises. The estimates for the replacement of a domestic LV pillar are relatively close, although the full scope of the ActewAGL estimate is not clear as it has a lump sum for contracted services that have not been described.
- The metering estimates are relatively close in dollar terms. SKM has used prices for the NSW market in its comparative estimates, and assumed the use of in-house labour, whilst the type 5 meter test is a contracted service to ActewAGL. In both cases, SKM considers that the ActewAGL estimates are efficient and reliable.
- The scopes of the inspection activities are not clearly defined, and SKM has relied upon standard job estimates used in developing operational expenditure forecasts for Australian electricity utilities. Similarly, ActewAGL normalised the different levels of inspection to produce a “standard” job for both the pole and zone substation infra-red inspections. Therefore, given the variance in the ActewAGL and SKM estimates were within the nominal range for reasonableness, SKM is satisfied that the ActewAGL estimates are a reasonable basis for the development of an operational expenditure forecast.

Table 15 Activity estimates higher than SKM comparative estimates

Asset Category	Activity	ActewAGL estimate	SKM estimate	Variance
Pole replacement/refurbishment	Transmission pole replacement	[redacted]	[redacted]	-7.21%
	HV concrete pole replacement			-10.36%
	LV concrete pole replacement			-14.52%
	LV fibreglass pole replacement			-5.45%
	Pole reinforcement			-2.44%
	Pole neutral bonding			-1.51%
Transformer replacement	500kVA pad mount transformer replacement			-4.59%
	Two-pole substation rebuild into one-pole configuration			-2.78%
	Pole mount transformer replacement			-7.63%
Cable replacement	HV mains cable replacement			-11.39%
	LV CONSAC cable replacement			-12.78%
Services	New greenfields UG service			-4.00%
Metering	Domestic meter testing			-0.92%
Inspection	Urban inspection program			-7.46%

- All of the ActewAGL estimates for pole replacement/refurbishment activities are higher than the SKM comparison estimate. In particular, the replacement of a transmission/HV/LV poles, SKM has not included a provision for water boring which is typically [redacted] and which essentially accounts for the difference in the estimate values.
- SKM has no market data available regarding the procurement and installation of fibreglass poles, and has relied upon the ActewAGL purchase cost and an adjusted estimate for the labour required based on the installation of an LV concrete pole.
- The estimates for the pole refurbishment activities are highly comparable.
- There is no specific cost item that has been identified as the cost difference between the SKM and ActewAGL estimates for transformer replacement, and the variances falling with the nominal range for reasonableness is in part due to compensating differences in the SKM and ActewAGL estimates:
  - For the pad mount unit, SKM modified its standard reference estimate to reflect the ActewAGL project activity scope as described, and the material costs in the SKM and ActewAGL estimates were comparable. SKM relied upon estimates of in-house labour and plant hire, whilst ActewAGL included provisional sums for miscellaneous contract service and plant hire costs which balanced the SKM allowances.
  - For the pole mount unit, there is a considerable difference in the material allocations between the SKM and ActewAGL estimates that has been offset by the SKM higher allocation for labour/services/plant. The ActewAGL material allocation has been based on an average cost from previous projects, and does not specify a transformer rating or any associated materials.
- For the HV and LV mains cable replacement activities, the primary difference between the SKM and ActewAGL estimates was the cost associated with directional boring. For both comparative estimates, SKM used its standard reference estimate which is based on internal labour and open trenching and reinstatement, whilst ActewAGL have based both of their estimates on directional boring rather than open trenching, and in the case of the LV cable, contracted services to undertake the directional boring work. All other costs between the estimates were comparable.

- The estimates for the testing of a domestic meter are highly comparable.
- For the development of the comparative estimate, SKM assumed that all ground based inspections are visual only, and the initial inspections is a brief visual identification of any identifiable defects, and the second inspection is a more detailed visual check to verify any priority defects that were reported. SKM accepted the ActewAGL estimate for costs associated with helicopter inspection of feeders in urban and fringe areas.

6.2.1 SKM recommendations

To assist with the assessment of the efficiency of the unit rate estimates, SKM would recommend the following:

- The pole inspection unit rate has been based on a standard job that is a normalisation of the different levels of inspection that ActewAGL applies to its pole population. In comparing costs, SKM has relied upon standard job costs from other electricity utilities that may or may not reflect the intent or scope of the normalised inspection task. SKM suggests that ActewAGL outlines the methodology used in normalising this activity, and the effective scope of work that results to ensure a like-for-like comparison.
- In some unit rates, the ActewAGL activity estimate has included a lump sum for contracted services that does not adequately explain the reason for the provision, which makes a comparison with a reference estimate difficult. For the LV pillar, SKM recommends that the scope covered by the lump sum allowance for contracted services is clarified - whilst the variance between the SKM and ActewAGL estimates is relatively small, there is insufficient information to verify that the scopes are comparable.
- The comparison of transformer replacement activities would be assisted through the estimate nominating the typical voltage and rating for the pad or pole mount transformer, together with any associated switchgear that is included in the unit rate.
- For all of the activities relating to replacement tasks, it is not apparent if the estimates include the recovery and/or disposal of the existing asset. Only in instances where it was directly implied, SKM has included costs for asset recovery; otherwise, SKM excluded any consideration of recovery and disposal costs. SKM recommends that ActewAGL specify in the activity description whether such costs are included or excluded.

6.3 Activity estimate outside nominal variance

Table 16 shows the ActewAGL activity estimate with a variance to the SKM comparison estimate that are outside the nominal range of ±15%.

Table 16 Activity estimate outside nominal range

Asset Category	Activity	ActewAGL estimate	SKM estimate	Variance
Inspection	Thermographic inspection by feeder	[redacted]	[redacted]	-19.01%

SKM has relied upon standard job costs from other Australian utilities for thermographic inspections of feeders and ground mounted assets, and accepts that there may be additional allowances in the ActewAGL estimate for access to feeders on private sites that have not been included in the SKM comparative estimate. As a result, whilst the variance is outside the SKM nominal range for assessing reasonableness, SKM is satisfied that the ActewAGL estimate reflects historic costs for this activity, and is therefore reasonable.

6.3.1 SKM recommendations

To assist with the assessment of the efficiency of the unit rate estimates, SKM would recommend the following:

- SKM recommends that ActewAGL provides more information with regards to the materials included in the thermographic inspection estimate to assist the assessment of cost efficiency and identify the primary factors in the variance.

6.4 Substation estimates findings

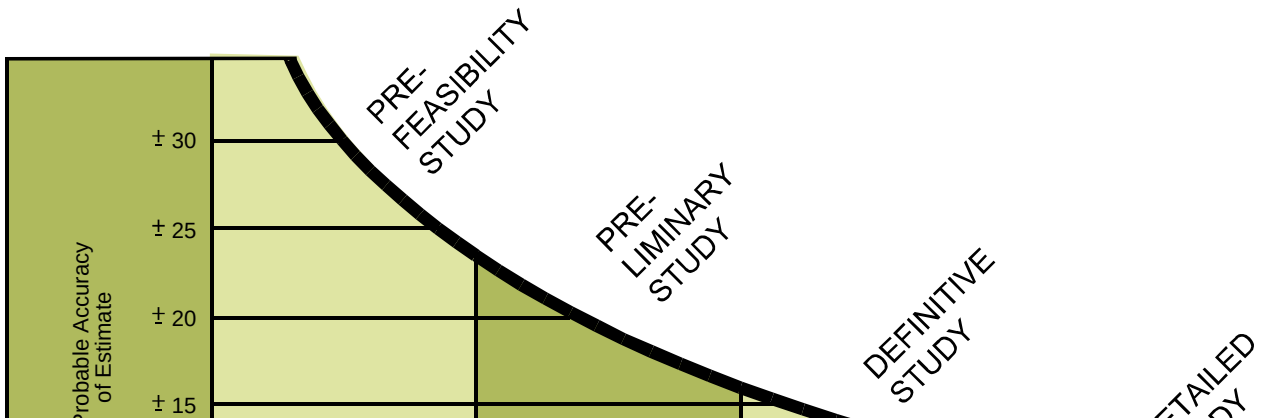
SKM has reviewed the 3 zone substation project cost estimates that ActewAGL provided. All 3 have used an estimate prepared by SKM for substation works in Molonglo Zone Substation as the base, and adjusted this for additional concept design costs, ActewAGL overheads, access road costs, and operational and maintenance costs.

For the Molonglo and Mitchell substation project estimates, SKM considers that ActewAGL has appropriately considered the inclusions and exclusions of the original Molonglo substation works estimate, and applied reasonable additional allowances for land acquisition, concept design, access road, overhead costs and an owner's contingency allowance for project uncertainties and risks outside of the project scope. SKM is satisfied that there is no duplication in contingency allowances.

For the Belconnen substation project estimate, SKM considers that whilst the ActewAGL estimate has adequately considered the scope of works for Belconnen Zone Substation and included a reasonable allowance from the original Molonglo substation works estimate for the electrical primary works, SKM is of the opinion that ActewAGL may not have included sufficient allocations for EPCM, contractor and contingency sums. SKM recommends that ActewAGL review its project cost estimate to clarify and verify that the estimate adequately considers all elements of expected cost.

Appendix A. Engineering estimate accuracy

Figure 1 Standard Estimate Accuracy Levels



Type of Estimate	Order of Magnitude	Preliminary	Definitive	Detailed
Provided Documentation	• Product capacity and Location • Cost Data on Similar Projects • Major Equipment List	• Preliminary Equipment List • Engineering Line Diagram • Plant Outline General Arrangement • Maps and Surveys • Bench Test Results • Nature of Facilities	• Equipment Specifications and Vendor Quotations • Construction Schedule • Electrical One Lines • Piping and Instrumentation Flow Diagrams • Soil Data and Architect Features • Site Survey and Labour Complete	• Bulk Material Specifications and Vendor Quotes • Construction Specification and Sub Contractor Quotations • Engineering Advanced Approximately 10%
Definition of Scope of Work	Conceptual	Approximate	Clearly Described Essentially Complete	Complete. Well Detailed
Estimating Procedure	Factoring	Combination of Factoring and Quantity Take-Off	Most Quantity Take-Off. Very little Factoring	Complete Quantity Take-Off
Use of Study	Comparison/ Rejection	Final Feasibility	Budget	Funding