



Unit Cost Efficiency Assessment

Energex

19 December 2018

Executive summary

Energy Queensland is preparing Energex's regulatory submission for the period 2020/25 to the Australian Energy regulator (AER). As part of this process, GHD was engaged by Energy Queensland to undertake a comparative review of unit rates for a selection of capital augmentation and replacement activities that are included in the forecast Energex expenditure programs.

In assessing the efficiency of the proposed Energex unit rates, GHD developed Class 4 ($\pm 30\%$) comparative estimates based on available market, in-house and public data, and calculated the variance of these estimates to the total Energex estimate values. Table 1 shows the summary of these comparisons.

The assessment uses a traffic light display, with variances in green being within the nominal $\pm 15\%$ range for reasonableness adopted by GHD, yellow for those variances between ± 15 and $\pm 15.5\%$ and red for variances outside $\pm 15.5\%$.

Table 1 Summary of estimate comparisons

Activity	Building Block	Energex Estimate	GHD Estimate	Variance
Pole replacement	Replace LV wood pole	\$6,563	\$7,461	14%
Pole replacement	Replace 11 kV wood pole	\$9,191	\$10,274	12%
Pole replacement	Replace 33 kV wood pole	\$13,209	\$14,363	9%
OH conductor replacement	Re-conductor 11 kV OH line	\$512,387	\$498,178	-3%
OH conductor replacement	Re-conductor 33 kV SCCT OH line	\$925,182	\$985,018	6%
OH conductor replacement	Replace copper pilot cable communications bearer	\$505,576	\$562,460	11%
OH conductor replacement	Replace LV mains with ABC	\$112,602	\$116,030	3%
Cable replacement	Replace 33 kV UG feeder	\$2,376,592	\$2,255,011	-5%
New distribution feeder	Construct new 11 kV feeder	\$494,026	\$523,003	6%
Services	LV OH service cable replacement	\$559	\$617	10%
Switchgear replacement	Replace 11 kV air break switch	\$14,418	\$13,861	-4%
Switchgear replacement	Replace 11 kV switchgear in C&I substation	\$579,943	\$537,512	-7%
Switchgear replacement	Replace 11 kV switchgear in zone substation	\$487,110	\$534,120	10%
Switchgear replacement	Replace 33 kV OD circuit breaker	\$748,974	\$830,351	11%
Transformer replacement	Replace instrument transformers	\$253,732	\$221,486	-13%
Transformer replacement	Replace 33/11 kV 8 MVA transformer	\$720,160	\$659,832	-8%

Activity	Building Block	Energex Estimate	GHD Estimate	Variance
Transformer replacement	Replace 33/11 kV 25 MVA transformer	\$1,020,790	\$936,560	-8%
Transformer replacement	Replace 110 kV 60 MVA transformer	\$2,237,304	\$2,251,210	1%
Zone Substation upgrade	Upgrade 33/11 kV 25 MVA zone substation	\$1,369,190	\$1,222,413	-11%

In conducting the comparisons, GHD adjusted its reference estimates to achieve close alignment with the Energex work descriptions where these were provided.

GHD is of the opinion that the Energex activity unit rates for the selected activities are reasonable and efficient compared with average market costs for similar work in the Australian electricity industry.

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1. Introduction

1.1 Purpose of report

Energy Queensland is preparing Energex's electricity distribution regulatory submissions to the Australian Energy Regulator (AER) for the 2020-25 regulatory control period. GHD (we) has been engaged to independently assess the efficiency of internal unit costs for routine asset replacement activities. Any significant differences between Energy Queensland's estimates and our estimates will be identified and evaluated.

1.2 Selected activities

This report will assess the reasonableness of unit costs for the following capex activities:

- Replacement of LV wood pole
- Replacement of 11 kV wood pole
- Replacement of 33 kV wood pole
- Re-conductoring of 11 kV overhead line
- Re-conductoring of 33 kV SCCT overhead line
- Replacement of copper pilot cable communications bearer
- Replacement of LV mains with ABC
- Replace 33 kV underground feeder
- New 11 kV feeder
- Replacement of LV overhead service
- Replacement of 11 kV air break switch
- Replacement of 11 kV indoor switchgear in C&I substation
- Replacement of 11 kV indoor switchgear in zone substation
- Replacement of instrument transformers
- Replacement of 33 kV outdoor circuit breaker
- Replacement of 33/11 kV 8 MVA skid mounted transformer
- Replacement of 33/11 kV 25 MVA transformer
- Replacement of 110 kV 60 MVA transformer
- Urban Zone Sub upgrade of 33/11 kV 25 MVA transformer

1.3 Assumptions

In generating the comparative estimates and assessing the reasonableness of the Energy Queensland estimated unit rates for the nominated Energex building blocks, we have assumed the following:

- The scope and approach are 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 market conditions in which Energex operates.
- The costs are based on current costs in 2018/19 direct dollars. No allowances for price escalations or potential exchange rate fluctuations have been included.
- The Energex unit costs include costs for planning, design and project management.

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- Energex on-costs have not been included in the rates reviewed and no contingency or risk allowance has been allocated to these values.
 - Energex estimates do not include provision for operational fleet and equipment.



2. Assessment approach

We have used comparative estimates based on market cost data for establishing a benchmark to assess the efficiency of the Energex unit rates.

Based on these estimate classifications, and assuming that Energex has included consideration of historic project data in developing its building block unit rates, we have developed Class 4 estimates ($\pm 30\%$)¹ for the asset replacement activities and zone substation projects as a comparative benchmark for the Energex unit costs.

While we independently estimated the unit rates for the nominated capital and maintenance works from our own data sources, we recognise that Energex may have particular design and field work requirements.

Where possible, we have adjusted our comparative estimates to consider any differences in work scope between that underpinning our estimates and that underpinning the Energex estimates. We have also taken into account specific Energex construction requirements (particularly where clear differences in cost drivers exist relative to requirements of other utilities) and geographic factors; otherwise, we have reviewed the variance in the comparative estimate to identify the difference in allowances between Energex's and our benchmark estimates.

We have applied a nominal criterion of $\pm 15\%$ as the first pass test of reasonableness for comparing the Energex estimates with our reference comparative estimates. Where there is a variance between the Energex estimate for a replacement activity or substation project, and our comparative estimate of less than $\pm 15\%$, we have assessed the Energex estimate as reasonable.

For Energex estimates where the variation is outside our nominal range, we have assessed any identifiable replacement activity or project-specific issues, or work practices, to establish the potential reasons for the cost difference. We have provided a final view on whether the associated costs of the activity can be considered reasonable and suitable for use in generating capital expenditure forecasts for the 2020/25 period.

¹ Based on Association for the Advancement of Cost Engineering (AACE) cost classification system

3. Estimating assumptions

3.1 Data sources

The data sources used for the development of unit rates include:

- Market cost data available through recent operational and capital expenditure reviews for electricity distribution utilities
- Contract and procurement costs available for recent projects completed by electricity utilities
- Material cost data that may be obtained from suppliers
- Recent asset valuations by GHD
- Cost data available in the public domain, including standard labour costs
- Category RIN data submitted by Australian electricity distribution utilities

These costs may not necessarily reflect the actual costs incurred by Energex.

3.2 Labour rate

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

- Basic hourly rates and allowances based on typical electricity industry awards for three categories of workers: senior technician/engineer, electrical line worker and plant operator
- Market average values for on-costs considered:
 - Leave - annual, personal, long service, statutory holidays
 - Workers Compensation
 - Payroll tax

The labour rate adopted for our estimates was developed on the assumption that Energex will be utilising its own field personnel for network augmentation and asset replacement activities, including protection and commissioning.

The standard direct cost hourly rates that we used are:

- Senior technician/engineer - \$124 per hour
- Linesman - \$106 per hour
- Plant operator - \$86 per hour

These labour rates exclude consideration of profit or GST.

Our hourly rates do not include any allowances for corporate or business overheads. This is consistent with Energex's estimates, given that Energex's estimates represent direct costs only.

The hourly rates used in our comparative estimates are not intended to directly reflect the various skill levels and associated hourly rates used by Energex in generating its unit rates.



3.3 Work scope

We have based our comparative estimates on our standard reference assets, which are typically used in support of asset valuations and project pre-feasibility and feasibility estimates.

Although we have independently estimated the unit rates for the nominated capital works from our own data sources, we appreciate that there may be differences in work scope and/or practices that Energex has adopted due to its network design, coverage and field work requirements. We have adjusted our comparative estimate to allow for reasonable comparison and alignment of scopes where differences in scope or work practices between the Energex and our comparative estimates were identified.

3.4 Level of accuracy

In establishing a criterion for assessing the reasonableness of the Energex unit rates, we are 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.

We note that the Energex's activity estimates have been provided to a component level of precision, including allowance for overtime and engineering/supervisory support, and we expect the estimates have been based on historic actual project costs or contracted service costs. Therefore, we consider the estimates to be within the Preliminary Study phase, but towards the top end of the range for that phase.

4. Unit rate review

We have grouped the estimates for the selected building blocks into activity groups.

For each comparison, the variance has been calculated as the variance of our comparative estimate from the Energex building block estimate. Table values shaded in green are within the nominal $\pm 15\%$ range and are considered reasonable. Variances outside of this range are shaded in yellow or red, and the associated commentary will highlight the differences that have been identified as contributing factors.

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

Where possible, we have used our comparative estimates for pole and service replacement in other activities where the Energex building block work scope for overhead re-conductoring or construction included such activities. Similarly we adapted our 33/11 kV 25 MVA transformer replacement comparative estimate for inclusion in the 33/11 kV zone sub upgrade unit rate estimate.

For each activity, we have relied upon its standard comparative estimate for the comparison. As such, these estimates may not directly reflect the construction crews nominated by Energex, the cost allocation method applied in the Energex estimates or the detailed material/labour/plant allocations used by Energex. In several instances, our comparative estimate has relied on single-line costs available to us, which we have attempted to split materials/labour to support any additional analysis that may be required if the variance is outside our nominal $\pm 15\%$ reasonable assessment test.

4.1 Pole replacement

Table 2 shows a summary of the comparison between the Energex unit rates for pole replacements and our comparative estimates.

Table 2 Pole replacement estimates

Activity	Description	Energex Estimate	GHD Estimate	Variance
LV wood pole replacement	Replacement of 11 m/8 kN wood pole incl. associated line post insulators & hardware	\$6,563	\$7,461	+14%
11 kV pole replacement	Replacement of 14 m/12 kN wood pole incl. HV & LV cross-arms, bridges, insulators & line hardware	\$9,191	\$10,274	+12%
33 kV pole replacement	Replacement of 18 m/12.5 kN wood pole incl. bridges, line post insulators & line hardware	\$13,209	\$14,363	+9%

In each instance, our comparative estimates were higher than those generated for the Energex area, although within our nominal $\pm 15\%$ range for assessing reasonableness. A comparison of the Energex and our comparative unit rates found:

- the allocations for materials in the Energex unit rates and the aggregated materials/plant from our comparative estimates were highly comparable for LV and 11 kV poles (1-3%) and reasonable for 33 kV poles (13%)

- there was good capability in the total labour hours (in the 3-12% range) between our and Energex's unit rates
- we included an equivalent allowance for overtime as specified in the Energex building block work scopes
- the primary difference in the estimates is due to our slightly higher overall average labour rate.

The variances are within our nominal assessment range of $\pm 15\%$, and therefore we consider the Energex estimates for wood pole replacements to be efficient.

4.2 Overhead conductor replacement

Table 3 shows a summary of the comparison between the Energex unit rates for re-conductoring of existing 3-phase and LV overhead lines, and replacing an existing copper communications cable with our comparative estimates.

Table 3 *Overhead conductor replacement estimates*

Activity	Description	Energex Estimate	GHD Estimate	Variance
11 kV OH line re-conductoring	Recover existing OH conductor, install 2.4 km of 7/3.75 AAC Moon conductor & 400 m of 120 mm ² cable, replace 22 off 12.5 m/8 kN wood poles, replace 14 off 14 m/20 kN wood poles, replace 36 services, transfer 48 services	\$512,387	\$498,178	-3%
33 kV SCCT OH line re-conductoring	Recover existing OH conductor, install 6 km of 19/3.75 AAC Pluto conductor, replace 12 off 17 m/20 kN shackle wood poles, replace 12 off 17 m/20 kN angle wood poles, replace 24 off 17 m/20 kN intermediate wood poles, install OPGW, replace 50 services, transfer 50 services	\$925,182	\$985,018	+6%
Copper pilot cable communications bearer replacement	Recover existing pilot cable, install 4 km of optical 72-fibre cable, install 1.3 km of optical 72-fibre cable in existing conduit, install 75 m of optical 72-fibre cable in new conduit	\$505,576	\$562,460	+11%
LV mains with ABC replacement	Recover existing LV mains, install 1.05 km of 25 mm ² 2-core LV ABC conductor, replace 10 off 11 m/12 kN wood poles, replace 20 services	\$112,602	\$116,030	+3%

4.2.1 Re-conductor 11 kV OH line

The Energex activity involved the replacement of 2.4 km of overhead conductor, requiring our comparative estimate to be adapted as our reference estimate is based on a per km basis. We included consideration of the specified number of pole replacements (using the standard comparative estimates developed for the wood pole replacement unit rates - refer section 4.1) and the replacement and transfer of overhead services (refer section 4.5).

Considering this building block is heavily based on other unit rates otherwise assessed as reasonable, there is relatively good comparison between the material² and labour allocations in the Energex and our comparative estimates. The overall variance is -3%, from which we assessed the Energex cost is efficient.

4.2.2 Re-conductor 33 kV OH line

In developing this estimate, we relied upon wood pole replacement estimates (refer section 4.1) and overhead services (refer section 4.5) and material costs available to us for 19/3.75 AAC Pluto overhead conductor and 72-core OPGW conductor.

We identified a small -3% difference in the total number of labour hours³ between the Energex estimate and our comparative estimate, with the 15% difference in labour cost allocations being due to our slightly higher labour rates.

There is no substantive difference in the aggregate material/plant allocations in the Energex and our estimates. We adopted the allowances for shackle, strain and suspension fittings for Pluto conductor, and traffic control allowances⁴ as used in the Energex estimate to ensure there was compatibility in the estimate work scopes.

The overall variance is +6%, which is within our nominal test for reasonableness. Given the close match in labour costs, and no variance in aggregate material/plant costs, we are satisfied that the Energex estimate is efficient.

4.2.3 Replace communications cable

For the replacement of fibre optic cable, the comparison between the estimates is:

- 13% difference in materials cost
- 7% difference in labour costs
- overall variance of 11%

These component allocations are considered as reasonable, with the primary difference in labour costs being due to our slightly higher labour rates used in our comparative estimates.

With the overall variance being 11%, we consider the Energex building block unit rate to be efficient.

4.2.4 LV mains replacement with ABC

The material and labour hour allocations for the Energex estimate and our comparative estimate were highly comparable, with the primary difference being our slightly relatively higher overall labour rate.

² Our equivalent allocation for Materials included materials and plant costs

³ Energex total labour hours 5,102 vs our comparative estimate 4,952 hours

⁴ We have adopted the Energex allowances as we do not have sufficient market information available to properly assess the traffic control requirements to suit the specific work scope for this building block

The variances are well within the nominal $\pm 15\%$ range for the assessment of reasonableness, and therefore we consider the Energex estimates to be efficient.

4.3 Cable replacement

Table 4 shows a summary of the comparison between the Energex unit rate for replacing a section of an existing 33 kV underground feeder and our comparative estimate.

Table 4 Cable replacement estimate

Activity	Description	Energex Estimate	GHD Estimate	Variance
33 kV UG feeder	Install 1.4 km of DC 630 mm ² 1-core Cu XLPE cable (1000 m trench in urban soil, 350 m trench in urban rock, 60 m trench in urban road crossing)	\$2,376,592	\$2,255,011	-5%

For the nominated work scope for this building block, the comparison of estimates identified:

- there is a -6% variance in material costs - to ensure comparability between the Energex and our estimates, we included the Energex material allowance of \$115 k for fluidised thermal bedding in the trench; the remaining variance is an aggregation of small differences across item rates and general material allowances between the two estimates
- labour cost allocations were within 6%, with the primary reason for the difference being the slightly higher number of labour hours and our average hourly rate in our comparative estimate
- the overall variance of -5% is within our nominal test for reasonableness.

For our assessment, we consider the Energex estimate for 33 kV UG feeder work is efficient.

4.4 New distribution feeder

Table 5 shows a summary of the comparison between the Energex unit rate for a new 11 kV distribution feeder (with both overhead and underground sections) to break up an existing overhead (OH) network and our comparative estimate.

Table 5 New 11 kV feeder estimate

Activity	Description	Energex Estimate	GHD Estimate	Variance
Build 11 kV feeder	New 1000 m OH line using 7/3.75 AAC Moon conductor, 2 off termination wood poles, 2 off shackle wood poles, 11 off intermediate wood poles, new 600 m UG using 400 mm ² 3-core Cu cable in conduit	\$494,026	\$523,003	+6%

The work scope for this building required the following components:

- 1000 m OH line using 7/3.75 AAC Moon conductor (refer section 4.2.1)

- 2 off 11 kV termination wood poles, 2 off 11 kV shackle wood poles and 11 off 11 kV intermediate wood poles (refer section 4.1)
- new 600 m UG using 400 mm² 3-core Cu cable in conduit
- new 11 kV air break switch (refer section 4.6)

Our labour allocation is higher than the Energex estimate; which was offset by higher Energex material allocations (including provision for disposing soil spoil from the UG trenching).

The overall variance of 6% is well within the nominal range, and we are satisfied that the Energex estimate is efficient.

4.5 Services

Table 6 shows a summary of the comparison between the Energex unit rate for replacing an LV overhead service and upgrading an existing LV mains, and our comparative estimate.

Table 6 Services estimate

Activity	Description	Energex Estimate	GHD Estimate	Variance
LV OH service cable replacement	Recover existing service, install 25 mm ² Al XLPE service conductor incl. minor hardware	\$559	\$617	+10%

The material and labour hour allocations for the Energex estimate and our comparative estimate were highly comparable, with the primary difference being our slightly relatively higher overall labour rate.

The variance is well within the nominal $\pm 15\%$ range for the assessment of reasonableness, and therefore we consider the Energex estimates to be efficient.

4.6 Switchgear replacement

Table 7 shows a summary of the comparison between the Energex unit rates for switchgear replacements and our comparative estimates.

Table 7 Switchgear replacement estimates

Activity	Description	Energex Estimate	GHD Estimate	Variance
11 kV air break switch (ABS) replacement	Recover existing ABS, install 12 kV 630 A 3-phase SF ₆ ABS including gang switch, install composite cross-arm	\$14,418	\$13,861	-4%
11 kV switchgear in C&I substation replacement	Recover existing 11 kV switchboard, install 6 off 11 kV indoor circuit breakers in new 11 kV switchboard, install temporary RMU for feeder changeover, remove temporary RMU	\$579,943	\$537,512	-7%

Activity	Description	Energex Estimate	GHD Estimate	Variance
11 kV switchgear in zone substation replacement	Recover existing circuit breakers, install 6 off 11 kV indoor circuit breakers on existing foundations	\$487,110	\$534,120	+10%
33 kV OD circuit breaker replacement	Recover existing circuit breaker, install 4 off 33 kV SF ₆ outdoor circuit breakers on existing foundations	\$748,974	\$830,351	+11%

4.6.1 Replace 11 kV air break switch

There is excellent comparison between the materials/plant and labour allocations between the Energex estimate and our comparative estimate:

- variance between the materials & plant allocations is -4%
- variance between the labour allocations is -4%
- overall variance between our comparative estimate and the Energex unit rate is -4%

We are of the opinion that the Energex building block unit rate for an 11 kV air break switch replacement is efficient.

4.6.2 Replace 11 kV C&I switchgear

We used a composite cost for 11 kV indoor circuit breakers which includes construction, engineering and design costs. We applied a nominal material/labour split to our comparative estimate to allow for a comparison with the Energex unit rate, which is more detailed and precise.

- There is a -3% variance in material costs, with the allowance in our comparative estimate being the lower. We are satisfied this is due to our costs being more suitable for asset valuation purposes, and the nominal split being slightly weighted to materials.
- Our comparative estimate has a labour allowance 11% lower than the Energex allowance. The lower number of labour hours in our comparative estimate is offset by the slightly higher average labour rate we have adopted.

Based on nominal approximation of the material/labour splits, and with the overall variance being -7%, we are satisfied the Energex unit rate is efficient.

4.6.3 Replace 11 kV zone substation switchgear

As for section 4.6.2, we have relied upon a similar scope of work as adopted for replacing 11 kV switchgear in a C&I substation, excluding consideration of a temporary ring main unit (RMU). As was identified for the 11 kV C&I switchgear building block, we applied a nominal material/labour split to our comparative estimate to allow for a comparison with the Energex unit rate, which is more detailed and precise.

- There is a -9% variance in material costs, with the allowance in our comparative estimate being the lower. We are satisfied this is due to our costs being more suitable for asset valuation purposes, and the nominal split being slightly weighted to materials.

- Our comparative estimate has a 6% higher allocation of labour hours than the Energex allowance. The higher number of labour hours in our comparative estimate produces a 35% variance in labour costs due to the slightly higher average labour rate we have adopted.

Based on our nominal approximation of the material/labour splits (based on the material/labour split for the Energex unit rate), and with the overall variance being +10%, we are satisfied the Energex unit rate is efficient.

4.6.4 Replace 33 kV circuit breaker

We used a composite cost for 33 kV outdoor circuit breakers which includes construction, engineering and design costs. We applied a nominal material/labour split to our comparative estimate to allow for a comparison with the Energex unit rate, which is more detailed and precise.

- There is a 12% variance in material costs, with the allowance in our comparative estimate being the higher. We are satisfied this is due to our costs being more suitable for asset valuation purposes, and the nominal split being slightly weighted to materials.
- There is reasonable agreement in the labour allocations, with our comparative estimate having a labour allowance 10% higher than the Energex allowance. This is primarily due to the slightly higher average labour rate we have adopted in our comparative estimates.

Based on the understanding of the material/labour splits, and with the overall variance being +11%, we are satisfied the Energex unit rate is efficient.

4.7 Transformer replacement

Table 8 shows a summary of the comparison between the Energex unit rates for selected transformer replacements in skids and zone substations, and our comparative estimates.

Table 8 Transformer replacement estimates

Activity	Description	Energex Estimate	GHD Estimate	Variance
Instrument transformer replacement	Recover existing current transformers, install 4 off 110 kV current transformers on new structures	\$253,732	\$221,486	-13%
33/11 kV 8 MVA transformer replacement	Install 33/11 kV 8 MVA skid mount power transformer with bushings, install new protection schemes	\$720,160	\$659,832	-8%
33/11 kV 25 MVA transformer replacement	Install 33/11 kV 25 MVA power transformer with bushings, install new protection schemes	\$1,020,790	\$936,560	-8%
110 kV 60 MVA transformer replacement	Recover existing 110 kV 30 MVA power transformer, install 110 kV 60 MVA power transformer, install new protection schemes, replace 33 kV neutral earth resistor	\$2,237,304	\$2,251,210	+1%

4.7.1 Replace 110 kV current transformers

We used a composite cost for 1-phase 110 kV outdoor current transformers which includes construction, engineering and design costs. We have applied a nominal material/labour split to our comparative estimate to allow for a comparison with the Energex unit rate, which is more detailed and precise.

- There is a -6% variance in material costs, with the allowance in our comparative estimate being the lower. We are satisfied this is due to our costs being more suitable for asset valuation purposes, and the nominal split being slightly weighted to materials.
- There is reasonable agreement in the labour allocations, with our comparative estimate having a labour allowance 19% higher than the Energex allowance. This is primarily due to the slightly lower number of labour hours we have adopted in our comparative estimates.

Based on the typical use for our market cost (that is, for asset valuation purposes), and understanding of the material/labour splits, and with the overall variance being -13%, we are satisfied the Energex unit rate is efficient.

4.7.2 Replace 33/11 kV 8 MVA power transformer

There was good comparisons between the materials/services and labour allocations between the Energex and our estimates, with a relatively small -7% variance in material allocations and -11% difference in labour costs.

To assist with ensuring consistency in the work scope for the building blocks, we included the Energex allowance for skid materials and labour, as we had no comparable costing information for this work.

The overall variance was -8%, which means that we are satisfied that the Energex estimate is efficient.

4.7.3 Replace 33/11 kV 25 MVA power transformer

The variance in materials/services cost allocations was -14%, with the primary reasons being allocations for a neutral earth reactor (NER), multicore cables and outdoor busworks for the replacement of the 25 MVA power transformer. To provide some consistency in the work scopes, our comparative estimate includes the Energex allowance for transformer foundations.

The variance of -7% in labour costs is relatively small.

The -8% variance is well within our nominal test range, and we assess the Energex unit rate to be efficient.

4.7.4 Replace 110 kV 60 MVA power transformer

For the 110 kV transformer, we based our estimate on a relatively recent manufacture price which was consistent with the unit rate and associated material for the 60 MVA costs in the Energex estimate. The labour costs varied 12% between the two estimates, which is considered a reasonable variance, particularly given that our comparative estimate excludes consideration of multiple labour rates for the labour hours allowed.

The overall variance was a minor 1% difference, which supports our assessment of the Energex unit rate is efficient.

4.8 Zone substation upgrade

Table 9 summarises the comparison between the Energex unit rate for upgrading a zone substation with a new 33/11 kV 25 MVA power transformer and 11 kV capacitor bank, and our comparative estimate.

Table 9 Zone substation estimate

Activity	Description	Energex Estimate	GHD Estimate	Variance
33/11 kV 25 MVA zone substation upgrade	Upgrade existing substation with new 33/11 kV 25 MVA power transformer & new 11 kV 5.4 MVA capacitor bank, replace existing cabling, install new protection schemes	\$1,369,190	\$1,222,413	-11%

We relied upon the 33/11 kV 25 MVA power transformer comparative estimate (refer section 4.7.3) together with a market price available to us for an 11 kV 5.4 MVA capacitor bank. The variance in material costs between the two estimates is relatively low (variance of -6%) whilst there is a larger variance in the labour component. We are of the opinion that the primary driver for this is additional design and management costs allowed in the Energex estimate, based on historical experience with modular substation works.

The overall variance of -11% is within our nominal range for reasonableness, and therefore we are satisfied that the Energex estimate is efficient.

5. Conclusion

Table 10 shows a summary of the estimate comparisons.

Table 10 Summary of estimate comparisons

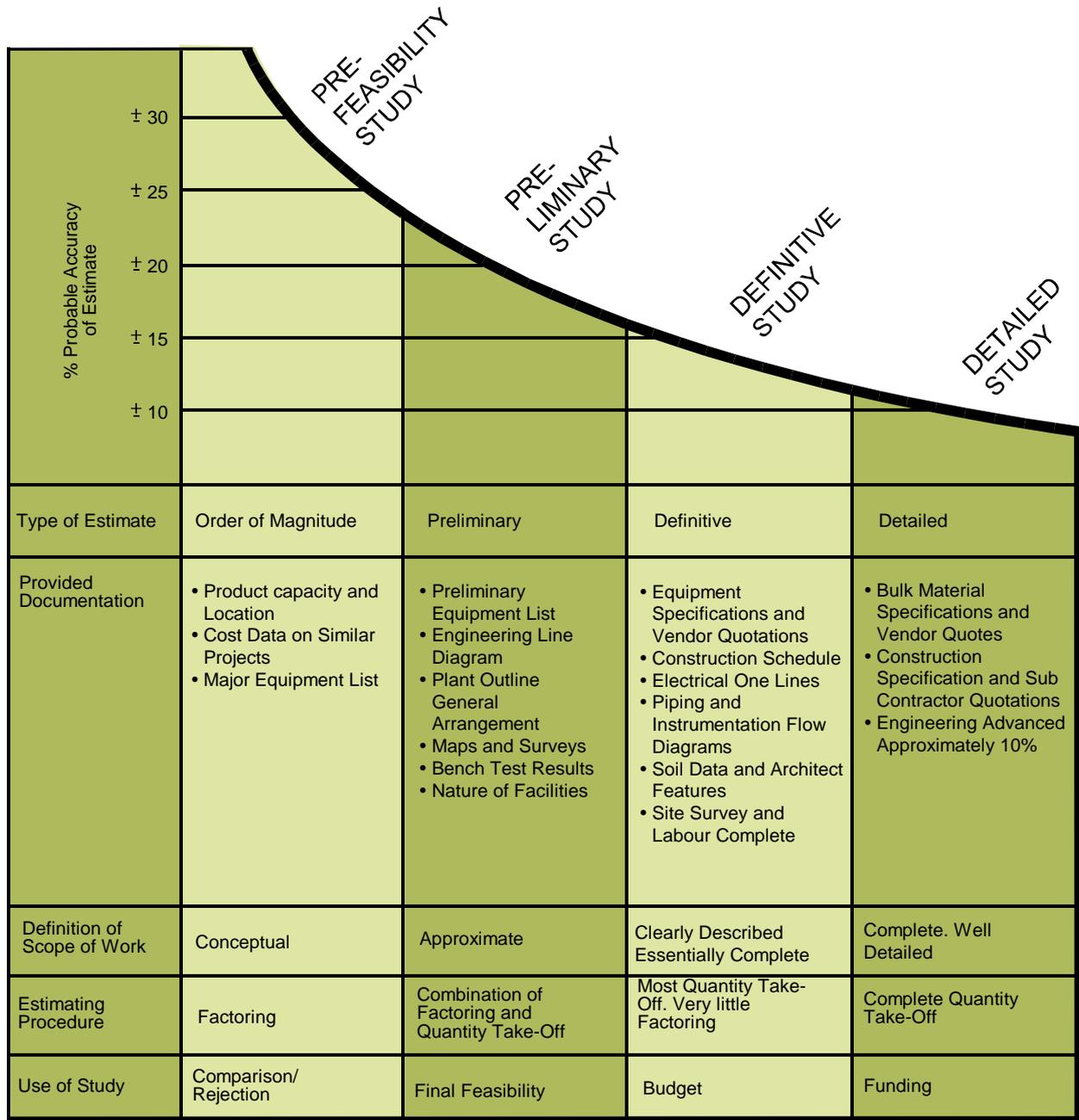
Activity	Building Block	Energex Estimate	GHD Estimate	Variance
Pole replacement	Replace LV wood pole	\$6,563	\$7,461	14%
Pole replacement	Replace 11 kV wood pole	\$9,191	\$10,274	12%
Pole replacement	Replace 33 kV wood pole	\$13,209	\$14,363	9%
OH conductor replacement	Reconductor 11 kV OH line	\$512,387	\$498,178	-3%
OH conductor replacement	Reconductor 33 kV SCCT OH line	\$925,182	\$985,018	6%
OH conductor replacement	Replace copper pilot cable communications bearer	\$505,576	\$562,460	11%
OH conductor replacement	Replace LV mains with ABC	\$112,602	\$116,030	3%
Cable replacement	Replace 33 kV UG feeder	\$2,376,592	\$2,255,011	-5%
New distribution feeder	Construct new 11 kV feeder	\$494,026	\$523,003	6%
Services	LV OH service cable replacement	\$559	\$617	10%
Switchgear replacement	Replace 11 kV air break switch	\$14,418	\$13,861	-4%
Switchgear replacement	Replace 11 kV switchgear in C&I substation	\$579,943	\$537,512	-7%
Switchgear replacement	Replace 11 kV switchgear in zone substation	\$487,110	\$534,120	10%
Switchgear replacement	Replace 33 kV OD circuit breaker	\$748,974	\$830,351	11%
Transformer replacement	Replace instrument transformers	\$253,732	\$221,486	-13%
Transformer replacement	Replace 33/11 kV 8 MVA transformer	\$720,160	\$659,832	-8%
Transformer replacement	Replace 33/11 kV 25 MVA transformer	\$1,020,790	\$936,560	-8%
Transformer replacement	Replace 110 kV 60 MVA transformer	\$2,237,304	\$2,251,210	1%
Zone Substation upgrade	Upgrade 33/11 kV 25 MVA zone substation	\$1,369,190	\$1,222,413	-11%

We are of the opinion, based on our analysis that the Energex activity unit rates for the selected activities are reasonable and efficient when compared with average market costs for similar work in the Australian electricity industry.

Appendices

Appendix A - Engineering estimate accuracy

Figure 1 Standard estimate accuracy levels

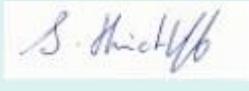
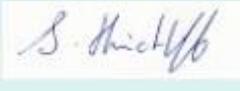


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Rev.No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
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