



# Unit Cost Efficiency Assessment

Ergon Energy

19 December 2018

# Executive summary

Energy Queensland is preparing Ergon Energy'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 Ergon Energy expenditure programs.

In assessing the efficiency of the proposed Ergon Energy 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 Ergon Energy 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  $\pm 15$  and  $\pm 15.5\%$  and red for variances outside  $\pm 15.5\%$ .

**Table 1** Summary of estimate comparisons

Activity	Building Block	Ergon Energy Estimate	GHD Estimate	Variance
Pole replacement	Replace LV wood pole	\$8,319	\$8,847	6%
Pole replacement	Replace 22 kV wood pole	\$11,911	\$11,663	-2%
Pole replacement	Replace 66 kV wood pole	\$11,901	\$13,030	9%
OH conductor replacement	Reconductor 22 kV OH line	\$21,285	\$22,861	7%
OH conductor replacement	Replace open wire LV mains with ABC	\$7,586	\$7,450	-2%
Services	LV OH service cable replacement	\$1,446	\$1,296	-10%
Switchgear replacement	Replace 22 kV OD circuit breaker in zone substation	\$114,178	\$ 124,488	9%
Switchgear replacement	Replace 66 kV OD circuit breaker	\$130,341	\$146,185	12%
Transformer replacement	Replace instrument transformer	\$117,895	\$132,258	12%
Transformer replacement	Replace 66 kV to 22 kV transformer	\$1,051,724	\$1,103,376	5%

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

GHD is of the opinion that the Ergon Energy 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 Ergon Energy'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 22 kV wood pole
- Replacement of 66 kV wood pole
- Reconductoring of 22 kV OH line
- Replacement of LV ABC
- Replacement of LV OH service cable
- Replacement of 22 kV outdoor circuit breaker in zone substation
- Replacement of 66 kV outdoor circuit breaker
- Replacement of instrument transformers
- Replacement of 66 to 22 kV transformer

## 1.3 Assumptions

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

- The scope and approach are based on the scope statements provided by Ergon Energy, 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 Ergon Energy 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 Ergon Energy unit costs include costs for planning, design and project management.
- Ergon Energy on-costs have not been included in the rates reviewed and no contingency or risk allowance has been allocated to these values.
- Ergon Energy estimates 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 Ergon Energy unit rates.

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

While we independently estimated the unit rates for the nominated capital and maintenance works from our own data sources, we recognise that Ergon Energy 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 Ergon Energy estimates. We have also taken into account specific Ergon Energy 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 Ergon Energy's and our benchmark estimates.

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

For Ergon Energy 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.

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<sup>1</sup> 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 Ergon Energy.

### 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 Ergon Energy 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 Ergon Energy's estimates given that Ergon Energy'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 Ergon Energy 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 Ergon Energy 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 Ergon Energy and our comparative estimates were identified.

### 3.4 Level of accuracy

In establishing a criterion for assessing the reasonableness of the Ergon Energy 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 Ergon Energy'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 accuracy 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 Ergon Energy 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 Ergon Energy task description unless otherwise indicated.

Where possible, we have used our comparative estimates for pole and service replacement in other activities where the Ergon Energy building block work scope for overhead re-conductoring or construction included such activities.

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 Ergon Energy, the cost allocation method applied in the Ergon Energy estimates or the detailed material/labour/plant allocations used by Ergon Energy. 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 Ergon Energy unit rates for pole replacements and our comparative estimates.

**Table 2** Pole replacement estimates

Activity	Description	Ergon Energy Estimate	GHD Estimate	Variance
LV wood pole replacement	Replacement of 9 m/8 kN wood pole, cross-arm, associated fittings & hardware, switching allowance	\$8,319	\$8,847	+6%
22 kV wood pole replacement	Replacement of 14 m/8 kN wood pole, cross-arm, associated fittings & hardware, switching allowance	\$11,911	\$11,663	-2%
66 kV wood pole replacement	Replacement of 18.5 m/12 kN wood pole, cross-arm, associated fittings & hardware, switching allowance	\$11,901	\$13,030	+9%

#### **4.1.1 Replace LV wood pole**

In comparing the two estimates, we found:

- the two estimates included effectively the same number of labour hours, with similar allocations for labour in the Ergon Energy estimate and our comparative estimate<sup>2</sup>
- there is a -1% variance difference between the aggregated materials/plant allocations between the two estimates, with our comparative estimate being the higher of the two.

The overall variance is +6%, which is well within the nominal range for reasonableness. Therefore, we are satisfied the Ergon Energy unit rate is efficient.

#### **4.1.2 Replace 22 kV wood pole**

We included the additional site delivery allowances as included in the Ergon Energy estimate. The comparison of the two estimates showed a good match in the materials/services and labour split:

- variance of +4% in materials/services
- variance of -5% in the labour costs, primarily due to our comparative estimate having slightly fewer hours than the Ergon Energy estimate.

The overall variance is -2%, and therefore we are satisfied the Ergon Energy unit rate is efficient.

#### **4.1.3 Replace 66 kV wood pole**

For the 66 kV wood pole, the comparison of the estimates highlighted minor differences in aggregated pole and plant costs, together with a higher labour content in our comparative estimate. However, these variances are within our nominal  $\pm 15\%$  range:

- there is a 1% variance in the aggregated materials/services/plant cost allocations between the two estimates
- the variance in the labour allocation is 15% - in our comparative estimate, our labour hours are slightly higher, and combined with our higher average labour hourly rate, our labour costs are approximately \$1 k higher than the Ergon Energy estimate.

The variance between our comparative estimate and the Ergon Energy estimate is 9%, which is well within our nominated range. We assess the Ergon Energy unit rate as efficient.

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<sup>2</sup> Ergon Energy included a total of 71 hours (\$5,984) whilst our comparative estimate allowed 68 hours (\$5,944)

## 4.2 Overhead conductor replacement

Table 3 shows a summary of the comparison between the Ergon Energy unit rate for re-conductoring of existing overhead lines and our comparative estimate.

**Table 3** *Overhead conductor estimates*

Activity	Description	Ergon Energy Estimate	GHD Estimate	Variance
Re-conductor 22 kV OH line	Recover existing OH conductor, install four spans of 7/3.75 AAC Mars conductor, replace one 14 m/8 kN wood pole complete with cross-arm	\$21,285	\$22,861	+7%
LV mains replacement with ABC	Recover existing LV mains, install 100 m of 50 mm <sup>2</sup> LV ABC conductor, install 40 m of service conductor circuit	\$7,586	\$7,450	-2%

### 4.2.1 Re-conductor 22 kV OH line

Our comparative estimate is based on the following assumptions:

- 260 m of 3-phase circuit using 7/3.75 AAC Mars conductor
- 22 kV wood pole replacement (refer section 4.1.2)
- replacement of 1 cross-arm.

The differences in the estimates are:

- variance of +11% in the aggregated materials/services/plant allocation, where the primary driver is the material cost for the 7/3.75 AAC Mars conductor
- variance of +6% for minor differences in the number of labour hours and average hourly rate

The overall variance of +7% is well within our nominal  $\pm 15\%$  range. We therefore consider that the Ergon Energy unit rate is efficient.

### 4.2.2 Replace open wire LV mains with ABC

The basic assumptions for our comparative estimate are:

- 100 m of 4 core 50 mm<sup>2</sup> ABC conductor
- 40 m OH service using 50 mm<sup>2</sup> XLPE conductor

There is good compatibility between the aggregated materials/plant allowances, with the primary reason being the conductor material costs used in our comparative estimate. Similarly, there is a good correlation in labour costs, with a small -4% difference.

The overall variance is -2%, which we conclude shows the Ergon Energy unit rate is efficient.

## 4.3 Services

Table 4 shows a summary of the comparison between the Ergon Energy unit rate for replacing an LV overhead service, and our comparative estimate.

**Table 4** *Services estimate*

Activity	Description	Ergon Energy Estimate	GHD Estimate	Variance
LV OH service cable replacement	Recover existing service conductor, install 50 mm <sup>2</sup> Al XLPE service conductor incl. minor hardware	\$1,446	\$1,296	-10%

Our estimate is based on the following:

- 50 m of single-phase 50 mm<sup>2</sup> conductor

The primary difference between our comparative estimate and the Ergon Energy rate is the allocation for fleet & equipment/plant hire. The total number of labour hours is similar between the two estimates, with the aggregated labour costs slightly higher in our comparative estimate.

The overall variance of -10% is within our nominal range, and therefore we are of the opinion that the proposed Ergon Energy rate is efficient.

## 4.4 Switchgear replacement

Table 5 shows a summary of the comparison between the Ergon Energy unit rates for switchgear and instrument transformer replacements and our comparative estimates.

**Table 5** *Switchgear replacement estimates*

Activity	Description	Ergon Energy Estimate	GHD Estimate	Variance
22 kV OD circuit breaker replacement	Recover existing circuit breaker, install 22 kV outdoor circuit breaker in existing zone substation switchyard without extension	\$114,178	\$124,488	9%
66 kV OD circuit breaker replacement	Recover existing circuit breaker, install 66 kV outdoor circuit breaker in existing zone substation switchyard without extension	\$130,341	\$146,185	+12%

#### 4.4.1 Replace 22 kV circuit breaker

Our standard comparative estimate showed a 9% variance with the Ergon Energy estimate, including our standard allowance for plant & vehicle hire.

Adjusting the plant & vehicle allowance to reflect the Ergon allowance, the variance between our and Ergon Energy's estimates is 0%.<sup>3</sup>

In comparing the two estimates:

- There is a -3% variance in labour costs, with our allowance having a smaller number of labour hours, but with a higher average labour hourly rate compared to Ergon Energy, our comparative estimate is only 3% lower than the Ergon Energy labour costs
- With the adjustment for the Ergon Energy plant & vehicle hire costs, there is a 10% variance in aggregate materials/plant & vehicle hire costs, with the primary difference being in the market rate we have for material costs for the circuit breaker and minor material compared to the Ergon Energy costs.

With there being a +9% difference between our comparative estimate and Ergon Energy estimate (which we have identified as being due to the allowance for plant & vehicle hire in the Ergon Energy unit rate), we are of the opinion that the Ergon Energy unit rate is efficient.

#### 4.4.2 Replace 66 kV circuit breaker

Our standard estimate for replacing a 66 kV outdoor circuit breaker has a 12% variance with the Ergon Energy unit rate.

As for the 22 kV circuit breaker building block (refer section 4.4.1), adopting the plant & vehicle hire allowance from the Ergon Energy estimate in our comparative estimate reduces the variance to +4%.<sup>4</sup> The differences in the material and labour allocations are:

- There is a 5% variance in labour costs, with our comparative estimate having smaller number of labour hours, but a higher labour cost allowance due to our slightly higher labour costs
- With the adjustment of the plant & vehicle allowance to reflect the Ergon Energy costs, the variance between our comparative estimate and the Ergon energy unit rate for aggregated materials/plant & vehicles is 1%.

The variance for the total costs on the original estimates is +12%. We note that the primary difference between our original comparative estimate and the Ergon Energy estimate is the plant & vehicle costs. The variance of 12% is within the nominal range, and with the primary difference identified, we assess the Ergon Energy unit rate to be efficient.

<sup>3</sup> Adopting the Ergon Energy plant & vehicle costs, our comparative estimate is \$114,282

<sup>4</sup> Adopting the Ergon Energy allowance for plant & vehicles amends our comparative estimate to \$135,360 or a variance of +4% compared to the Ergon Energy unit rate

## 4.5 Transformer replacement

Table 6 shows a summary of the comparison between the Ergon Energy unit rates for selected transformer replacement in a zone substation, and our comparative estimates.

**Table 6** *Transformer replacement estimates*

Activity	Description	Ergon Energy Estimate	GHD Estimate	Variance
Instrument transformer replacement	Recover existing current transformers, install 3 off 66 kV outdoor current transformers on new structures & foundations	\$117,895	\$132,444	+12%
66 kV to 22 kV transformer replacement	Recover existing 32 MVA transformer, install 66/11 kV 32 MVA power transformer & minor hardware, new protection schemes, 66 kV surge arresters	\$1,051,724	\$1,103,376	+5%

### 4.5.1 Replace 66 kV current transformers

We used a composite cost for 1-phase 66 kV current transformers which includes some construction and engineering/design costs. We have applied a nominal material/labour split to our comparative estimate to allow for a comparison with the Ergon Energy unit rate, which is more precise and detailed.

- There is a variance of 128% in material costs, with the allowance in the GHD comparative estimate being significantly higher. We are satisfied this is due to our costs being more suitable for asset valuation purposes, and the nominal split being too heavily weighted to materials
- The variance in labour costs is -13%, which is more comparable. The Ergon Energy unit rate is heavily weighted towards the labour content, with labour representing approximately 82% of the estimate unit rate of \$117,895.

The overall variance with our comparative estimate is +12%. This variance is within our  $\pm 15\%$  nominal range, and we consequently accept the Ergon Energy unit rate as efficient.

### 4.5.2 Replace 32 MVA power transformer

Aggregated materials and plant costs represent approximately 90% of the total unit rate.

To ensure there was consistency in the work scopes for the two estimates, we have included the allowance of \$150,000 that is included in the Ergon Energy estimate for civil works required for the installation of the new 32 MVA power transformer, as we had no means of generating comparable costs for these works.

The difference in the aggregate materials/plant allocation between the two estimates is 1%.

For the labour allocation, the number of hours included in our comparative estimate are higher than those provided for in the Ergon Energy estimate.

With the very heavy weighting on the materials costs for this building block, the overall variance is +5%, which is well within our acceptable range of  $\pm 15\%$ . We assess the Ergon Energy unit rate to be efficient.

## 5. Conclusion

Table 7 shows a summary of the estimate comparisons.

**Table 7** Summary of estimate comparisons

Activity	Building Block	Ergon Energy Estimate	GHD Estimate	Variance
Pole replacement	Replace LV wood pole	\$8,319	\$8,847	6%
Pole replacement	Replace 22 kV wood pole	\$11,911	\$11,663	-2%
Pole replacement	Replace 66 kV wood pole	\$11,901	\$13,030	9%
OH conductor replacement	Reconductor 22 kV OH line	\$21,285	\$22,861	7%
OH conductor replacement	Replace open wire LV mains with ABC	\$7,586	\$7,450	-2%
Services	LV OH service cable replacement	\$1,446	\$1,296	-10%
Switchgear replacement	Replace 22 kV OD circuit breaker in zone substation	\$114,178	\$ 124,488	9%
	Replace 22 kV OD circuit breaker including Ergon Energy plant & vehicle allowance	\$114,178	\$114,282	0%
Switchgear replacement	Replace 66 kV OD circuit breaker	\$130,341	\$146,185	12%
	Replace 66 kV OD circuit breaker including Ergon Energy plant & vehicle allowance	\$130,341	\$135,360	4%
Transformer replacement	Replace instrument transformer	\$117,895	\$132,258	12%
Transformer replacement	Replace 66 kV to 22 kV transformer	\$1,051,724	\$1,103,376	5%

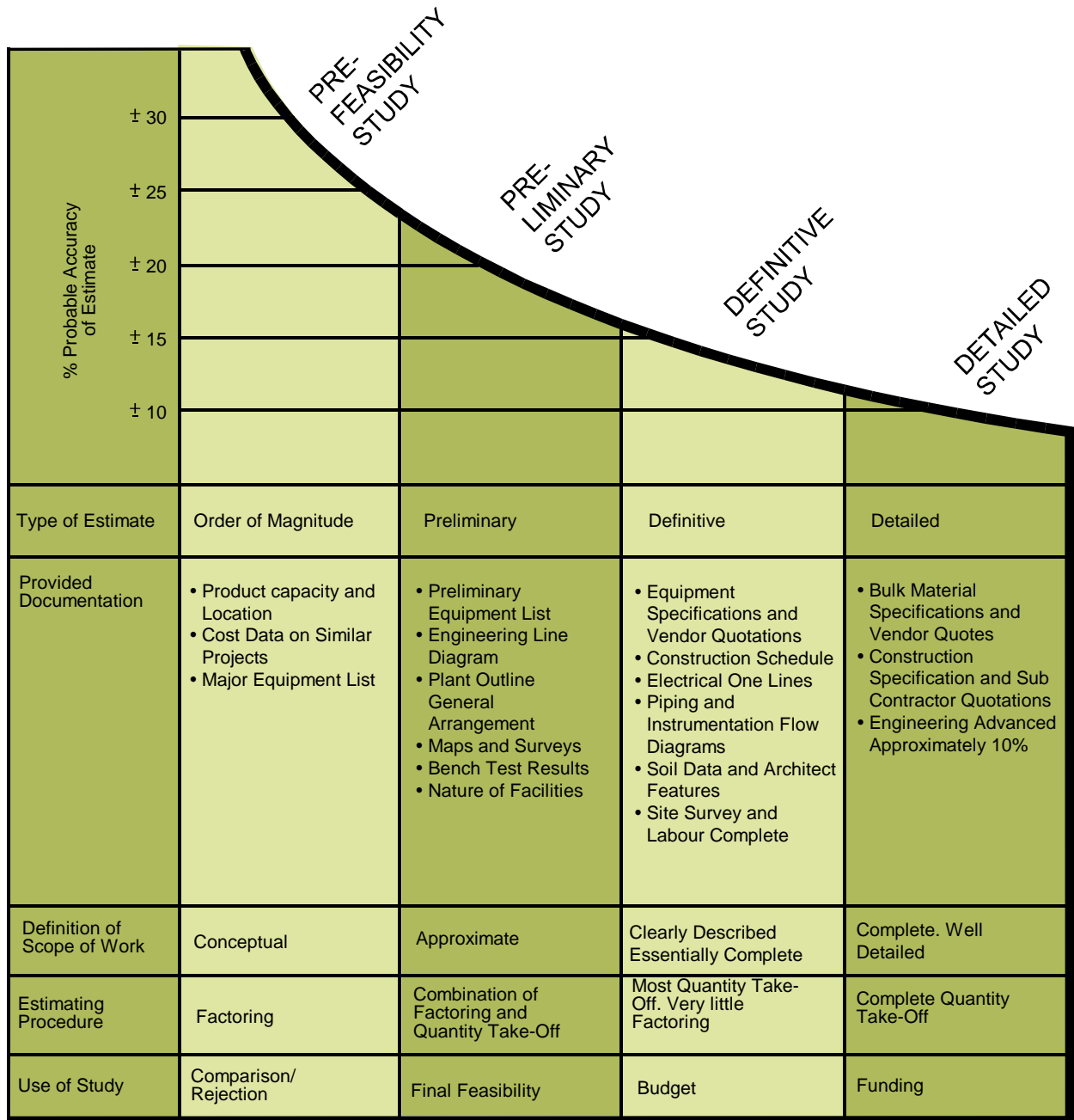
We are of the opinion, based on our analysis, that the Ergon Energy activity unit rates for the selected activities are reasonable and efficient when compared with average market costs for similar work in the Australian electricity industry.



## Appendices

# Appendix A - Engineering estimate accuracy

**Figure 1** Standard estimate accuracy levels



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