



**Commentary on Country Energy's Proposal
relating to
The Marking of Power Lines for Aviation Safety**

Prepared by

**Energy and Management Services Pty Ltd
ABN 12 075 128 513
7/149 Ambleside Circuit, Lakelands, NSW 2282
Tel 02 4954 6100 Fax 02 4954 6495**

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1 Engagement

The Australian Energy Regulator (AER) requested Energy and Management Services Pty Limited (EMS) to provide commentary on Country Energy's proposal relating to works required for improving the visibility of powerlines in order to improve aviation safety.

In particular, EMS has been requested to comment on:

- The reasonableness of the methodology employed by Country Energy to forecast the relevant expenditure;
- Whether the costings are reasonably robust, including whether the unit costs are efficient;
- The degree of certainty surrounding the forecasts; and
- If there are alternative methods that Country Energy could adopt to mitigate the identified risks.

2 Background

Since 1999 Country Energy's overhead power lines have been struck by helicopters in three separate incidents resulting in a number of fatalities. In the first incident (Sheather 1999) the New South Wales Court of Appeal ruled that Country Energy owed a duty of care to the aircraft owner, notwithstanding that the pilot was flying below the mandatory height. A subsequent application to seek leave to appeal to the High Court was rejected.

In August 2008, the NSW Deputy State Coroner handed down his findings in relation to two helicopter incidents which occurred in Dunedoo (November 2004) and Parkes (February 2006)¹. The Coroner's formal recommendations to Country Energy were:

- That immediate and urgent action is taken to mark the power line subject to the Parkes incident with appropriate spherical ball markers or flag markers.
- The [That] Country Energy conduct a study of all power lines that may be identified as being at risk of a wire strike and formulate a strategy and feasibility study to identify, prioritise and mark those power lines.
- That Country Energy considers the painting of power [line] support poles in order to make them more identifiable and ensure that easements remain clear of vegetation².

The first of the recommendations was immediately implemented by Country Energy. On the basis that there was insufficient time to determine the full costs of fulfilling the second and third of the Coroner's recommendations before Country Energy was due to submit its revenue proposal, Country Energy proposed that the costs be treated by the AER as a pass through event.

In its draft decision, the AER rejected the proposal for the matter to be treated as a pass through event and indicated that Country Energy should provide forecast costs to include in its proposed expenditure allowances.

In response, Country Energy provided costing proposals as described in the next Section. The methodology and quantum of these proposals, are the subject of this Report.

¹ Inquests into the Deaths of Ross Kenneth Mill, Benjamin McDonnell, Shane Haldane Thrupp, Ian Phillip Stephenson and Malcolm John Buerckner, *Magistrate Milovanovich Deputy State Coroner*, Mudgee Court 30.4.07 to 4.5.07 and Forbes Court 21.7.08 to 1.8.08

² In reference to the 1999 Court case, the issue of power line marking for aviation safety is sometimes referred to as "Sheather" findings, marking, works, costs, etc. It should be noted however, that the Coroner did not review the Sheather incident.

3 Country Energy's Proposals³

In view of the fact that the Sheather incident and the Parkes incident involved power lines with long spans, Country Energy proposes to investigate power lines with a span exceeding 750 metres. Some 1,124 such spans have been identified. Country Energy intends that the investigation will initially consider the height of the powerline above ground level and the topography of the surrounding area. This information will provide a risk matrix which will be further refined by physical inspection and recording of:

- Surrounding land use
- Visibility of the lines
- Aircraft flight paths
- Location of hang gliding clubs and the like
- Any other factors considered relevant by the working group.

Country Energy will consider risk mitigation actions including but not limited to:

- Accepting the risk and:
 - installing a limited number of markers above roadways
 - installing line markers in accordance with AS3891.1
 - relocating the powerline;
- Painting poles.

Country Energy assumes that 50 per cent of the 1,124 spans will require remedial action. It is proposed that the work be carried out over a 10 year period commencing from 1 July 2010. (Thus four years of the 10 year remediation program will fall within the 2009-2014 Regulatory Period). The risk matrix will progressively be refined in order to efficiently plan the works but at this stage, Country Energy have made the assumption that the average remedial action will be to install markers on the line in accordance with AS3891.1 and that the supporting poles will require upgrading.

Country Energy has calculated the total cost of pole replacement and line marking to be \$40.2 million (2008-09).

In response to questions raised by the AER, Country Energy has provided further detail to support their estimate of total costs. Full details are shown in the Appendix to this Report. In summary:

- An estimated 448 poles will require replacement at \$7027.50 per pole, total \$3,148,320.
- An estimated 8,064 marker balls will be fitted at \$4600 each, total cost \$37,094,400.
- The unit costs are based on previous work of a similar nature:

Marker Balls	
Labour	\$2229
Materials	\$2253
Plant	\$118

Poles	
Labour	\$2932
Materials	\$3325
Plant	\$771

- Country Energy has assumed that 50% of the lines identified will require some action which will range from "Accept the Risk" through to "Relocate the Line". Marking the

³ Revised Regulatory Proposal 2009-2014, *Country Energy*, 16 January 2009, pp 28, 29

lines in accordance with the Australian Standard was taken as an average of the available actions.

- Country Energy state that painting or otherwise marking the poles may be a part solution to the Sheather decision, however it is not the total solution.

4 Commentary

4.1 Country Energy's Approach

Dealing with the last of the Coroner's recommendations first: that Country Energy considers the painting of support poles and ensuring easements remain clear of vegetation.

From their response to the AER's questions, Country Energy has indicated that painting of poles will be considered but go on to point out⁴ that, in their opinion, little would be gained from this action because in the case of long, high spans (such as were the case in the Sheather and Parkes incidents), the poles would likely be outside a pilot's normal field of vision. Country Energy has not included any estimate of costs for pole painting in their Revised Regulatory Proposal.

Country Energy has not addressed the matter of easement clearing either in their Proposal or in their responses to the AER's questions.

The Australian Transport Safety Bureau's investigation into the Parkes incident (available at http://www.atsb.gov.au/publications/investigation_reports/2006/AAIR/pdf/aaair200600523_001.pdf) includes photographs which tend to support Country Energy's opinion that the support poles may not have been visually noticeable even if painted.

Whilst the Poles in the Dunedoo incident would have been made more noticeable by painting (see photographs in ATSB Report at http://www.atsb.gov.au/publications/investigation_reports/2004/AAIR/pdf/aaair200404590_001.pdf), the poles in this case, are supporting common spans (300m) at common height (6.4m). In EMS's view it would be economically inefficient to paint all poles in such common circumstances (the number of common poles in rural locations would be in the hundreds of thousands). It is further suggested that the prolific presence of common poles in rural situations would ultimately render any such painting ineffective as a hazard warning device due to familiarity.

With regard to keeping easements clear of vegetation, it is assumed that the Coroner is referring to the fact that from a sufficiently high elevation, the route of power lines may be visually highlighted by virtue of the straight narrow swathe of cleared land that power line easements create. EMS is aware that Country Energy rigorously maintains easements for reasons of supply reliably and bush fire prevention and to that extent, the Coroner's recommendation is being fulfilled.

In EMS's opinion (which is based only upon experience in the electricity distribution industry and does not in any way purport to represent aviation-based knowledge or experience), Country Energy's approach to both pole painting and easement clearing is appropriate.

Turning now to the key recommendation: that Country Energy conduct a study of all power lines that may be identified as being at risk of a wire strike and formulate a strategy and feasibility study to identify, prioritise and mark those power lines.

The information provided by Country Energy in their Revised Regulatory Proposal and responses to the AER's questions indicates that to date, the full extent of their response to the Coroner's recommendation is to count the number of spans exceeding 750m and to estimate

⁴ See Appendix, second set of questions, Q3 b.

the works which may be required to address these spans. Country Energy indicates that this is only the first step in the process and that their risk matrix will be refined over time.

EMS is concerned that Country Energy appear to be intending to use only their own resources to identify and prioritise power lines that are at risk of wire strike. No mention is made of interaction with the Civil Aviation Safety Authority (CASA) or other bodies with expertise in aviation, to assist in the task. EMS suggests that Country Energy does not have aviation knowledge or expertise and, regardless of the bona fides of their intentions, a work plan based on insufficient or misguided expertise is certain to fall short of optimum levels of effectiveness and economic efficiency.

Elsewhere in his findings, the Coroner makes a formal recommendation that CASA "give consideration to establishing and maintaining an appropriate data base of information in regard to low level hazards such as power lines"⁵. EMS suggests that this will require the establishment of a close linkage between CASA and Country Energy such that all maps of power lines will be made available to CASA, that such maps will be enhanced with data relating to height above ground, and a regular up-date service will be provided such that CASA is kept advised of all new and altered power line installations.

In reply, when advised of the location and height of power lines, CASA should be expected to use its aviation expertise to advise Country Energy of those power lines that exhibit an appreciable risk of wire strike. Further, CASA (or other body with aviation experience) may be in a position to suggest solutions to hazard identification and risk mitigation, including pole painting or marking where appropriate, span marking where appropriate, or perhaps alternative technologies. For example, it seems feasible that pole mounted radio beacons could be developed that sound an alarm in the cockpit when an aircraft enters the hazard zone of a high-risk power line.

Over time, Country Energy would gain a better appreciation of aviation hazards caused by power lines and amend their design practices such that the avoidance of aviation hazards becomes part of the design criteria, thus reducing the need for costly post-construction remedial hazard warning measures.

4.2 Reasonableness of Country Energy's Cost Forecasting Methodology and Robustness and Efficiency of Country Energy's Costings and Forecast of Extent of Works

Country Energy's methodology is based on a number of assumptions which appear to have little in the way of sound rationale:

- On what basis has 750m been chosen as the length of span beyond which a risk of wire strike is created?
- The estimate that 50% of such spans will require remediation is proposed because it is an "average" between the extremes of doing nothing and completing full asset relocations on all such spans. There does not seem to have been any attempt to specifically analyse the identified spans even though Country Energy recognise that factors such as topography, surrounding land use, and proximity of regular aviation activity need to be considered. Much of this information could have been obtained, at least in a first-pass unrefined form, by simple desk-top analysis of readily available maps. As it stands, EMS is of the view that the 50% estimate falls well short of a sound forecasting methodology.
- The installation of marker balls to AS3891.1 will require balls to be fitted at approximately 32.5m intervals throughout the length of the span and Country Energy have adopted this as an anticipated "average of the available actions"⁶. EMS notes

⁵ See Footnote 1

⁶ See Appendix, second set of questions, Q3 b.

that Country Energy have not indicated that any discussions have been held with CASA or other body with aviation expertise. The application of AS3891.1 would not be strictly applicable to most of the spans identified by Country Energy as being at risk of wire strike and it is noted that Country Energy's response⁷ to the Coroner's first recommendation was to install just two marker balls on a span of 1,260m in length.⁸ Thus Country Energy's proposal to invoke AS3891.1 is inconsistent with their own recent practice and in any case, may be considered to be an excessive response.

EMS readily acknowledges that the mitigation of aviation hazards caused by power lines is a very complex issue and Country Energy have had little time to address the matter since the Coroner's findings were handed down in August 2008. Country Energy's submissions clearly indicate an intention to refine their methodology, costings, and forecasting of the proposed extent of works as the issue is addressed in more detail.

In response to the AER's specific requests for comment, EMS's views are that:

- Country Energy's proposals as they currently stand, are not sufficiently robust to justify a proposed expenditure of \$40.2m and, given the coarse assumptions made, are not necessarily reasonable;
- There is very little certainty surrounding the forecasts;
- Country Energy's unit costs appear reasonable and we agree that the installation of marker balls will require new poles to be erected in the majority of circumstances.

4.3 Alternative Methodologies

As discussed in Section 4.1, Country Energy does not have aviation knowledge or expertise. EMS suggests that an essential component of fulfilling the Coroner's recommendation should be the obtaining of specialised advice from CASA and/or other bodies with aviation expertise. We have discussed the two-way working relationship that should be established between Country Energy and CASA. We have also indicated that alternative technologies may be developed that are both more effective in terms of risk mitigation and less costly to implement.

From EMS's experience in working with inter-departmental arrangements in the public sector, it should be expected that the establishment of an effective two-way working relationship between CASA and Country Energy will take at least 12 months to achieve. This is due to the complexities of public policy and accountability that need to be addressed, the scale and complexity of the issue at hand, and simply the fact that in the initial stages, the task of developing the relationship will fall to senior staff in each organisation who already have heavy demands upon their time and resources. Whilst the cost of developing the relationship (involving senior staff) would be absorbed in the existing administrative overheads of each organisation, some costs may be incurred in obtaining expert advice on aviation safety and related matters.

When the relationship is regularised, the ongoing arrangements may be assigned as additional duties to line managers and specialist staff. In EMS's view, it seems unlikely that additional staff would be required to support the arrangements.

EMS suggests that an alternative proposal, with no more uncertainty of occurrence than Country Energy's proposal, is that CASA may quickly identify major risk sites that Country Energy will feel obliged to respond to in the short term (that is, within the 2009-2014 regulatory period) and then the long term arrangements, and full-scale remediation work plan, will not require major expenditure until the next regulatory period. In this regard, EMS is unable to forecast probable expenditure with any more certainty or robustness than has been put forward by Country Energy. As a guess (and that is all it is), say ten spans are identified as

⁷ See Appendix, first set of questions, Q2 b.

⁸ Details of the span involved in the Parkes incident are provided in ATSB's Report available at http://www.atsb.gov.au/publications/investigation_reports/2006/AAIR/pdf/aaair200600523_001.pdf

requiring urgent attention in the short term, requiring 20 new poles and 100 marker balls. Using Country Energy's unit costs, this would incur an expense of some \$600,550.

5 Conclusion

EMS is of the view that Country Energy's current proposal for an allowance of \$40.2m is not based on assumptions or forecasts that could be described as sufficiently reasonable or robust. At the other extreme, EMS suggests that costs incurred in the 2009-2014 regulatory period may be as low as under \$1m. Neither forecast is based on a sound, defensible reasoning and yet both carry a degree of intuitive logic.

Much further work is required to fulfil the Coroner's recommendation that a strategy and feasibility study be developed to identify, prioritise and mark power lines at risk of a wire strike. At the very least, the study should draw on aviation knowledge and expertise, which Country Energy cannot be expected to hold.

It is envisaged that CASA and Country Energy would work together to formulate an optimally efficient and effective solution. Consultants' advice should be obtained, overseas practices considered, and alternative technologies investigated. Outcomes would include improved power line design standards that reduce aviation hazards in the first place, and a remediation work plan for existing hazardous lines, jointly devised by CASA and Country Energy.

Given the need for much further work and the wide range of likely costs, EMS suggests that the AER may wish to reconsider whether this matter should be allowed as a cost pass-through event. The submission by Country Energy of costing proposals based on the work plan, and the formal endorsement of the work plan by CASA, could be accepted by the AER as the trigger for such a pass-through event.

6 Disclaimer

The analysis, findings, conclusions and recommendations and all written material contained in this Report represent the best professional judgement of Energy and Management Services Pty Ltd (EMS), based on the information made available.

In preparing the Report, EMS has relied upon information provided by the Client and others. Whilst this information has been reviewed to assess its reasonableness and internal consistency, EMS does not warrant the accuracy of any information so provided.

APPENDIX

First Set of AER Questions and Country Energy Responses (26 February 2009)

1. In its revised proposal, Country Energy noted that it had 'calculated the total cost of pole replacement and line marking to be \$40.2 million (2008-09)'. Could Country Energy please outline its method for determining this figure to be an appropriate amount?

Pole Replacement

1124 spans x 50% = 562 spans x 2 poles = 1124 poles/ 10 year cycle = 112 poles per annum

Total cost 112 poles x \$7,027.50 per pole x 4 years = \$3,148,320

Line Marking

1124 spans/ 10 year cycle = 112 @50% = 56 spans per annum

Average span length (750 + 1600 metres)/ 2 = 1175 metres

AS 3891.1 provides for a marker interval of between 25 and 40 metres.

Average marker interval (25 + 40 metres)/ 2 = 32.5 metres

Average number of markers per span 1175 metres/ 32.5 metres = 36 markers

Total cost 56 spans per annum x 36 markers @\$4,600 per marker x 4 years = \$37,094,400

2. Country Energy identified potential actions which may mitigate its risk or exposure, such as:

1. Accept the risk, and
 - place a limited number of markers above roadways by means of high tower, aerial attachment or dropping the line
 - mark the line in accordance with the Australian Standard by means of high tower, aerial attachment or dropping the line, or
 - relocate the line; and
2. Painting poles.

a. Can Country Energy please provide a breakdown of the costs according to these forecast projects?

There is some uncertainty as to the exact combination of the above potential actions that will ultimately be used to mitigate the risks arising from the Sheather decision. Therefore, for the revised regulatory proposal, Country Energy made an assumption on how the eventual risk mitigation strategy would eventuate.

The result of this assumption is reflected in question 1 above. Effectively, the assumption was that Country Energy has to take action on 50 per cent of the lines at risk conducted over a 10 year period, using an average approach of the above potential actions. This average effectively equates to line marking, being between the extremes of doing nothing or completing full asset relocations.

b. Has Country Energy engaged in these types of projects before?

After a coronial inquest into an earlier Parkes helicopter accident, the Coroner's recommendation was to mark the lines. This involved fitting 2 marker balls to the span by means of high tower.

- c. If so, can Country Energy please provide relevant examples of historical costs for these projects (consistent with the breakdown at question 2a)?

These costs are provided in question 1 above and are reflective of the approach adopted for the Parkes accident described in 2b. The pole replacement costs are based on a company average for this activity.

Second Set of AER Questions and Country Energy Responses (9 March 2009)

1. In its response of 26 February 2009, Country Energy indicated that it included costs for markers of \$4600 each. Can Country Energy please provide a breakdown (for example, markers, installation labour etc) of the items that are included in this cost?

The \$4,600 cost used was based on the previous fitting of aerial markers on an 11kV line in the Parkes area. The breakdown of costs is as follows:

<i>Labour</i>	<i>\$2,229</i>
<i>Materials</i>	<i>\$2,253</i>
<i>Plant</i>	<i>\$118</i>

2. Similar to the previous question Country Energy indicated that it included costs for pole replacement of \$7027.50 per pole. Can Country Energy please provide a breakdown of the items that are included in this cost?

The breakdown of the \$7,027.50 cost used is as follows:

<i>Labour</i>	<i>\$2,932</i>
<i>Materials</i>	<i>\$3,325</i>
<i>Plant</i>	<i>\$771</i>

3. Country Energy also indicated that it would need to replace 50 per cent of all the poles.

- a. Can Country Energy please explain why all these poles would need to be replaced and it would not be able to just paint or otherwise mark the poles?

- b. To the extent these poles are replaced, why are the costs expensed rather than capitalised.

(a) As previously advised, Country Energy has assumed that 50% of the lines identified will require some action which will range from "Accept the Risk" through to "Relocate the Line". Marking the lines in accordance with the Australian Standard was taken as an average of the available actions. If the lines are marked in accordance with the Australian Standard, the weight of the line will increase and/or the additional area of the markers will increase the wind load and cause clashing of the line. Accordingly, on average, it has been assumed the poles will need replacing.

Painting or otherwise marking the poles may be a part solution to the Sheather decision, however it is not the total solution. Painting or marking the poles would assist in the identification of the existence of a line if the pilot undertook high level surveillance but if flying at low level (as was the case in the Sheather and the subsequent Parkes helicopter accident) the poles may be some distance above eye level (note we are talking about poles that are at least 750 metres and up to 1600 metres apart).

Even if the lines were at the same level as the poles research has shown that the human brain has difficulty in recognising and connecting poles that are more than 250 metres apart.

(b) The poles were expensed as they are a replacement pole, and are not extending the asset life of the poles or lines.