Appendix C: Electricity transmission lines case study – background data and information

The case study in Section 3.1 examines the Tatong bushfire of January 2007, which resulted in both transmission lines that connect Victoria to NSW being lost to service. It examines the cost and benefits of the implemented resilience measures following the event, and the potential benefits of such measures should they be correctly analysed and implemented. The case study suggests that it may be economically feasible to change the design and construction of these lines to improve resilience in at-risk areas.

This appendix provides background information to support this analysis.

Specifically:

- **Table C.1** presents a summary of the advantages and disadvantages of three options identified by Nous Group (2007) that could make the power lines more resilient
- **Table C.2** presents the summary of a cost estimate for installing underground transmission cables, derived from Australian and international sources.

Table C.1: High-level comparison of resilience options for electricity transmission lines

Resilience option	Advantages	Disadvantages
Change vegetation clearance standards around overhead powerlines	Relatively low additional costs compared with other options	• Vegetation clearance standards are designed to prevent lines from starting fires, and prevent lasting physical damage to lines • Bushfires produce flame heights that exceed any realistically achievable clearance standards • Changes to standards would not significantly reduce the risk of loss of lines.
Separate the two 330kV transmission lines into separate easements	Increasing the distance between lines could greatly reduce the risk of losing both at once	• The risks would not be completely removed, as bushfires often cover large areas, as demonstrated in NSW • This measure is unlikely to be cost-effective, as a new line could cost about $2 billion, in addition to substantial clearing of national parks and native forests. This is relatively more expensive than upgrading the existing lines.
Replace overhead lines with underground transmission cables	This is the only transmission line option that exhibits a degree of immunity to bushfires	• Indicative cost comparisons suggest that replacing both 330kV lines would cost some billions of dollars • The technical feasibility is unclear, as there are limited examples of long-distance underground transmission cables of a similar length and capacity.

Source: Adapted from Nous Group (2007)

Table C.2: Comparison of underground cable costs

Country	Year	Route length (km)	Voltage (kV)	Cost per km (A$, 2015)
Australia	2015	N/A	N/A	2,000,000
Australia	2012	19.2	330	6,978,780
New Zealand	2005	200	400	11,207,048
USA	2011	N/A	138	1,384,409
Ireland	2008	N/A	400	6,697,774
United Kingdom	2012	75	400	12,098,909
United Kingdom	2012	75	400	22,035,917
United Kingdom	2012	75	400	23,930,439

Source: Western Power (2015); Diona Civil Engineering Contractors (2014); PB Power in Transpower (2005); Public Service Commission of Wisconsin (2011); Ecofys Germany GmbH, University of Duisburg-Essen & Golder Associates Ireland (2008); Parsons Brinckerhoff (2012)

A note on other costs

In addition, placing the transmission cables underground would reduce the costs of vegetation management, which is only required for overhead lines. In 2014–15, AusNet Services spent $3,803,006 on vegetation management across its transmission line network, at an average cost of $760.30 per kilometre. This estimate has been escalated to 2015–16 price terms using CPI data, producing an average vegetation management cost saving of $769 per kilometre if underground cables were installed.