Dulhunty Power Limited

Carbon footprint analysis for wood and alternative power pole types used in Australia

Prepared by ipernica Ventures Pty Ltd

31 October 2008

Disclaimer

The best efforts of Dulhunty Power Limited and ipernica Ventures Pty Ltd have been applied to the preparation of this report, however, neither Dulhunty Power Limited or ipernica Ventures Pty Ltd make any warranty of any kind, expressed or implied, with regard to information contained in this report.

No warranty is made as to the accuracy, completeness or usefulness for any particular purpose of the information.

No liability is accepted for any loss or damage, however caused, arising from reliance on or use of any information or arising from the absence of information or any particular information in this report.

Contents

Topic	**Page**
Introduction, Purpose of the Report and Methodology	1
Types of Power Poles Compared	2
Point of Comparison 1 - Raw Materials	3
Point of Comparison 2 - Manufacturing	4
Point of Comparison 3 - Installation	5
Point of Comparison 4 - Maintenance	6
Point of Comparison 5 - End of Life	7
Findings – Performance of all Power Poles	8-11

Introduction and Purpose of Report

Introduction
This report was prepared by ipernica Ventures Pty Ltd on behalf of Dulhunty Power Limited (ASX Code: DUL). Dulhunty Power Limited is a manufacturer and supplier of quality Electricity Transmission and Distribution products. The company has manufacturing plants in Sydney, Australia, Yangzhou, China and Bangkok, Thailand. It also has sales offices in New Zealand and Hong Kong.

Purpose of the report
This report was commissioned by Dulhunty Power Limited who are manufacturing a new type of power pole known as a Fibreglass Reinforced Cement (FRC) pole. This report compares the total estimated carbon dioxide (CO_2) emissions of seven different types of power pole found in Australia across five key stages being:

1. Raw materials — The key components of each power pole.
2. Manufacture — The inputs into the production of each power pole.
3. Installation — The inputs into the delivery of the finished poles and installation of each power pole.
4. Maintenance — The inputs into the maintenance of each type of power pole.
5. End of life — The inputs into the removal and subsequent disposal of each type of power pole.

Methodology
The methodology used in determining the estimated carbon emissions for each power pole across the five stages above involved the development of a series of spreadsheets which modelled a number of assumptions based on independent reports from a number of sources as well as information provided by key staff from Dulhunty Power Limited.

Types of Power Poles Compared

The types of power pole compared were as follows:

Type of power pole	Key components	Height	Life Expectancy	Strength
1. Wood – Treated Eucalypt	Wood and Chromated Copper Arsenate	12.5 meters	50 years	8 kN
2. Steel Reinforced Concrete	Concrete and Steel	12.5 meters	70 years	8 kN
3. Galvanised Steel	Steel, Zinc and Polyethelene	12.5 meters	70 years	8 kN
4. Stobie	Concrete and Steel	12.5 meters	70 years	*
5. Fibreglass Reinforced Plastic (FRP)	Polymer Resin and Glass Fibre	12.5 meters	50 years	8 kN
6. Fibreglass Reinforced Cement (FRC)	Cement, Glass Fibre, Water, Clay and Additives	12.5 meters	70 years	8 kN
7. Wood-Steel Composite**	Wood, Chromated Copper Arsenate, Steel and Zinc	12.5 meters	50 years	8 kN

Note: ‘kN’ refers to a ‘Kilonewton’ – a unit measurement of force being 1,000 Newtons.
* Stobie poles have a “strong” and a “weak” direction. The pole included in the study is designated 12-155-329T
**Two part wood with central steel sleeve joiner.

Points of Comparison and Assumptions

Processes and key assumptions

There were five key stages of comparison and a number of key assumptions under each stage of comparison that were considered and modelled as part of the process to establish the total estimated Kilograms (kg) of CO_2 emissions for each pole across each stage. These were as follows:

Point of comparison 1 - Raw materials

The process was as follows:

- The estimated total weight was assigned to each type of power pole. The weight of each pole (other than the Fibreglass Reinforced Cement pole to be manufactured by Dulhunty Power Limited and the wood-steel composite pole) was obtained from Integral Energy and ETSA Utilities data sheets.

- The total weight was then broken down into various components and a corresponding weight value (in kg) was assigned.

- Once these weight values were assigned, the estimated CO_2 emissions per kg were assigned to each component. The estimated CO_2 emissions per kg were obtained from the following sources:

  - The Environmental Impact of Building Materials, Victorian Native Forest Timbers, Dr Alastair Woodward and Mr Boris Iskra, February 2006.

  - Embodied Energy and CO_2 Coefficients of New Zealand Building Materials.

  - Material Intensity of Advanced Composite Materials by Hartmut Stiller, February 1990.

  - Centre for Environmental Assessment of Product and Material Systems – Chalmers.

- Appropriate energy input conversions were undertaken to ensure the estimated carbon emissions were derived from the same basis. It should be noted that the steel used in some of the poles was estimated to be comprised of 87% virgin steel and 13% recycled steel.

- A 'waste' premium was also incorporated which represented an estimation of the surplus energy inputs required to produce the specific raw material.

- The estimated total CO_2 emissions per kg per power pole at the raw material stage were determined by multiplying the individual component of each pole

Points of Comparison and Assumptions

Point of comparison 2 - Manufacturing
The process was as follows:

- The key steps in the manufacturing process for each power pole were identified by Dulhunty Power Limited.

- The corresponding energy inputs per step were estimated. These were expressed as Kilowatt Hours (kWh) and were estimated by Dulhunty Power Limited.

- A ‘waste’ premium was also incorporated which represented an estimation of the surplus energy inputs required to manufacture each pole.

- The estimated total kg of CO_2 emitted per manufacturing step was determined by multiplying the estimated CO_2 emissions per kg per kWh per step by the corresponding estimated kWh used in each step.

Points of Comparison and Assumptions

Point of comparison 3 - Installation
The process was as follows:

- The key steps in the installation process for each power pole were identified. These focussed on delivery of the poles (different load numbers per truck per power pole type were considered) from suppliers to the customer and then the customer taking an individual pole to the installation site and installing it.

- Two types of trucks were considered here:

    - An Articulated Truck for the delivery of the poles and transport to the installation site.

    - A Rigid Truck to drive to the site, dig the hole and install the power pole via a hydraulic arm.

- An estimated distance of 150km was assumed for the delivery of the poles from the manufacturer to the customer.

- The corresponding fuel and electricity inputs per step were estimated. These were expressed as:

    - Fuel: CO_2 emissions per litre of fuel used. It should be noted that corresponding fuel values relating to average consumption per 100Kms (for both Articulated and Rigid Trucks) were taken from the Australian Bureau of Statistics report 9208.0 - Survey of Motor Vehicle Use, Australia, 12 months ended 31 Oct 2007.

    - Electricity: kg of CO_2 emissions per kWh.

- The estimated total kg of CO_2 emissions per the installation process were calculated by adding the total estimated CO_2 emissions for fuel usage and the total estimated CO_2 emissions for electricity usage.

Points of Comparisons and Assumptions

Point of comparison 4 - Maintenance
The process was as follows:

- The key steps in the maintenance process for each power pole were identified. These were centred around travel to and from the power pole site as well as electrical inputs used in the maintenance process. Alternate maintenance practices were assumed for each pole given the different raw materials in each.

- It is important to note that the period of time over which the model measures the total estimated CO_2 emissions from all poles across each stage is the effective life assigned to each pole. This is relevant as 2 maintenance visits within a 9 year period has been factored in for wood (treated Eucalypt) poles and wood-steel composite poles. All other poles require 1 maintenance visit in this timeframe.

- The corresponding fuel and energy inputs per step were estimated. These were expressed as estimated CO_2 emissions per litre of fuel used as well as estimated kg of CO_2 emissions released per kWh.

- One type of truck was considered here:

    - A Rigid Truck to drive to the site and if necessary elevate personnel to carry out maintenance works.

- The corresponding fuel and electricity inputs per step were estimated. These were expressed as:

    - Fuel: CO_2 emissions per litre of fuel used. It should be noted that corresponding fuel values relating to average consumption per 100Kms were taken from the Australian Bureau of Statistics report 9208.0 - Survey of Motor Vehicle Use, Australia, 12 months ended 31 Oct 2007.

    - Electricity: kg of CO_2 emissions per kWh.

- The estimated total kg of CO_2 emitted per the maintenance process were calculated by adding the total estimated CO_2 emissions for fuel and the total estimated CO_2 emissions for electricity.

Points of Comparisons and Assumptions

Point of comparison 5 – End of Life
The process was as follows:

- The key steps in the end of life process for each power pole were identified. Again, these centred around travel to and from each power pole site to disconnect the power lines and remove a single pole.

- The corresponding fuel and energy inputs per step were estimated. These were expressed as estimated CO_2 emissions per litre of fuel used as well as estimated kg of CO_2 emissions per kWh.

- Two types of trucks were considered here:

  - An Articulated Truck to carry the power pole away from the site.

  - A Rigid Truck to drive to the site, disconnect the power lines and remove the pole from the ground via a hydraulic arm.

- The corresponding fuel and electricity inputs per step were estimated. These were expressed as:

  - Fuel: CO_2 emissions per litre of fuel used. It should be noted that corresponding fuel values relating to average consumption per 100Kms were taken from the Australian Bureau of Statistics report 9208.0 - Survey of Motor Vehicle Use, Australia, 12 months ended 31 Oct 2007.

  - Electricity: kg of CO_2 emissions per kWh.

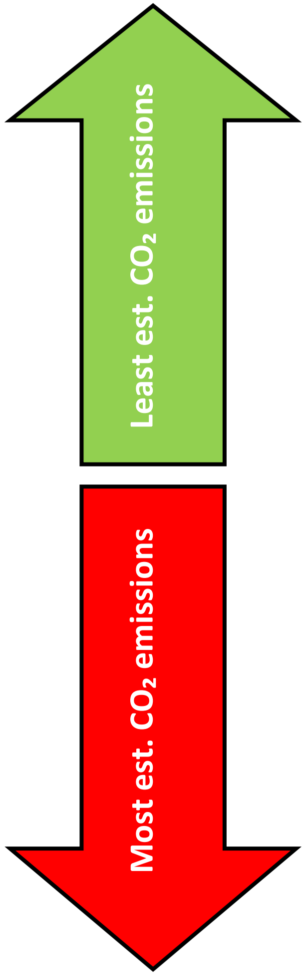
- The estimated total estimated kg of CO_2 emissions per the maintenance process were calculated by adding the total estimated CO_2 emissions for fuel and the total estimated CO_2 emissions for electricity.

Findings

The key findings of the report focussed on identifying the relative CO_2 emissions for all pole types.

<u>Performance of the FRC pole to be manufactured by Dulhunty Power Limited</u>
Although wooden power poles emit the least amount of carbon dioxide, the Fibreglass Reinforced Cement (FRC) pole to be manufactured by Dulhunty Power Limited has the second smallest carbon footprint and therefore is the next best alternative to wooden power poles.

Fibreglass Reinforced Plastic on the other hand has the highest estimated carbon footprint which is mainly due to the production of the polymer resin which is a key component of the pole.

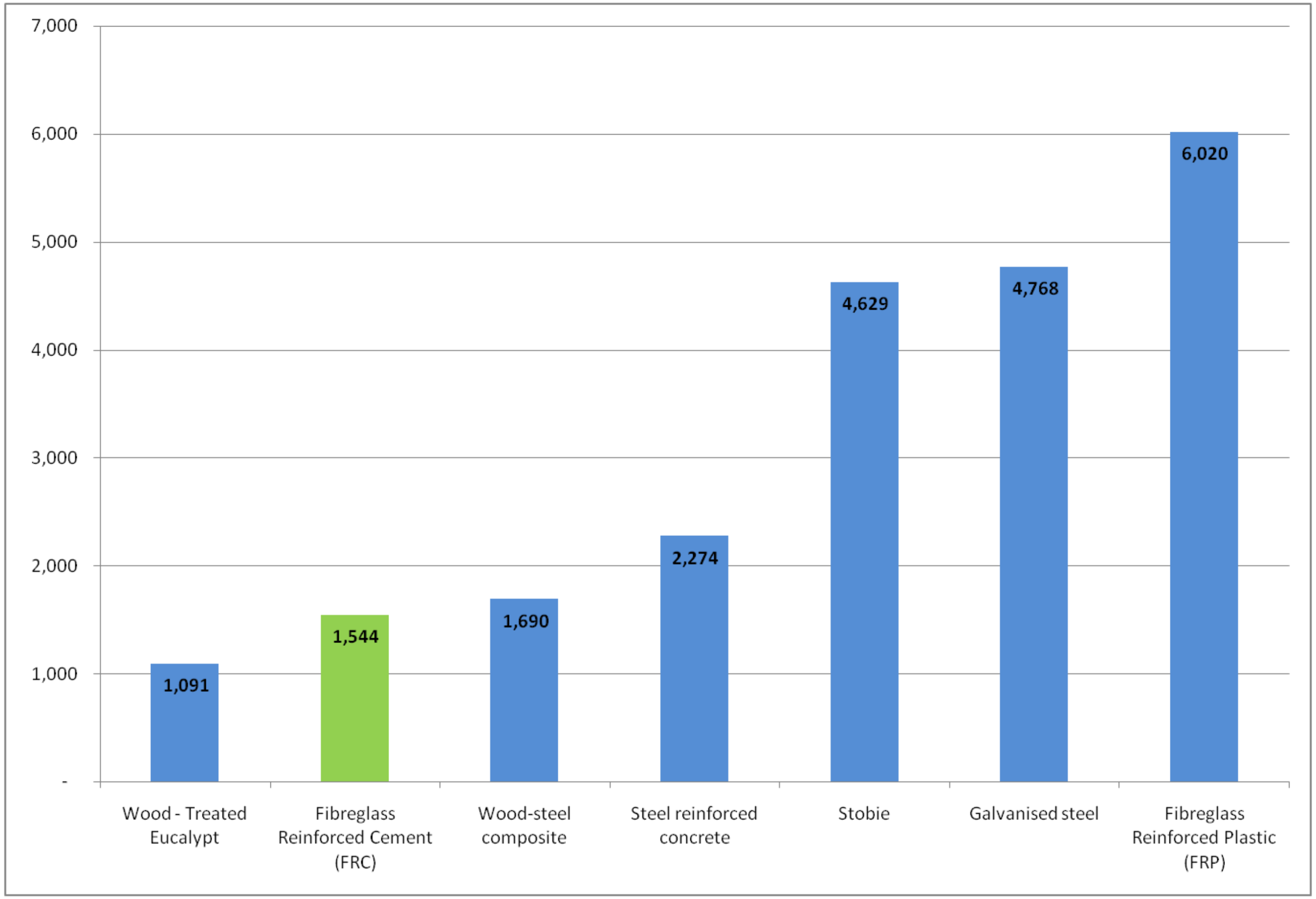


Performance of all power poles

Ranking	Type of Power Pole	Est Kgs of Co_2 emitted over lifetime
Rank 1	Wood – Treated Eucalypt	1,091
Rank 2	*Dulhunty Power Limited* Fibreglass Reinforced Cement (FRC)	1,544
Rank 3	Wood-Steel Composite	1,690
Rank 4	Steel Reinforced Concrete	2,274
Rank 5	Stobie	4,629
Rank 6	Galvanised Steel	4,768
Rank 7	Fibreglass Reinforced Plastic (FRP)	6,020

Findings

Total estimated kg of CO_2 emitted/power pole from raw material through to end of life



Findings

Comparison Table

The table to the right breaks down the estimated CO_2 emissions per power pole across each input process.

It is evident that in all cases (other than wood) the carbon emitted at the raw material stage is the key contributor to the overall emissions of each pole.

Components such as Steel, Concrete, Cement (in addition to Polymer Resin mentioned earlier) produced the largest estimated CO_2 output from their production.

Type of Pole	Height (Meters)	Strength (kN)	Life expectancy (Years)	Cost ($AUD)	Weight (Kilograms)	Total estimated CO_2 emitted / input process: Raw Material (Kilograms)	Manufacturing (Kilograms)	Installation (Kilograms)	Maintenance (Kilograms)	End of Life (Kilograms)	Totals (Kilograms)
Wood - Treated Eucalypt	12.5	8	50	600	1187	293.25	2.74	154.24	464.01	176.72	**1090.95**
						26.88%	*0.25%*	*14.14%*	*42.53%*	*16.20%*	***100.00%***
Steel reinforced concrete	12.5	8	70	1200	1680	1544.58	38.32	158.97	316.68	215.66	**2274.20**
						67.92%	*1.68%*	*6.99%*	*13.92%*	*9.48%*	***100.00%***
Galvanised steel	12.5	8	70	1200	479	4103.62	11.54	149.33	324.80	178.80	**4768.10**
						86.06%	*0.24%*	*3.13%*	*6.81%*	*3.75%*	***100.00%***
Stobie	12.5	8	70	?	1432	3933.33	10.55	156.70	312.62	215.66	**4628.85**
						84.97%	*0.23%*	*3.39%*	*6.75%*	*4.66%*	***100.00%***
Fibreglass Reinforced Plastic (FRP)	12.5	8	50	2500	315	5462.62	8.23	149.33	223.30	176.72	**6020.19**
						90.74%	*0.14%*	*2.48%*	*3.71%*	*2.94%*	***100.00%***
Fibreglass Reinforced Cement (FRC)	12.5	8	70	1200	415	900.38	4.75	149.33	312.62	176.72	**1543.79**
						58.32%	*0.31%*	*9.67%*	*20.25%*	*11.45%*	***100.00%***
Wood-steel composite	12.5	8	50	?	1239	847.55	8.86	154.24	464.01	215.66	**1690.31**
						50.14%	*0.52%*	*9.13%*	*27.45%*	*12.76%*	***100.00%***

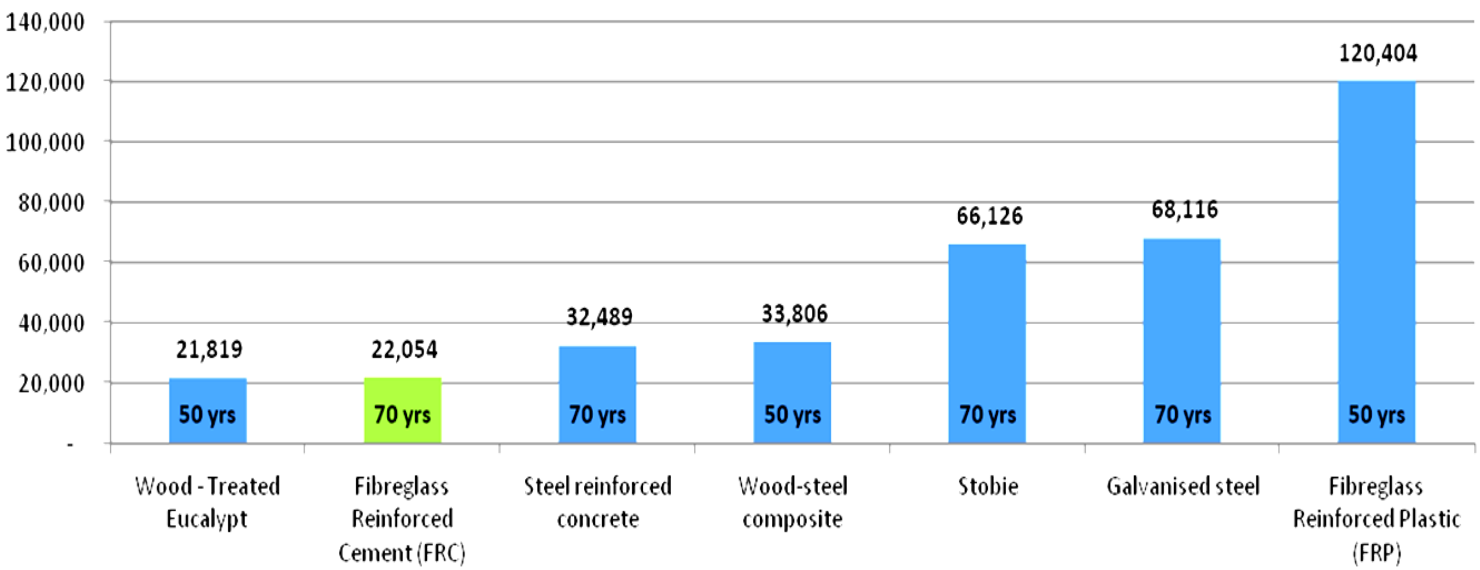
Findings

Bar Chart
The chart to the right provides an indication of the estimated kilograms of CO_2 emitted per 1,000 poles per power pole type.

For example, it is estimated that 1,000 FRC poles would emit over 22 tonnes of CO_2 across their effective life of 70 years.

This compares favourably against the wood power pole whose life expectancy is 50 years and the wood-steel composite pole whose estimated carbon emissions exceed Dulhunty's FRC pole for the same period of time.

Total estimated kg of CO_2 emitted/1,000 power poles from raw material through to end of life



Findings

Bar Chart
The chart to the right extrapolates the chart on page 11 with all life cycles extended to 70 years, inferring replacement of poles with expected lifetimes of 50 years.

This allows uniform comparison of the carbon emissions. The Dulhunty FRC pole on a 70 year projection clearly results in the lowest emission footprint.

Total estimated kg of CO_2 emitted/1,000 power poles from raw material through 70 years cycle