

## Understanding AGL's "Utilisation of habitat by Brolga within the vicinity of the Macarthur wind farm 2013."

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Using the AGL report and AEMO generation data.

### SUMMARY

the Macarthur wind farm has in effect displaced Brolga from effectively using the area within 5km of the wind farm, including 25 potential nesting sites.. The only reported successful nesting in the area is 6km from the wind farm.

**From January to June, no Brolga were recorded within 5km of the wind farm at any time. Brolga never flocked at the site in either flocking period at the start or end of the year, even though that had prior to commissioning.**

**From June to December 17 Brolga came within 3km of the wind farm to feed or attempt to breed. However all of these were displaced, and the time taken to displace became shorter as the year progressed, suggesting the Brolga became less tolerant to the noise or whatever was causing the displacement.**

**After working through over 120,000 AEMO data points of the Macarthur wind farms generation for the period January 1 to December 31 2013, it has become clear that the Brolga that visited the wind farm site to feed or attempt to breed, only ever came within 3km of the turbines when daily average generation was between zero and 30%. Feeding Brolga exited the wind farm and could not be found within 3km, once the average generation exceeded 30%. The only exception to this was a single bird on one occasion, who had been in the wind farm when average generation was below 30% and when it rose above 30% the bird exited the wind farm and stayed another day 500m from the extreme edge, in the normal prevailing wind direction, then left. This also suggests noise is the displacement cause, as the wind would have carried the noise in the opposite direction to where the Brolga was. As the average generation went in excess of 70%, the wind speed must have been quite high.**

**Brolga that came into the wind farm to attempt to breed also did not arrive until after several days of average generation being between zero and 30%. They were eventually displaced by the noise, but did stay on the nests initially even when average generation exceeded 30%. One pair had three attempts to nest, the first time (page 8 of my analysis) they stayed 32 days, even through 14 of these days had average generation over 30%,. The second time they arrived in a wind lull, after 5 days of low generation (page 9 of my analysis) they laid eggs and endured only 19 days, abandoning the nest after 6 occasions where the average generation was over 30%. The third time the Brolga pair attempted to nest, (page 9 of my analysis) was after three days of virtually zero generation, this time they only stayed 7 days, leaving after the second day of average generation being over 30%. They appeared to be less tolerant to the noise after each attempt, both for entry into the wind farm and the number of noise bursts before they exit.**

## **METHOD.**

**AEMO has provided the complete generation data in 5 minute generation intervals. for all generators from November 2010 to June 2014. For the period covered by the AGL report, in excess of 120,000 data points were extracted from the AEMO source for this exercise**

**The data was then processed through numerous spread sheets to enable an averaging method to be developed to easily show daily average generation figures and maximum generation spikes. This enables a clear and quick comparison of generation activity in relation to Brolga activity on the Macarthur wind farm site.**

## **INTRODUCTION**

**I worked through the AGL report results section, starting on page 5, and examined each recorded Brolga activity event and graphed the daily average generation for each of these events.**

**My results are outlined in the following 14 pages. It is worth reiterating some of the comments in the AGL Report , prior to you going through each of the activity records.**

**The AGL introduction states:**

- 1. that the wind farm has a 420Mw capacity and was commissioned 31 January 2013.**
- 2. breeding was successful in the wind farm in 2012, before the completion and commissioning in 2013.**
- 3. during construction brolga were seen on the site, including a flock of juveniles.**

**The AGL Report Methods on page 2 states:**

- 1. DSE wetland mapping was reviewed. Page 7 the final paragraph states there were 41 wetlands visited within 3km of the wind farm (and in Page 2 paragraph 1, it states there were many more that were not accessible.) Page 7 states that of the 41 visited, 25 were deemed potential breeding sites.**
- 2. Surveying was done January to June within 5km of the wind farm looking for flocks, and from June to December within 3km looking for breeding.**

**Report section 3 Results on page 5 states:**

**No Brolga were seen at all within 5km of the wind farm from January 1 to June 10.**

**From June 10 to December 24 only a total of 17 Brolga were seen within 3km of the wind farm.**

## RESULTS

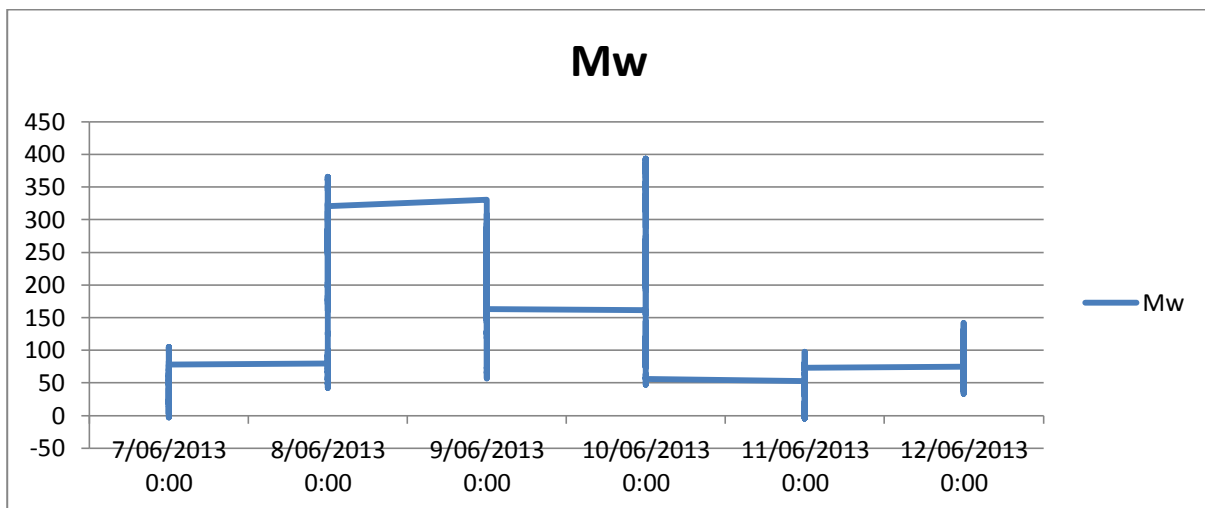
I will now go through each reported sighting from the AGL report and match up distances from turbines, wind directions if available, and AEMO generation data.

You will see the trend of Brolga arriving during still or low wind periods, and then in most cases leaving when average generation exceeds 30%.

### First Brolga pair reported in AGL report.

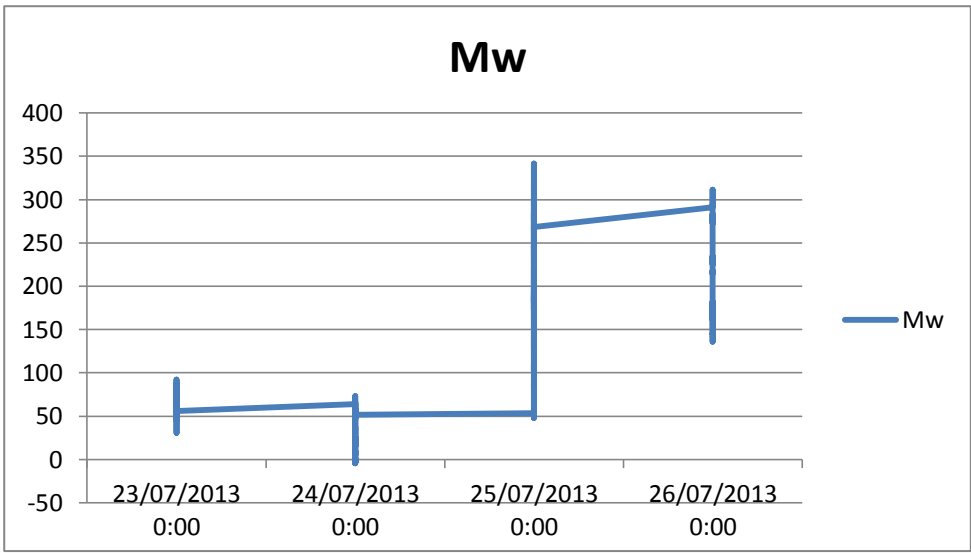
10 June 2013, 2 Brolga seen within 250m of 5 turbines. One was leg banded T3

The graph below is showing the generation trend Over 6 days, apart from a spike of 88% generation earlier on 10 June, the later part of June 10 and June 11 averages to only 11% of wind farm generation capacity.



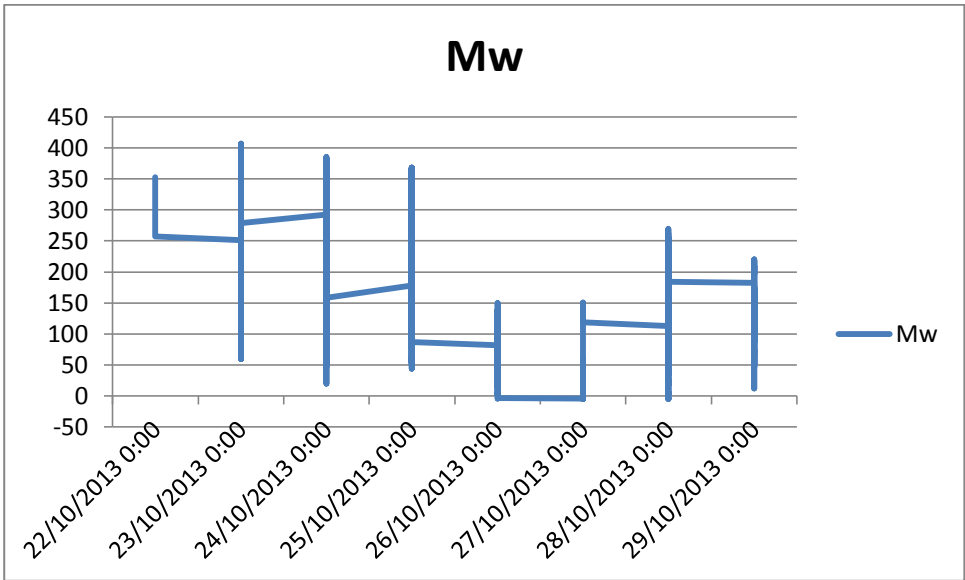
T3 was observed with its partner on 25 July, in the same area as above.

But as the wind picked up later on the 25<sup>th</sup>, the Brolga left.



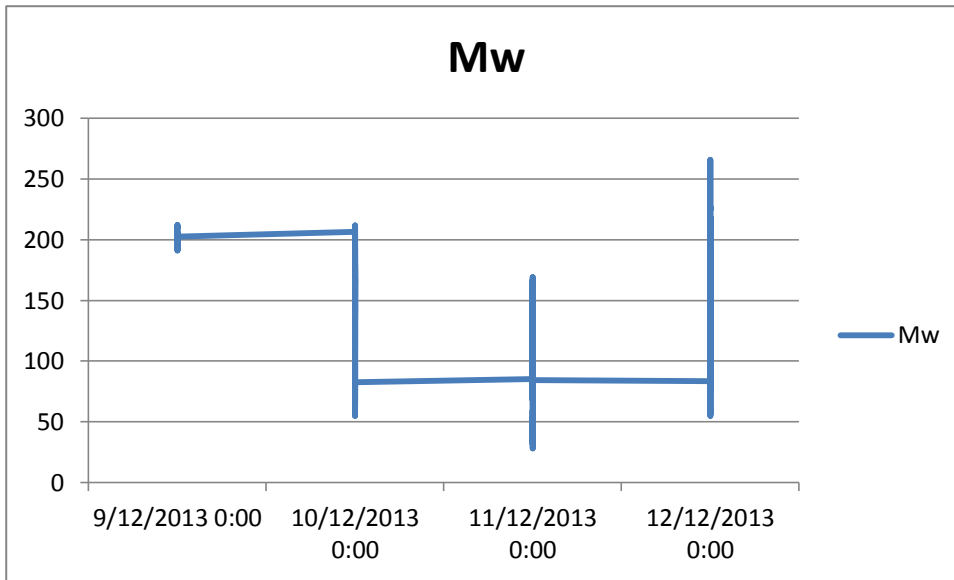
**T3 was again observed on 24 October with its partner, again in the same area.**

**The birds appeared to arrive after the generators had been running at average 66%, dropping to average 33%, and apart from some generation peaks for short periods, the average drops to zero by day 2 of their visit, and they stay until the average jumps back up to being 40% or higher.**



**The next time T3 appeared was briefly on 11 December, and on its own, then not seen again.**

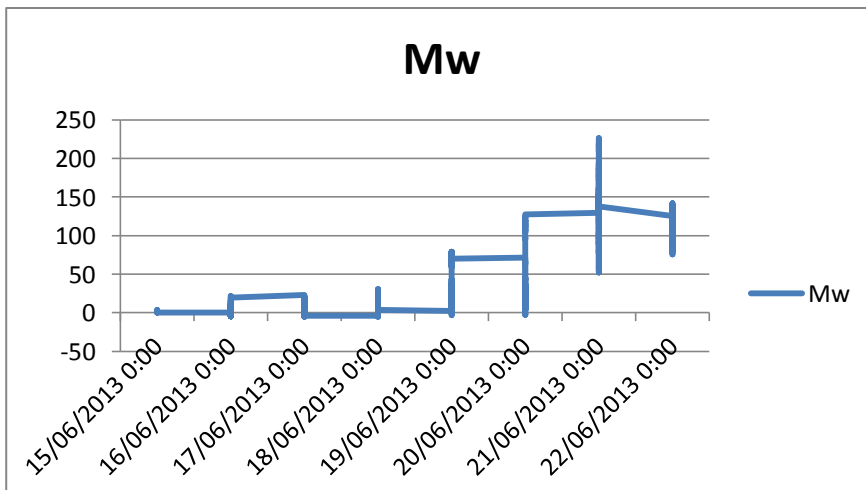
**11 December was once again a low generation period.**



**Second Brolga pair reported in AGL report.**

The pair was banded and was seen in the Southern section of the wind farm on 21 June.

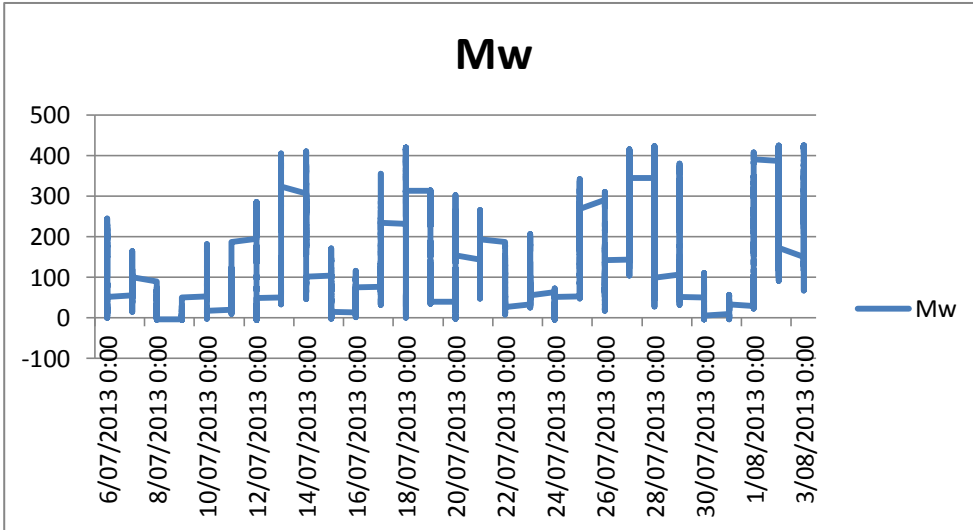
You can see there had been an extended period of virtually no generation for several days leading up to the sighting of the Brolga pair, and then as generation spiked to over 50% and averaged over 30%, for an extended period, they have left.



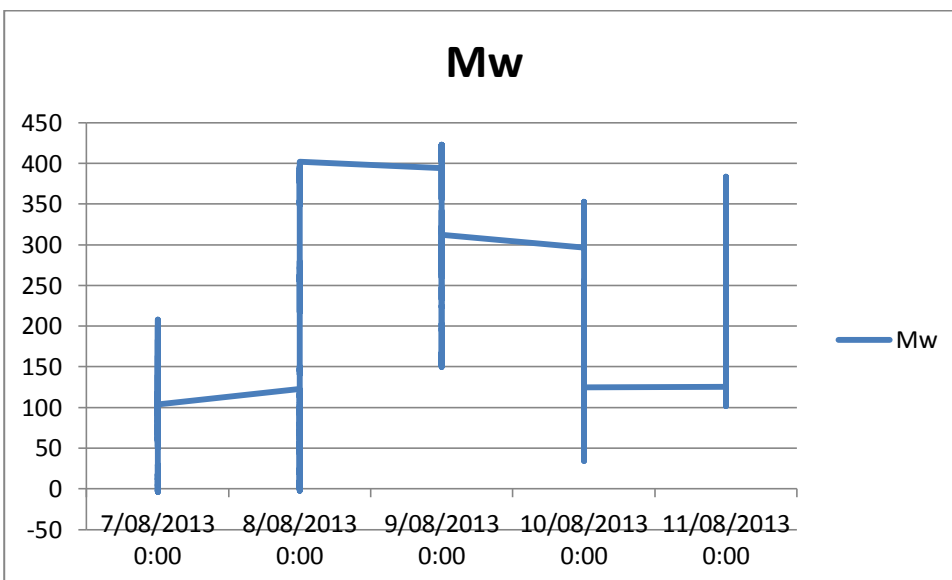
The report then sights the two parent Brolga and the banded chicks from last year. A family of four they call it. Spotted on 6 July and on various occasions until 20 July. The location appears to be more than 3km from the nearest turbine.

You will see from the graph below that only 8 days of the 15 days stated had generation over 30% of capacity and only two had average generation over 70%.

There is not enough information in the report to determine if the Brolga were in the same location each day or just seen several times during that time period. There is insufficient information from AGL to determine the actual days that the Brolga were present.



The same parent pair as above was seen on 8 August and 10 August in the wetland 300m from turbine number 77. The graph below shows both days had average generation less than the 30% that we have repeatedly seen in this comparison of Brolga visits and generation. The pair was seen building a nest on 10 August.



The nesting pair of Brolga was seen to have built a nest and laid an egg on 19 August. Again on a day the average generation dropping below 30%. See graph bottom of the page.

They abandoned the nest sometime between 21 September and 27 September. The graph below shows that out of the 32 days present, they had endured 14 days of average generation over 30% before being displaced.

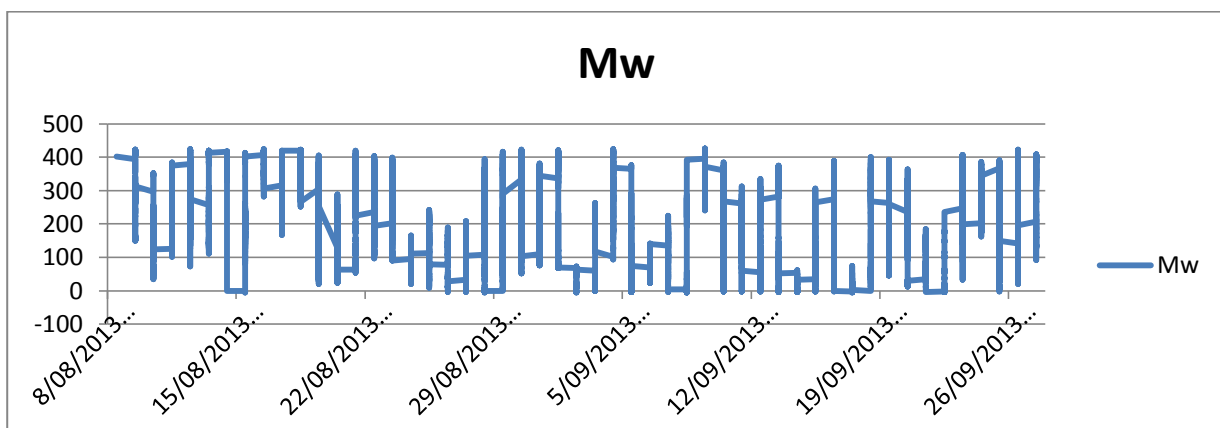
There is insufficient information in the AGL report to determine if the Brolga had continuous presence on the nest. The period of time should have been long enough to hatch a healthy egg.

Many reports have been made by chicken farmers near wind farms claiming soft shell eggs, deformed eggs and infertile eggs.

The Brolga will stay and defend a nest under all sorts of extreme conditions, once they are hunkered down. I have seen airplanes repeatedly dive bomb Brolga on a nest, and helicopters setting down next to Brolga nests the week before wind farm area nest surveys and the Brolga stayed glued to the nest on both occasions. Repeated harassment or disturbance does drive them away, but they seem to be able to defend for short periods of time.

If the Brolga remained with the nest during the whole 32 days, then they have tolerated generation peaks that are over the 30% that seems to displace Brolga that are not nesting and can freely move away.

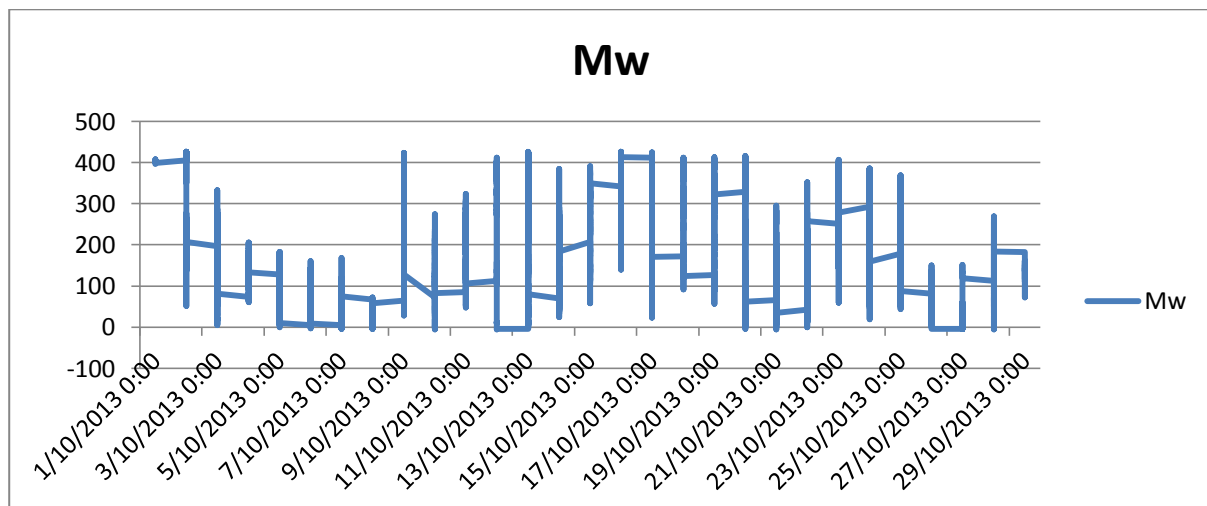
Brolga are a territorial bird, and will repeatedly return to a nesting site even if it has been destroyed. This has been observed where swamps have been drained and cropped, the Brolga have been seen to nest in the crop on dry ground. They have also been seen to nest in raised beds that replaced their nesting swamp the prior year. I am not surprised that Brolga have attempted to nest at a historic site, but I am also not surprised that the nesting attempt has failed. The Laura Navarrete report on cranes and Texas wind farms, does show some cranes try to feed in the wind farms, close to turbines, but she found that within 2km of the turbines they are so stressed that they cannot eat enough food to offset the energy they burn away in being stressed and constantly vigilant, unable to rest.



Sorry about the compression in the graph, but there are nearly 20,000 individual generation records averaged in it. The graph does show about half the days had generation over 30% that has previously displaced the non nesting birds, and there has been almost 30 peaks of nearly 100% generation in that period. It must have driven those poor nesting Brolga nearly mad!!!!!!!!!!!!!!!!!!!!!!

The AGL report states the pair returned to the wind farm 4 October.

The graph below shows on October 4 Average generation drops to 16%. The Brolga were located in the extreme North of the wind farm, 6km from their first nest site.

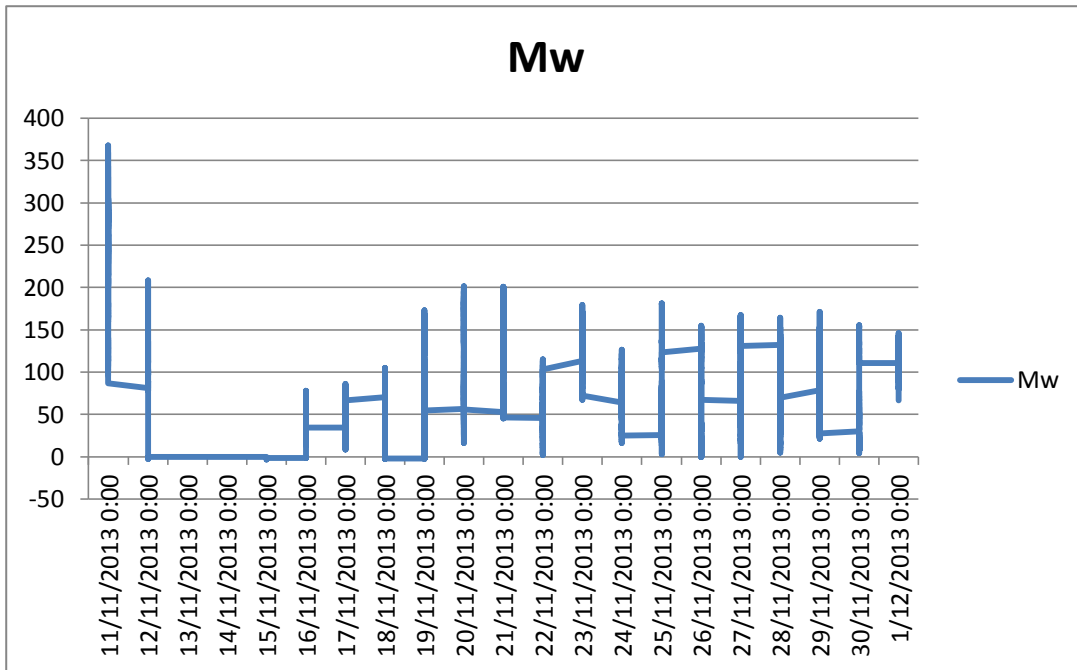


On 10 October, the Brolga tried a second time to resurrect their original nest and laid 2 eggs after the wind farm was below 22% for 4 days. In the next 19 days the wind farm exceeded 30% average generation only on 6 occasions. On the seventh occasion, the Brolga abandoned the nest.

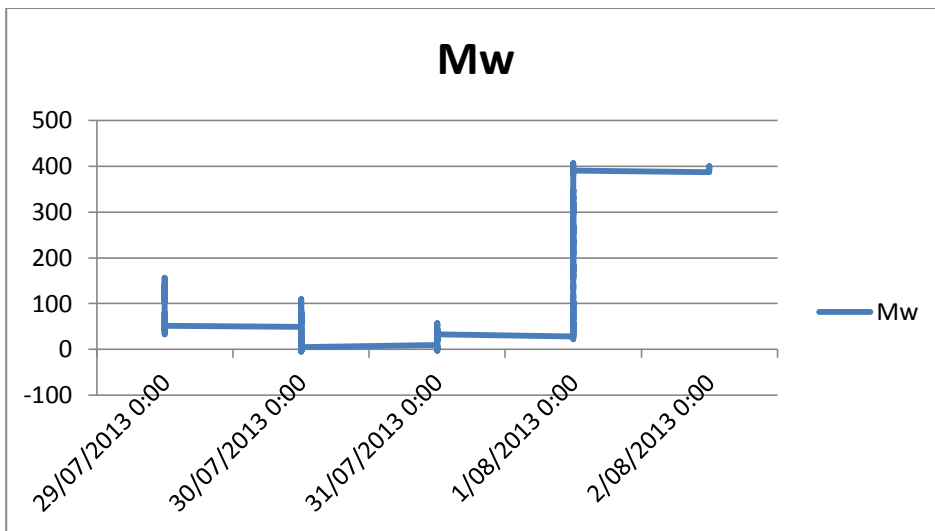
The Brolga pair returned again on 20 November and laid an egg and stayed for a week, then abandoned the nest once more. They arrived after 3 days of virtually zero generation, and this time only tolerated 5 peaks of generation around 40%, and 2 average generation days exceeding 30%, then departed. It appears that they became less tolerant to the increase in generation every attempt. This appears to show that the displacement occurs easier and sooner as attempts are repeated, and the Brolga do not get used to the turbines operating above certain levels over time. (30% average generation seems to be the displacement number)

Laura Navarrete's report done over 4 years in the Texas wind farms showed exactly the same thing. The problem got worse over time, and the tolerance reduced year on year for the 4 years.

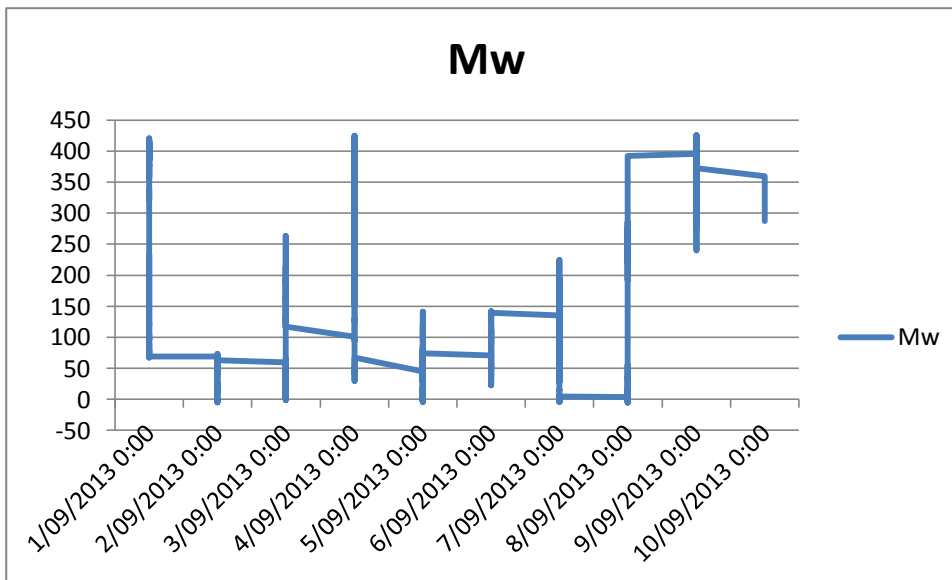




The next entry in the report is a Juvenile Brolga on 1 August. As you can see in the graph below, the Brolga returned in a time of low generation, less than 10%, and left as soon as the generation ramped up. This same scenario has been repeated now numerous times, in fact there has not been a scenario where the birds arrive during generation over 30%.



The next entry is for the same tagged Brolga arriving on September 4 and leaving after September 7. Again the average generation shows why this would be so.



The next entry is for a pair of Brolga seen in the wind farm for only one day on July 6.

As shown on the graph on page 6 ( of my assessment) for Brolga Family of four, also spotted on July 6. The average generation that day was only 11%. The report says the Brolga were seen flying through the turbines, but with a 11% average generation for the day, the time the Brolga flew through could have been with turbines stationary, or hardly generating. Reporting needs far more information in future.

The next entry in the AGL report is for an individual Brolga on July 26. The graph on Page 6 shows the average generation was below 30%. The Brolga then moved the next day 500m outside the wind farm. This is interesting, as on 27<sup>th</sup> the average generation rose to 70%, this is the first time the Brolga have been within 3km of the wind farm on a generation average over 30%. I looked at the Bureau of Meteorology data for monthly average wind directions and found July has mostly North West winds. See wind data below. If this was the case on the 27<sup>th</sup>, the Brolga would have put himself in a position where the noise from the wind farm was not blowing towards him. I have asked the Bureau of Meteorology for the wind direction data for that day, so I will have precise data.

The Brolga was back inside the wind farm the following two days when the average generation was 22%, then 11%. The Brolga was gone from the wind farm a few days later when the average

generation was up again to over 80%.

### Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 28 Jun 1983)

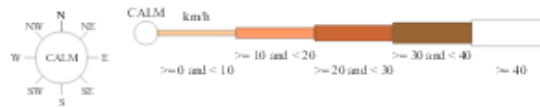
Custom times selected, refer to attached note for details

#### HAMILTON

Site No: 090044 • Opened Jan 1959 • Closed Dec 1983 • Latitude: -37.7333° • Longitude: 142.0167° • Elevation 209m

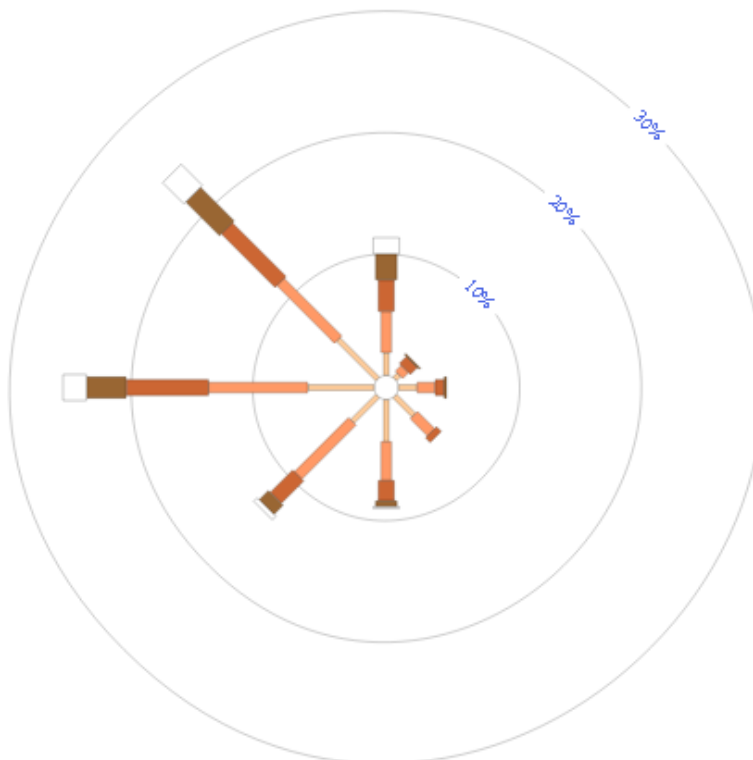
An asterisk (\*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Aug  
742 Total Observations

Calm 5%



Source:

[http://www.bom.gov.au/clim\\_data/cdio/tables/pdf/windrose/IDCJCM0021.090044.3pmAug.pdf](http://www.bom.gov.au/clim_data/cdio/tables/pdf/windrose/IDCJCM0021.090044.3pmAug.pdf)

On 1 August another pair of Brolga was seen 2km north of the wind farm attempting to nest, this was unsuccessful reportedly due to water inundation of the nest. This nest site was nearly 2.5km from the nearest turbine, in the extreme North of the wind farm.

### Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 28 Jun 1983)

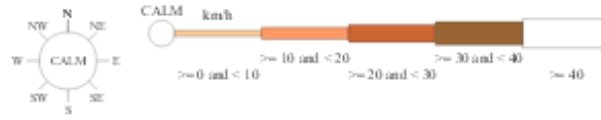
Custom times selected, refer to attached note for details

#### HAMILTON

Site No: 090044 • Opened Jan 1989 • Closed Dec 1983 • Latitude: -37.7333° • Longitude: 142.0167° • Elevation 209m

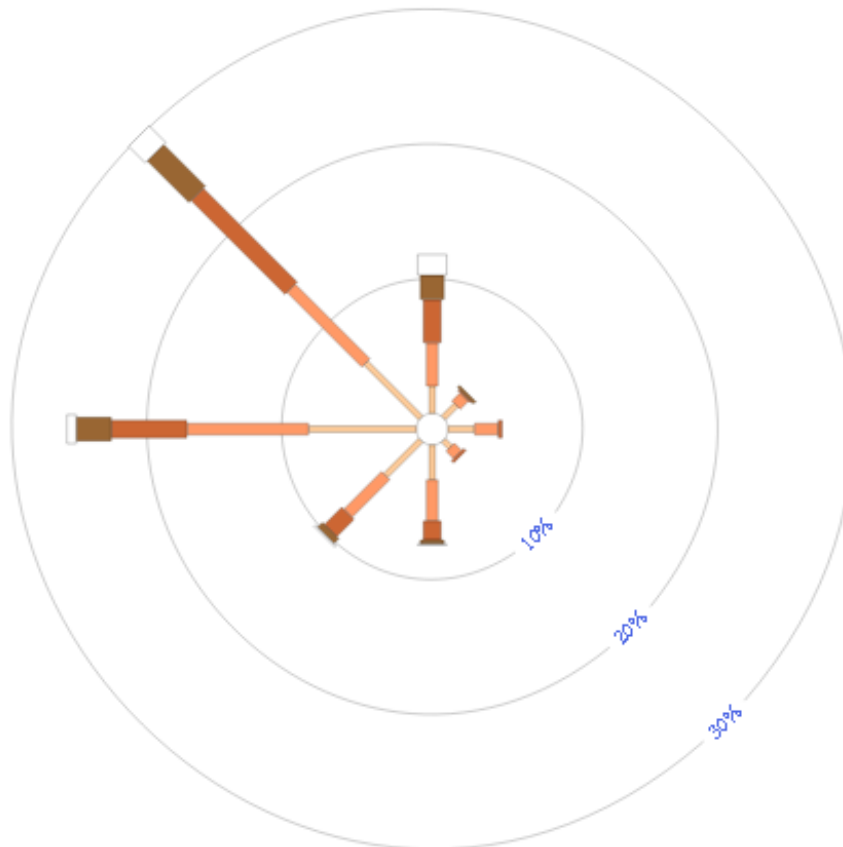
An asterisk (\*) indicates that calm is less than 0.5%.

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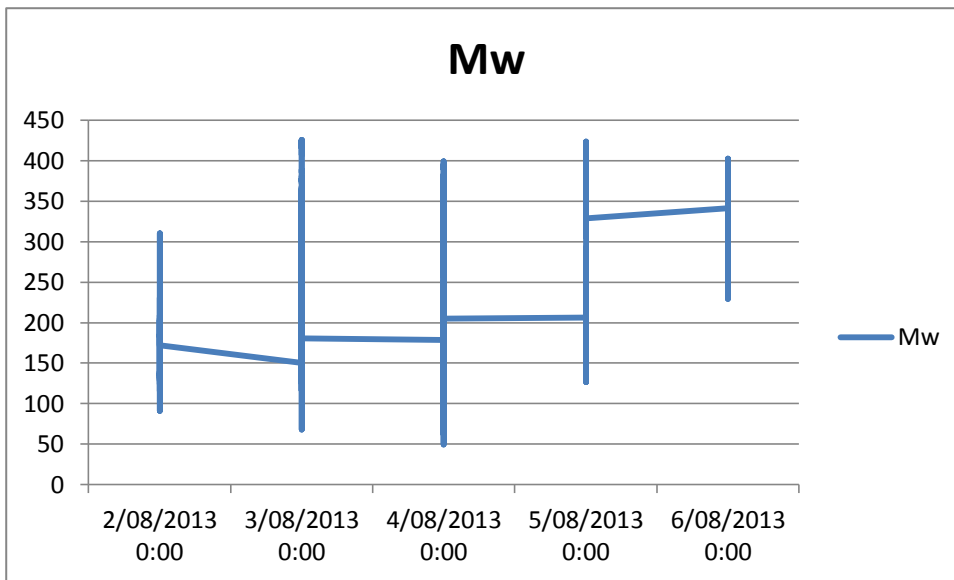
3 pm Jul  
710 Total Observations

Calm 6%



Wind direction data from the Bureau of Meteorology shows that this nest position would seldom have noise blowing toward the nest most of July and August.

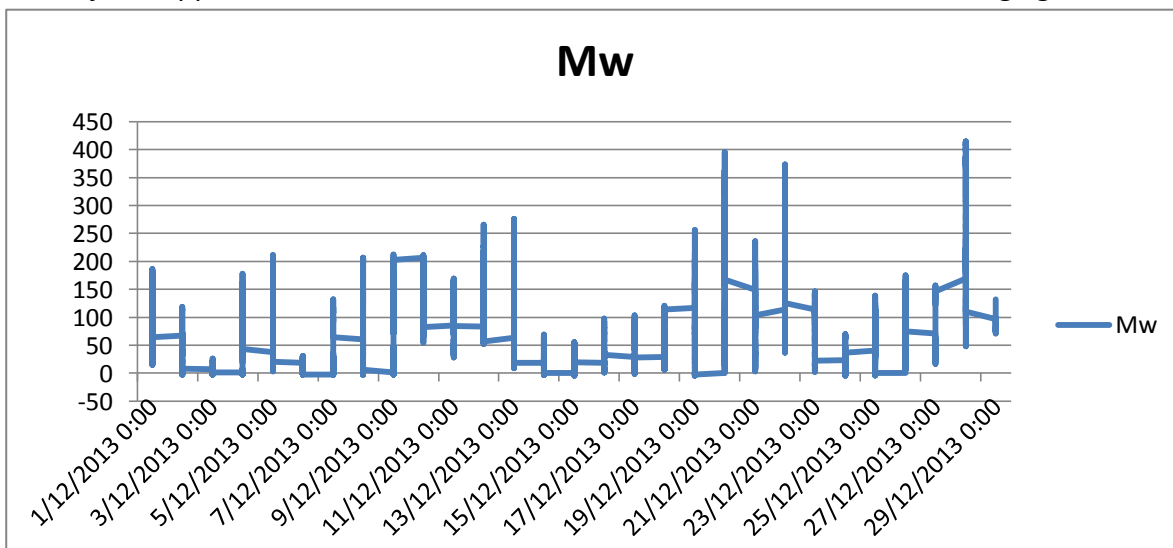
The next entry in the AGL report is for August 3, a pair of Brolga 800m outside the wind farm turbine area. The average generation on the 3<sup>rd</sup> dropped to 33% then rose to 38%. The next day average generation rose to 57% . The report then said the pair was not seen again.



The next entry is for a pair of brolga seen on 18 September, and again on 4 October and 5 October. The graph on page 7 shows average generation prior to 18 September was near zero for two days and then rose to over 70%, prompting Brolga to disappear. The graph on page 8 shows 4 October and 5 October with average generation of 26% and then dropping to near zero.

The last AGL report entry was for a pair of Brolga that were found on Dec 5 nesting, the mate disappeared 23 December and the sitting bird was gone by 28 Dec after being seen to feed on her own leaving the nest unattended. This is extremely abnormal behaviour for a Brolga mate to voluntarily leave a nest. Generally this would only be due to death, or an extreme reaction to the turbines displacing the mate.

The graph below shows average generation leading up to and including 5 December was less than 10%. The generation level was low for 16 days, with only two days with average generation over 20%, and with only three spike of generation over 40%. The first Brolga had left around the same time average generation exceeded 30% 3 days in a row. The second Brolga was gone 5 days later, which just happened to be the next time the wind farm exceeded 30% average generation.



## CONCLUSION

It is apparent that the wind farm has displaced Brolga flocks out beyond 5km.

It appears in nearly all cases Brolga will not enter the wind farm or be within 3km of the wind farm if the average generation is over 30%.

It appears that brolga that come to the wind farm to feed will leave when average generation exceeds 30%.

It appears Brolga that nest during a low generation period will try to stick it out and stay even if the average generation exceeds 30%, but they do eventually give up. Brolga that repeated their nest attempts in subsequent quiet periods became less tolerant to entry into the wind farm, on second attempt entry was at less than 22% average generation and the third attempt it was at Zero generation. It is also apparent that with each attempt at nesting their tolerance lowers toward noise that displaces them, with the number of over 30% generation days being tolerated dropping from 14 to 6 to 2.

So the Macarthur wind farm has in effect displaced Brolga from effectively using the area within 3km of the wind farm, including 25 potential nesting sites.. The only reported successful nesting in the area is 6km from the wind farm.