University of Southern Queensland

Faculty of Health, Engineering and Sciences

The Viability of Small-Scale Wind Turbines for Domestic Use in South East Queensland

A dissertation submitted by

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In fulfilment of the requirements of

ENG4111 and ENG4112 Research Project

towards the degree of
Bachelor of Power Engineering (Honours)

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Abstract

Power prices have increased in Queensland by over 136% in 10 years. Roof top solar has been one answer to reducing energy costs, another option could be wind power. Wind power is also an abundant, renewable and clean energy source however, Australia lags other developing nations in wind power generation. To date, wind power has been the domain of large scale energy producers while smaller scale wind turbines (SSWTs) are significantly under-represented. Wind power for domestic use has been largely unexplored and further research may unlock its full potential. Therefore, the aim of this research is to theoretically establish if SSWTs can be a viable renewable energy source and compete with photovoltaic systems for domestic applications.

To ascertain the potential of wind power, five SSWTs were selected to operate on three South East Queensland locations, one coastal, one city and a rural site. Wind data was sourced from the Bureau of Meteorology and together with the power curves for each SSWT, power outputs were calculated using a *MATLAB* program. This data is compared to a photovoltaic system for power generation, savings in electricity, purchase and installation costs plus life operability and warranty. The turbines are ranked and a pay-back period for each turbine calculated and feasibility established.

Results indicated that turbines located in a coastal area can eclipse solar. Two wind turbines out performed the solar system, one by more than 57%. However, these results were not reproduced further inland. For the city and rural sites the winds were not consistent enough to produce a reliable source of power and lagged behind solar. When comparing costs SSWTs had significantly higher purchase and installation costs than solar, resulting in a payback period, with one exception, that is outside the operational life of the turbine and therefore considered unacceptable. One turbine was considered a viable option, it substantially outperformed the other wind turbines and solar system and had the lowest purchase cost.

Despite these findings, wind power still has a place in the renewable energy sector for domestic applications. Generating power from wind, especially on the coast, has the potential to be a 24 hour a day operation, unlike photovoltaic systems which are restricted to the daylight hours. Generating power outside the peak solar production hours can have additional benefits for users and the national power network.

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Abbreviations

BoM:	Bureau of Meteorology
DAWTs:	Dual Axis Wind Turbines
HAWTs:	Horizontal Axis Wind Turbines
kW:	kilo Watt
MW:	Mega Watt
PV:	Photovoltaic
QLD:	Queensland
SE:	South East
SSWTs:	Small Scale Wind Turbines
SRES:	Small scale Renewable Energy Scheme
VAWTs:	Vertical Axis Wind Turbines

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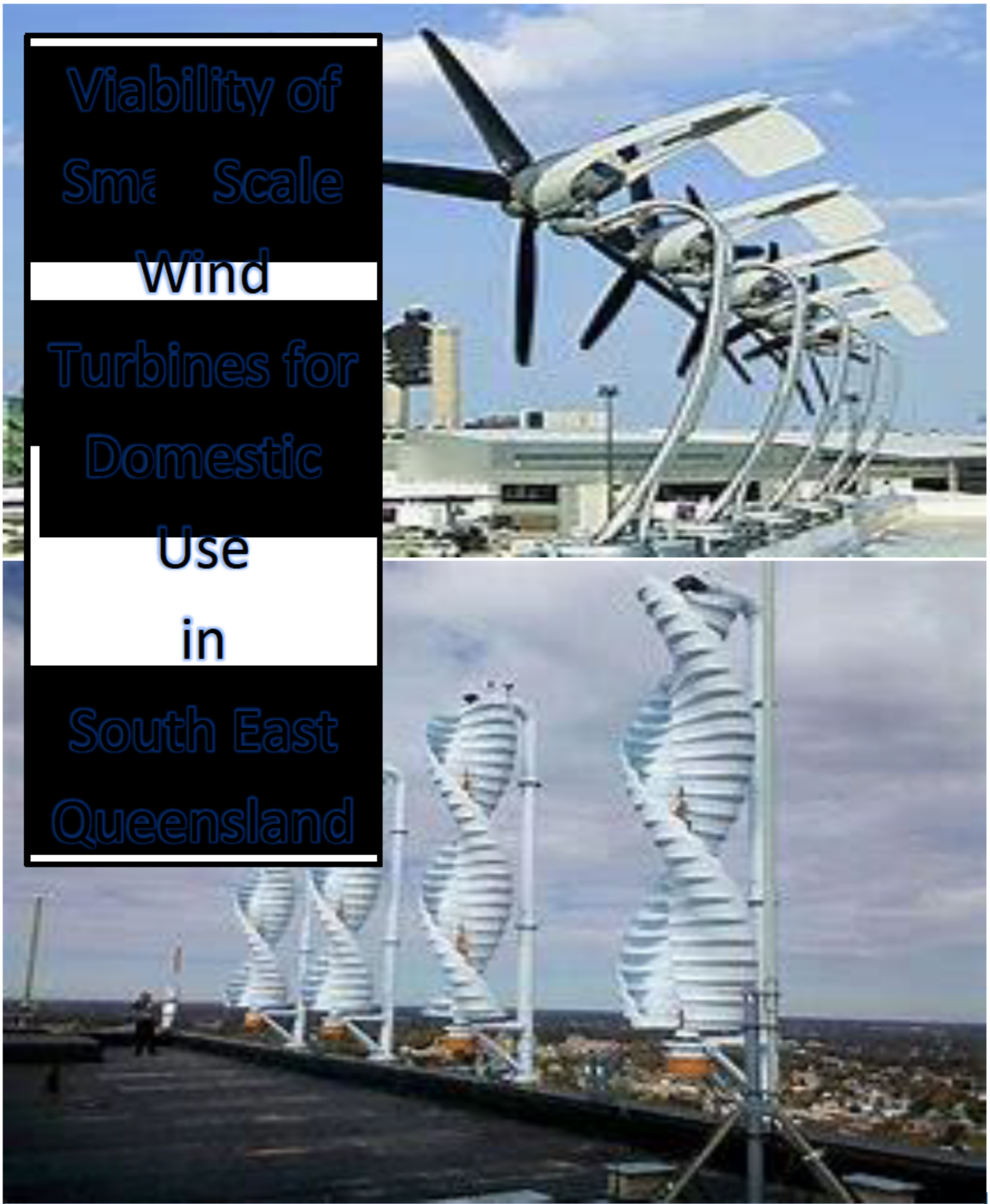
- Australian Wind and Solar
- Energy Matters
- Solarzone
- Windpower Australia Pty Ltd

Viability of Small Scale Wind Turbines for Domestic Use in South East Queensland



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ENG4111 and ENG4112 Research Project

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Chapter 1 Introduction

The world is starting to see the consequences from the reliance on fossil fuels for our energy needs. This year saw the hottest July recorded worldwide (BoM 2019). Closer to home, historical data from Brisbane airport show that temperatures have risen 1 degree Celsius since 1970. 22 long standing Australian weather records have been broken in just the last 20 years.

While world leaders debate over policies and set reduction targets (Paris Agreement, 2015), public awareness is growing and the desire to act on a local level is increasing. The solar photovoltaic array has become a popular renewable energy source with over 2 million residences in Australia now having some level of solar power generation (Clean Energy Regulator, 2018). This form of clean energy is widely recognised as the viable option for households. Add to the equation power prices rising substantially over the last 10 years (Figure 1.1), the desire for householders to reduce energy costs is paramount. (Clean Energy Council, 2018). So why only rely on solar panels when wind power generation has the same environmental credentials as solar (Alam et al. 2012)?

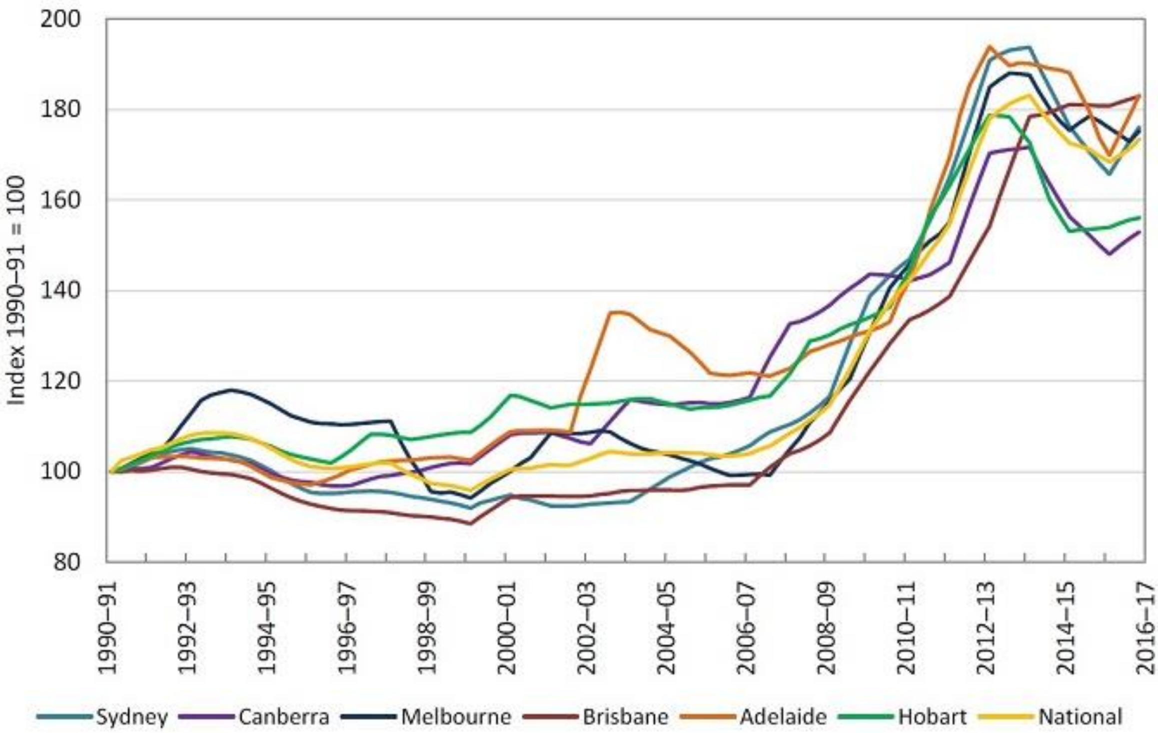

Figure 1.1: Increase in power prices from 1990 – 2017 (Source ACCC)

Wind power is also an abundant, renewable and clean energy alternative with no greenhouse gas emissions. Despite Australia having an excellent wind resource, it lags other developing nations as a source of renewable power generation (Alam et al. 2012). Large scale wind turbine farms are now starting to dot the landscape (ARENA, 2018). Love them or loathe them the world-wide adoption of wind power is growing at 25% per annum. In Australia wind power accounts for only 5.3% of our energy needs and 30.8% of the total renewable energy produced (ARENA, 2018). South Australia leads the nation in wind generated power producing over 50% of its power from wind turbines (ARENA, 2018).

In 2015 the Australian Federal Government announced that by 2020 at least 33,000 Gigawatt-hours (GWh), 23.5% of Australia's energy, will come from renewable energy (Clean Energy Council, 2018). To achieve this target a greater number of renewable energy sources need to be developed. A higher percentage of power generation could come from domestic scale wind turbines, if only, Australians were to embrace wind technology in the same way as it does solar (Tummala et al. 2016).

However, if this was to happen there are still many barriers to the use of wide scale small wind turbines for domestic power generation. One issue is the cost. In most cases, a wind turbine is substantially more than a similar size solar system. Secondly, people's opposition to wind turbines is still prevalent, despite research debunking many of the myths and thirdly, aesthetic and environmental concerns.

The Small-scale Renewable Energy Scheme (SRES) is one approach offered by the Clean Energy Council to reach the renewable energy target. It offers financial incentives to small business and individuals to install small-scale renewable energy systems such as solar panels, wind turbines, hydro systems as well as solar hot water heaters and air sourced heat pumps (Clean Energy Council, 2018). SRES applying to wind turbines encouraged further research and lead to an idea for the current research project.

1.1 Aims, Objectives and Scope

The aim of this project is to quantify if SSWTs are a viable option as a renewable energy source in domestic and light commercial dwellings. The project will establish the maximum power that can be generated from a variety of SSWTs that are currently commercially available on the Australian market. The project will evaluate if they can compete economically against photovoltaic solar cells and if not, why not?
To ensure that the aims are met during the research project the following objectives are:

- To collect wind data from three South East Queensland sites.

- View the range of SSWTs that are currently available on the Australian market and obtain specification data sheets. Determine from the specification sheets the typical power generation capabilities.

- Generate a list of associated costs for the purchase, installation and maintenance of the systems over their projected life cycle.

- Use the wind data and turbine data sheets to calculate anticipated power generated over the trial period.

- Compare costs associated with generating power by SSWTs against similar size solar systems.

- Ascertain if SSWTs are a viable option for power generation in an urban environment.

The scope of this project will be limited to three locations within South East Queensland. One site a coastal location, one inner Brisbane site and one positioned in a rural township. The localities have been chosen to provide a diverse cross-section of the study area and offer a broad range of wind conditions, elevations and land use. The 3 regions chosen for this project are shown in Figure 1.2. The areas are:

• Sunshine Coast Airport	Sunshine Coast
• Amberley Airport	Outer suburb of Brisbane
• Kingaroy Airport	Rural Township

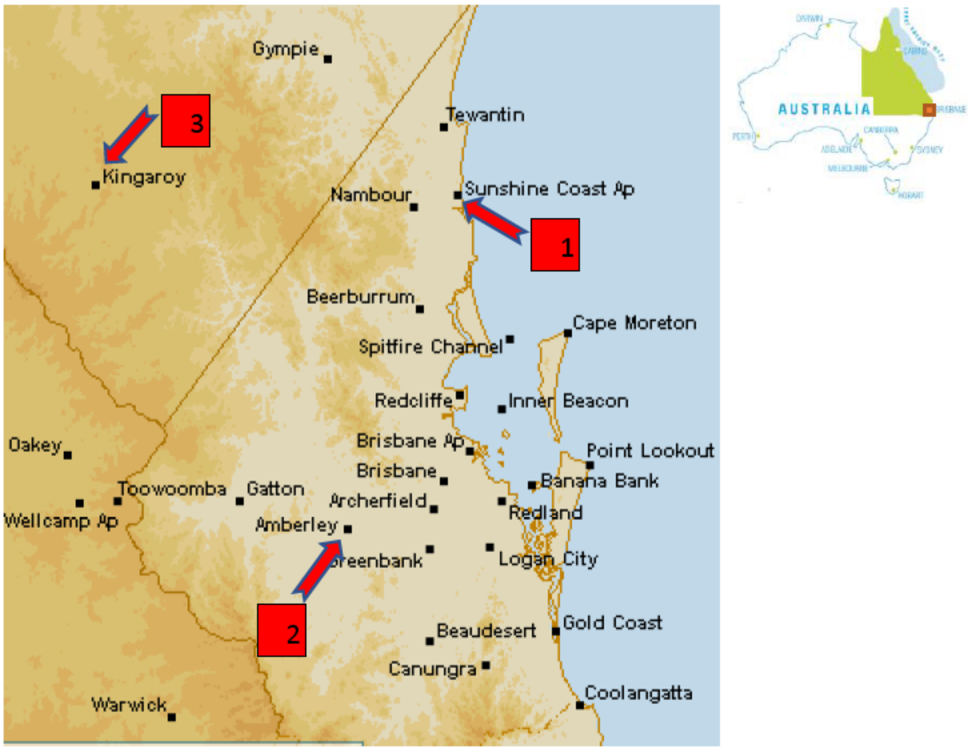

Figure 1.2: Chosen South East Queensland sites for wind turbine power project. (Source: Bureau of Meteorology)

1.2 Outcomes and Benefits

This project will provide data on the theoretical power generated by various SSWTs, when installed in three areas of South East Queensland. Once the power calculations have been performed a cost benefit analysis can be conducted on the viability of SSWTs. This is achieved by calculating the cost of purchasing the same amount of power, that has been generated from the wind turbine system, from the local energy supplier. This dollar figure, i.e. the savings from generating your own power, is subtracted from the overall cost to install and maintain the system. The resultant is divided by the number of days in the trial period to give a daily cost benefit. From this calculation an approximated pay-back time of the system can be achieved. Simply, how many years does it take in cost savings to pay back the total cost of installing and operating the SSWT? On average, payback time for a 10 kW solar system is between 8-13 years (Shephard, 2016). The goal of this report is to compare the solar payback period figure to the figure of an SSWT system to ascertain viability.

The benefit from this report will be in providing economic costings in purchasing and operating an SSWT plus, the expected payback period. The outcome will differentiate between a wind and solar system and consider if the gap is an acceptable outcome. A figure less than 15 years will produce a return greater than 6.6% on the money invested in the system. Although this number is subjective, a financial institution recently announced that a superannuation return between 6 - 8 % was considered a "good return" under the current economic climate (Business Insiders, 2018). An informed decision can then be made when choosing the renewable energy system that is most suited to your location.

1.3 Limitations

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Latest Weather Observations for Amberley

IDQ60901

Issued at 6:11 pm EST Monday 20 May 2019 (issued every 10 minutes, with the page automatically refreshed every 10 minutes)

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Station Details ID: 040004 Name: AMBERLEY AMO Lat: -27.63 Lon: 152.71 Height: 24.2 m

Data from the previous 72 hours. | See also: Recent months at Amberley

Date/Time EST	Temp °C	App Temp °C	Dew Point °C	Rel Hum %	Delta-T °C	Wind					Press QNH hPa	Press MSL hPa	Rain since 9am mm
						Dir	Spd km/h	Gust km/h	Spd kts	Gust kts			
20/06:00pm	19.9	20.1	14.7	72	3.0	E	7	9	4	5	1024.9	1024.9	0.2
20/05:30pm	20.2	19.4	15.0	72	3.1	E	13	19	7	10	1024.7	1024.7	0.2
20/05:00pm	20.5	19.3	15.1	71	3.2	ESE	15	19	8	10	1024.6	1024.6	0.2
20/04:30pm	20.9	19.8	15.2	70	3.4	E	15	17	8	9	1024.5	1024.5	0.2
20/04:00pm	21.2	20.4	15.1	68	3.6	E	13	19	7	10	1024.5	1024.5	0.2
20/03:30pm	21.3	21.0	15.4	69	3.5	E	11	15	6	8	1024.4	1024.4	0.2
20/03:00pm	21.3	20.3	15.6	70	3.4	ESE	15	20	8	11	1024.4	1024.4	0.2
20/02:30pm	21.3	20.3	15.6	70	3.4	ESE	15	22	8	12	1024.4	1024.4	0.2
20/02:00pm	21.7	19.7	15.5	68	3.7	SE	20	26	11	14	1024.5	1024.5	0.2
20/01:30pm	22.0	20.6	15.6	67	3.8	ESE	17	22	9	12	1024.7	1024.7	0.2
20/01:00pm	22.2	21.2	15.5	66	4.0	SE	15	19	8	10	1024.9	1024.9	0.2
20/12:30pm	22.1	21.3	15.2	65	4.1	ESE	13	17	7	9	1025.3	1025.3	0.2
20/12:00pm	20.6	19.7	15.8	74	2.9	ESE	15	19	8	10	1025.7	1025.7	0.2
20/11:30am	21.7	21.0	15.3	67	3.8	ESE	13	19	7	10	1026.2	1026.2	0.0
20/11:00am	22.1	22.8	17.0	73	3.1	ESE	9	17	5	9	1026.5	1026.5	0.0
20/10:30am	20.6	22.3	16.2	76	2.6	E	2	9	1	5	1027.1	1027.1	0.0
20/10:00am	19.9	20.9	16.3	80	2.2	ENE	6	9	3	5	1027.2	1027.2	0.0
20/09:30am	19.2	19.9	16.2	83	1.8	SSW	7	11	4	6	1027.4	1027.4	0.0
20/09:00am	18.4	19.3	16.7	90	1.0	SSW	7	11	4	6	1027.4	1027.4	0.6
20/08:30am	16.8	18.8	16.0	95	0.5	CALM	0	0	0	0	1027.4	1027.4	0.6

Figure 1.3 Typical Bureau of Meteorology Weather Observation (Source: Bureau of Meteorology)

Throughout the project, the projected power generated by the various SSWTs and cost saving associated with these figures are purely theoretical. The wind speed data has been obtained from Bureau of Meteorology (BoM) which collects data every 10 minutes and averages it out over a 30 minute period (Figure 1.3). Calculations are not conducted on a minute by minute basis and therefore some errors could be introduced into the final figures. In addition, wind turbine performance specifications are provided by the wind turbine manufacturers. It should be noted that the turbines are often tested in ideal controlled conditions, i.e. wind tunnels. Turbines generally do not perform to the rated power curves and other specification data when under operational conditions. All data generated will be evaluated as maximum outcomes and the limitations will need to be considered in these calculations.

Chapter 2 Literature Review

Many articles have been written questioning the use and effectiveness of wind turbines for the urban environment. As technology improves some challenges have been reduced or eliminated but there are still many barriers. The literature highlights advancements made in both horizonal and vertical axis wind turbines and in some instances site case studies to support their argument. However, one problem or gap exists in the literature when trying to establish which turbine is right for a specific area rather than a general overview, or if wind turbines are indeed the best option for that location. Therefore, this section will review current literature and present some of the best practices to adopt when considering SSWTs for domestic applications. Using the information obtained from this review a detailed approach to achieving the aims and objectives of this research project can be met. The review will also compare barriers presented in the literature with current and past barriers.

2.1 Urban Wind

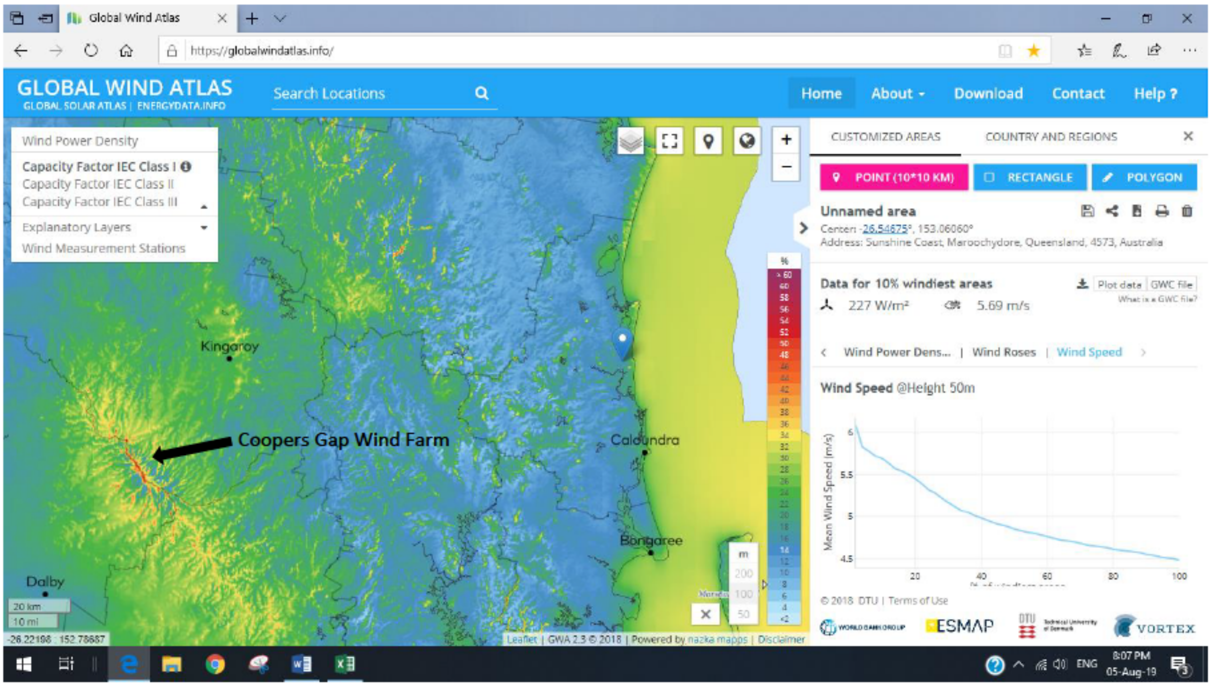


Figure 2.1: Wind Map of South East Queensland (Source Global Wind Atlas)

Wind as a resource, is the most important factor when calculating the viability of an SSWT for domestic use. As suggested in Bilir et al. (2015) a good starting place is to view a wind map of the area in question. Figure 2.1 shows a wind map of the area under study i.e. South East Queensland. The maps give an annual mean wind speed at predetermined elevations. The BoM, Science to Services Department proposed the web site 'global wind atlas' as a helpful tool. These wind maps are a useful aid in deciding the location of large commercial wind farms. This can be easily demonstrated from the location of the Coopers Gap Wind Farm, in Figure 2.1, located in a high wind area, shown as red on the map. According to Hassan (2017) these maps can be beneficial for providing data for smaller scale production. Unfortunately, as detailed in Battisti. et al. (2018) this data is not an accurate tool for modelling as it does not take into consideration the complex lower level terrain, urban dwellings/buildings, vegetation and land use. Any of these factors distort the properties of the wind. Another issue with the wind maps is the data is presented at varying heights, in the case of the ‘global wind atlas’, 50, 100 and 200 metres. This information is an advantage to large scale wind farms where the turbines can be mounted over 100 meters above the ground, but for SSWTs, unless mounted on high density housing roof tops, this figure is likely to be much less. In addition, the data contained within the wind maps is an annual mean wind speed. As one would know, the wind speed varies throughout the day, night and the seasons and one mean measurement would be unacceptable to base power production calculations.

Therefore, as recommended in Kumar et al. (2018) the best option is to record the wind speed at the proposed wind turbine site. An accurate and cheap method for wind measurement is an anemometer or similar device. Although there are no clear guidelines within the literature, a standard that appears to have been adopted amongst most articles, is a wind reading at least every 10 minutes, which also includes a maximum and minimum speed.

This was the philosophy to be adopted for the research project, where wind recording devices were installed at three sites in South East Queensland. Unfortunately, a severe hailstorm, Figure 2.2 (right) and some very inquisitive parrots saw two of the three devices damaged beyond repair in the early phase of the project. An alternative plan has been to gather the data daily from the BoM. Their equipment records data every 10 minutes and averages the data over a 30 minute cycle. This method of data collection was utilised in Webb (2017) and is considered acceptable. Figure 2.2 (left) shows a typical BoM remote weather station.

Figure 2.2 Bureau of Meteorology Remote Weather Station (Left), Damaged Weather Station (Right)

2.2 Choosing a Turbine

In both Webb (2017) and Enhar (2010) two key points are noted when choosing an SSWT. Firstly, one must be aware of the types of turbine that are available on the market and secondly, what wind turbine best suits your needs.

Tummala.et al (2016) focus is primarily on Vertical Axis Wind Turbines (VAWTs) indicating they are the more suitable wind turbine for an urban environment where the wind has a tendency to be more turbulent. However, Enhar (2010) research and case studies are heavily in favour of Horizonal Axis Wind Turbines (HAWTs). They point out that the HAWTs are more efficient, giving higher generated power outputs for similar wind speeds. Firoz et al. (2012) economic analysis on grid connected domestic scale wind turbines use only HAWTs in their calculations. No author is right or wrong, all wind turbines have their advantages and disadvantages however it does highlight how one particular document could sway the choice of turbines. A consensus is, for an urban environment, VAWTs are more suitable due to the turbulent nature of the wind and where the wind is more likely to be consistently in the same direction, i.e. rural environment, HAWTs are a better alternative.

For this project, a selection of both HAWTs and VAWTs has be selected for all sites. In addition, the maximum output power will be set at 3 kW however, this can be in the form of one turbine or a series of turbines totalling 3kW. James et al. (2017) explains in their paper that the best option may not be one turbine but a series of smaller turbines. This could be due to a lack of space or restricted access to the site. It can be argued that smaller turbines will have less wind drag, a lower start up speed and therefore be more effective in lighter winds. However, if the wind is consistently strong, a larger turbine is recommended. A similar verdict was reached in Breeze (2016) where trials were conducted using several size wind turbines along the British Coastline. No conclusive results were able to clarify which is better and the general rule is do your research before embarking on a costly purchase. It is for this reason that not only a variety of designs are considered for this research project but also power output capacity and combinations i.e. one turbine or multiple turbines.

2.3 What Constitutes an SSWT?

One issue facing most countries is the lack of legally binding definitions of what is an SSWT. This may seem unimportant, but for councils, governments and legislative authorities an unclear definition can cloud regulation. Turbines are loosely sorted on the type and shape, plus other features such as height, power rating, rotor diameter and wind surface area (Teschner al et. 2018). In Australia, wind turbines are usually rated into the four categories of micro, small, medium or large turbines (Teschner al et. 2018). The larger units are predominantly the commercial unit located on wind farms and in Australia are in the order of 3 Megawatts (MW) (Clean Energy Council, 2018). The SSWTs for household use are typically between 1.4 - 20 kW (Tummala al et. 2014). This project will primarily focus on the small scale wind turbines with a maximum output of less than 3.5 kW. The shire councils for the three chosen sites, Sunshine Coast Regional Council, Brisbane City Council and the South Burnett Regional

Council will be contacted during the course of this project to establish if clear definitions are included in any regulations.

2.4 Economic Challenges

Currently over 2 million households have roof top solar as a source for generating power. The Clean Energy Council 2018 report highlighted the cost of solar systems has dramatically reduced over the last 10 years, making it much more viable for households. Shephard (2016) calculated in his report, that the payback period can be as little as 8 years. The same cannot be easily stated for SSWTs. An issue with SSWTs, as stated in Teschner al et. (2018) is the "challenge of economy of scale". In other words, as solar systems became more popular and production increased, the price decreased. The same is required for SSWTs. This is why Teschner al et. (2018) is strongly in favour of a National incentive scheme, so households have a greater inducement to adopt SSWTs as a renewable energy source. If demand and production of SSWTs is increased, the price is expected to fall. It is therefore an aim of this project to establish if SSWTs are firstly, cost effective when compared to solar and if so, a second phase would be to promote and encourage the use of wind turbines for domestic applications. An outcome would be greater demand for SSWTs, an increase in their production and a corresponding cost reduction.

2.5 Barriers to SSWTs

The social and environmental barriers to the use of SSWTs in an urban setting have yet to be adequately addressed to reduce the fears of the average resident (Bilir et al. 2015). Issues relating to noise, visual disturbance, social acceptance of the technology, the perceived health risk, electromagnetic interference and environmental concerns i.e. bird strikes, remain the major reasons behind the opposition to wind turbines. Teschner et al. (2018) discusses the fact that other countries including USA, Denmark, Norway, UK and New Zealand struggle with similar concerns, however historically smaller scale wind projects are favoured over larger projects. Just as people have become accustomed to roof top solar, over-head power lines and mobile phone towers, residents need to change their perceptions on the urban landscape and consider SSWTs in a similar light (Bilir et al. 2015). A short survey of family friends and neighbours indicated that many of these barriers are still firmly entrenched in modern society. However, it was also noted that many people were able to be easily won over when scientific data was presented, debunking many of their fears and concerns. It was found that one of the most persuasive tools were pictures of aesthetically pleasing turbines, showing people are willing to accept technology if conditions are right.

2.5.1 Noise

Noise is a critical issue for wind turbines when considered for urban use. Although the VAWTs are generally quieter than the HAWTs the air passing over the blade will produce a level of noise. Noise standards exist for large scale wind farms. The Environmental Protection Agency (EPA) guidelines on wind farms is; Noise should not exceed: 35 dB(A), or the background noise plus no more than 5 dB(A). Paul Gipe published a paper called ‘Noise from Small Turbines’ and although it focuses on the United Kingdom, some of the turbines tested are available in Australia. He noted that a problem with SSWTs is the manufacturers are not testing or not releasing the noise data of its turbines. Research into SSWTs available in Australia confirmed that data on noise levels is almost non-existent and it is difficult to base turbine selection on this information. Problems usually only arise when a neighbour lodges a complaint with the council on excessive noise from a turbine. It is then the responsibility of the council to perform noise level tests. Gipe also stated that the noise of turbines running at the power level produced from running at 8 m/s is usually below the background noise and therefore within the Australian EPA guidelines. Many examples of complaints with neighbours over excessive wind turbine noise can be found on the internet.

2.5.2 Roof Mounting

Careful consideration needs to be addressed when mounting any wind turbine on the roof of a dwelling. Vibration from the turbines could enter the building and create internal noise as well as cause structural issues. Turbines are significantly heavier than solar panels plus, the turbines introduce additional stress from movement and therefore the structural integrity of the building needs to be considered. The mounting of turbines on structures is included in AS/NZS 1170.2.2011 (R2016) – Structural design action.

2.5.3 Bird Strike Risk

Numerous studies have been undertaken on the potential risk wind turbines pose to birds. These studies have been largely based on the larger scale wind farms and not the smaller scale domestic turbines. Therefore, it is unclear if these smaller turbines could increase the risk to birds beyond hazards that already exist. Reports from overseas from the UK Royal Society for the Protection of Birds and The American Wind Energy Association indicate that they believe the risk to birds from SSWTs is equal to the risk posed by any normal structure. To quote from UK Royal Society for the Protection of Birds, “birds have a greater risk of flying into a window or a clear glass door than a small wind turbine”.

2.5.4 Electromagnetic Interference

According to the Australian Wind Energy Association (AWEA) modern SSWTs are too small to cause any electromagnetic interference. In addition, the blades which make up the bulk of the turbines, are usually made from fibreglass, plastics and resins and therefore cannot produce any electromagnetic signals. Electromagnetic interference from SSWTs is considered negligible and as such will not be considered in this project.

2.5.5 Lightning Strikes

SSWTs are at risk of lightning strikes. Lightning protection is recommended to avoid costly damage. The Australian Greenhouse Office recommends lightning arrestors should be installed on all turbines.

2.6 Land use Regulations and Urban Planning

In the past, SSWTs have been used primarily in a rural environment, where no planning permission is required and not in the urban domain for domestic applications. Therefore, many councils have yet to establish planning guidelines for such an event. Councils will clearly need to address some of the issues of noise, visual aesthetics, shadowing etc if wind turbines take on a more prevalent role in renewable power generation. (Webb, 2017). Most councils do have restrictions on the maximum height of a building and structures and that would limit the installation of pole mounted turbines in an urban landscape (Tummala et al. 2016). Turbines mounted to roof tops or the side of a building is an entirely different matter. There were no rules to start with on the installation of satellite dishes but when the number of installations increased, control guidelines were implemented. It is highly likely that a similar pattern will also apply to domestic wind turbines. Case studies in Webb (2017), Enhar (2010), and Firoz et al. (2012) showed some current obstacles in planning requirements. A school is exempt local council regulations because it is state owned property. Turbines along a major road are exempted local council regulations because they are within Federal control. It is this “where the turbine is located” scenario that inhibits a centralised co-ordinated approach to regulations. In contacting the shire councils for the three chosen sites, Sunshine Coast Regional Council, Brisbane City Council and the South Burnett Regional Council it is hoped that a clearer picture can be give on local guidelines and regulations of SSWTs.

Chapter 3 Methodology

3.1 Project Plan

The project is planned to be conducted in 6 phases.

- Phase 1: Collect wind data. From 01 January to 31 August (2019) collate wind speed data from the BoM for the three selected sites, Sunshine Coast, Amberley and Kingaroy. Ideally a period of 12 months would be desirable however, a research project period of 8 months should ensure seasonal variations are reflected in the calculations. At the end of each week enter wind speed data into database. Figure 3.1 illustrates data transfer from BoM to spreadsheet.

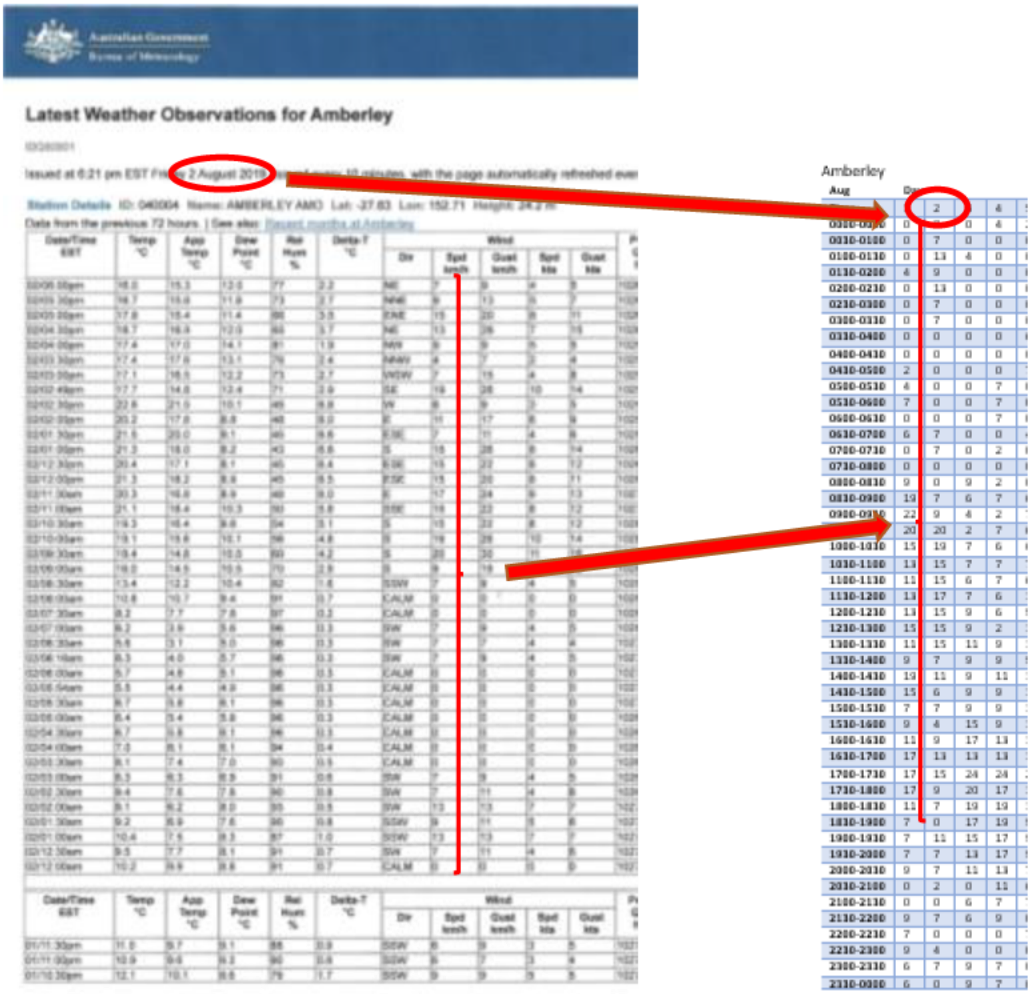


Figure 3.1 Bureau of Meteorology Wind Data to Spreadsheet for 02 August Amberley

- Phase 2: Select wind turbines for project. Review wind turbines that are commercially available in the Australian marketplace and select at least 2 HAWTs and 2 VAWTs. Download specification data sheets, power curves, costing and other relevant information on these turbine models. Contact the manufacturer or distributors, if required, to obtain further information. Enter relevant information into *wind power* *program©*, Figure 3.2. Run program to obtain data curves, efficiency curves and other information that may be useful to the project.

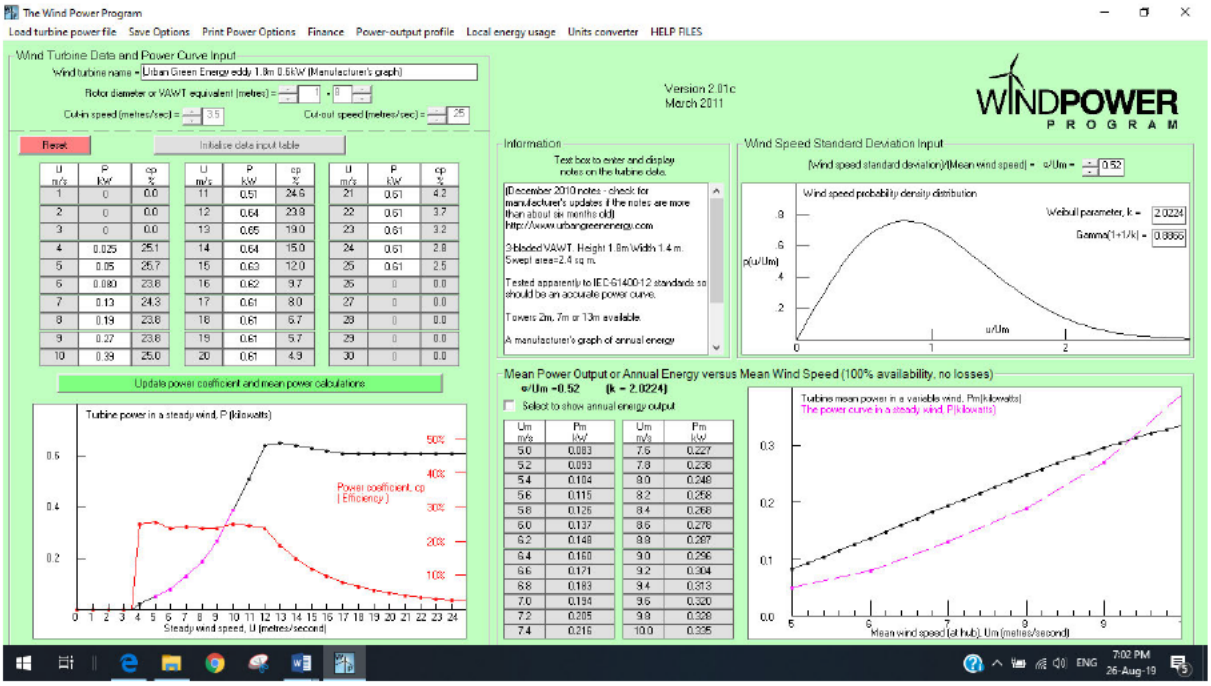


Figure 3.2 Screenshot Windpower Program

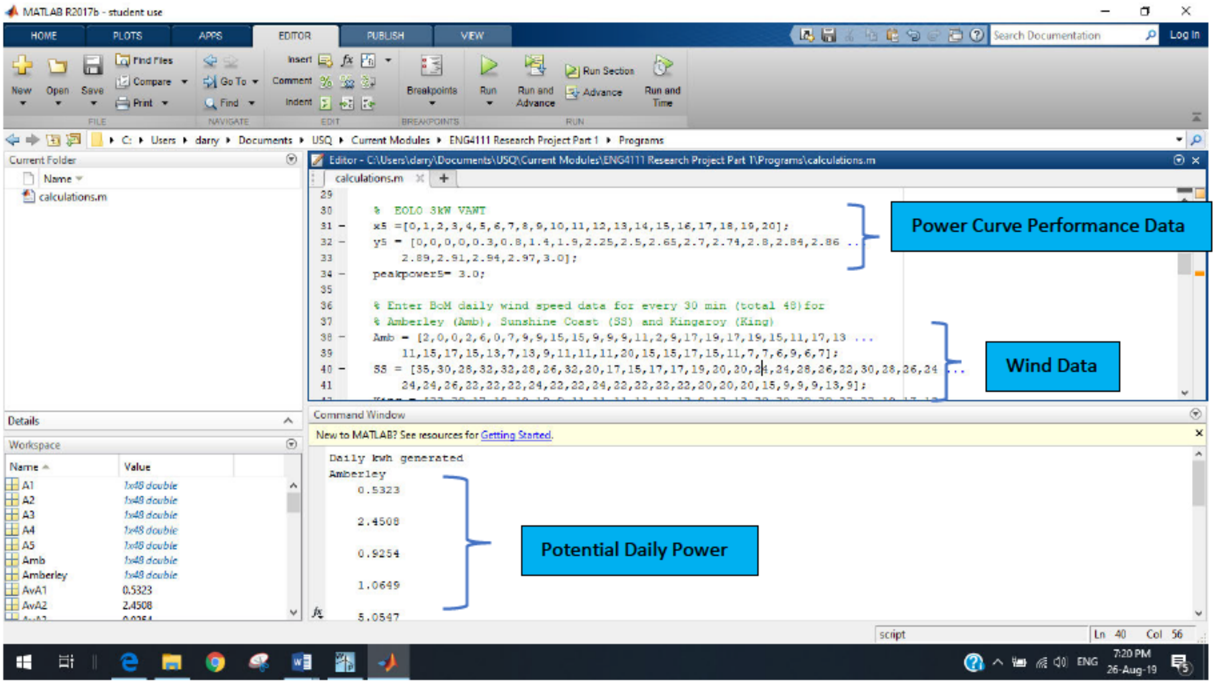
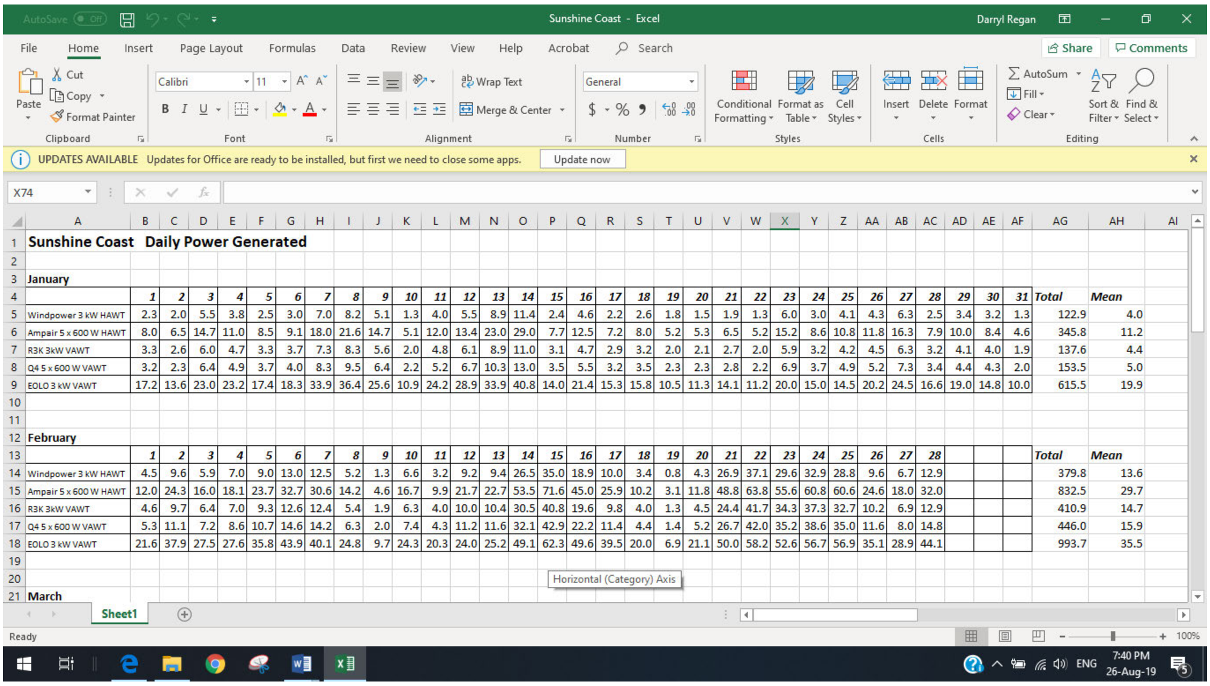


Figure 3.3 Screenshot MATLAB Program after Run (23 August 2019)

- Phase 3: Calculate maximum power generation. Write a *MATLAB* program (Annex B) to calculate the maximum power that can be generated from the wind data. In addition, input the wind turbine power curve data into the program. At the end of each month, separately enter the daily wind data into the *MATLAB* program and run program. Figure 3.3 illustrates the program run for 23 August. Record answers into an *EXCEL* spreadsheet as demonstrated in Figure 3.4.



Sunshine Coast Daily Power Generated

January

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	2.3	2.0	5.5	3.8	2.5	3.0	7.0	8.2	5.1	1.3	4.0	5.5	8.9	11.4	2.4	4.6	2.2	2.6	1.8	1.5	1.9	1.3	6.0	3.0	4.1	4.3	6.3	2.5	3.4	3.2	1.3	122.9	4.0
Ampair 5 x 600 W HAWT	8.0	6.5	14.7	11.0	8.5	9.1	18.0	21.6	14.7	5.1	12.0	13.4	23.0	29.0	7.7	12.5	7.2	8.0	5.2	5.3	6.5	5.2	15.2	8.6	10.8	11.8	16.3	7.9	10.0	8.4	4.6	345.8	11.2
R3K 3kW VAWT	3.3	2.6	6.0	4.7	3.3	3.7	7.3	8.3	5.6	2.0	4.8	6.1	8.9	11.0	3.1	4.7	2.9	3.2	2.0	2.1	2.7	2.0	5.9	3.2	4.2	4.5	6.3	3.2	4.1	4.0	1.9	137.6	4.4
Q4 5 x 600 W VAWT	3.2	2.3	6.4	4.9	3.7	4.0	8.3	9.5	6.4	2.2	5.2	6.7	10.3	13.0	3.5	5.5	3.2	3.5	2.3	2.3	2.8	2.2	6.9	3.7	4.9	5.2	7.3	3.4	4.4	4.3	2.0	153.5	5.0
EOLO 3 kW VAWT	17.2	13.6	23.0	23.2	17.4	18.3	33.9	36.4	25.6	10.9	24.2	28.9	33.9	40.8	14.0	21.4	15.3	15.8	10.5	11.3	14.1	11.2	20.0	15.0	14.5	20.2	24.5	16.6	19.0	14.8	10.0	615.5	19.9

February

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28				Total	Mean
Windpower 3 kW HAWT	4.5	9.6	5.9	7.0	9.0	13.0	12.5	5.2	1.3	6.6	3.2	9.2	9.4	26.5	35.0	18.9	10.0	3.4	0.8	4.3	26.9	37.1	29.6	32.9	28.8	9.6	6.7	12.9				379.8	13.6
Ampair 5 x 600 W HAWT	12.0	24.3	16.0	18.1	23.7	32.7	30.6	14.2	4.6	16.7	9.9	21.7	22.7	53.5	71.6	45.0	25.9	10.2	3.1	11.8	48.8	63.8	55.6	60.8	60.6	24.6	18.0	32.0				832.5	29.7
R3K 3kW VAWT	4.6	9.7	6.4	7.0	9.3	12.6	12.4	5.4	1.9	6.3	4.0	10.0	10.4	30.5	40.8	19.6	9.8	4.0	1.3	4.5	24.4	41.7	34.3	37.3	32.7	10.2	6.9	12.9				410.9	14.7
Q4 5 x 600 W VAWT	5.3	11.1	7.2	8.6	10.7	14.6	14.2	6.3	2.0	7.4	4.3	11.2	11.6	32.1	42.9	22.2	11.4	4.4	1.4	5.2	26.7	42.0	35.2	38.6	35.0	11.6	8.0	14.8				446.0	15.9
EOLO 3 kW VAWT	21.6	37.9	27.5	27.6	35.8	43.9	40.1	24.8	9.7	24.3	20.3	24.0	25.2	49.1	62.3	49.6	39.5	20.0	6.9	21.1	50.0	58.2	52.6	56.7	56.9	35.1	28.9	44.1				993.7	35.5

March

Figure 3.4 Screenshot Excel Spreadsheet Daily Power Generation for Sunshine Coast

- Phase 4: Calculate cost savings. Obtain residential electricity prices and tariffs from energy suppliers. Using data obtained from Phase 3, computate the savings anticipated from generating wind power against purchasing general supply from an energy provider. From the cost saving figures determine a pay-back period for the wind turbine systems. All calculations are performed using formulas within *Excel* spreadsheet. Example shown in Figure 3.5.

- Phase 5: Analyse and compare results. Compare results obtained in Phase 4 to the pay-back period of a similar size solar panel system. Ascertain if an SSWT system is a viable renewable energy alternative. Examine results, review possible wind/solar combination, provide a conclusion with recommendations as applicable.

- Phase 6: Complete dissertation report. Write up dissertation in accordance with Section 11 of study book "Dissertation preparation – guidelines and requirements". Forward electronic copy to USQ.

A breakdown of the individual phases into specific tasks can be seen in Table 3.1.

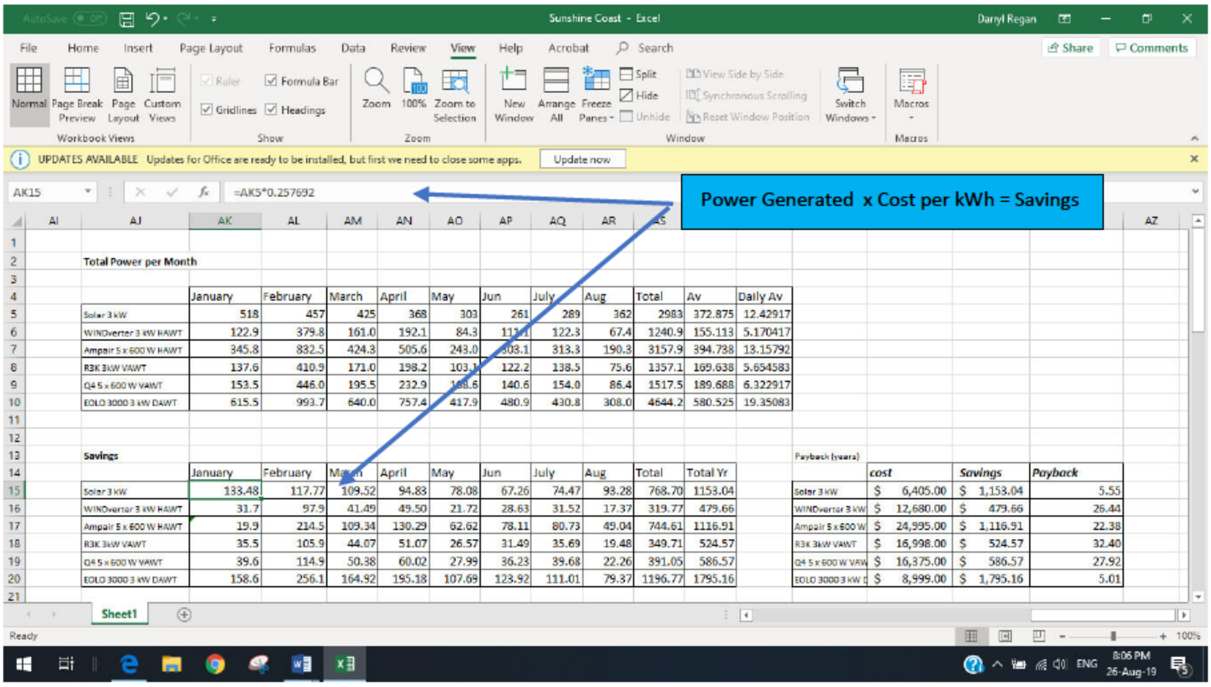


Figure 3.5 Screenshot Savings Calculations and Payback Period – Sunshine Coast

Table 3.1: Breakdown of phases

Phase 1	**Collect wind data**
1A	Collate weather observations for Sunshine Coast, Amberley and Kingaroy
1B	Extract wind speed information from observation data
1C	Enter data into a spreadsheet/table
Phase 2	Collect Wind Turbine data
2A	Select appropriate SSWTs
2B	Download data specification sheets for each SSWT model. Enter data into 'Wind Power' program.
2C	Review and analyse relevant power curve data
2D	Arrange data into an Excel spreadsheet
Phase 3	Calculate power generated
3A	Write a MATLAB program to calculate generated power
3B	Calculate maximum daily power generated by each SSWT for each site
3C	Enter data into Excel spreadsheet
Phase 4	Calculate costings
4A	Obtain feed in tariffs from Energex and Ergon
4B	Formulate EXCEL spreadsheet to calculate costings
4C	Enter power reading, run program to obtain cost savings
4D	Using cost saving data for the test period to calculate a payback period
Phase 5	Analyse Data
5A	Review results
5B	Write a preliminary report
5C	Submit report for Research Project Part1 (ENG4111)
Phase 6	Dissertation
6A	Complete a draft dissertation for supervisor's evaluation
6B	Attend Professional Practice 2, (ENG4903), present findings to peers, supervisors and other academic staff
6C	Complete final dissertation, submit electronic copy to study desk.

3.2 Quality Assurance

- It is assumed that the wind speed data collected from the BoM is accurate and reliable. It is anticipated that there are 8 months of uninterrupted data available from each site.
- All calculations will be conducted using the mathematical program *MATLAB or Excel*.
- Power curve data sourced from the respective turbine manufacturers will be assessed using *wind power program*© prior to use. Although the validity of the information cannot be collaborated, data considered outside of what is deemed "reasonable expectations" will be rejected.
- Anticipated power generation figures will be compared against case studies contained in the references from the literature reviews to authenticate calculations.
- Daily solar power generation figures will be obtained from data stored on *SUNGROW SG3K-S* Residential String Inverters.
- Journals, papers and reports used in the literature review are to be less than 5 years old.
- It is assumed that quotes obtained from manufacturers and installers are accurate at the time of issue.

3.3 Resources

The resources required for this project are listed in Table 3.2 below;

Table 3.2: Resources required

Task	Resource Item	Cost	Supplier
1A	Purchase Jan/Feb wind data from BoM	$99.00	Student
All Tasks	Personal Computer	Nil	Student
2B	*Wind power program©*	$60.00	Student
1C,2D, 3B,3C	Microsoft Excel	Nil	Student
5B,6A,6C	Microsoft Word	Nil	Student
3A, 4B, 4C	MATLAB program	$ 285.00	Student
1A, 2A, 2B,4A	Internet Access	Nil	Student
	Total Cost	***$444.00***	

3.4 Risk Assessment

Due to the nature of this research being entirely theoretical, a risk analysis of the project concludes that there is a low risk of personal injury during the undertaking of the tasks documented in Table 3.2. For this reason, a risk assessment table has not been included in the dissertation. However, standard ergonomic practices should be adopted when performing desk related or computer related activities. The use of a standing workstation or desk is considered best practice, in addition 5 minute breaks every hour, leaving the desk and conducting some light movement or exercise is considered beneficial.

Chapter 4 Background

4.1 Establishing a Common Definition

Despite there being no international classification on wind turbines their definition is usually based on the parameters of the turbine. Turbines are loosely sorted on the type and shape, plus other features such as height, power rating and wind surface area (Teschner al et. 2018). These factors will be explored in more detail below.

4.1.1 Wind Turbine Energy System

To maintain standardization throughout this report, a grid connected wind turbine system consists of the following components (Webb, 2017).

- A wind turbine to convert kinetic energy into electrical energy,
- an inverter to convert the generated voltage, usually DC, into mains power 240V, 50 Hz,
- possibly a battery storage unit (*Powerwall 2*) to store excess charge generated,
- a metering device for monitoring, and
- interconnecting cables.

4.2 Types of Wind Turbines and their Advantages and Disadvantages

Wind turbines can be classified into two main types - horizontal or vertical axis wind turbines.

4.2.1 Horizonal Axis Wind Turbine (HAWT)

Figure 4.1: Example of a HAWT (Source: Webb, 2017)

HAWTs are the most common and recognisable wind turbines. They are the turbines typically seen on the large-scale commercial wind farms. Despite this design having several disadvantages they are the most efficient in a clear wind zone area (Alam, 2012).
The typical HAWT, as shown in Figure 4.1, has three blades and point into the direction of the wind. The larger commercial units are hydraulically driven, whereas, the smaller units tend to

have a tail fin that passively steers the turbine to face into the wind. This consistent twisting around the vertical axis increases the wear and tear on the rotating points.

Another problem with HAWTs is they can free run when unloaded (Alam, 2010). That is, if the turbine for some reason is disconnected from the grid or battery bank, with no load the turbines spins freely and will overspeed. This can result in the turbine self-destructing due to the extra stress on the rotating components. Most modern HAWTs have some safety over speed mechanism to protect itself from excess speeds. Commercial turbines feather the blades, thereby adjusting the pitch and controlling the revolutions.

HAWTs typically produce more noise due to the air flow over the blades. This is more common with the smaller scale devices due to their faster rotating speed. This noise in addition to the need to place the HAWT on a tower is a negative point and the main reason for opposition to wind turbines in an urban situation (Battisti, 2018).

4.2.2 Vertical Axis Wind Turbine (VAWT)

VAWTs can be categorised into one of two types: Darrieus or Savonius. (Figure 4.2)
Darrieus turbines are lift-based and generally have a few blades joined at central locations. The Savonius turbines are drag based, containing cups or fins, such as an anemometer. The Darrieus are significantly more efficient than the Savonius and therefore more suitable to domestic use, however they are still less efficient than the HAWT.

Figure 4.2: Example of VAWT, a Darrieus (left) and Savonius (right). (Source: Webb, 2007)

Both types of VAWT have some advantages over the HAWT. The VAWTs have fewer moving parts as they rotate around the vertical axis and are therefore much quieter and require less maintenance. They are less sensitive to changing wind direction and therefore turbulence, making them much more suitable to the urban environment (Tummala et al. 2016).

Table 4.1 summaries the major advantages and disadvantages for both types of wind turbines.

Table 4.1: Wind Turbines Types – Advantages and Disadvantages

Turbine	Advantages	Disadvantages
Horizontal Axis Wind Turbines (HAWTs)	More efficient in converting wind energy to electrical energy	Without protection can overspeed and self-destruct
	Size range from small scale up to large commercial wind farms	Turbine constantly twisting around its vertical axis increasing wear
		Noisier than VAWTs
		Poor visual aesthetics
Vertical Axis Wind Turbines (VAWTs)	Quieter operation	Lower aerodynamic efficiency
	Fewer moving parts, less ongoing maintenance	Unsuitable for larger wattage turbines
	More suitable to turbulent winds and changes in wind direction	
	Creative appealing designs	

4.3 Theoretical Power in Wind

SSWTs, as a rule, have much shorter blades and a smaller rotational area, than their large-scale commercial turbine brothers. Therefore, it is important to understand the limitations of these devices.

The turbine is driven by the kinetic energy of the wind. The formula for kinetic energy is

$$E_{kin} = \frac{1}{2}.m.v^2 \qquad \text{(equation 1)}$$

where m = mass and v = speed

By substituting mass with the air flow per second through a 1 metre square area, the result is energy per second, power or watts (W).

$$m = \rho.v.A \qquad \text{(equation 2)}$$

Where v = velocity of the wind

ρ = air density

A = area of wind turbine swept m^2

By combining equation 1 and 2 we obtain

$$P_{wind} = \frac{1}{2}.\rho.v^3.A \qquad \text{(equation 3)}$$

The theoretical power of wind is represented graphically below in Figure 4.3.

Unfortunately, this is only the theoretical power that can be generated. In practice wind escapes around the turbine. The maximum power that can be generated is predicted using Betz Law.

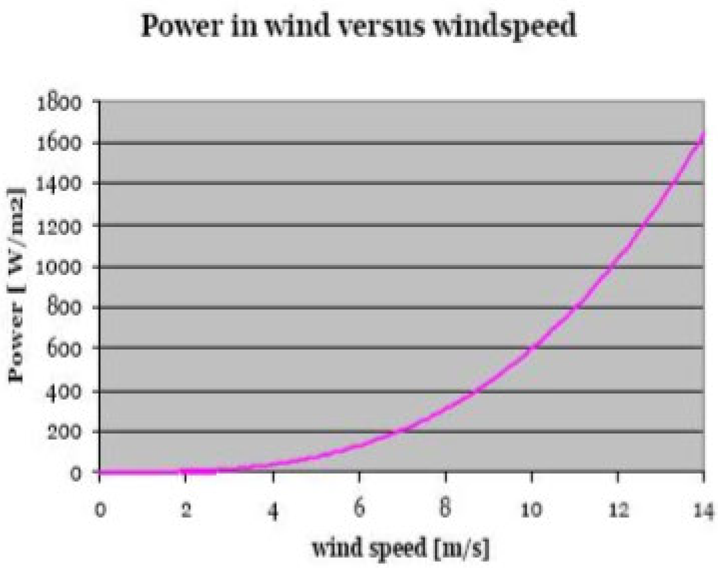


Figure 4.3: Theoretical Power in Wind

4.3.1 Betz Law

Betz Law states that no turbine can capture more than 16/27 of the kinetic energy of the wind. The swept area of the turbines is related to the length of the blades.

$$A = \pi r^2 \qquad \text{(equation 4)}$$

Figure 4.4 demonstrates the maximum power that can be generated and shows how increasing the blade length increases exponentially the power generated.

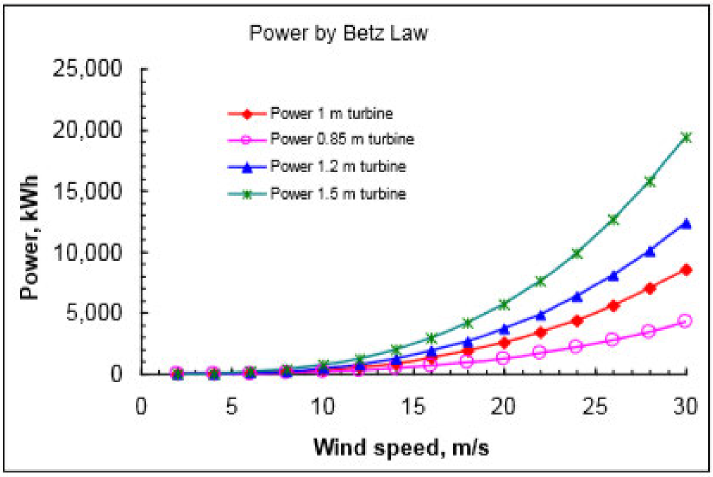


Figure 4.4: Betz Law – increased power by increasing wind speed and diameter of wind turbine

4.3.2 Power Curves

Performance of a wind turbine is generally represented as a power curve. The x axis, wind speed is plotted against the output power, y axis. Figure 4.5 represents a typical power curve.

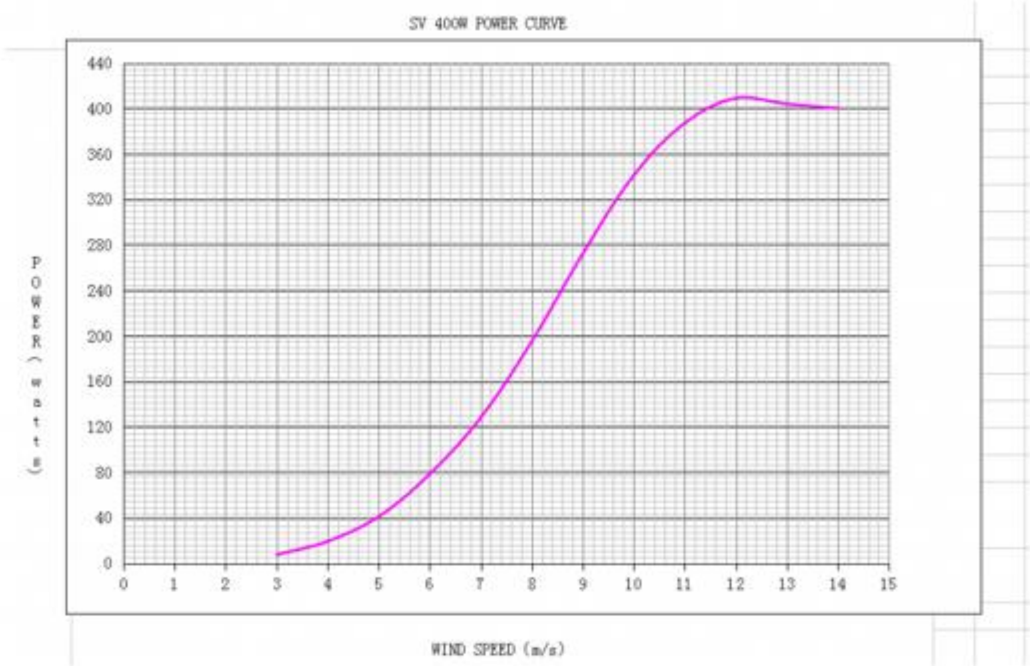


Figure 4.5: Power Curve for the Red Spiral 400w Wind Generator (Source: Solazone)

A typical manufacturer's power curve does not continue to increase as wind speed increases. They usually taper off or flatten out to a maximum rated power output. At the lower speeds some turbines can exhibit properties like the theoretical power calculations.

4.4 Selecting the Wind Turbines for Project

Five SSWTs have been selected for this research project, two HAWTs, two VAWTs and one turbine that employs both vertical axis profiles, Darrieus and Savonius. The total output power in all cases is 3kW either by using a single wind turbine rated at 3 kW or by using a series of small turbines adding up to 3 kW. The turbines can then be compared to a similar size photovoltaic system. The turbines have been selected due to their variations in design, specifications and power curves. In this approach, the data calculated in this research project has been strengthened by using an extended selection of turbines.

4.4.1 WINDverter V2 Wind Turbine

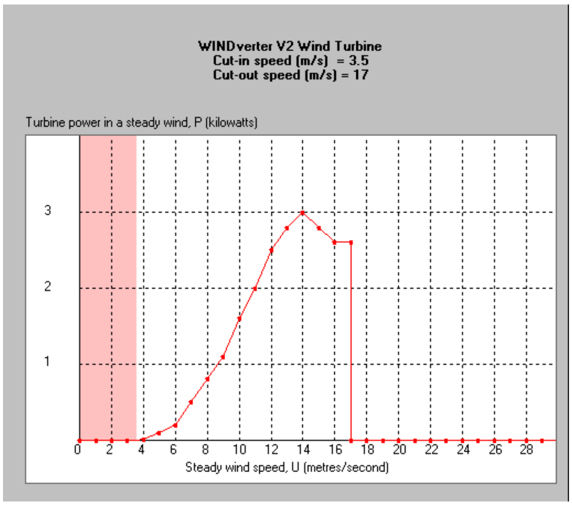


Figure 4.6: WINDverter V2 Wind Turbine (left) (Source: Windpower Australia Pty Ltd) WINDverter Power Curve (right)

The WINDverter V2 is rated at 3000 watts maximum output. It consists of three blades 2900mm in diameter. The start-up is 3.0 m/s with a cut in at 3.5m/s. Its maximum output is achieved at 14 m/s and has a survival speed to 40 m/s (144 km/h).

The WINDverter V2 utilises a brushless permanent magnet 3 phase alternator, requiring minimal maintenance. The blades are made from a Fibreglass Reinforced Composite, giving high strength and durability. The housing is fully alloy with stainless steel fixtures giving high anti corrosion properties. The range of WINDverter wind turbines is built to provide many years of trouble free operation.

The wind turbine system can be used as a stand-alone power system to recharge batteries or grid connect to utilise the generated power and feeding excess power back into the grid.

4.4.2 Ampair 600

The Ampair is a 600 watt “micro” wind turbine. It has a 1700mm diameter, three blade construction optimized for low and medium speed winds. In higher winds the turbine incorporates a PowerFurl™ system which slows the turbine down, reducing noise, system mounting stresses and damage to the turbine. The Ampair 600 is available in two versions, a 24V for battery charging or 240V grid connected model. The turbine can be mounted on a pole, tilt mast or to the side of a building.

The cut in speed is 3.0 m/s and total weight is 16.0 kg. The generator is a direct drive NeFeBr permanent magnet, the body is powder coated die cast aluminium and blades are glass reinforced plastic (GRP) The turbine has an expected operational life of 15 years.

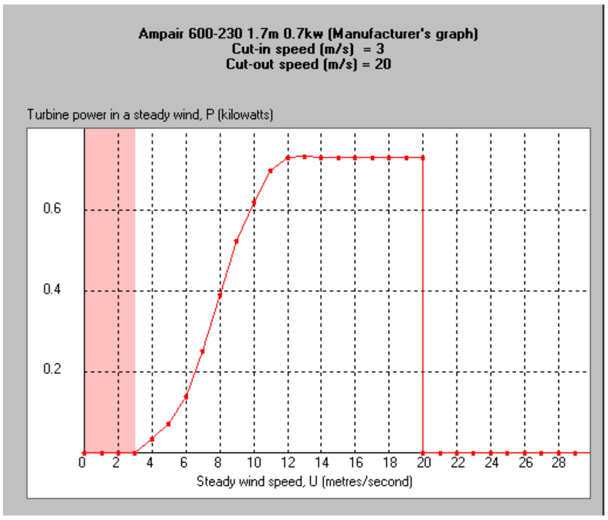


Figure 4.7 Ampair 600 (left) (Source: www.ampair.com), Ampair 600 Power Curve (right)

4.4.3 R3K H-series VAWT

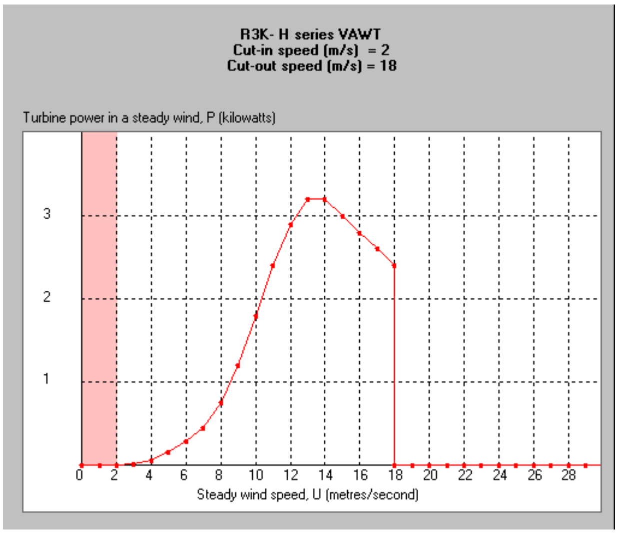


Figure 4.8 H Series Wind Generator (left) (Source: Solazone), R3K power curve (right)

The R3K is a 3000 watt VAWT with a maximum power of 3500 watts. It has a low start up speed of 3m/s and a rated speed (maximum power) at 12 m/s. The generator has a permanent magnet rotor alternator which uses Neodymium Iron Boron Magnets which are lighter and more efficient than other forms of magnets. The 5 fibreglass blades have a diameter of 2.85m and a height of 3.5m. The turbine features a creative appealing design, low noise and low vibration. They are easy to install, low in maintenance, reliable and durable.

4.4.4 Q4-series VAWT

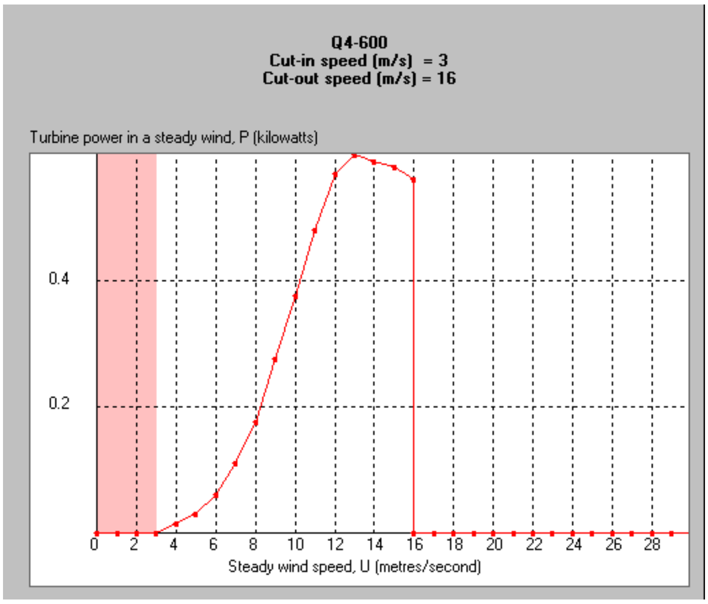


Figure 4.9 Q4-series VAWT (left) (Source: Solazone), Q4 power curve (right)

The Q4-600 is a 600 watt VAWT. It has a very low start up speed of 1.5 m/s and rated maximum power at 13 m/s. The diameter of the unit is 580mm with a height of 1600mm. The complete turbine weighs 90 kg. The blades are made from aluminium alloy, spray painted with an anti-oxidation treatment of the blade surface, strengthening the anti-corrosion characteristics and giving a durable finish. The generator is a patented permanent magnet AC generator with a special maglev generator stator, which effectively reduces the torque to a third of a standard wind generator.

4.4.5 EOLO 3000

Figure 4.10: EOLO 3000 3 blade (left) and 6 Blade (right) (Source: Makemu Green Energy)

The EOLO 3000 is a 3000 watt VAWT turbine however it utilises both horizontal Savonius and vertical Darrieus profiles. The Savonius lowers the start-up threshold and increases efficiency at low regimes, the vertical profile Darrieus captures a larger volume of air and increases performance at high revolutions. The result is an improved output curve. The standard 3 blade configuration uses 3 vertical blades Darrieus and 6 horizontal blades Savonius, the optional 6 blade unit has 6 vertical blade Darrieus and 12 horizontal blade Savonius. The 6 blade option allows capture of twice the wind in the same volume thereby doubling the power.

The turbine is activated at very low wind speeds (3 m/s). It nominally operates at 60 rpm and is therefore extremely quiet. The aerodynamic nature of the turbine acts as a self-braking mechanism once the unit has reached its working rotation, and this stabilises the rotation speed and efficiency. The turbine is pole mounted which can be customised to the customer's height requirement. The turbine can be configured as a stand-alone system or grid connected.

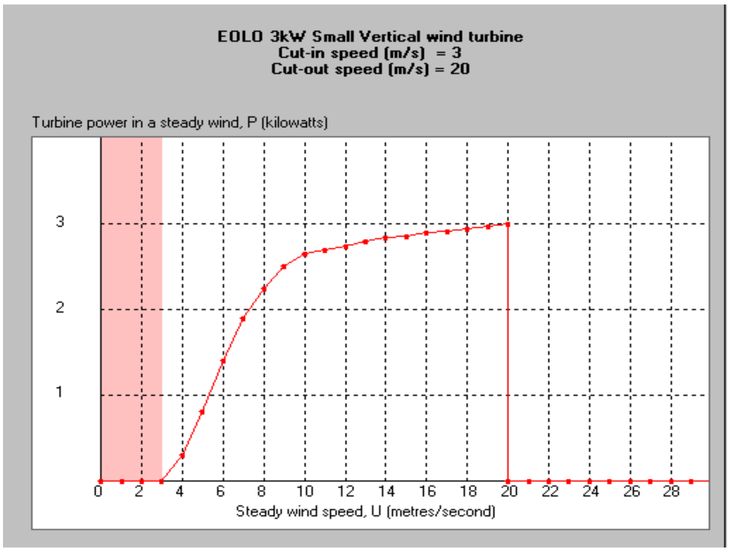


Figure 4.11 EOLO 3000 Power Curve

4.4.6 Wind Turbine General Specification Summary

A summary of the mechanical specifications for the five selected SSWTs is contained below in Table 4.2. Weight shown in the table is unit weight only i.e. tower top. Since mounting devices can vary between installation their weight has not been included in the specifications.

Table 4.2: Mechanical Specifications

	Turbine	*Wattage*	*Diameter*	*Height*	*Weight*
	WINDverter HAWT	3000 Watts	2900 mm	N/A	77 kg
	Ampair 600 HAWT	600 Watts	1700 mm	N/A	16 kg
	R3K VAWT	3000 Watts	2850 mm	3500 mm	94 kg
	Q4 VAWT	600 Watts	580 mm	1600 mm	90 kg
	EOLO 3000 DAWT	3000 Watts	1300 mm	1950 mm	92 kg

4.4.7 Other Designs

The scope of the research project was to only use SSWTs that were commercially available on the Australian market. Figure 4.12 illustrates some of the many VAWT and HAWT designs that are available overseas and highlights the broad and diverse range of SSWTs.

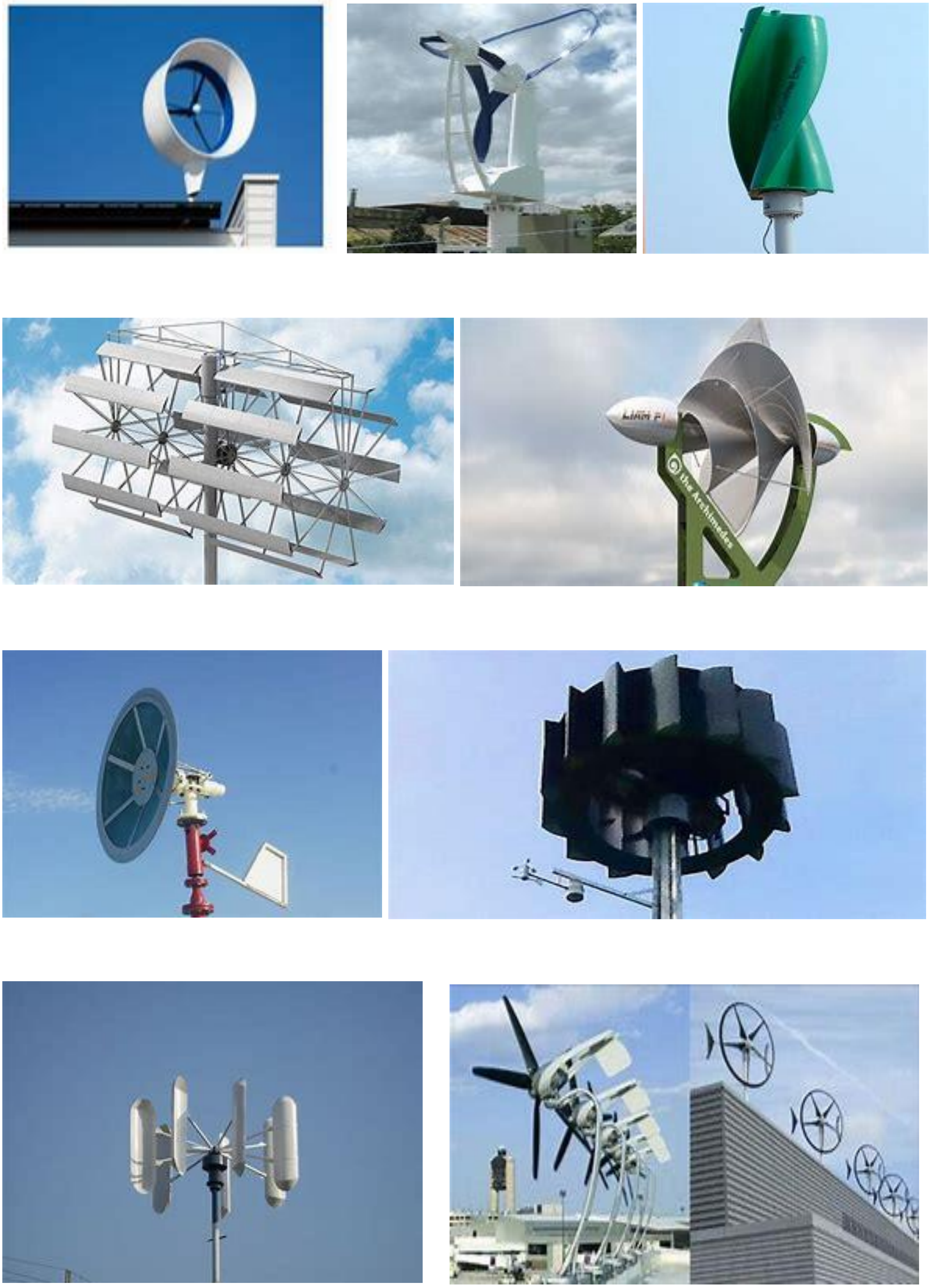


Figure 4.12 Additional Wind Turbine Designs (Source Award Designs.com)

Chapter 5 Results and Discussion

5.1 Generated Power

The research project was conducted between 01 January and 31 August 2019. During this time wind data was obtained from the BoM for the three sites, Sunshine Coast, Amberley and Kingaroy. The BoM records the wind speed every 10 minutes and averages the data out over a 30 minute period. These 30 minute recordings form the basis of the power calculations. The collected data is entered into the *MATLAB* program (Appendix B) which incorporates the power curves (power output Vs wind speed) for each SSWT. When the program is run, daily power generation figures are calculated. The results of those calculations are contained below.

5.1.1 Sunshine Coast

Table 5.1 displays the power generated by each turbine for the months Jan – Aug. In late February and again in April, South East Queensland was affected by two Ex Tropical Cyclones, Oma and Trevor respectively. This weather event had a significant impact on the coast. High winds over several days resulted in two wind turbines, *EOLO 3000* and *Ampair 600* producing greater than 80% more power than the equivalent size solar system. The other three SSWTs, *WINDverter, R3K* and the *Q4,* although their results were similar in magnitude, did not exceed the power generated by the solar system.

Table 5.1 Power Generation for Sunshine Coast.

	January	February	March	April	May	Jun	July	Aug	Total
Solar 3 kW	518	457	425	368	303	261	289	362	2983
WINDverter 3 kW HAWT	122.9	379.8	161.0	192.1	84.3	111.1	122.3	82.3	1255.8
Ampair 5 x 600 W HAWT	345.8	832.5	424.3	505.6	243.0	303.1	313.3	235.9	3203.5
R3K 3kW VAWT	137.6	410.9	171.0	198.2	103.1	122.2	138.5	93.1	1374.6
Q4 5 x 600 W VAWT	153.5	446.0	195.5	232.9	108.6	140.6	154.0	106.3	1537.4
EOLO 3000 3 kW DAWT	615.5	993.7	640.0	757.4	417.9	480.9	430.8	391.8	4728

During the entire research period, both the *EOLO 3000* and *Ampair 600* outperformed the solar system, producing 1745 kWh and 220.5 kWh more power respectively, than the roof top solar system. The total power produced by the *EOLO 3000* was 4728 kWh, averaging 19.7 kWh per day and the *Ampair 600*, 3203 kWh, averaging 13.3kWh. The solar system average over the same period was 12.4 kWh. The other 3 SSWTs, *WINDverter, R3K* and *Q4* power generation was less than the solar system however their power generation figures were very similar. Figure 5.2 presents the average power generation for the research period. The calculations also indicated that the *Ampair 600*, which comprises 5 x 600w turbines running in parallel, did consistently better than the other vertical and horizontal axis turbines, *WINDverter, R3K* and *Q4*. It should be noted that the *Q4* turbine also operated with 5 units in parallel. The initial theory, which was discussed in the Literature Review, Chapter 2, was the lower wattage turbines, being smaller and lighter, would perform better in the light winds. Their lower start-up speed, in theory, would effectively generate more power at the lower wind speeds. This hypothesis could not be substantiated using only one vertical axis and one horizontal axis turbine. Each gave a difference outcome, one in favour of the theory and one opposing.

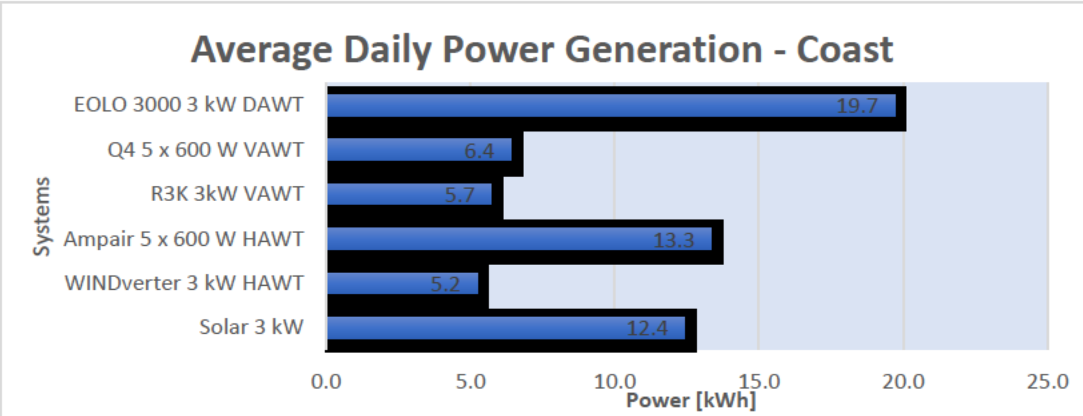


Figure 5.1 Average Power Generation for Sunshine Coast.

The *WINDverter, R3K* and the *Q4* produced less than half the power of the solar system i.e. 1256 kWh, 1375 kWh and 1537 kWh respectively. At these levels of power generation, it can be easily ascertained that the turbines would be unsatisfactory as a primary source of power. However, the turbines have potential as back up for solar, especially in the evening when the sun has set. Data collected indicates that the regular evening sea breezes can produce several kW of power when no or reduced solar energy is being produced. For this reason, the use of any of these turbines as an additional power source would be considered beneficial. This is discussed in greater detail in Section 5.1.4.

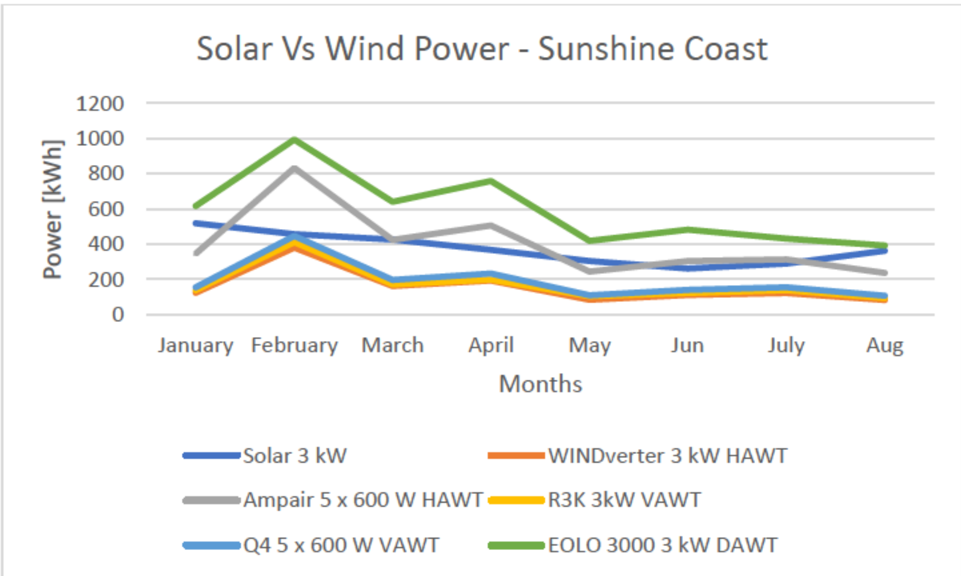


Figure 5.2 Graphical Representation of Power Generated - Sunshine Coast

Figure 5.2 shows a graphical representation of the power generated over the research period.

Figure 5.2 clearly indicates the *WINDverter, R3K* and the *Q4* turbine's power generation are consistent with each other and produce far less than the solar system. The *EOLO 3000*, in all months, produced more than the solar system where the *Ampair 600,* in most months, produced more than the solar system. The Figure also indicates seasonal trends, reduced sunlight over the winter months and reduced solar power production. The same effect was also noticed with the wind power generation. This had not been expected as South East Queensland usually experiences strong westerly winds during winter.

5.1.2 Amberley

Apart from February, Table 5.2 points out that none of the 5 SSWTs produced power near the levels recorded on the solar system. The better than average results for February was due to Ex Tropical Cyclone Oma. Recorded wind speeds for this period were well above the average but were not as strong or persistent as the wind speeds experienced on the coast. Therefore, power generation for this period was not as dramatic as viewed earlier with figures for the Sunshine Coast. The most efficient turbine was again the *EOLO 3000* producing 2325kWh, but this was 22% less than the solar system. As seen at the Sunshine Coast, the *Ampair 600*, was the second most productive wind turbine. However, unlike figures recorded on the coast the *Ampair 600* power production was almost half the power produced by the solar system. The *WINDverter, R3K* and the *Q4* turbines again had similar recorded power production however were less than 25% of the total solar system power production. It can be concluded that these three turbines are ineffective when installed further inland. The winds do not appear to be of sufficient and consistent strength to drive the turbines in an area of the power curve to produce effective power generation.

Table 5.2 Power Generation for Amberley

	January	February	March	April	May	Jun	July	Aug	Total
Solar 3 kW	518	457	425	368	303	261	289	362	2983
WINDverter 3 kW HAWT	111.2	167.1	74.1	40.4	69.6	34.3	49.4	84.3	630.4
Ampair 5 x 600 W HAWT	300.7	414.9	204.8	121.4	105.1	95.9	136.8	214.5	1594.1
R3K 3kW VAWT	116.4	188.7	76.7	62.6	40.7	39.1	55.7	96.1	676.0
Q4 5 x 600 W VAWT	133.0	202.1	94.0	54.3	48.4	45.1	63.6	107.4	747.9
EOLO 3000 3 kW DAWT	438.7	550.0	312.0	209.3	178.3	144.6	207.1	284.9	2324.9

The dramatic difference in power production between the solar system and the SSWTs is evident in Figure 5.2. The spike in February is the only aberration to a line well below the solar production. However, it could be argued that both the *EOLO 3000* and the *Ampair 600* could be used in conjunction with a solar system to provide an additional power source during cloudy days or during the night. As stated earlier this may or may not be feasible subject to the costs incurred with purchase and installation of these SSWTs.

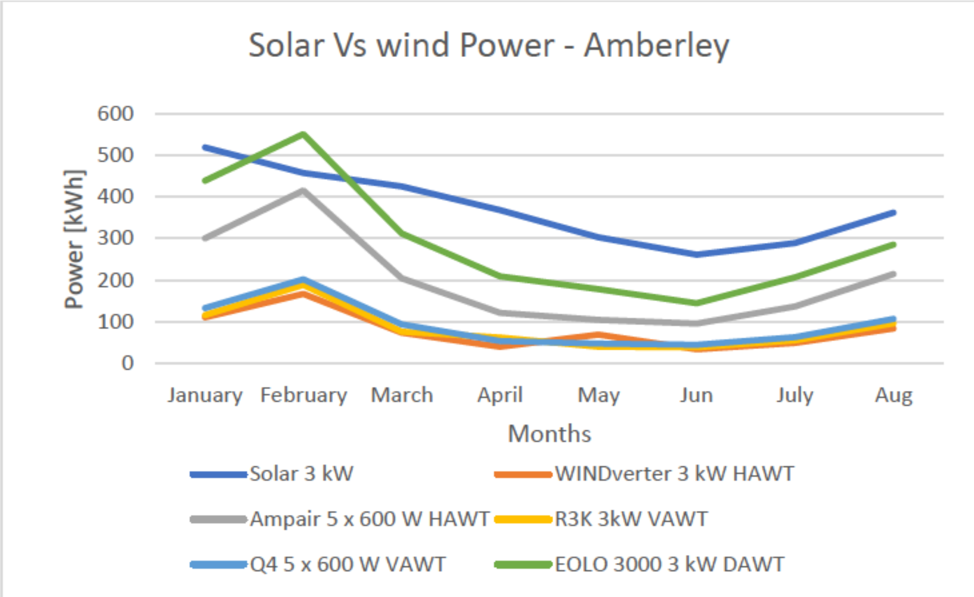


Figure 5.3 Graphical Representation of Power Generated – Amberley

The average daily power generation is displayed in Table 5.4. It is clear from this Figure that the wind turbines, in this location, are not as effective as PV.

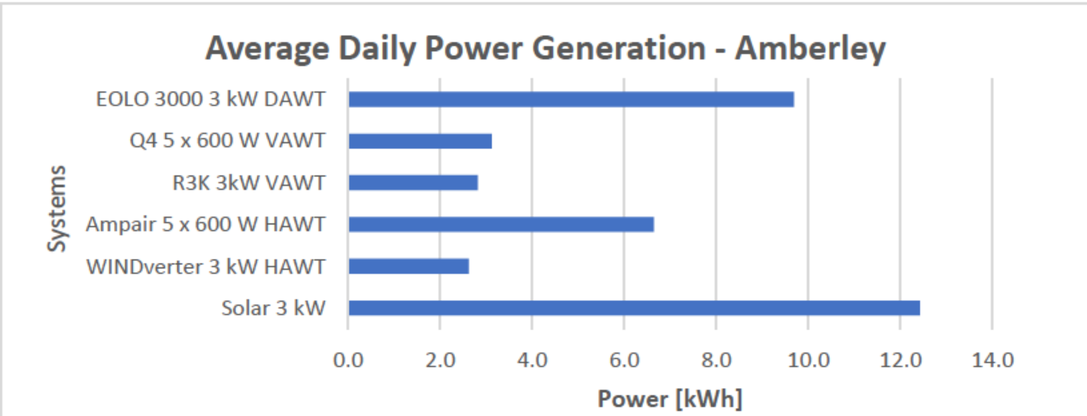


Figure 5.4 Average Daily Power Generation for Amberley

5.1.3 Kingaroy

Kingaroy was chosen as the third site for the wind turbine research project due to its higher elevation (433 m) and proximity to the Bunya Mountains. With a commercial wind farm (Coopers Gap Wind Farm) currently under construction less than 60 km away and a second small farm due to start construction in March 2020, it was anticipated that the SSWTs in this location would indicate strong power generation figures. From Table 5.3 it is evident that this has not been the case and although disappointing from the SSWT research project it has been an excellent example and learning experience to display the difference between large turbines mounted 180m above ground and small scale turbines 10m above ground. At no time during the research period did the SSWTs produce power that would be considered close to the solar system. At best, the *EOLO 3000* obtained figures around 60% of the solar system and the worst result was the *WINDverter* producing less than 12% in comparison. Slight spikes were again experienced in February and April due to the ex-tropical cyclones.

Table 5.3 Power Generation for Kingaroy

	January	February	March	April	May	Jun	July	Aug	Total
Solar 3 kW	518	457	425	368	303	261	289	362	2983
WINDverter 3 kW HAWT	19.3	72.0	54.8	38.1	34.5	33.7	41.2	52.3	345.9
Ampair 5 x 600 W HAWT	97.6	212.6	118.4	126.7	112.7	105.4	123.6	148.2	1045.2
R3K 3kW VAWT	30.3	82.8	45.3	50.9	43.8	42.4	48.6	60.4	404.5
Q4 5 x 600 W VAWT	35.1	94.2	51.6	56.9	49.5	47.9	55.5	68.4	459.1
EOLO 3000 3 kW DAWT	163.9	380.0	223.5	235.3	213.5	178.6	213.2	223.1	1831.1

The graphical representation of Figure 5.5 gives a clearer picture of the SSWTs versus the solar system. It can be easily seen from this Figure, the much lower power production of the SSWTs. Unlike Amberley where it was considered feasible to use SSWTs in conjunction with solar, for Kingaroy, this option would be considered not cost effective due to their poor performance.

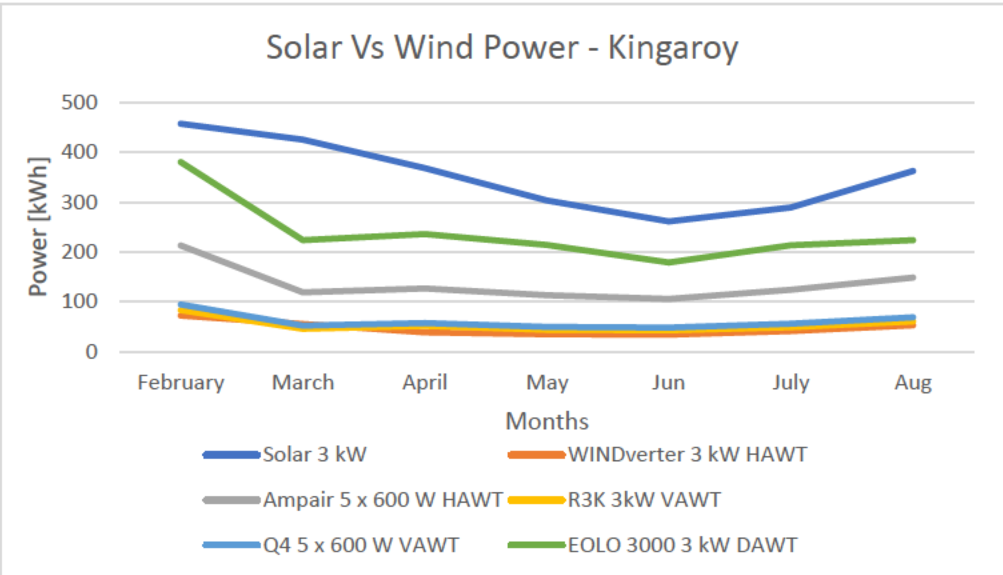


Figure 5.5 Graphical Representation of Power Generated – Kingaroy

The average power generated for Kingaroy is illustrated in Figure 5.6. Again, it gives a clear indication that wind power is not as effective as solar in this location.

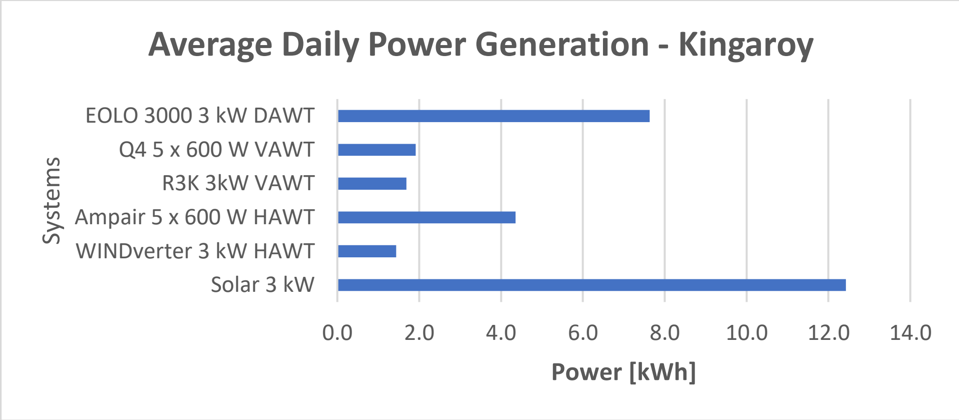


Figure 5.6 Average Daily Power Generation for Kingaroy

5.1.4 Power Generation Non Daylight Hours

As previously discussed, the benefits of wind power extend beyond daylight hours. Unlike photovoltaic panels which only produce power when the sun is shining, wind power has the potential for power generation 24 hours per day. Figure 5.7 shows the Sunshine Coast wind data for the month of January. It can be seen from this example that, with a few exceptions, there is very little difference in wind speed between day and night. The wind power calculations for the Sunshine Coast, when broken up into 12 hour day and night blocks, show the results are very similar. On average 50% of the daily power produced occurred outside of daylight hours. The highest recorded reading was on 28 March when the percentage of power produced at night was almost 69%. Of course, some variations did exist and there are examples when night-time power production was far less than the daytime production. However, fluctuations can also be experienced with daily solar power generation. Not every day is cloud free and the percentage of cloud cover can vary daily effecting PV power production.

On average, the coastal sea breezes were responsible for producing 50% of the power outside of daylight hours, unfortunately, this action did not extend to the other locations. As you progress further inland, the breezes diminish and therefore the potential for power generation also diminishes. Figure 5.8 illustrates the wind data for Kingaroy over the same period as Figure 5.7. During sunlight hours, most days, have the potential to produce power from the wind, however, as a rule, outside of these hours the wind tended to die away. Kingaroy is located only 140 km inland from the coast but as can be seen from Figure 5.8, many mornings are calm, experiencing no or very little wind. This is a stark contrast to that experienced on the coast.

The third location, Amberley, is located 48 km from the coastline. It displayed minor fluctuations in wind speed. While on some days power calculations indicated that a considerable percentage of the daily power generated was outside of day light hours there were also days when the opposite could be said.

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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0030-0100	24	5	17	22	24	9	24	26	24	9	18	18	17	30	13	13	13	17	11	8	11	13	8	9	8	15	13	21	18	17	9
0100-0130	21	8	28	22	21	9	22	22	28	8	18	18	18	28	15	11	8	8	8	8	5	15	9	8	8	15	11	18	30	13	8
0130-0200	21	8	25	22	21	8	22	24	26	5	18	21	17	26	11	9	8	9	9	8	5	17	9	9	8	11	9	4	21	17	11
0200-0230	21	5	24	22	18	4	22	24	28	5	17	21	15	28	17	5	9	8	8	8	9	17	9	9	8	9	9	9	8	15	8
0230-0300	21	5	24	22	17	4	22	21	26	9	18	22	17	26	17	8	5	5	8	5	8	17	8	8	5	8	11	8	17	15	5
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0600-0630	5	8	0	18	21	9	24	24	18	5	11	22	8	22	8	8	5	9	8	5	8	11	8	9	5	8	0	8	9	5	8
0630-0700	2	9	9	17	22	9	22	26	21	5	11	21	18	30	8	5	8	26	5	5	9	8	5	11	5	5	8	4	5	13	8
0700-0730	17	9	8	17	21	13	21	26	21	15	13	24	22	24	8	8	5	17	8	8	13	8	8	9	5	5	8	8	9	18	8
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0900-0930	18	11	11	18	22	22	21	22	24	17	21	24	22	26	11	15	17	17	11	21	17	18	13	11	13	13	17	18	18	21	9
0930-1000	17	11	9	15	18	18	22	24	24	17	18	24	22	26	13	15	17	17	13	18	18	15	17	18	15	15	22	18	21	21	9
1000-1030	17	13	13	15	17	18	22	22	21	15	17	22	22	28	13	17	18	13	13	18	17	17	22	21	15	15	22	18	18	21	17
1030-1100	17	13	17	15	21	21	22	22	21	13	18	21	24	26	13	18	21	13	13	18	17	17	22	22	17	22	22	17	21	21	15
1100-1130	18	15	11	17	15	22	24	21	21	17	18	22	22	28	17	18	18	18	13	17	18	17	26	24	18	22	22	15	18	17	15
1130-1200	17	17	15	17	17	22	24	22	18	17	21	24	24	28	18	18	21	18	17	17	17	17	26	26	21	22	24	15	21	17	17
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1800-1830	18	21	21	18	15	18	22	18	17	15	21	21	26	24	17	24	17	18	22	17	18	18	24	15	17	22	26	17	18	13	15
1830-1900	18	21	26	18	15	15	21	21	17	17	21	17	26	22	18	24	17	17	22	15	18	17	22	17	17	22	22	17	15	17	15
1900-1930	18	21	24	18	15	17	21	18	17	15	18	18	28	17	21	26	17	17	13	17	18	15	18	17	17	22	21	18	21	15	13
1930-2000	15	21	24	18	15	18	15	21	15	15	21	18	26	17	18	26	17	17	11	17	18	13	18	17	18	21	21	21	21	17	17
2000-2030	17	21	24	18	17	17	21	22	15	17	21	17	28	21	17	24	17	17	9	17	21	13	15	15	18	18	21	21	21	13	17
2030-2100	21	17	28	26	18	17	24	24	17	18	21	21	28	21	17	26	17	17	11	17	21	13	13	15	18	17	18	21	22	11	17
2100-2130	17	17	26	26	18	17	21	26	15	18	24	21	31	17	15	24	17	17	13	15	18	15	13	15	21	17	18	18	18	11	18
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2300-2330	15	13	22	21	18	21	24	24	13	17	18	18	26	15	17	21	22	8	0	13	17	13	11	5	15	21	17	15	21	13	17
2330-0000	15	17	22	21	17	24	26	24	9	17	21	17	26	17	17	17	22	9	8	11	15	13	9	2	13	18	21	15	18	2	13

Figure 5.7 Wind Data Sunshine Coast

Generally, it can be stated that the percentage of power produced outside of daylight hours decreases the further you travel away from the coast. A good representation of this is presented in Figure 5.9. The solar system power generation presents a classic bell curve, peaking around midday, the city and rural power generating is predominantly around similar hours. On the coast, power generation tends to be consistent across the entire 24 hour period.

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	7	6	9	9	13	0	7	0	0	0	19	19	9	13	6	7	7	7	9	0	9	6	7	7	6	9	2	7	6	0	13
0030-0100	-	6	11	6	15	0	6	0	0	0	20	22	9	17	7	6	4	6	9	7	13	6	0	6	0	7	0	0	0	0	7
0100-0130	-	7	7	9	15	0	2	0	0	9	20	15	13	13	2	6	06	4	6	9	6	0	0	7	0	0	0	0	0	0	9
0130-0200	-	6	6	11	11	0	0	0	0	0	20	7	13	11	7	7	7	2	7	7	4	4	6	6	4	0	0	6	0	0	7
0200-0230	9	6	7	11	7	0	0	0	0	7	20	6	19	11	13	9	9	4	7	9	4	7	6	9	0	0	0	7	0	0	9
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0400-0430	9	6	11	7	11	0	0	0	0	0	20	7	13	7	9	7	13	7	7	7	0	0	6	9	0	0	0	0	0	0	2
0430-0500	13	7	9	9	7	0	0	0	7	4	22	6	11	9	9	7	13	4	7	9	0	0	9	9	0	0	0	0	0	0	7
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0600-0630	11	7	0	9	6	2	7	2	0	9	22	6	13	13	9	9	15	6	7	7	7	0	2	9	0	6	0	6	0	6	2
0630-0700	15	0	0	4	6	4	0	2	4	6	15	6	13	19	11	7	11	6	7	0	4	2	6	0	0	0	0	0	0	0	0
0700-0730	11	7	0	4	7	2	0	0	6	4	15	0	15	13	15	9	13	6	2	6	0	0	7	0	0	0	4	0	0	0	7
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0830-0900	11	9	7	9	15	6	0	2	0	4	26	19	15	13	17	19	15	13	15	13	11	9	11	13	6	4	0	0	6	0	7
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0930-1000	13	13	9	17	22	13	4	19	11	19	26	17	22	13	19	19	17	20	15	15	13	13	15	13	15	7	4	13	11	2	24
1000-1030	19	17	13	17	22	13	9	17	9	17	28	19	20	17	20	19	17	19	22	13	13	15	19	13	13	11	7	13	7	15	22
1030-1100	11	17	13	15	20	13	15	15	7	19	26	13	20	17	20	20	13	19	19	15	13	13	19	13	13	15	9	15	17	24	24
1100-1130	13	15	13	15	19	11	17	22	7	20	26	15	22	15	19	20	17	19	20	17	13	13	17	15	17	11	17	13	20	22	22
1130-1200	17	17	13	19	22	13	17	19	6	24	32	20	20	19	17	20	17	22	22	15	11	15	15	13	17	6	22	22	20	22	24
1200-1230	19	13	11	19	22	7	13	17	9	24	24	19	20	17	19	19	15	19	19	17	15	13	15	11	17	15	19	20	20	20	24
1230-1300	17	15	13	13	15	7	15	17	6	24	28	17	19	20	15	20	15	20	22	13	13	15	17	15	11	15	24	22	24	24	22
1300-1330	15	17	13	11	20	9	13	19	9	26	28	17	22	19	17	20	17	19	20	11	13	15	15	9	19	18	24	20	20	24	20
1330-1400	20	19	11	24	17	9	13	17	9	28	22	17	22	17	17	17	17	17	22	13	11	17	11	7	17	9	30	20	24	22	22
1400-1430	22	17	11	13	22	13	15	17	11	22	24	17	24	15	17	15	11	17	17	13	13	17	13	9	20	11	28	19	20	24	20
1430-1500	22	13	17	4	20	7	11	15	7	20	28	17	19	13	17	19	19	19	22	17	15	15	13	7	15	13	24	24	24	20	20
1500-1530	19	15	11	6	22	7	11	13	15	20	24	17	15	17	17	20	22	19	24	17	11	15	11	9	9	9	22	19	20	24	15
1530-1600	20	15	11	9	17	11	6	11	11	22	20	19	19	13	17	19	20	19	24	11	13	15	11	11	9	9	24	20	19	17	13
1600-1630	19	19	13	13	17	4	13	13	13	19	20	19	15	20	19	17	20	20	20	13	15	15	11	9	13	9	24	19	17	17	17
1630-1700	17	15	9	15	20	7	9	13	9	20	20	15	20	15	17	19	15	24	20	11	15	13	7	11	13	6	19	17	13	20	17
1700-1730	13	17	6	9	17	7	9	7	7	17	20	11	20	11	17	15	17	20	15	9	7	11	13	11	9	7	15	9	13	17	13
1730-1800	13	15	0	7	9	6	0	0	4	9	15	7	17	13	15	15	11	19	15	11	6	7	7	9	11	2	15	11	7	17	9
1800-1830	9	9	0	9	0	7	4	7	4	19	15	7	17	11	9	9	11	13	13	11	2	9	6	9	9	4	15	13	7	15	9
1830-1900	13	13	0	13	0	6	0	4	6	11	17	0	13	7	9	13	11	11	11	9	7	11	6	9	7	0	11	9	4	11	6
1900-1930	6	9	6	13	2	4	0	4	6	20	19	0	11	0	9	13	11	13	9	9	7	11	7	9	6	0	11	7	2	11	7
1930-2000	6	9	0	13	11	2	0	2	7	19	17	0	11	7	7	11	11	11	7	9	6	11	2	6	4	0	11	6	0	9	11
2000-2030	9	6	9	9	7	0	0	0	11	24	13	0	11	7	7	13	11	9	7	7	6	11	0	6	6	2	15	6	6	9	11
2030-2100	7	9	2	13	9	6	7	0	7	20	17	9	9	7	4	13	9	9	6	11	7	9	7	6	0	6	15	6	2	9	7
2100-2130	2	7	0	13	6	6	7	0	6	17	20	11	7	7	7	11	7	7	9	9	6	7	7	7	2	0	11	6	6	7	0
2130-2200	7	7	0	13	0	0	2	0	7	17	20	11	9	2	9	13	9	11	7	11	6	9	7	0	2	0	13	0	0	9	9
2200-2230	7	9	9	9	6	0	6	6	7	20	24	9	15	7	9	15	7	9	9	2	11	11	6	2	0	0	9	6	0	11	9
2230-2300	13	11	6	17	2	0	4	0	6	15	22	9	13	9	11	15	6	9	7	7	15	13	6	6	0	0	6	0	9	13	7
2300-2330	9	7	7	15	0	0	4	0	4	20	24	11	13	13	11	11	7	9	7	6	11	9	7	0	0	0	2	0	0	13	6
2330-0000	9	7	9	9	0	9	0	0	0	19	26	9	7	9	9	11	0	9	0	9	7	6	6	2	0	0	9	2	0	17	6

Figure 5.8 Wind Data Kingaroy

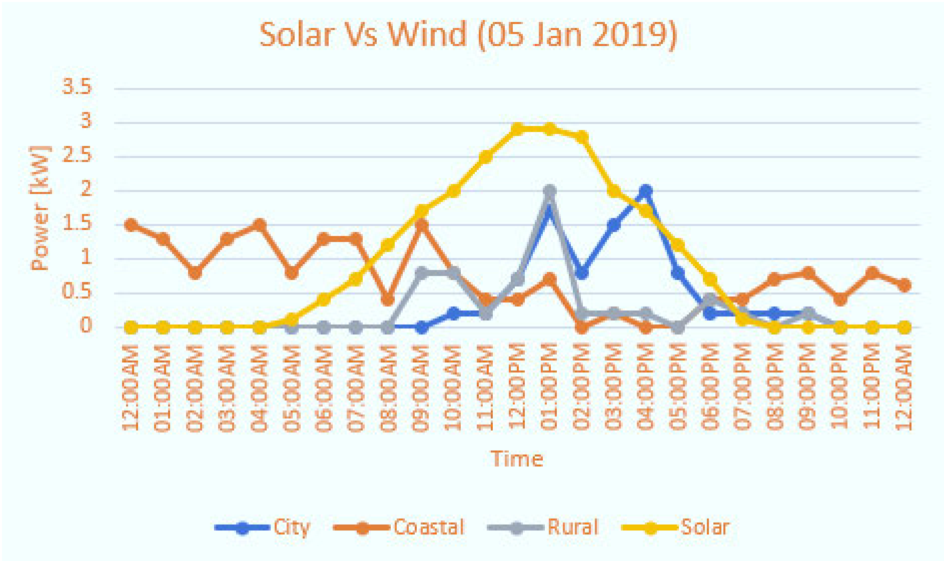

Figure 5.9 24 Hours Power Generation – 05 January 2019

5.2 Benefits of Generating Power over 24 Hours.

5.2.1 Improving the "Duck Curve"

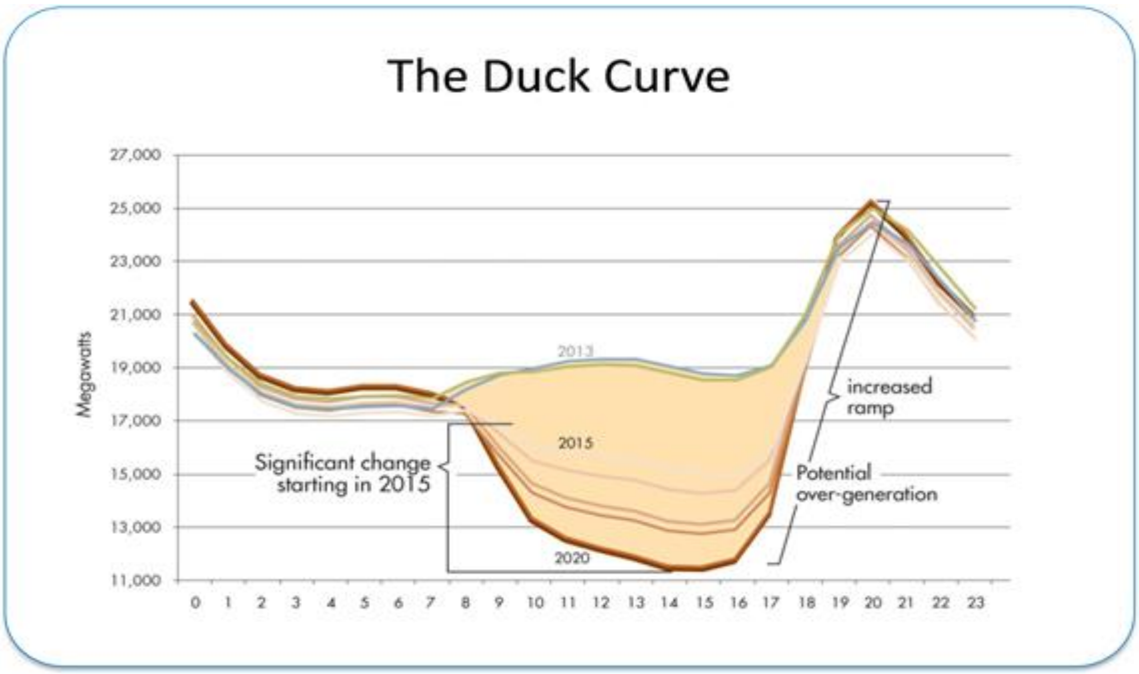

Figure 5.10 Duck Curve Illustration (Source Green Tech Media)

With the increasing number of Australian households taking up solar power a phenomenon called the "Duck Curve" is emerging. Residential peak demand is first thing in the morning and late evening when most of the population return home from work and school. Maximum solar production is in the middle of the day when demand is lower, therefore the base load suppliers must reduce production to allow for excess solar power production to be exported onto the grid during this time. However, the demand then rises rapidly for the evening. The problem for power generators is it is difficult and expensive to ramp up and down production to meet this changing demand. This graphical representation of demand is illustrated in Figure 5.10. showing energy producer demand decreasing during the day and ramping up rapidly late evening. As more and more solar is added to the network this problem will only get worse.

The need to flatten out the duck curve is of high concern. One method is energy storage, this may be in the form of battery storage or in the case of "Snowy 2.0" using the excess energy to pump water into reservoirs or catchments to be later released producing hydro-electricity.

An additional method to help smooth out the demand curve is SSWTs. As discussed in previous chapters SSWTs can produce almost 50% of its power outside of daylight hours. Unlike solar, SSWTs do not produce the midday peak power and as such are better able to more evenly distribute power onto the grid. Also shown in the research wind speed varies by location and therefore power production varies. This could also be beneficial as the excess generated power is not being imported to the grid at the same time. Figure 5.11 illustrates the effectiveness of using wind turbines to balance the total power generated from renewables over the 24 hour period.

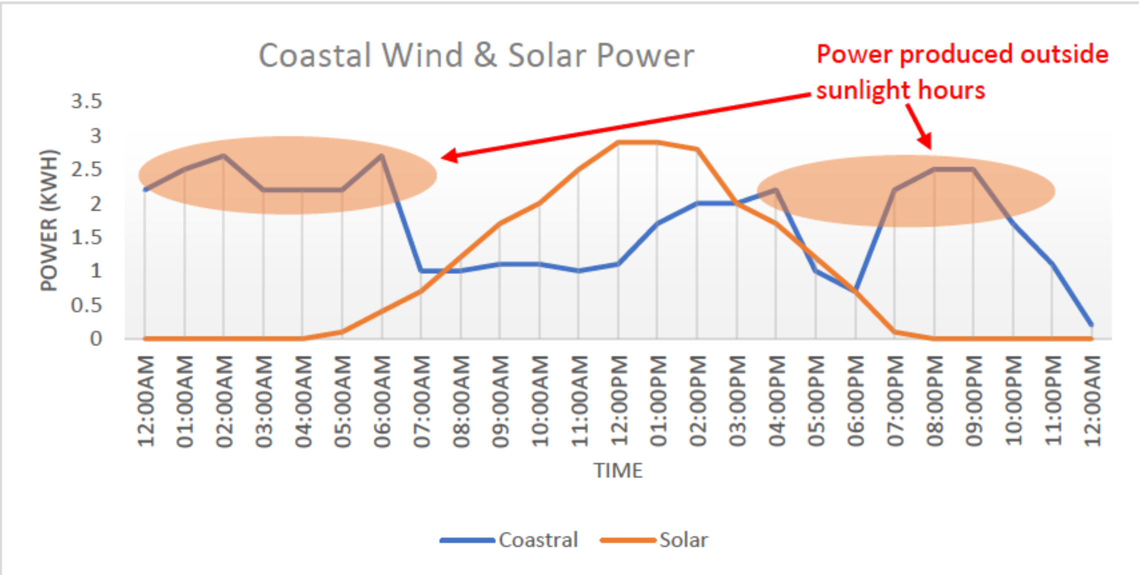

Figure 5.11 Comparison Wind and Solar

5.2.2 Charging Electric Vehicles (EVs)

Despite a slow start, the latest figures indicate that sales of new electric cars in Australia has doubled in the first six months of 2019 compared to a fall of 8.4% in petrol and diesel models (Murphy 2019). Although the sales figures of EVs is modest, when compared to total car sales, it does indicate a trend toward users wanting a greener form of transport. If sales continue to double as indicated in Figure 5.12, Australia is only a few years behind equalling sales of traditional petrol and diesel model vehicles. This will mean a greater demand on the power network to charge EVs.

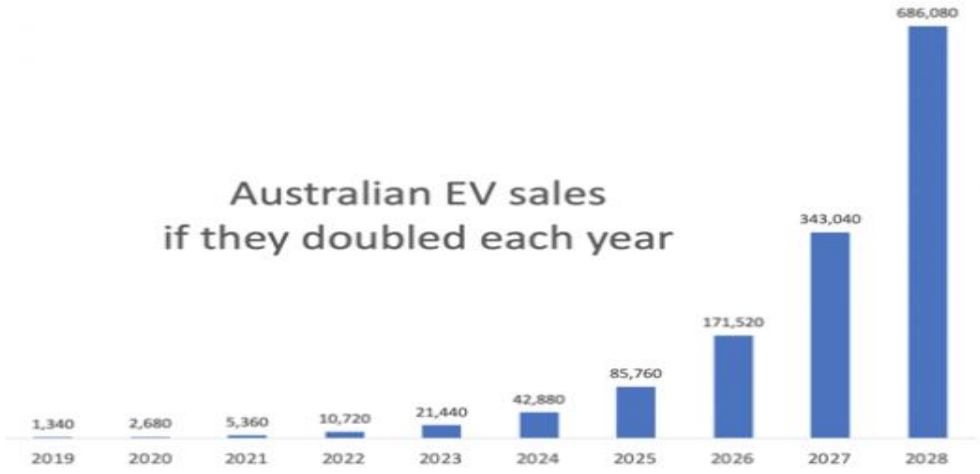

Figure 5.12 Projected Electric Car Sales (Source: The News Daily)

The three methods of charging EVs are usually at home, work or a public charging station. Charging an EV at a Queensland charging station will cost 0.45c per kWh, however if charging from home, the average price of domestic power is 0.26c per kWh. Ergon recommends using an off peak or shoulder tariff (Tariff 31 or 33) to reduce charging costs. A typical medium size vehicle comparison between an EV and petrol car is as follows. Using the Nissan Leaf as an example it would cost approximately $10.40 to fully charge the vehicle and have a range of almost 400km. That same distance travelled in a similar size 2.0 litre unleaded vehicle would cost around $39.00. That is a saving of almost $29.00 and as indicated by RACQ is the average Queenslander's motoring week.

Figure 5.13 Home Charging Electric Vehicles (Source RACQ)

Now consider using your own free power generated from SSWTs and the saving on fuel becomes even more enticing. RACQ surveys indicate that on average a vehicle spends between 10-12 hours a day parked or garaged at the owner's residence. This gives an ideal opportunity to fully charge an EV from a standard 240v output socket or for a quicker charging time using an EV charger as shown in Figure 5.11. There are indications that the world has passed peak oil production therefore it is only natural that fuel prices will rise as supply diminishes. EV is one answer to new modes of transport. When the price of EVs becomes less prohibitive and compare favourably to the cost of traditional vehicles they will become more common place on our roads and options for cheap renewable electricity will become vital.

5.2.3 Single Wire Earth Return (SWER) Restrictions.

Currently Ergon restricts the maximum allowable size solar system a resident can install if connected to a SWER line. In South East Queensland that limit is set at 2.5 kW (Ergon 2018). Using solar as the primary source of renewable power generation the potential to feed into the grid when generation exceeds usage, and obtain a solar rebate, is limited. This is probably only a reality in the middle of the day when production is at its maximum. If SSWTs were used, power production can be extended to all hours of the day and night allowing for greater opportunity to export onto the grid, obtaining a subsidy, reducing electricity expenses and feel good about generating a renewable energy source.

Figure 5.14 Single Wire Earth Return – SWER example (Source Ergon)

5.2.4 Power Generated Close to Demand.

The traditional method of power production is to generate electricity from either a renewable, hydro, gas or coal plant and feed that power to where it is needed by a series of expensive distribution networks i.e. substations, poles and wires. However, if a similar number of Australian residents had SSWTs when compared to solar, a mini network could be established in each suburb and town, suppling power on a local level. Such solar schemes already exist, where residents get paid for exporting power onto their local network. This energy is stored in battery banks and local residents then purchase electricity back from the grid at varying rates according to the demand cycle. Residents are paying more at peak times and less outside these hours, similar to any domestic service. If SSWTs were to be implemented, rather than solar, the generated power would be more evenly produced over the day and the size of battery storage could be reduced since it would not be produced in just a few hours.

Examples of current local power generation and storage suburbs include;

- Alkimos Beach, North Perth, Western Australia,
- Meadow Springs, Mandurah, Western Australia,
- West Dapto, Wollongong, New South Wales, and
- Salisbury, South Australia.

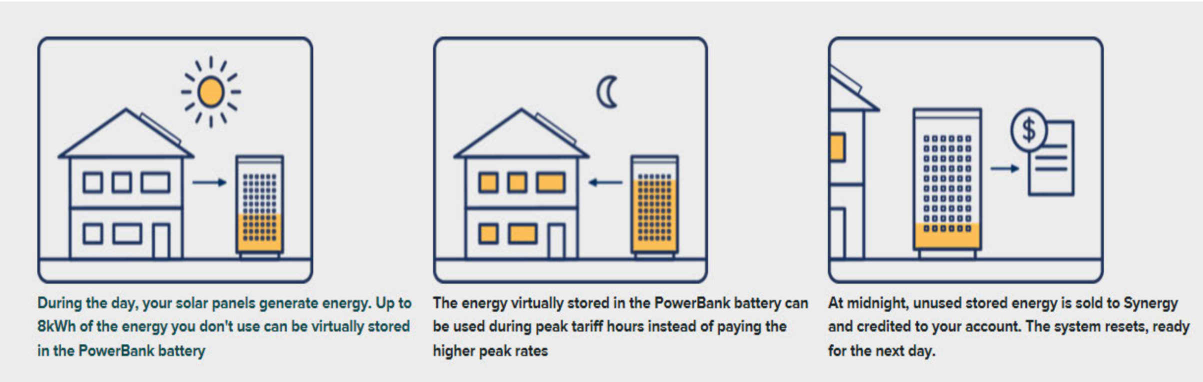

Figure 5.15 Meadow Springs Power Bank System (Source Synergy)

5.3 Costing

The cost to purchase each of the 5 SSWTs was obtained from the various suppliers/installers, along with a standard installation cost. Table 5.4 summarizes these costs. It should be noted that the installation costs can be subject to many factors that could dramatically influence the total purchase price. To be able to equitably compare installation costs for each of the turbine systems and not unduly burden the installers with requesting several quotes, it has been assumed for the purpose of this research project, that all sites are equally distanced apart from the installers, systems are to be installed in a similar fashion, have similar terrain and have no underlining issues that could add additional costs to the project. In addition, the quotes were modified to include a standardized inverter on all 5 systems. A Carbon Management Systems (CMS) 3000 was chosen as a suitable low cost inverter at a purchase price of $1430.00.

Costings were provided by the following companies:

- Australian Wind and Solar
- Energy Matters
- Solarzone
- Windpower Australia Pty Ltd

All the wind turbine systems totalled a maximum power output of 3 kW. In the case of the *Ampair 600* and the *Q4* turbines both these units are 600 watts each. Therefore, five units in

series are required to make up the 3 kW. The Ampair 600 also had the option of a 240 volt model, this would alleviate the need for an inverter, but some electronics would be required to synchronise the five units with mains supply. This was considered outside the scope of the project. In addition, for the purpose of best practice when comparing systems i.e. compare apples to apples, it was decided that all the systems be of similar output voltages. The output voltage selected for this project was 24v DC.
All turbines come with a 2 year warranty and have an operational life of between 15-20 years.

Table 5.4 Purchasing and Installation Costs

WIND TURBINE SYSTEM	COST PER UNIT	COST FULLY INSTALLED
WINDVERTER V2 HAWT	$7,480.00	$12,680.00
AMPAIR 600 VAWT	$3,925.00 each	$24,995.00
R3K HAWT	$12,198.00	$16,998.00
Q4 VAWT	$2,475.00 each	$16,375.00
EOLO 3000 DAWT	$4,478.18	$8,999.00
3 KW SOLAR SYSTEM		*$6,405*

Note: The prices quoted above are correct at mid-2019. Prices are subject to change without notice and these figures should not be used for any commercial undertaking.

5.4 Anticipated Savings on Electricity Expenses.

For this project, a saving is considered when electrical energy produced by the wind turbine would, under normal circumstances, have been purchased from an energy provider. It is assumed all the power produced by the wind turbine is utilized on site and no power is exported to the grid i.e. no feed in tariff applies.

Table 5.5 Energy Providers Residential Tariffs

ENERGY PROVIDER	COST - CENTS PER KWH (TARIFF 11)
ERGON	26.027
ORIGIN	26.62
ENERGEX	25.036
AGL	25.667
ALINTA ENERGY	25.487
AVERAGE	**25.7674**

All three sites are subject to different electricity energy providers. Sunshine Coast and Amberley, on average, have five providers whereas Kingaroy has only one. Tariffs vary slightly between each provider, subject to contracts and energy plans. To standardise the energy savings calculation across all three sites, an average of Tariff 11 from the five major players in the South East Queensland electricity market has been used. Tariff 11 was used for this project because it is the most common residential tariff. Users pay a flat rate per kilowatt hour (kWh) throughout the day and night plus a daily supply charge. The Tariff 11 charges are listed in Table 5.5. All rates include GST and were correct on 6 August 2019.

5.4.1 Method of Calculating Savings

The daily power produced by each turbine (Section 5.1) was entered into an *Excel* database. Each figure is multiplied by the average tariff calculated above, 25.7674 cents, to give a daily electricity saving. The months are totalled and a final tally for the full research period is calculated. The results are displayed below in the Tables 5.6, 5.7 and 5.8 for each of the three locations, Sunshine Coast, Amberley and Kingaroy respectively.

Table 5.6 Anticipated Savings Obtained from Producing Electricity- Sunshine Coast

	January	February	March	April	May	Jun	July	Aug	Total Year
Solar 3 kW	133.5	117.8	109.5	94.8	78.1	67.3	74.5	93.3	1153.0
WINDverter 3 kW HAWT	31.7	97.9	41.5	49.5	21.7	28.6	31.5	21.2	485.4
Ampair 5 x 600 W HAWT	19.9	214.5	109.3	130.3	62.6	78.1	80.7	60.8	1134.5
R3K 3kW VAWT	35.5	105.9	44.1	51.1	26.6	31.5	35.7	24.0	531.3
Q4 5 x 600 W VAWT	39.6	114.9	50.4	60.0	28.0	36.2	39.7	27.4	594.3
EOLO 3000 3 kW DAWT	158.6	256.1	164.9	195.2	107.7	123.9	111.0	101.0	1827.6

The electricity saving for the Sunshine Coast ranged from $1827 for the *EOLO 3000* dropping to $485 for the *WINDverter*. The *EOLO 3000* achieved better results than the solar system by more than $670. The *Ampair 600* was only $19 less than the solar system and could be considered compatible for this short research period. The other 3 SSWTs produced savings of less than half that of the solar system, which is in line with the power generated.

Table 5.7 Anticipated Savings Obtained from Producing Electricity- Amberley

	January	February	March	April	May	Jun	July	Aug	Total Year
Solar 3 kW	133.5	117.8	109.5	94.8	78.1	67.3	74.5	93.3	1153.04
WINDverter 3 kW HAWT	28.7	43.1	19.1	10.4	17.9	8.8	12.7	21.7	243.67
Ampair 5 x 600 W HAWT	17.3	106.9	52.8	31.3	27.1	24.7	35.3	55.3	525.97
R3K 3kW VAWT	30.0	48.6	19.8	16.1	10.5	10.1	14.4	24.8	261.30
Q4 5 x 600 W VAWT	34.3	52.1	24.2	14.0	12.5	11.6	16.4	27.7	289.09
EOLO 3000 3 kW DAWT	113.0	141.7	80.4	53.9	45.9	37.3	53.4	73.4	898.66

The electricity saving for the Amberley site ranged from $899 to $244. The *EOLO 3000* achieved the better results although it was still $255 less than the solar system. The *Ampair*

600 was slightly less than half the savings achieved with a solar system for the same period. The other 3 SSWTs were in the region of 25% of the solar system. These results indicated that wind turbines in this area would provide electricity savings, however, these results are less than can be achieved using a solar system.

Table 5.8 Anticipated Savings Obtained from Producing Electricity- Kingaroy

	January	February	March	April	May	Jun	July	Aug	Total Year
Solar 3 kW	133.48	117.77	109.52	94.83	78.08	67.26	74.47	93.28	1153.04
WINDverter 3 kW HAWT	4.97	18.55	14.12	9.82	8.89	8.68	10.62	13.48	133.70
Ampair 5 x 600 W HAWT	25.15	54.79	30.51	32.65	29.04	27.16	31.85	38.19	404.01
R3K 3kW VAWT	7.81	21.34	11.67	13.12	11.29	10.93	12.52	15.56	156.35
Q4 5 x 600 W VAWT	9.04	24.27	13.31	14.66	12.76	12.34	14.30	17.63	177.48
EOLO 3000 3 kW DAWT	42.24	97.92	57.59	60.63	55.02	46.02	54.94	57.49	707.79

The electricity savings for Kingaroy ranged from $708 to $134. All five SSWT results were substantially less than the solar system. The *EOLO 3000*, although the strongest performer, was still less than 40% of the equivalent solar system. The other 4 SSWTs were as low as 11% of the solar system. These results indicated that wind turbines in this area would be considerably less productive when compared to a solar system.

5.5 Payback Period

Payback period was calculated by using the electricity saving derived in Section 5.3 and dividing that figure into the total cost of purchasing and installing the wind turbine system, Section 5.2. The resultant is the payback period, or the number of years it would take to recoup the money initially invested in purchasing the wind turbine system. A figure less than 15 years will produce a return greater than 6.6%. Although this figure is subjective, a return between 6 - 8 % would be considered a "good return" under the current economic climate where the Reserve Bank Cash rate is at a record low of 0.75% (Reserve Bank Meeting 01/10/19).

A summary of the calculated payback period is displayed in Table 5.9. It can be clearly determined from the table that with only one exception, the *EOLO 3000*, all the other SSWTs have a payback period that is unacceptable and is also far outside the working life of the turbine system. These excessive payback periods are predominantly due to the much higher costs associated with purchasing and installing the wind turbine systems. For example, the *Ampair 600* was able to provide power generation, in some cases better or equal to the equivalent solar system however, the need to purchase 5 units in order to obtain a total of 3 kW resulted in a blowout of the purchasing costs. The *WINDverter, R3K* and the *Q4* turbines throughout the research period did not generate adequate power to offset the initial purchasing costs and therefore failed to provide a reasonable payback period.

During the research period, the *EOLO 3000* is the standout wind turbine of the 5 systems. Its lower purchase and installation cost and higher power production make it a system for consideration in an area where wind speed is constant and of sufficient strength. It was unfortunate that for both Amberley and Kingaroy the wind speeds did not provide a constant force to drive the turbine in a zone of its power curve and generate substantial quantities of power. However, the payback period for the *EOLO 3000* located at Amberley and Kingaroy is 10 and 12.7 years respectively. These figures provide returns on the initial investment of greater than 7 % and as stated earlier, this would be considered an acceptable return on an investment.

Table 5.9 Payback Period

System	Purchase & installation Cost $	Sunshine Coast		Amberley		Kingaroy	
		Savings ($)	Payback (years)	Savings ($)	Payback (years)	Savings ($)	Payback (years)
Solar 3 kW	6405.00	1153.04	**5.6**	1153.04	**5.6**	1153.04	**5.6**
WINDverter 3 kW HAWT	12680.00	485.41	**26.1**	243.67	**52.0**	133.70	**94.8**
Ampair 5 x 600 W HAWT	24995.00	1134.53	**22.0**	525.97	**47.5**	404.01	**61.9**
R3K 3kW VAWT	16998.00	531.34	**32.0**	261.30	**65.0**	156.35	**108.7**
Q4 5 x 600 W VAWT	16375.00	594.26	**27.5**	289.09	**56.6**	177.48	**92.3**
EOLO 3000 3 kW DAWT	8999.00	1827.55	**4.9**	898.66	**10.0**	707.79	**12.7**

5.6 Ranking of SSWTs versus Solar

The ranking of the SSWTs was determined by comparing the following four criteria of the wind turbines with an equivalent wattage photovoltaic (solar) system:

i. Cost to purchase and install each system,
ii. the power generated over the research period,
iii. anticipated payback period, and
iv. operational life and warranty of each system.

Purchasing and Installation Costs: The purchasing and installation costs of the wind turbines, in all cases, was substantially higher than the same wattage solar system. The best priced unit was the *EOLO 3000,* but it was almost 30% higher than a solar system. The most expensive was the *Ampair 600* at four times the cost of the solar system.

Power generation: The *WINDverter, R3K* and the *Q4* turbines produced less power than the solar system for each of the three sites. On the Sunshine Coast the *EOLO 3000* and the *Ampair 600* produced more power than the equivalent solar system. At Amberley only the *EOLO 3000* exceeded the power production of solar system in February when under the influence of an ex-tropical cyclone. The result could be considered abnormal and not a true reflection of a standard month's power generation.

Payback Period: Only the *EOLO 3000* was able to provide a payback period that was acceptable for all three site locations. The other four turbines have a payback period that was greater than the expected operational life of the wind turbine system.

Warranty and Operational Life: The warranty for all five wind turbines is 2 years. In comparison to the photovoltaic panel, warranties of between 15-25 years with a reduced efficiency rate over that time is standard. With a solar panel operational life of greater than 20 years the wind turbines are 5 to 10 years less by comparison.

The solar system and each of the 5 wind turbines were rated from 1 to 6, with 1 being the highest performer and 6 the lowest, for the first three categories. A rating of 1 or 2 were assigned for warranty and operational life. Since all wind turbines have a similar warranty and operational life, no separation was possible for this category. The scores were totalled, a total score less than the solar system implies the wind turbine was more feasible than the solar system. This process was repeated for the three locations. Table 5.10 illustates the process and outcomes.

Table 5.10 Ranking Score Chart

	Sunshine Coast				
System	**Installation Cost**	**Power Generated**	**Payback Period**	**Warranty & Operation Life**	**Total**
Solar	1	2	2	1	**6**
WINDverter 3 kW HAWT	3	6	4	2	**15**
Ampair 5 x 600 W HAWT	6	3	3	2	**14**
R3K 3kW VAWT	5	5	6	2	**18**
Q4 5 x 600 W VAWT	4	4	5	2	**15**
EOLO 3000 3 kW DAWT	2	1	1	2	**6**
	Amberley				
Solar	1	1	2	1	**4**
WINDverter 3 kW HAWT	3	6	4	2	**15**
Ampair 5 x 600 W HAWT	6	3	3	2	**14**
R3K 3kW VAWT	5	5	6	2	**18**
Q4 5 x 600 W VAWT	4	4	5	2	**15**
EOLO 3000 3 kW DAWT	2	2	1	2	**5**
	Kingaroy				
Solar	1	1	2	1	**4**
WINDverter 3 kW HAWT	3	6	4	2	**15**
Ampair 5 x 600 W HAWT	6	3	3	2	**14**
R3K 3kW VAWT	5	5	6	2	**18**
Q4 5 x 600 W VAWT	4	4	5	2	**15**
EOLO 3000 3 kW DAWT	2	2	1	2	**5**

In all cases, the *EOLO 3000* outshone the other 4 wind turbines. At the Sunshine Coast the *EOLO 3000* matched the solar system, for the other two locations it was ranked a close second.

5.7 Viability of SSWTs

The aim of this research project was to ascertain if SSWTs could be a viable option to roof top solar for domestic applications. Using the results obtained in the course of this project it is concluded only the *EOLO 3000* is viable for all three locations. The additional payback period for locations Amberley and Kingaroy, although almost double and treble that of the solar system, is still considered acceptable in the current economic environment. The higher purchase and installation cost of the other four turbines *Ampair 600, WINDverter, R3K* and the *Q4* has disadvantaged these options despite the *Ampair 600* showing strong potential power generating capabilities. Table 5.11 summarises the final assessment.

Table 5.11 Viability of each Wind Turbine System

SYSTEM	Sunshine Coast	Amberley	Kingaroy
WINDverter 3 kW HAWT	✗	✗	✗
Ampair 5 x 600 W HAWT	✗	✗	✗
R3K 3kW VAWT	✗	✗	✗
Q4 5 x 600 W VAWT	✗	✗	✗
EOLO 3000 3 kW DAWT	✓	✓	✓

Chapter 6 Conclusion

6.1 Summary of Outcomes

Using wind data sourced from the Bureau of Meteorology, five Small Scale Wind Turbines *EOLO 3000*, *Ampair 600*, *WINDverter*, *R3K* and the *Q4* were theoretically tested at three locations in South East Queensland. The three sites being Sunshine Coast, Amberley and Kingaroy. The predicted power generated, cost to purchase and install the system and payback period was compared to an equivalent wattage solar system to determine if SSWTs could be a viable renewable energy option for domestic use.

Findings show that some wind turbines can match a solar system in power generation. The best results were achieved on the Sunshine Coast where the winds tended to be stronger and more consistent, producing more evenly distributed power generation. Two major weather events, ex tropical cyclone Oma and Trevor boosted power production and distorted figures for February and April. However, the general trend would still support that the *EOLO 3000* and the *Ampair 600* can out-perform the equivalent wattage solar system, most months. For the site locations of Amberley and Kingaroy, the wind turbines did not produce power on a similar scale to the solar system. At best the results were 80% of those recorded for the solar system, decreasing to as low as 16%.

When comparing purchase and installation costs, the wind turbines were all more expensive than a solar system. Prices ranged from 30% more for the *EOLO 3000* to 400% for the *Ampair 600*. In defence, both the *Ampair 600* and the *Q4* had five units in series to produce the 3kW. Consequently, their purchase price was scaled upwards accordingly. The smaller wattage *Ampair 600* and the *Q4* were chosen to establish if a series of smaller wattage wind turbines could be more efficient than one larger unit. This theory proved to be inconclusive as one turbine, the *Ampair 600*, produced good results whereas the *Q4* results were much more subdued.

The primary factor of SSWTs being more expensive than solar basically comes down to economy of scale. If there was a greater demand, production would increase, and prices would fall. A similar fact was experienced with the price of photovoltaic panels. Prices have halved in less than 10 years primarily because demand has increased substantially in the same period.

The higher purchase and installation costs had a flow on effect when calculating the payback period for each system. Due to its lower purchasing cost and higher power generation, only the *EOLO 3000* was able to achieve a payback period of between 5 and 13 years for the three locations and be considered a “reasonable investment” netting a return of between 20% to 7%. The other four SSWTs had a payback period that was greater than the operational life of the system and therefore considered unacceptable.

The operational life of the wind turbine varies from 15 to 20 years with an average warranty of 2 years. In comparison, a photovoltaic panel usually has an operational life greater than 20 years and a warranty that is infinitely larger at 20 years. The limited warranty of the wind turbines is considered a potential disadvantage and will need to be addressed by the manufacturers for SSWTs to become more popular.

Using a weighted criteria of power generation, purchasing costs, payback period, operational life and warranty, it was concluded that of the five wind turbines, only the *EOLO 3000* is a viable option as a renewable energy source for all three locations. It's superior power production also makes it a viable alternative to a solar system when installed on the coast. Since 85% of Australians live within 50 km of the coast, this is a worthy consideration and it does seem irresponsible to not utilise this abundant, renewable resource. Disappointingly, as the turbine is located further away from the coast the monetary worth decreases, although it is still considered a viable option.

In addition, it was found that on average 50-60% of power production from wind turbines occurs outside of the hours when solar is producing peak power. By spreading the power production of SSWTs over the entire day, huge benefits can be gained by the user. The requirement for smaller battery storage, ability to export more power and receive additional feed in tariff, use wind power to charge electric vehicles or have SSWTs in conjunction with solar to improve intermittency and reliability of power, are just some examples. Benefits also extend to the national power grid network, by resorting to wind power as opposed to solar, improvements can be made on the steadily rising concern of the phenomenon known as the "duck curve".

Examples of mini electricity networks employing home roof top solar and a central battery storage are becoming more prevalent in suburbs and towns. Residents export unused solar power onto the local network where it is stored in community battery banks and purchased back when required. The use of SSWTs for these systems is equally appealing and would extend the power production period beyond daylight hours.

This project has been able to prove that SSWTs can match and even outperform roof top solar installations and a viable model is feasible with a payback period less than solar however, a major barrier to SSWTs is still social and environmental concerns. Issues relating to noise, visual disturbance, the perceived health risk, electromagnetic interference and environmental concerns i.e. bird strikes, remain and unless these issues are adequately addressed to reduce the fears of the average resident, SSWTs will not be widely accepted. Just as people have become accustomed to roof top solar, over-head power lines and mobile phone towers, residents need to change their perceptions on the urban landscape and consider SSWTs in a similar light.

6.2 Further Considerations

The results show that the EOLO 3000 is the only viable option however, it also indicated promising results for the *Ampair 600*. The downside was the initial cost to purchase and install the turbines making them unfeasible. In this case, purchasing 5 units at a cost of $3925 each, appears to be its handicap. The BoM wind data for the coast indicates that there is reasonable wind velocity outside of the prime solar generation periods, 8 am – 4 pm. A consistent sea breeze is prevalent most mornings and evenings, it seems only reasonable to try and capture some of this wind power potential. Using an *Ampair 600* as a backup or additional power generation to an already existing solar system is a practical option. Calculations indicate that at least 2 kWh can be produced each day from just one turbine. This makes it a win-win alternative, producing power outside of day light hours while keeping the initial purchasing costs to a minimum.

It is therefore strongly recommended that for coastal locations an *Ampair 600* or similar wind turbine be included in any roof top solar package.

6.3 Further Work

The power generation figures were calculated using data from the BoM and the wind turbine manufacturer's performance charts. It is usually common practice for manufacturers to test their turbines in ideal controlled conditions, i.e. a wind tunnel. As such the turbines do not perform to the rated power curves under operational conditions.

The *EOLO 3000* produced power generation figures that were well above the other four wind turbines. The *EOLO 3000* was also the only wind turbine that was considered a viable option and an alternative to photovoltaic panels. It is most unlikely that these theoretical figures calculated would match an operational model. The next phase of the project would be to test a fully installed working *EOLO 3000* system on a coastal site. Power generation figures could then be monitored over a set period and compared to the theoretical modelling. An accurate assessment of the wind turbine viability compared to a solar system would become apparent.

Firstly, inquiries will need to be made with the Sunshine Coast Regional Council to ascertain if any approval or planning permission is required. Many councils have yet to establish planning guidelines for such an event and although height restrictions apply, turbines mounted to roof tops, the side of a building or standalone pole may not fall under these guidelines.

A potential site at Caloundra has been made available for this next phase of the project however funding has not yet been sourced. It is anticipated that installation costs could be reduced considerably from that indicated in this report by utilising a network of tradesmen at 'mates rates'.

It is widely acknowledged that the cost of an item plays an important factor in its purchase. If it can be proven that SSWTs are a better and cheaper alternative to roof top solar many of the other barriers may be overlooked by the consumer. Over 2 million houses have roof top solar, the future goal would see 2 million households with SSWTs.

References

Alam, F, Abdulkadir Ali, Khan, I, Mobin, S, 2012, *Status of Power Generation by Domestic Scale Wind Turbines in Australia*, Procedia Engineering, vol. 49, pp. 205- 212.

Australian Renewable Energy Agency (ARENA) 2018, *Wind Energy*, Australian Government, Canberra, viewed 10 May 2019, <https://arena.gov.au/about/what-is-renewable-energy/wind-energy>.

Breeze, P, 2016, *Small Wind Turbines*, Wind Power Generation, pp 67-73 Academic Press, London

Battisti, L, Benini, E, Brighenti, S, Dell-Anna, M, Castelli, R 2018, Small wind turbines effectiveness in the urban environment, Renewable Energy, vol 129, pp. 102-113.

Bilir, L, Imir, M, Devrim, Y, Albostan, A 2015, *An investigation on wind energy potential and small-scale wind turbine performance*, Energy Conversion and Management, Vol 103, pp. 910-923.

Clean Energy Council (CEC) 2018, *Renewable Energy Target*, Melbourne, Australia.

Clean Energy Regulator (CER) 2017, *Solar Energy in Australia*, Department of Environment and Energy, Canberra, ACT.

Enhar Sustainable Energy Solutions, 2010, *NSW Small Wind Turbines Consumer Guide*, Office of Environment and Heritage, Sydney South, Australia.

Energy and Environment, 2018. *Energy bills help and rebates*, South Australian Government, Adelaide, viewed 09 May 2019, <https://www.sa.gov.au/topics/energy-and-environment/energy-bills>.

James P, Bahai, A, 2017, *Small Scale Wind Turbines,* Wind Energy Engineering**,** pp. 389- 418, Academic Press, London.

Firoz, A, Abdulkadir, A, Iftekhar, K, Saleh, M, 2012, *Status of power generation by domestic scale wind turbines in Australia*. Procedia Engineering 49 p.p.205 -212.
Intergovernmental panel on climate change, (IPPC), 2018, *IPCC presents findings of the Special Report on Global Warming of 1.5°C*,
<ipcc.ch/news_and_events/pr_outreach_vietnam_2018.shtml>.

Krishnan, S, Araby, S, AL Ali, M, Al Hammadi, Q, Al Ali, MS, Al Mansoori, H 2018, *Design and development of small capacity vertical axis wind turbine*, Advances in Science and Engineering Technology International Conferences, Dubai, United Arab Emirates, pp.1-5.

Kumar, R, Raahemifar, K, Fung AS 2018, *A critical review of vertical axis wind turbines for urban applications*, Renewable and Sustainable Energy Reviews, Vol 89, pp. 281- 291.

Murphy, J 2019, *The sales statistics that show the electric vehicle surge is underway in Australia*, The News Daily, 05 July.

Pash, C 2018, *Top 10 performing super funds for 201*8, Business Insiders, viewed 9 May 2019, <https://www.businessinsider.com.au/top-returns-super-funds-of-2018-2018-7>.
Shepard, S 2016, *Home based solar power generation, storage and localised grids*, USQ Projects, University of Southern Queensland, Toowoomba

RACQ, Royal Automobile Club of Queensland, 2019, *Electric Vehicles for Greener Motoring*, RACQ Motoring Magazine, viewed 01 October 2019, <https://www.racq.com.au>.

Teschner, N, Alterman, R (2018) *Preparing the ground: regulatory challenges in siting small-scale wind turbines in urban areas,* Renewable and Sustainable Energy Reviews, vol 81, pp. 1660-166.

Tummala, A, Velamati, RK, Sinha, DK, Indraja, V, Hari Krishna, V 2016, *A review of small scale wind turbines*, Renewable and Sustainable Review, Vol 56, pp. 1351-1371.

Webb, A 2017, *Viability of Domestic Wind Turbine for Urban Melbourne*, Sustainable Victoria, Victorian State Government, Melbourne, Australia.

Appendix A Project Specification

ENG4111/4112 Research Project

Project Specification

For: Darryl Regan

Title: The viability of small scale winds turbines (SSWTs) for domestic use in South East Queensland.

Major: Power Engineering

Supervisor: Dr Les Bowtell

Enrolment: ENG4111 – EXT S1, 2019
ENG4112 – EXT S2, 2019

Project Aim: To ascertain if the use of SSWT, both horizontal and vertical axis, to generate renewable energy is a viable option to roof top solar. If not, could SSWT be used in a combination system to better utilise our natural resources of sun and wind.

Programme: Version 1, 6th March 2019

1. Collate daily wind speed data from the Bureau of Meteorology for three South East Queensland sites. Sites chosen are:
   - Sunshine Coast Airport — South East Queensland Coastal Area
   - Amberley — Outer South East Queensland suburb
   - Kingaroy — Rural South East Queensland township

2. View the range of SSWT currently available on the Australian market, obtain specification data sheets, costing and other relevant information. Select several appropriate vertical and horizonal axis wind turbines for the project.

3. Detail the differences between VAWT and HAWT including advantages and disadvantages.

4. Using MATLAB (or similar program) calculate the maximum power that could be generated for the selected SSWT.

5. Calculate the cost savings that would be associated with generating power. Determine a pay-back period for each wind turbine system.

6. Analyse and compare results to similar size solar systems, ascertain viability.

If time and resources permit:

7. Discuss obstacles to SSWT in an urban environment, i.e. The opposition to wind turbines due to health concerns, electromagnetic radiation, aesthetics and environmental aspects.

In addition, review local government legislation/laws (if any) on the use of SSWT in an urban setting.

Appendix B *MATLAB* Program

```
% MATLAB program to determine maximum power generated from selected wind
% turbines using BOM wind speed data. Created by Darryl Regan for Research
% Project ENG4111 dated 10 March 2019.
clc, clear % clear command window, remove all variables from memory.
%Enter x and y components and peak power for wind turbine power curves.
% Five SSWTs

%  Windpower 3kW HAWT
x1 =[0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17];
y1 = [0,0,0,0,0.01,0.1,0.25,0.5,0.8,1.1,1.5,2.0,2.5,2.8,3.0,2.8,2.6,2.6];
peakpower1= 3.0;

%  Ampair 600w HAWT
x2 =[0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17];
y2 = [0,0,0,0,0.034,0.07,0.137,0.252,0.39,0.524,0.621,0.699,0.73...
    0.73,0.73,0.73,0.73,0.73];
peakpower2= 0.73;

%  R3K VAWT
x3 =[0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16];
y3 = [0,0,0,0,0.05,0.15,0.28,0.45,0.75,1.2,1.8,2.4,2.9,3.2,3.2,3.0,3.0];
peakpower3= 3.0;

%  Q4 600W VAWT
x4 =[0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16];
y4 = [0,0,0,0,0.015,0.03,0.06,0.111,0.175,0.275,0.375,0.48,0.57,0.6 ...
    0.59,0.58,0.56];
peakpower4= 0.60;

%  EOLO 3kW VAWT
x5 =[0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20];
y5 = [0,0,0,0,0.3,0.8,1.4,1.9,2.25,2.5,2.65,2.7,2.74,2.8,2.84,2.86 ...
    2.89,2.91,2.94,2.97,3.0];
peakpower5= 3.0;

% Enter BoM daily wind speed data for every 30 min (total 48)for
% Amberley (Amb), Sunshine Coast (SS) and Kingaroy (King)

Amb = [0,0,4,0,0,0,0,0,0,9,7,4,7,0,0,9,9,9,7,6,9,11,11,11,13 ...
    15,13,11,9,13,15,13,17,7,11,6,0,13,13,7,7,0,6,0,0,2,0,7];
SS = [13,15,11,13,9,11,7,7,6,7,9,9,6,6,6,9,9,15,20,20,22,22,20,19,13 ...
    11,9,20,20,20,20,22,26,20,20,19,17,9,6,7,7,6,7,6,13,13,13,9];
King = [0,6,7,4,9,6,9,4,0,0,0,9,0,4,0,0,4,4,11,17,19,15,17,15,15 ...
    15,11,17,11,15,17,15,13,13,13,11,13,13,13,15,13,15,13,9,8,8,2,5];

%Convert from km/h, to m/s

Amberley = [Amb]*0.2778;
SSCoast = [SS]*0.2778;
Kingaroy = [King]*0.2778;

%Interpolation - estimate the value of y (power generated) from
% the wind speed data.

A1 = interp1(x1,y1,Amberley);
A2 = interp1(x2,y2,Amberley);
```

```
A3 = interp1(x3,y3,Amberley);
A4 = interp1(x4,y4,Amberley);
A5 = interp1(x5,y5,Amberley);

SS1 = interp1(x1,y1,SSCoast);
SS2 = interp1(x2,y2,SSCoast);
SS3 = interp1(x3,y3,SSCoast);
SS4 = interp1(x4,y4,SSCoast);
SS5 = interp1(x5,y5,SSCoast);


K1 = interp1(x1,y1,Kingaroy);
K2 = interp1(x2,y2,Kingaroy);
K3 = interp1(x3,y3,Kingaroy);
K4 = interp1(x4,y4,Kingaroy);
K5 = interp1(x5,y5,Kingaroy);

% Add totals and Divide sum by the 2 (samples every 30 min)
% give average power generated per day in kwh. Multipy 600w turbines
% by 5 = 3kW

AvA1 = sum (A1)/2; AvA2 = sum (A2)*5/2;
AvA3 = sum (A3)/2; AvA4 = sum (A4)*5/2; AvA5 = sum (A5)/2;

AvSS1 = sum (SS1)/2; AvSS2 = sum (SS2)*5/2;
AvSS3 = sum (SS3)/2; AvSS4 = sum (SS4)*5/2; AvSS5 = sum (SS5)/2;

AvK1 = sum (K1)/2; AvK2 = sum (K2)*5/2;
AvK3 = sum (K3)/2; AvK4 = sum (K4)*5/2; AvK5 = sum (K5)/2;

% display results for Amberley, Sunshine Coast and Kingaroy.

disp('Daily kwh generated')
disp ('Amberley')
disp (AvA1)
disp (AvA2)
disp (AvA3)
disp (AvA4)
disp (AvA5)
disp ('Sunshine Coast')
disp (AvSS1)
disp (AvSS2)
disp (AvSS3)
disp (AvSS4)
disp (AvSS5)
disp ('Kingaroy')
disp (AvK1)
disp (AvK2)
disp (AvK3)
disp (AvK4)
disp (AvK5)

% END
```

Appendix C BoM Wind Data

Sunshine Coast

Sunshine Coast Airport (040861) Wind Data – Km/hr

January

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	22	17	15	24	22	15	26	24	26	13	17	18	17	28	13	15	13	21	8	8	8	17	9	11	8	15	17	21	13	17	9
0030-0100	24	5	17	22	24	9	24	26	24	9	18	18	17	30	13	13	13	17	11	8	11	13	8	9	8	15	13	21	18	17	9
0100-0130	21	8	28	22	21	9	22	22	28	8	18	18	18	28	15	11	8	8	8	8	5	15	9	8	8	15	11	18	30	13	8
0130-0200	21	8	25	22	21	8	22	24	26	5	18	21	17	26	11	9	8	9	9	8	5	17	9	9	8	11	9	4	21	17	11
0200-0230	21	5	24	22	18	4	22	24	28	5	17	21	15	28	17	5	9	8	8	8	9	17	9	9	8	9	9	9	8	15	8
0230-0300	21	5	24	22	17	4	22	21	26	9	18	22	17	26	17	8	5	5	8	5	8	17	8	8	5	8	11	8	17	15	5
0300-0330	18	5	21	22	21	0	24	24	26	5	18	24	17	26	17	9	8	5	8	8	8	15	9	11	5	5	9	5	15	17	9
0330-0400	17	8	37	21	21	11	24	21	24	5	17	21	17	26	15	8	8	5	9	5	8	13	0	8	0	5	11	5	9	13	8
0400-0430	17	5	31	22	22	13	24	24	24	0	13	22	9	26	13	8	8	8	8	5	5	8	0	9	0	8	9	8	2	13	5
0430-0500	17	8	15	21	21	13	21	26	21	5	17	21	9	28	13	5	9	9	9	5	8	9	4	8	9	4	8	8	8	11	8
0500-0530	15	5	13	21	18	9	24	24	18	5	18	18	9	24	8	5	8	8	8	8	5	8	5	9	2	5	0	5	9	15	8
0530-0600	8	8	5	21	21	9	24	26	17	0	13	21	8	24	9	8	5	8	9	8	9	5	8	9	0	5	0	8	8	8	5
0600-0630	5	8	0	18	21	9	24	24	18	5	11	22	8	22	8	8	5	9	8	5	8	11	8	9	5	8	0	8	9	5	8
0630-0700	2	9	9	17	22	9	22	26	21	5	11	21	18	30	8	5	8	26	5	5	9	8	5	11	5	5	8	4	5	13	8
0700-0730	17	9	8	17	21	13	21	26	21	15	13	24	22	24	8	8	5	17	8	8	13	8	8	9	5	5	8	8	9	18	8
0730-0800	15	9	5	18	18	17	24	26	21	17	18	24	22	28	8	8	13	15	5	15	17	11	4	13	8	5	9	21	8	22	5
0800-0830	17	8	11	18	15	21	22	28	18	13	21	22	21	26	9	8	15	17	9	13	17	9	5	11	9	8	13	18	2	21	8
0830-0900	18	9	11	15	17	21	22	28	24	15	22	24	21	28	11	9	17	17	8	15	17	11	11	11	13	9	21	21	18	21	2
0900-0930	18	11	11	18	22	22	21	22	24	17	21	24	22	26	11	15	17	17	11	21	17	18	13	11	13	13	17	18	18	21	9
0930-1000	17	11	9	15	18	18	22	24	24	17	18	24	22	26	13	15	17	17	13	18	18	15	17	18	15	15	22	18	21	21	9
1000-1030	17	13	13	15	17	18	22	22	21	15	17	22	22	28	13	17	18	13	13	18	17	17	22	21	15	15	22	18	18	21	17
1030-1100	17	13	17	15	21	21	22	22	21	13	18	21	24	26	13	18	21	13	13	18	17	17	22	22	17	22	22	17	21	21	15
1100-1130	18	15	11	17	15	22	24	21	21	17	18	22	22	28	17	18	18	18	13	17	18	17	26	24	18	22	22	15	18	17	15
1130-1200	17	17	15	17	17	22	24	22	18	17	21	24	24	28	18	18	21	18	17	17	17	17	26	26	21	22	24	15	21	17	17
1200-1230	18	21	18	15	15	24	22	21	21	17	21	22	22	30	18	22	21	21	21	17	18	18	30	24	22	24	24	15	22	15	17
1230-1300	17	21	18	17	17	22	22	21	24	18	21	22	22	28	18	22	21	21	21	18	18	18	28	24	21	22	24	17	21	17	17
1300-1330	17	21	21	15	17	22	21	21	22	18	21	22	22	28	31	24	21	21	21	18	17	17	28	24	18	24	28	21	22	17	18
1330-1400	18	21	17	17	17	22	21	21	21	17	21	22	24	26	22	24	21	22	21	18	22	18	28	24	21	28	28	21	22	15	21
1400-1430	18	18	18	17	11	21	21	22	18	17	22	22	24	26	21	24	18	24	22	21	17	21	28	24	21	26	26	22	21	17	21
1430-1500	18	18	15	17	13	21	18	21	18	17	24	24	26	26	21	24	21	24	21	21	17	21	30	24	21	26	28	21	18	17	21
1500-1530	21	21	13	15	13	18	17	18	17	15	24	22	28	28	18	22	21	24	24	22	21	18	28	22	18	26	31	21	21	17	21
1530-1600	17	21	15	18	13	18	17	18	17	15	22	22	26	24	18	22	21	21	21	21	21	18	30	22	21	24	30	21	21	17	18
1600-1630	18	21	17	17	11	18	18	21	17	18	18	21	30	22	18	24	18	21	21	17	18	18	30	24	21	26	28	21	18	17	18
1630-1700	18	21	18	17	9	21	21	18	15	17	18	21	26	24	18	24	18	21	21	18	21	21	26	24	21	24	28	18	18	18	18
1700-1730	18	21	22	18	9	18	21	18	17	17	22	21	28	22	18	24	18	21	21	21	18	18	30	18	21	24	28	18	21	24	18
1730-1800	17	21	21	18	11	18	22	21	15	15	22	18	24	22	18	24	17	18	22	17	18	17	26	17	21	24	26	15	21	17	17
1800-1830	18	21	21	18	15	18	22	18	17	15	21	21	26	24	17	24	17	18	22	17	18	18	24	15	17	22	26	17	18	13	15
1830-1900	18	21	26	18	15	15	21	21	17	17	21	17	26	22	18	24	17	17	22	15	18	17	22	17	17	22	22	17	15	17	15
1900-1930	18	21	24	18	15	17	21	18	17	15	18	18	28	17	21	26	17	17	13	17	18	15	18	17	17	22	21	18	21	15	13
1930-2000	15	21	24	18	15	18	15	21	15	15	21	18	26	17	18	26	17	17	11	17	18	13	18	17	18	21	21	21	21	17	17
2000-2030	17	21	24	18	17	17	21	22	15	17	21	17	28	21	17	24	17	17	9	17	21	13	15	15	18	18	21	21	21	13	17
2030-2100	21	17	28	26	18	17	24	24	17	18	21	21	28	21	17	26	17	17	11	17	21	13	13	15	18	17	18	21	22	11	17
2100-2130	17	17	26	26	18	17	21	26	15	18	24	21	31	17	15	24	17	17	13	15	18	15	13	15	21	17	18	18	18	11	18
2130-2200	18	18	24	21	17	21	24	26	17	21	21	17	28	18	17	22	17	15	9	13	18	15	11	15	18	18	21	21	18	11	17
2200-2230	17	17	21	22	15	18	26	24	15	22	24	18	26	17	17	22	21	17	9	15	21	13	11	15	15	18	17	18	18	5	17
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2300-2330	15	13	22	21	18	21	24	24	13	17	18	18	26	15	17	21	22	8	0	13	17	13	11	5	15	21	17	15	21	13	17
2330-0000	15	17	22	21	17	24	26	24	9	17	21	17	26	17	17	17	22	9	8	11	15	13	9	2	13	18	21	15	18	2	13

Sunshine Coast Airport (040861) Wind Data – Km/hr

February Day

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
0000-0030	5	22	24	21	18	22	28	30	15	2	24	8	8	22	39	37	28	18	9	2	22	31	22	35	35	30	24	30
0030-0100	4	24	21	21	22	18	28	24	8	0	24	8	0	17	39	31	28	18	5	5	21	33	24	28	21	31	24	26
0100-0130	5	22	21	21	21	11	24	24	9	9	21	9	0	13	37	37	26	13	5	8	21	33	18	26	26	30	18	26
0130-0200	5	21	21	17	18	22	24	24	8	8	22	9	8	11	39	35	28	8	8	5	26	31	21	33	24	26	21	30
0200-0230	8	21	21	21	21	24	26	24	8	8	22	5	8	13	42	30	26	8	9	0	26	28	21	28	31	18	22	30
0230-0300	9	21	22	21	17	28	39	22	8	9	21	9	9	15	37	31	22	8	11	0	24	33	22	26	37	28	18	26
0300-0330	4	28	21	21	17	21	15	22	5	8	21	9	8	15	37	32	22	9	8	0	21	35	22	24	39	28	21	26
0330-0400	4	28	18	21	17	22	21	22	8	5	21	5	11	15	37	31	17	13	9	8	18	31	22	26	42	33	22	26
0400-0430	4	24	24	18	18	22	9	22	8	2	18	8	8	9	37	15	17	9	9	8	21	28	21	24	39	31	21	26
0430-0500	8	37	21	21	17	21	11	22	9	9	18	5	9	11	39	15	18	11	9	9	13	39	21	24	39	30	18	33
0500-0530	5	31	21	21	21	24	9	24	9	5	21	9	11	21	39	13	18	9	9	9	13	28	24	24	39	31	9	33
0530-0600	8	17	21	15	22	18	13	21	0	0	17	8	13	24	39	17	17	18	9	9	13	22	24	21	39	17	11	37
0600-0630	8	13	22	17	21	24	28	24	4	0	17	8	17	24	35	17	21	18	5	9	22	35	18	24	37	22	9	24
0630-0700	5	13	22	18	22	28	28	21	4	5	17	9	11	31	37	22	21	18	9	11	22	31	17	24	33	15	11	26
0700-0730	8	26	21	21	24	28	28	26	9	5	17	9	17	31	39	22	21	21	9	13	22	39	22	30	31	9	9	28
0730-0800	8	26	24	18	21	21	28	15	8	8	15	9	15	30	35	21	22	17	13	17	26	39	24	30	37	17	17	28
0800-0830	11	24	30	26	21	28	28	11	9	8	15	11	13	30	33	28	21	18	15	18	28	46	26	24	39	24	15	26
0830-0900	13	22	31	17	21	26	26	24	11	5	15	17	17	31	33	35	21	17	13	18	28	46	33	26	35	26	17	26
0900-0930	18	26	28	26	21	24	22	21	11	9	15	15	18	31	35	28	21	22	13	24	31	42	31	26	39	33	18	24
0930-1000	18	24	26	28	21	22	24	22	11	15	15	13	17	31	37	31	24	24	15	22	31	41	30	33	35	33	17	22
1000-1030	21	11	22	28	21	17	21	24	13	17	17	9	24	31	31	31	28	22	15	24	33	46	33	31	35	28	21	22
1030-1100	-	24	21	22	22	21	24	21	13	18	17	24	28	33	35	31	24	22	17	22	33	50	31	41	35	22	24	21
1100-1130	-	26	30	24	26	24	24	21	13	21	17	28	31	31	37	31	26	24	17	22	30	46	39	42	33	21	26	22
1130-1200	-	28	15	26	22	28	22	17	15	18	17	28	33	33	35	30	24	21	18	22	33	50	41	37	33	26	22	22
1200-1230	-	24	15	18	24	28	28	24	17	21	17	30	33	33	35	33	21	22	18	24	31	48	37	44	31	15	30	18
1230-1300	-	26	8	18	24	28	28	24	21	21	18	30	33	35	37	30	26	22	18	24	33	52	37	44	37	18	26	21
1300-1330	22	24	9	17	26	28	26	22	21	18	18	31	35	33	37	28	26	21	17	26	31	48	41	44	33	17	18	21
1330-1400	18	22	9	18	26	28	28	24	18	22	18	33	35	35	33	28	26	22	18	24	35	50	37	42	33	21	13	22
1400-1430	21	24	8	35	28	26	31	21	21	28	21	33	37	37	33	34	28	24	18	24	31	46	41	44	39	21	13	24
1430-1500	22	22	8	13	28	28	28	21	21	28	21	35	31	37	35	30	28	24	17	24	39	46	39	41	21	22	13	24
1500-1530	24	22	13	11	28	28	35	18	21	26	21	35	31	35	33	28	26	24	18	22	33	35	37	39	35	24	17	24
1530-1600	26	22	17	13	28	24	18	22	17	28	21	35	33	39	35	30	26	21	18	24	33	31	35	39	33	18	15	22
1600-1630	21	24	17	15	24	28	18	18	17	26	18	35	31	35	35	28	28	22	18	24	31	37	37	41	30	22	22	24
1630-1700	24	24	15	13	24	28	21	13	18	24	21	33	28	39	35	26	28	18	21	26	35	41	37	37	37	18	22	22
1700-1730	22	26	17	5	28	26	13	13	18	24	21	31	31	42	35	28	24	21	17	24	35	35	44	41	33	21	24	24
1730-1800	21	24	22	9	31	26	17	13	18	26	18	33	28	41	35	30	24	17	17	18	35	35	44	42	33	21	22	21
1800-1830	21	24	21	26	28	28	28	11	21	26	18	24	26	42	35	28	24	18	13	21	37	31	44	41	28	21	26	21
1830-1900	18	22	18	24	30	28	28	9	21	26	21	24	28	44	31	28	22	18	13	18	39	30	41	41	30	21	24	21
1900-1930	24	22	21	22	31	30	24	9	17	24	21	21	22	41	31	28	26	18	13	17	35	39	41	42	33	18	24	24
1930-2000	24	22	18	21	26	28	24	9	18	24	21	22	13	39	31	30	26	18	11	15	41	37	37	39	31	18	24	26
2000-2030	24	24	21	28	26	28	26	11	17	28	18	26	11	39	39	28	26	17	11	17	35	24	41	39	30	22	28	26
2030-2100	24	22	18	21	26	30	28	11	21	28	18	24	13	39	35	28	26	17	11	18	31	22	39	39	22	21	28	26
2100-2130	24	22	21	37	28	30	26	13	13	28	13	9	11	37	30	26	24	17	9	15	33	22	41	37	13	21	28	26
2130-2200	26	22	21	33	17	28	28	13	13	28	11	9	13	33	35	30	22	15	8	15	35	22	41	26	28	18	26	28
2200-2230	22	21	22	15	18	28	26	17	11	26	8	5	5	30	30	28	24	15	8	18	37	24	39	30	28	21	22	28
2230-2300	24	22	21	13	11	28	28	17	8	26	9	9	13	37	33	30	21	15	8	22	33	24	35	26	28	21	26	28
2300-2330	24	24	21	15	24	28	24	13	9	26	9	17	9	35	33	30	22	13	8	21	28	24	31	33	28	21	24	28
2330-0000	22	22	21	21	13	28	28	15	9	24	9	11	22	35	33	28	21	11	5	22	33	24	31	35	31	21	28	28

Sunshine Coast Airport (040861) Wind Data – Km/hr

March	Day																														
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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0030-0100	26	19	24	28	22	13	11	20	20	6	13	13	1	11	13	7	6	7	13	13	0	9	9	9	9	9	4	30	7	20	7
0100-0130	26	20	24	28	26	11	9	22	19	7	17	11	13	13	7	11	4	7	11	13	0	4	7	9	11	11	7	32	17	13	13
0130-0200	28	24	28	26	24	11	7	20	17	7	19	19	9	7	2	11	6	7	15	17	0	9	6	9	9	11	6	28	28	13	13
0200-0230	26	19	26	28	19	9	9	19	19	6	20	15	11	1	7	13	6	6	11	13	0	7	6	9	6	11	13	37	24	17	15
0230-0300	28	24	26	26	20	7	7	20	15	6	15	13	9	1	11	7	6	6	17	15	7	7	6	13	9	11	9	33	30	20	13
0300-0330	26	24	26	26	20	9	7	19	19	7	17	11	11	15	13	7	7	4	11	13	6	7	7	13	9	9	4	28	32	26	17
0330-0400	26	22	26	26	20	7	7	19	17	6	13	13	15	11	17	0	4	7	13	11	9	7	9	13	9	7	0	30	19	20	22
0400-0430	28	24	24	28	24	7	7	22	17	4	13	19	17	13	11	2	0	7	13	6	9	7	9	11	7	9	6	28	6	17	15
0430-0500	26	22	26	26	20	7	0	22	15	7	13	20	13	13	11	6	7	9	9	9	7	6	7	6	9	9	0	26	24	19	19
0500-0530	15	24	28	26	22	6	7	20	13	7	11	20	15	13	13	7	7	6	7	13	4	6	7	0	11	9	9	28	22	9	9
0530-0600	24	30	28	33	24	6	7	20	11	6	11	13	13	15	13	11	7	2	9	11	0	7	7	0	11	7	15	39	22	7	13
0600-0630	26	26	28	32	20	7	7	20	13	7	9	13	9	11	11	11	7	6	9	7	0	7	2	0	13	7	13	39	20	9	7
0630-0700	24	28	26	26	24	6	0	19	17	6	9	17	13	11	9	9	7	6	6	9	0	6	7	7	9	7	20	22	19	9	17
0700-0730	22	26	24	30	26	7	7	20	13	9	13	13	7	11	7	7	7	6	6	11	0	7	7	6	11	7	22	19	20	9	7
0730-0800	24	28	20	22	26	13	4	24	15	9	17	13	9	13	9	7	7	7	7	13	7	6	9	9	9	7	32	19	19	13	13
0800-0830	20	28	22	19	26	9	7	22	17	7	17	13	15	9	11	9	9	2	7	9	6	6	6	13	11	11	22	20	19	24	15
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0900-0930	26	26	26	30	24	13	7	24	17	13	20	11	20	19	19	13	13	9	7	4	20	7	6	11	17	9	24	20	17	19	15
0930-1000	20	24	26	30	24	11	11	22	17	13	19	11	22	19	20	9	11	13	9	4	22	13	7	15	17	13	22	20	22	15	17
1000-1030	20	24	26	32	24	13	11	22	19	13	11	13	24	19	17	9	11	11	11	13	17	15	13	17	17	15	26	19	22	22	22
1030-1100	20	26	28	28	22	15	20	24	17	17	17	22	22	19	19	11	13	15	13	13	22	17	15	20	17	15	26	17	20	22	24
1100-1130	20	24	28	26	22	15	20	22	17	19	20	20	20	20	15	9	13	17	15	15	22	17	17	24	19	15	30	20	20	24	17
1130-1200	22	26	22	24	20	15	20	24	17	20	26	26	22	20	20	6	15	20	17	17	24	17	19	24	24	15	24	19	20	24	19
1200-1230	24	26	13	20	20	17	20	22	19	20	30	26	22	19	13	9	19	22	19	17	26	20	19	24	26	15	32	24	19	24	17
1230-1300	22	24	32	19	20	17	20	24	19	24	35	28	26	17	28	7	20	24	19	19	26	20	22	26	24	15	33	28	19	22	22
1300-1330	22	26	26	26	24	17	26	24	19	22	35	28	28	17	28	13	17	26	22	20	24	19	22	26	30	19	30	26	19	19	22
1330-1400	22	22	24	22	22	19	26	26	19	24	37	28	24	19	32	15	20	24	24	20	26	20	22	26	30	20	28	28	19	30	20
1400-1430	24	24	24	24	24	20	28	22	19	24	39	30	26	19	33	9	19	26	24	20	22	19	24	28	28	20	32	26	17	20	20
1430-1500	24	28	22	26	24	20	28	24	20	20	33	33	20	19	35	11	24	26	22	17	20	20	24	28	30	20	30	26	19	19	19
1500-1530	24	30	24	28	22	20	24	24	20	24	32	32	22	17	37	11	20	26	22	13	17	20	24	28	32	22	26	28	22	15	20
1530-1600	24	28	22	28	20	22	26	24	20	24	24	35	19	19	37	15	19	22	20	15	13	17	26	26	30	20	26	32	11	11	19
1600-1630	26	24	26	30	22	24	30	22	19	26	22	30	19	19	39	13	19	9	20	17	13	17	26	26	28	19	28	19	19	9	19
1630-1700	26	24	26	28	20	22	30	24	17	26	32	26	17	15	39	13	17	9	22	20	13	17	26	26	24	15	26	17	19	11	20
1700-1730	26	20	28	24	20	19	30	20	17	28	20	26	20	15	35	15	20	24	20	20	17	17	24	26	20	13	26	17	17	11	17
1730-1800	28	19	26	26	20	19	32	22	15	26	19	22	13	9	32	19	19	11	17	19	15	17	22	22	20	9	24	32	15	11	15
1800-1830	28	26	28	26	20	15	30	22	15	24	15	20	17	11	33	20	11	15	9	15	17	15	19	20	20	9	24	28	15	9	13
1830-1900	28	24	26	26	22	9	28	19	15	20	15	17	17	9	30	22	13	13	7	11	15	15	19	20	20	9	17	28	17	9	15
1900-1930	28	19	26	26	17	11	30	20	15	24	17	9	15	6	24	24	7	9	6	7	17	13	17	22	19	6	19	32	19	9	13
1930-2000	28	26	26	26	15	13	19	20	17	20	9	13	17	11	30	24	9	13	9	0	17	15	17	19	17	7	26	32	19	7	11
2000-2030	28	26	28	22	19	17	19	20	17	20	7	17	17	7	17	26	11	17	9	7	15	15	13	15	15	6	24	32	22	11	9
2030-2100	33	24	30	28	19	15	20	20	17	17	11	17	17	9	22	17	9	11	9	9	17	13	11	15	13	6	28	28	24	15	7
2100-2130	32	26	28	26	17	9	22	20	11	13	9	17	19	15	17	13	6	15	11	13	17	17	11	13	13	6	24	24	24	13	6
2130-2200	28	26	28	26	13	9	22	19	9	11	7	11	17	4	15	9	9	15	6	11	17	11	9	13	11	0	24	24	20	9	6
2200-2230	24	26	26	24	13	9	24	17	6	11	13	15	15	9	19	15	9	11	11	13	15	13	9	9	9	4	20	20	22	11	6
2230-2300	26	26	28	26	9	11	20	20	6	13	17	9	15	4	20	19	11	9	11	13	17	13	9	11	9	7	26	17	24	13	7
2300-2330	26	24	28	24	15	6	20	19	6	11	15	7	17	9	17	6	7	9	11	9	15	9	9	11	7	9	20	20	19	11	9
2330-0000	19	19	28	26	13	7	22	19	9	9	13	9	13	6	17	7	9	15	15	7	13	9	7	13	9	0	24	13	22	9	6

Sunshine Coast Airport (040861) Wind Data – Km/hr

April	Day																													
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0000-0030	7	19	20	20	17	11	6	6	9	11	30	13	24	9	20	20	19	13	19	30	32	30	32	28	13	7	9	13	7	7
0030-0100	7	17	24	17	15	9	7	6	7	11	30	19	22	9	20	119	19	15	17	28	28	26	20	28	9	7	9	17	7	9
0100-0130	9	19	24	20	17	28	6	7	7	11	26	17	17	11	19	15	17	17	17	28	32	24	22	24	9	6	11	17	7	11
0130-0200	9	17	22	20	20	17	6	7	7	11	28	19	22	11	17	13	17	17	19	28	32	17	20	26	11	7	11	9	9	13
0200-0230	7	17	24	15	20	15	7	9	7	13	26	17	13	9	19	20	19	17	19	32	30	19	28	26	13	9	11	13	9	13
0230-0300	9	17	24	17	22	17	7	6	7	11	15	15	20	13	17	19	19	20	13	30	30	24	28	24	11	9	11	13	7	19
0300-0330	11	19	20	17	19	17	7	7	7	13	20	24	20	17	20	19	19	19	17	28	28	24	26	28	9	9	11	15	7	15
0330-0400	9	19	28	13	20	13	6	9	7	11	24	17	17	17	17	20	24	17	20	26	30	24	24	22	9	9	13	13	6	19
0400-0430	9	20	22	19	22	15	7	7	9	13	22	17	17	17	17	19	24	19	19	30	28	26	28	20	7	9	13	13	7	20
0430-0500	11	22	22	22	20	15	6	7	7	9	24	20	13	20	17	19	20	19	20	28	28	24	26	26	13	7	11	13	7	17
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Sunshine Coast Airport (040861) Wind Data – Km/hr

May	Day																														
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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0100-0130	32	26	15	13	9	11	7	11	7	9	6	17	24	32	15	9	17	17	17	19	9	9	11	11	9	7	7	15	9	9	17
0130-0200	28	24	11	11	13	13	7	11	6	6	13	17	19	26	15	15	17	15	22	13	7	7	11	13	9	7	6	9	9	7	13
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0400-0430	26	22	9	9	9	11	9	11	9	7	17	13	17	11	15	11	17	22	22	13	4	7	15	15	11	9	13	13	11	11	20
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Sunshine Coast Airport (040861) Wind Data – Km/hr

June	Day																													
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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0030-0100	9	19	0	28	9	17	19	15	17	6	7	9	6	-	11	11	9	7	11	9	17	15	11	19	19	20	24	17	28	7
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1530-1600	20	17	19	43	20	22	17	17	15	13	19	9	15	17	17	24	17	9	19	20	19	20	22	20	15	24	28	26	15	13
1600-1630	20	11	22	28	17	19	17	17	13	13	17	9	-	17	17	24	15	9	17	19	13	19	20	19	19	24	28	20	15	13
1630-1700	17	11	19	28	17	19	22	9	11	11	17	11	-	15	17	24	11	7	15	17	13	19	20	17	22	20	28	33	15	13
1700-1730	15	6	11	20	11	19	17	6	11	9	13	9	-	13	19	20	11	6	15	13	7	17	17	15	24	17	26	24	17	11
1730-1800	11	4	17	17	11	15	15	9	9	11	13	7	-	9	17	19	9	6	15	17	11	15	17	13	24	17	28	32	15	9
1800-1830	11	6	6	24	11	13	7	7	7	7	11	7	-	7	15	19	7	7	17	22	11	19	15	19	26	19	28	17	17	7
1830-1900	7	9	9	24	9	15	15	6	6	9	11	6	-	7	9	11	7	6	9	22	11	19	15	15	17	19	24	17	17	4
1900-1930	6	9	9	20	7	15	15	6	9	11	11	7	-	7	9	11	7	11	7	22	13	7	13	15	22	24	19	26	15	6
1930-2000	9	15	4	19	9	13	15	7	6	13	13	7	-	7	11	13	13	11	9	17	17	11	13	15	22	20	13	24	9	6
2000-2030	9	6	6	24	13	11	17	6	6	7	7	6	-	11	13	20	7	7	6	13	13	9	17	15	20	33	17	24	11	6
2030-2100	13	6	7	24	11	9	28	0	6	9	9	6	-	6	9	28	9	9	6	19	15	9	17	13	20	33	11	24	7	6
2100-2130	15	9	9	20	20	9	15	7	0	7	7	6	-	6	7	11	9	7	6	15	7	7	17	15	19	33	13	28	7	7
2130-2200	19	9	7	20	22	9	13	11	7	7	7	6	-	6	7	6	9	9	6	13	13	11	19	17	15	30	22	20	4	7
2200-2230	20	11	13	19	20	17	7	15	6	7	7	7	-	0	9	11	9	9	7	13	15	11	19	20	11	26	19	37	9	6
2230-2300	15	9	15	19	22	15	19	7	6	6	6	6	-	0	13	4	11	11	7	15	15	11	22	19	15	24	9	24	7	6
2300-2330	19	11	13	17	20	13	17	7	6	6	6	6	-	9	15	6	9	11	9	15	13	11	19	20	17	26	17	28	0	6
2330-0000	19	6	15	9	22	17	15	11	6	7	7	7	-	9	13	11	7	13	7	17	17	13	17	20	15	32	20	24	7	6

Sunshine Coast Airport (040861) Wind Data – Km/hr

July Day

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	6	19	9	17	24	35	28	22	7	7	9	7	11	17	7	13	9	9	7	9	7	7	7	9	11	11	9	11	6	9	17
0030-0100	7	17	9	17	20	39	28	20	9	9	6	9	11	20	9	13	7	9	6	7	7	9	9	13	11	13	11	9	7	9	26
0100-0130	7	17	11	15	28	28	24	19	7	9	6	6	11	20	4	13	9	6	9	7	7	7	9	11	9	13	9	6	6	7	20
0130-0200	6	13	13	20	28	30	22	17	7	15	6	9	9	26	11	11	9	9	9	7	7	7	7	9	7	9	7	6	7	6	20
0200-0230	7	11	19	20	33	39	26	9	7	11	7	11	15	22	11	13	11	9	11	9	6	4	9	9	6	11	9	9	9	0	13
0230-0300	4	11	20	20	37	35	24	7	9	9	7	15	13	20	15	9	7	9	11	9	6	6	11	7	7	9	11	13	7	0	13
0300-0330	6	15	19	19	39	33	24	4	9	11	6	9	11	22	11	11	9	9	7	9	7	6	7	11	9	7	7	7	7	7	15
0330-0400	7	17	20	15	37	32	26	13	6	11	6	7	13	19	13	11	13	7	9	9	9	9	9	6	11	6	7	7	7	7	15
0400-0430	9	15	19	15	35	35	24	11	9	9	7	13	13	20	7	11	11	9	7	9	7	4	11	2	9	7	7	6	9	7	17
0430-0500	0	17	20	19	35	33	26	15	11	6	11	7	17	15	7	9	9	6	9	9	7	6	7	0	7	9	7	9	9	6	15
0500-0530	6	17	20	19	35	28	22	13	9	7	9	9	15	7	6	7	9	9	9	7	6	7	7	4	6	6	11	9	9	6	15
0530-0600	6	19	19	20	35	33	20	9	9	0	9	13	9	7	9	7	9	13	7	7	6	7	9	6	7	7	9	13	7	7	15
0600-0630	6	19	19	17	37	32	19	11	11	7	13	15	11	6	15	11	7	9	9	6	7	6	9	0	9	9	9	13	6	6	15
0630-0700	7	17	20	22	35	32	17	9	9	6	11	13	13	11	9	13	9	4	11	7	6	7	9	6	13	9	9	13	6	7	20
0700-0730	9	17	24	28	32	32	9	11	9	6	13	9	13	15	9	9	7	11	11	6	9	7	7	6	11	9	7	9	6	7	19
0730-0800	15	19	24	33	35	30	9	15	9	0	11	6	11	13	7	9	7	9	9	7	7	9	7	2	19	6	13	11	6	7	19
0800-0830	17	17	24	28	30	26	15	20	7	0	9	13	13	19	9	11	6	9	7	6	7	7	6	4	15	2	11	9	7	7	20
0830-0900	20	19	24	33	24	26	20	19	6	6	9	9	17	24	13	11	7	13	7	7	6	6	0	6	20	7	9	9	6	7	17
0900-0930	22	19	28	35	22	28	17	17	6	4	9	7	9	28	17	11	7	19	7	7	6	9	0	7	20	9	9	19	9	7	20
0930-1000	22	19	28	35	30	30	20	19	7	11	9	11	11	33	22	11	6	22	0	9	7	6	0	7	17	9	9	20	13	6	24
1000-1030	22	19	26	32	32	26	15	22	9	19	7	7	11	35	19	11	7	17	9	11	13	7	9	7	20	7	17	19	11	7	24
1030-1100	17	22	24	37	35	35	15	19	9	24	15	9	13	32	19	17	15	9	13	11	15	7	13	9	22	7	17	19	15	9	26
1100-1130	22	20	26	30	35	30	13	19	13	26	15	7	11	22	30	13	13	9	13	13	15	9	13	7	22	7	22	22	17	7	26
1130-1200	22	20	28	30	37	28	20	17	17	20	19	7	13	22	24	13	15	15	9	15	17	11	11	7	22	9	19	22	17	13	26
1200-1230	20	20	28	30	35	26	20	17	11	26	19	13	15	20	24	17	15	11	9	13	11	13	13	11	20	11	17	20	17	15	28
1230-1300	19	20	28	41	35	20	24	15	13	20	17	15	26	19	26	15	15	17	13	13	15	13	13	15	19	11	11	20	17	13	24
1300-1330	26	19	28	33	28	22	22	15	17	17	19	15	22	17	17	13	15	13	15	13	17	15	13	13	22	11	9	17	15	15	26
1330-1400	24	17	28	35	30	24	20	15	17	19	20	19	24	11	22	15	13	13	13	15	15	15	17	13	20	11	13	19	13	15	28
1400-1430	24	17	26	32	22	26	20	17	17	17	24	17	20	9	22	13	13	11	13	15	15	17	17	15	20	9	20	20	13	17	26
1430-1500	22	17	24	33	39	26	20	17	13	13	15	20	15	6	28	13	13	13	13	17	15	17	17	13	20	11	22	19	13	15	28
1500-1530	20	17	22	33	37	26	20	15	15	15	15	17	19	15	24	13	13	13	11	17	15	17	19	11	19	13	22	20	13	13	26
1530-1600	20	15	26	32	33	28	24	15	15	13	13	17	13	17	24	9	13	9	13	15	15	15	19	20	15	13	24	19	13	13	26
1600-1630	20	15	30	30	30	28	22	15	15	7	11	15	15	13	20	9	13	9	13	13	17	15	19	17	19	9	22	17	13	11	26
1630-1700	19	11	32	32	30	24	26	13	13	9	9	20	13	13	28	9	13	0	11	13	17	15	17	13	19	9	20	17	13	11	24
1700-1730	17	9	30	30	32	24	26	11	13	6	7	17	13	9	17	6	7	7	11	9	17	13	15	11	19	9	20	15	13	9	24
1730-1800	19	9	30	32	33	19	20	9	11	7	7	15	13	7	17	7	6	7	11	9	19	15	11	11	17	9	17	13	13	9	26
1800-1830	19	7	28	32	32	24	9	7	6	4	15	11	9	9	13	9	0	11	9	9	20	7	11	7	17	13	11	13	11	7	28
1830-1900	24	6	32	33	35	20	20	7	6	4	9	11	15	9	13	9	9	7	7	7	20	7	9	9	19	6	9	13	7	9	22
1900-1930	22	6	33	33	41	22	19	6	6	9	9	11	13	9	13	9	9	9	7	6	17	7	6	2	19	7	7	13	0	17	24
1930-2000	22	9	28	35	35	30	22	7	0	9	7	11	15	9	13	9	11	9	4	6	6	0	6	9	20	9	6	7	7	19	26
2000-2030	22	9	20	35	28	28	20	7	0	7	11	9	17	9	11	9	9	11	7	7	9	4	4	15	17	9	9	9	7	20	19
2030-2100	20	9	28	35	32	28	24	7	6	7	9	11	13	11	11	9	7	4	7	6	7	6	6	11	13	6	9	9	7	20	19
2100-2130	17	9	20	32	32	30	22	9	11	11	9	13	15	9	13	9	11	7	7	4	6	6	13	7	15	6	6	6	7	22	17
2130-2200	19	7	17	32	39	28	20	9	7	11	11	15	17	9	11	9	11	6	7	7	6	6	11	9	13	6	6	7	7	20	17
2200-2230	20	7	15	26	39	28	24	7	7	11	7	13	13	13	9	9	9	13	7	6	7	7	11	9	11	7	9	6	7	11	15
2230-2300	20	9	20	17	37	32	24	7	9	9	7	13	13	13	13	7	11	13	7	6	9	7	11	2	13	7	7	7	4	13	13
2300-2330	19	7	35	24	37	32	24	11	7	9	9	9	15	15	11	7	6	9	7	7	9	6	15	11	17	6	6	7	9	7	20
2330-0000	20	7	24	19	37	26	22	9	7	7	9	11	17	13	11	6	13	9	7	7	9	7	13	13	17	9	9	6	6	13	19

Sunshine Coast Airport (040861) Wind Data – Km/hr

August Day

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	13	11	9	7	6	6	6	7	7	7	28	13	7	0	6	9	13	13	11	17	9	19	35	7	7	11	0	7	9	11	13
0030-0100	15	9	7	6	6	6	9	6	6	7	33	17	9	9	6	7	15	15	9	17	9	13	30	7	7	7	2	7	11	11	11
0100-0130	13	20	11	7	6	7	7	17	7	11	28	13	11	0	7	9	11	13	13	19	13	20	28	7	9	9	6	7	9	7	15
0130-0200	15	24	13	9	7	6	7	9	9	7	32	13	11	4	6	9	13	7	11	20	11	20	32	7	9	9	7	7	7	6	20
0200-0230	17	17	11	9	6	6	6	13	9	9	30	11	9	9	6	9	9	9	9	19	13	22	32	7	13	9	6	6	6	9	15
0230-0300	19	20	13	7	6	6	7	11	7	13	22	13	9	6	6	7	11	2	13	20	13	26	28	7	9	9	6	6	6	7	15
0300-0330	19	17	9	7	7	6	6	11	7	6	24	13	9	6	6	9	7	9	9	17	11	13	26	9	11	9	7	6	9	7	22
0330-0400	26	17	13	7	9	6	7	9	7	6	26	13	11	9	6	9	7	15	9	15	0	13	32	9	6	9	6	13	13	7	17
0400-0430	20	17	13	7	7	7	7	7	7	7	28	11	7	7	7	7	6	7	11	15	0	15	20	7	7	13	7	9	9	6	17
0430-0500	20	19	19	9	7	7	6	6	9	9	28	17	9	6	6	9	7	7	13	19	7	15	17	7	9	11	9	7	13	7	9
0500-0530	20	17	11	9	7	7	6	0	9	9	26	17	7	6	7	9	9	7	15	17	9	13	15	9	11	13	6	9	11	9	15
0530-0600	24	20	11	9	7	7	7	9	7	13	24	22	9	6	6	9	9	7	9	13	6	9	17	9	9	17	9	7	13	7	17
0600-0630	22	20	19	9	7	6	6	7	9	11	17	7	9	9	6	9	6	7	7	17	15	9	17	9	7	13	4	7	13	6	17
0630-0700	22	24	20	9	7	6	6	11	11	11	20	19	9	9	0	9	6	6	9	24	7	20	19	9	9	9	7	7	17	6	17
0700-0730	22	26	20	9	6	7	6	17	6	11	17	20	9	7	6	7	6	7	9	19	9	19	20	9	9	0	6	6	11	13	20
0730-0800	26	26	22	9	6	4	0	19	9	7	24	30	7	7	4	9	9	9	13	19	6	13	20	9	11	0	11	9	15	19	22
0800-0830	24	26	22	7	6	7	6	20	7	9	22	20	7	7	6	7	9	9	13	20	7	17	24	11	11	0	9	9	15	24	24
0830-0900	20	26	26	7	7	7	6	15	9	9	28	20	7	6	7	9	15	13	17	20	9	15	24	7	13	6	6	9	15	22	26
0900-0930	28	28	26	7	15	11	6	11	11	9	32	26	13	7	7	9	20	13	20	20	9	22	28	17	13	9	9	9	13	26	22
0930-1000	22	24	24	4	15	15	0	9	17	13	28	24	17	13	7	11	20	17	26	24	11	28	26	17	19	11	11	6	11	19	26
1000-1030	20	26	24	6	17	15	11	17	15	15	19	22	24	13	11	11	22	17	30	20	22	22	22	17	20	13	4	6	13	19	19
1030-1100	22	22	20	11	19	13	11	15	19	15	20	26	20	15	11	15	22	17	24	20	19	30	30	17	20	15	11	7	15	22	19
1100-1130	24	28	19	11	17	13	11	26	22	24	20	28	19	17	9	17	20	17	20	17	17	28	28	13	17	17	13	11	9	26	22
1130-1200	24	26	19	11	17	13	11	28	22	24	22	24	20	17	9	20	19	19	19	20	24	22	26	9	7	15	17	13	6	28	26
1200-1230	24	28	17	13	17	15	13	30	22	28	22	26	20	20	9	24	13	17	19	19	28	26	24	13	20	15	15	13	7	26	28
1230-1300	20	30	19	13	15	17	13	20	20	24	22	20	22	19	9	24	11	17	22	19	33	32	24	15	20	15	17	13	7	26	26
1300-1330	17	28	20	13	15	17	11	26	20	24	20	19	24	17	9	26	9	17	17	19	22	26	24	13	24	17	19	17	13	24	26
1330-1400	24	26	19	15	17	19	13	24	20	30	20	17	20	15	9	28	20	15	19	17	28	33	26	15	22	17	19	20	13	24	24
1400-1430	20	24	19	15	15	19	15	22	20	32	19	15	19	17	9	26	20	15	22	17	24	35	22	15	24	20	20	19	15	26	24
1430-1500	24	20	19	17	15	19	15	19	24	33	20	17	20	13	11	24	20	17	22	17	24	32	22	17	24	19	20	15	19	24	26
1500-1530	32	15	19	17	15	13	17	19	20	32	24	17	20	11	13	24	20	17	19	15	20	33	22	17	26	20	19	13	19	22	24
1530-1600	19	17	17	15	17	15	13	17	20	30	26	17	20	11	13	22	22	15	20	15	24	28	24	17	22	20	19	11	22	20	22
1600-1630	20	19	15	15	11	15	11	15	19	35	24	17	19	9	13	22	26	15	24	11	30	33	22	17	24	20	17	19	17	20	20
1630-1700	19	17	13	15	13	13	15	11	17	28	24	15	17	11	13	20	20	13	26	9	19	26	22	15	22	17	15	17	15	20	20
1700-1730	17	19	15	13	13	11	13	7	13	32	20	13	17	13	13	19	20	13	19	7	11	20	24	15	20	15	15	17	11	24	20
1730-1800	22	15	15	13	13	13	11	11	13	19	17	9	15	13	15	17	19	13	20	6	13	19	22	15	20	15	13	17	11	20	20
1800-1830	24	17	15	13	11	13	7	11	17	24	17	6	15	11	13	19	17	9	19	7	17	19	22	15	15	13	15	13	9	19	24
1830-1900	22	11	11	13	9	13	11	15	11	24	15	6	13	6	9	17	9	9	24	9	9	22	22	13	13	6	13	13	11	19	20
1900-1930	15	1	6	15	11	11	17	11	4	15	11	0	15	11	7	9	6	7	20	9	7	17	22	9	7	6	9	9	11	20	19
1930-2000	19	11	7	15	6	19	13	6	2	13	7	6	13	7	6	9	7	7	20	9	17	15	20	7	9	7	7	9	9	20	20
2000-2030	13	9	6	17	7	22	6	7	4	17	7	4	15	7	9	11	7	9	24	1	15	22	20	6	11	7	9	11	9	20	20
2030-2100	13	11	7	15	6	20	9	6	0	15	11	6	15	7	11	7	6	11	26	11	17	24	20	6	13	7	9	6	9	20	20
2100-2130	13	13	6	4	7	17	11	7	9	15	15	6	13	9	9	17	7	9	19	13	17	20	15	6	13	9	9	7	9	20	20
2130-2200	24	13	6	9	7	17	9	6	13	17	15	7	9	6	7	15	6	11	17	11	22	19	9	7	9	4	7	9	7	22	20
2200-2230	15	13	6	9	6	19	9	6	11	22	13	7	7	7	0	13	13	9	22	9	26	22	9	7	7	0	6	6	0	20	22
2230-2300	13	11	7	0	6	9	11	6	11	30	13	7	6	6	7	13	13	9	20	9	19	24	9	7	11	0	6	6	6	20	20
2300-2330	9	20	9	6	7	6	11	7	11	32	11	7	0	6	7	13	13	13	24	9	13	35	13	9	9	7	6	7	7	6	6
2330-0000	11	20	6	4	9	7	9	9	7	32	13	9	0	6	7	15	9	11	15	11	13	33	9	7	9	7	7	9	9	13	13

Amberley

Amberley (040004) Wind Data – Km/hr

January	Day																														
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	11	0	5	9	4	11	15	11	0	4	0	9	0	9	4	8	5	8	8	17	8	8	2	11	13	9	0	0	8	2	0
0030-0100	0	5	0	13	11	11	13	13	0	0	0	8	8	11	8	0	11	8	0	11	8	5	8	9	8	8	4	0	8	9	8
0100-0130	0	0	9	13	8	9	13	17	4	5	0	8	0	9	5	0	9	0	0	13	0	5	5	9	8	8	8	0	8	8	5
0130-0200	4	0	0	15	2	9	13	11	5	0	0	2	2	11	8	0	8	9	0	11	8	8	9	8	5	2	0	4	8	0	5
0200-0230	2	0	8	17	0	9	9	13	0	0	4	0	9	11	8	0	0	2	0	13	2	4	5	0	5	4	0	0	0	5	9
0230-0300	9	0	5	13	5	0	11	13	11	0	0	5	9	13	0	0	0	0	0	9	0	5	0	5	8	9	0	4	0	8	8
0300-0330	5	0	0	9	8	0	11	9	9	0	0	8	9	13	8	0	0	0	0	8	0	5	0	9	5	0	0	2	0	8	0
0330-0400	0	0	0	8	8	8	9	8	9	0	0	9	9	11	0	0	0	0	0	9	8	9	0	13	2	5	0	0	9	2	5
0400-0430	0	0	0	8	0	0	11	8	5	0	0	9	5	11	0	2	0	8	0	9	9	8	0	9	8	9	0	2	9	0	4
0430-0500	0	0	0	8	2	11	13	9	0	8	0	5	5	13	0	5	0	5	5	5	0	0	0	9	0	5	0	0	9	0	9
0500-0530	0	0	4	0	2	9	9	9	0	8	0	9	9	11	0	8	0	0	8	8	11	5	0	8	4	0	0	8	9	0	9
0530-0600	0	0	18	8	0	9	8	11	9	8	0	8	5	13	0	9	0	9	0	0	5	8	0	8	0	9	0	0	9	0	5
0600-0630	4	0	5	9	8	0	5	11	0	0	4	9	8	18	0	0	0	0	0	8	0	0	0	8	4	8	0	9	0	0	8
0630-0700	4	2	8	9	5	8	9	11	0	13	0	5	8	15	0	2	0	0	4	0	2	9	0	13	8	0	0	2	0	8	8
0700-0730	0	4	8	9	8	0	11	13	0	9	2	4	8	18	5	2	0	9	5	2	11	8	0	8	0	0	4	2	8	8	2
0730-0800	8	4	5	9	8	5	13	11	11	11	8	5	8	17	5	8	0	9	0	2	11	8	5	9	5	2	2	5	17	2	4
0800-0830	5	5	9	0	5	8	15	9	11	8	8	8	5	24	8	9	5	8	8	9	13	8	8	11	5	5	9	5	15	4	5
0830-0900	9	8	8	11	9	11	17	9	9	4	15	9	21	26	4	8	2	8	9	13	13	13	9	9	9	11	9	8	11	9	9
0900-0930	8	11	9	22	13	13	26	8	9	0	18	21	22	24	9	9	5	8	9	13	18	8	13	11	5	8	13	9	13	22	9
0930-1000	11	5	9	15	11	17	17	11	8	4	21	17	18	17	8	9	8	11	11	17	18	9	9	8	8	9	11	11	13	26	9
1000-1030	13	8	5	21	15	17	18	15	5	4	22	17	17	15	5	9	9	13	11	11	21	13	18	11	9	8	8	17	15	30	9
1030-1100	9	5	5	17	13	15	22	13	8	5	17	18	24	15	13	8	8	13	9	13	21	11	13	19	11	13	9	13	22	24	13
1100-1130	13	11	9	21	18	21	22	22	8	9	21	15	18	13	11	9	9	13	9	18	21	11	-	9	13	18	11	11	24	17	13
1130-1200	9	13	13	24	17	24	24	21	4	9	24	18	24	13	11	13	11	11	13	15	24	21	8	18	11	13	15	15	22	30	18
1200-1230	13	8	17	28	18	18	26	21	9	13	22	17	24	28	9	11	17	13	15	17	21	15	-	15	15	24	13	22	30	30	13
1230-1300	9	11	22	24	24	26	28	22	9	13	22	17	22	18	13	15	15	18	13	18	17	17	-	15		17	15	22	26	30	18
1300-1330	13	9	21	28	18	22	30	21	5	17	22	24	21	22	9	9	21	17	18	18	21	17	-	18	17	21	17	24	26	28	15
1330-1400	9	15	17	24	18	26	24	22	13	13	24	13	24	28	11	9	17	22	15	21	21	21	-	24	22	24	18	24	24	26	21
1400-1430	13	13	18	26	22	26	28	21	15	21	26	22	21	22	13	11	21	24	15	21	28	21	11	21	15	28	28	26	26	17	22
1430-1500	21	24	17	24	26	24	24	21	8	17	24	24	26	28	11	18	21	18	15	17	22	18	8	22	26	28	28	30	28	28	28
1500-1530	17	26	24	21	26	26	24	18	15	21	24	26	24	24	18	28	22	26	11	24	24	28	11	22	30	26	31	28	26	26	24
1530-1600	21	24	28	24	26	30	24	18	13	21	30	22	28	28	24	28	24	24	17	26	26	26	24	22	28	28	31	26	26	28	28
1600-1630	22	28	28	24	24	31	22	18	15	21	24	24	30	28	31	33	28	24	24	26	26	22	30	22	28	30	31	30	24	30	28
1630-1700	21	28	28	22	18	24	22	18	17	24	26	26	26	28	30	28	28	22	28	26	28	24	31	24	31	31	31	28	22	31	26
1700-1730	26	26	28	24	18	28	24	18	15	28	26	26	30	28	30	31	28	24	28	28	31	22	28	28	30	28	30	28	22	30	26
1730-1800	28	31	28	24	13	26	24	22	17	28	24	26	30	22	28	30	26	26	30	28	30	28	26	28	26	30	30	28	28	30	28
1800-1830	26	30	24	26	13	24	17	21	17	26	30	26	24	24	30	31	24	24	28	24	33	22	22	26	28	31	30	30	22	30	28
1830-1900	24	28	26	21	13	26	17	21	17	22	24	26	28	26	30	30	22	26	18	24	31	24	21	28	28	28	28	26	24	21	21
1900-1930	22	22	18	22	9	24	21	18	11	18	18	24	26	21	28	28	22	18	17	22	26	24	15	22	24	21	24	21	21	18	20
1930-2000	24	18	21	15	13	21	17	17	13	21	17	21	28	17	26	30	26	18	18	24	26	18	17	22	21	24	21	18	18	17	24
2000-2030	21	18	21	13	13	18	11	15	9	18	15	15	26	18	24	30	22	17	17	13	24	24	17	21	17	17	17	17	17	17	21
2030-2100	17	17	17	17	13	15	9	11	9	13	11	17	24	13	15	21	22	17	15	17	26	22	13	21	17	17	15	15	15	15	17
2100-2130	17	15	17	11	9	15	11	13	4	13	9	15	18	13	11	18	17	18	13	15	22	15	13	17	17	13	13	13	11	15	11
2130-2200	15	11	11	8	13	13	9	8	8	11	9	11	11	9	11	17	15	15	13	13	21	13	13	15	15	13	13	15	15	13	9
2200-2230	13	8	15	5	11	11	5	9	9	9	9	9	17	8	11	15	13	11	11	13	17	11	11	15	11	8	13	15	11	15	5
2230-2300	9	0	13	8	11	13	8	2	9	8	9	9	11	11	11	11	13	11	13	11	13	11	9	15	11	13	17	15	11	11	5
2300-2330	9	0	13	9	9	9	8	0	9	8	9	9	9	9	8	9	11	8	13	9	9	13	9	13	11	9	9	21	9	5	5
2330-0000	4	8	8	4	0	9	9	0	8	5	9	5	8	5	11	9	11	9	13	9	5	11	8	13	11	0	8	17	4	0	8

Amberley (040004) Wind Data – Km/hr

February	Day																											
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
0000-0030	0	9	11	8	11	13	9	9	11	13	15	9	0	11	8	5	11	0	9	4	13	18	28	21	15	11	8	8
0030-0100	0	9	9	9	11	15	8	9	11	11	15	0	0	17	5	0	11	0	0	13	2	24	24	30	18	24	0	5
0100-0130	5	9	11	8	9	18	8	9	0	9	17	0	0	18	8	0	9	0	8	13	9	24	15	22	15	17	8	8
0130-0200	2	9	9	0	9	11	11	8	9	9	17	5	2	17	9	0	11	8	5	9	5	21	9	22	15	13	0	9
0200-0230	9	11	8	5	9	13	11	11	5	8	15	8	8	17	8	0	11	5	0	9	5	15	4	24	13	0	8	8
0230-0300	8	11	5	0	8	13	11	11	0	8	8	0	8	15	9	0	11	2	8	8	4	21	13	30	13	15	8	9
0300-0330	8	9	5	9	8	11	9	9	8	4	9	4	5	15	8	0	13	5	0	9	0	17	18	26	15	13	2	8
0330-0400	9	8	8	2	4	11	11	8	0	0	4	8	0	9	8	0	13	8	0	9	0	18	21	13	13	13	8	8
0400-0430	8	8	9	0	8	11	8	5	9	0	0	0	5	9	8	0	15	0	0	8	0	28	18	13	17	9	4	8
0430-0500	0	11	9	0	9	15	2	11	5	0	5	0	2	11	8	0	13	9	0	2	0	22	13	15	13	9	4	9
0500-0530	0	13	9	2	9	13	8	11	0	0	5	0	0	11	0	2	15	11	0	9	0	17	11	17	9	9	0	9
0530-0600	8	8	8	0	8	11	9	13	0	0	2	0	9	9	0	0	13	8	8	8	0	24	9	13	8	11	0	17
0600-0630	0	8	0	8	8	13	13	9	0	0	8	0	8	9	0	9	11	5	0	8	4	24	22	18	8	5	2	9
0630-0700	0	9	9	9	8	11	11	11	0	2	8	0	5	13	0	9	13	9	0	2	5	28	24	21	9	0	0	0
0700-0730	0	11	9	9	5	21	9	4	0	2	8	0	8	15	13	15	13	9	0	11	11	26	28	18	11	9	9	15
0730-0800	8	15	17	9	11	11	9	8	8	0	11	4	5	21	17	21	15	8	5	11	9	24	28	24	13	8	8	9
0800-0830	8	5	26	8	13	13	9	0	8	5	15	8	15	22	18	21	17	8	5	9	13	31	31	24	13	8	8	9
0830-0900	9	8	31	21	22	15	13	11	4	8	13	11	9	18	18	18	17	9	9	11	17	35	31	30	17	9	9	8
0900-0930	8	15	21	9	17	15	21	9	5	5	9	17	9	18	18	18	22	11	9	17	11	37	39	31	26	13	18	11
0930-1000	15	21	24	13	22	15	15	18	9	9	9	21	5	24	17	22	15	13	9	9	13	39	42	30	24	21	17	18
1000-1030	13	24	28	21	21	26	17	15	9	13	9	13	11	24	22	21	15	15	9	9	15	37	35	33	28	18	17	11
1030-1100	21	30	22	17	26	22	24	17	9	13	13	15	11	22	17	17	15	11	9	9	11	42	39	31	28	17	18	13
1100-1130	26	26	21	11	24	24	30	22	8	11	17	13	13	26	17	21	17	15	8	11	13	44	22	30	24	17	17	21
1130-1200	24	24	18	24	24	24	26	17	11	13	8	17	9	26	17	15	9	17	9	13	13	42	24	31	22	21	17	15
1200-1230	24	28	18	15	24	21	26	22	13	13	8	13	13	22	18	17	15	15	13	11	17	42	35	28	24	18	21	5
1230-1300	30	30	9	17	33	28	26	22	11	17	13	18	11	21	13	13	11	21	11	13	18	46	24	28	30	21	18	24
1300-1330	31	30	9	18	21	28	30	18	11	21	11	11	8	26	18	17	13	15	11	15	18	42	30	24	24	28	24	26
1330-1400	30	28	9	30	26	28	28	21	15	24	13	13	13	24	15	30	11	17	9	17	21	37	31	28	28	30	31	15
1400-1430	31	30	22	24	24	31	31	21	15	18	15	18	26	24	18	22	13	17	13	18	26	35	30	26	18	24	31	15
1430-1500	26	33	22	33	30	33	26	22	18	26	11	22	28	28	21	26	15	21	11	18	22	30	31	33	28	21	31	22
1500-1530	28	30	24	28	30	31	28	22	21	24	22	15	28	28	21	22	22	22	15	21	30	31	39	33	30	24	30	24
1530-1600	31	31	26	28	28	33	26	21	24	30	22	22	28	26	18	24	28	22	13	21	31	35	35	31	31	28	28	21
1600-1630	30	33	26	28	33	30	22	22	28	61	22	30	28	26	26	26	26	22	26	28	28	35	37	26	26	22	31	22
1630-1700	30	30	30	26	33	30	21	17	26	33	30	26	28	24	24	21	30	24	26	20	30	30	31	35	26	26	31	28
1700-1730	30	28	24	26	31	31	26	21	28	35	30	31	30	30	28	18	31	30	31	33	31	31	33	28	24	26	28	21
1730-1800	30	28	28	24	35	30	21	21	28	35	35	26	26	28	28	28	31	26	31	30	30	25	30	24	17	21	21	15
1800-1830	30	28	26	21	33	31	17	18	26	33	31	22	28	26	28	26	33	28	28	26	30	39	26	26	21	21	21	15
1830-1900	28	26	28	24	31	28	17	18	28	31	31	21	24	22	28	22	30	26	30	31	30	31	28	30	31	24	24	9
1900-1930	24	21	21	26	33	18	17	13	24	26	28	22	21	18	22	17	31	15	24	24	30	30	35	28	30	17	17	0
1930-2000	21	15	15	21	21	21	13	18	22	30	24	22	21	17	22	17	26	17	21	22	24	35	30	21	24	21	21	17
2000-2030	17	18	11	18	28	17	11	13	24	22	28	18	15	18	13	18	24	17	18	17	24	31	17	18	15	22	22	13
2030-2100	15	13	13	17	30	11	13	11	21	21	24	17	15	15	18	17	18	13	18	15	17	21	17	15	15	21	21	18
2100-2130	17	11	9	13	31	9	9	15	17	17	18	15	13	13	17	13	11	13	13	15	21	22	17	21	15	13	13	11
2130-2200	15	11	9	13	22	11	8	9	15	18	11	13	11	9	11	11	8	13	13	15	17	26	15	13	15	9	9	18
2200-2230	15	13	9	13	18	9	9	11	15	17	8	11	17	13	8	11	4	9	11	15	13	26	17	9	13	2	2	11
2230-2300	11	11	9	13	17	9	13	9	15	15	4	5	11	11	8	5	0	5	11	13	11	30	21	17	17	5	5	11
2300-2330	11	11	9	11	11	9	11	9	4	17	0	5	15	9	8	8	0	8	11	13	13	24	17	21	13	8	8	9
2330-0000	9	11	8	9	17	9	11	8	0	15	4	8	13	8	0	9	8	9	11	11	15	24	17	17	13	8	8	11

Amberley (040004) Wind Data – Km/hr

March	Day																														
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	9	17	9	0	7	9	7	11	6	7	9	6	2	11	9	9	9	7	6	11	13	7	9	7	0	9	0	0	9	4	19
0030-0100	11	19	2	7	11	11	2	9	7	0	7	0	2	7	9	2	11	7	6	9	7	7	7	7	6	7	0	0	4	0	13
0100-0130	13	11	11	7	2	6	7	11	0	0	7	0	0	7	9	9	6	6	0	2	9	6	9	9	6	6	9	0	4	0	7
0130-0200	9	13	9	9	13	9	4	4	6	7	7	0	6	0	9	7	7	7	0	0	2	7	7	2	0	0	7	0	6	15	20
0200-0230	9	19	11	9	11	9	4	13	7	0	9	0	6	7	2	11	4	7	0	0	7	6	0	7	4	0	9	0	9	6	26
0230-0300	13	17	13	9	9	9	11	6	7	0	9	9	6	2	9	9	7	7	7	4	9	2	2	0	0	0	9	0	2	6	17
0300-0330	9	20	7	7	9	13	9	6	7	0	7	9	7	6	9	9	11	0	9	4	11	9	2	0	0	0	9	6	7	9	9
0330-0400	11	9	6	6	6	11	0	13	9	0	6	17	7	7	0	9	2	0	9	0	2	9	0	0	0	6	11	0	6	13	7
0400-0430	17	15	11	11	7	11	0	9	9	0	7	15	7	7	0	0	6	0	9	0	4	9	0	7	0	0	7	0	7	7	7
0430-0500	13	17	9	7	4	11	0	7	9	0	0	9	6	2	0	2	0	6	0	0	0	9	0	0	0	6	11	4	9	6	11
0500-0530	13	13	9	7	6	6	0	0	11	4	0	11	2	2	2	7	0	0	0	0	0	11	0	0	0	0	19	6	6	0	13
0530-0600	9	13	6	0	0	0	0	0	9	4	0	0	0	7	0	9	0	0	4	0	0	7	0	0	2	0	30	7	0	0	9
0600-0630	11	7	6	7	0	4	9	0	6	0	2	13	0	9	0	7	0	0	0	0	0	4	0	0	6	7	26	0	6	4	15
0630-0700	11	7	7	7	7	7	6	6	0	0	0	11	0	6	0	9	0	6	0	0	0	7	7	0	0	6	19	0	0	7	15
0700-0730	15	9	9	7	9	0	0	0	9	0	0	11	0	7	9	6	6	7	0	0	0	7	7	0	13	9	15	0	0	0	7
0730-0800	11	9	9	11	7	0	9	6	9	6	7	9	9	9	7	9	7	7	0	7	0	6	2	9	13	11	15	0	9	2	11
0800-0830	11	11	11	11	9	6	7	7	2	7	9	15	7	6	9	9	9	9	2	6	2	7	4	6	15	13	11	9	11	2	13
0830-0900	13	7	9	20	20	6	15	7	4	7	9	13	6	9	6	9	7	9	4	4	9	7	4	9	17	11	11	13	13	9	11
0900-0930	15	0	7	24	19	7	22	13	9	2	11	9	6	11	9	6	6	7	9	6	9	4	7	6	17	11	0	17	9	9	11
0930-1000	13	7	13	24	19	9	19	24	11	9	13	11	9	11	9	11	7	9	9	7	9	6	9	9	15	11	7	13	9	9	9
1000-1030	20	11	20	24	17	9	19	24	13	6	15	13	9	17	7	11	4	11	7	7	11	9	11	6	15	7	11	13	19	11	9
1030-1100	17	9	22	22	13	7	15	24	17	6	17	19	11	17	7	13	7	11	6	7	11	7	13	6	13	13	19	13	17	11	11
1100-1130	15	17	20	22	24	9	15	24	13	9	15	22	11	15	11	9	11	9	9	9	11	6	9	13	13	11	17	13	19	9	9
1130-1200	19	20	19	24	19	11	15	24	15	13	11	32	15	15	13	11	9	11	13	11	11	9	11	11	11	9	13	13	13	15	11
1200-1230	17	20	13	24	19	11	13	20	13	9	9	19	13	19	11	11	4	9	11	6	13	9	13	17	11	9	15	19	20	15	7
1230-1300	17	20	7	26	20	7	15	20	2	9	9	26	13	22	11	11	11	11	11	9	7	13	15	13	13	9	17	22	19	13	9
1300-1330	22	26	28	26	19	11	17	24	11	9	13	30	13	22	11	11	11	6	7	9	7	11	15	11	13	9	22	19	20	19	7
1330-1400	24	30	24	24	19	15	28	28	13	11	7	32	19	22	4	11	13	32	9	7	11	11	13	13	17	13	26	20	20	17	9
1400-1430	30	26	22	26	19	11	20	22	17	15	15	28	24	22	22	13	9	20	9	9	9	26	15	13	11	13	22	20	22	22	7
1430-1500	26	24	28	26	19	6	20	32	17	13	9	30	30	24	35	13	15	15	11	6	11	24	15	9	11	13	22	20	24	19	7
1500-1530	24	30	30	28	20	17	20	33	20	9	24	24	32	28	28	7	24	20	6	9	17	22	9	11	11	17	24	20	24	19	9
1530-1600	28	35	28	32	20	24	20	30	19	22	24	33	33	28	28	11	22	13	13	26	17	28	9	11	19	17	17	17	24	24	9
1600-1630	28	26	30	28	20	30	30	28	24	24	26	30	35	28	32	13	28	13	7	32	20	28	13	11	19	13	15	20	20	24	9
1630-1700	28	30	26	30	24	28	30	24	22	28	26	28	33	26	28	11	19	13	9	35	30	20	9	15	20	13	13	22	24	15	2
1700-1730	22	24	22	28	22	32	28	26	28	28	26	24	33	28	30	9	9	15	9	28	32	22	9	24	22	11	13	17	22	26	13
1730-1800	24	15	28	30	24	26	30	28	24	28	24	26	33	30	20	11	9	9	7	26	20	20	9	17	20	7	11	17	17	22	9
1800-1830	15	15	24	24	24	24	30	22	26	24	28	22	30	26	24	13	11	15	9	26	24	19	7	19	19	11	15	15	15	17	9
1830-1900	19	17	17	28	17	22	28	22	24	20	26	22	22	24	17	11	15	13	19	26	22	15	17	17	19	11	13	13	17	19	19
1900-1930	15	24	13	22	20	17	24	19	26	19	19	17	26	22	15	11	9	11	17	22	28	19	17	15	22	9	11	13	17	13	17
1930-2000	17	19	13	17	22	9	20	19	26	17	20	9	19	17	6	13	11	11	17	20	22	11	17	9	20	7	11	11	15	20	13
2000-2030	17	11	13	15	17	9	17	17	19	17	19	7	13	20	6	11	9	15	13	17	17	11	13	13	17	0	11	7	13	20	15
2030-2100	20	9	9	9	17	9	17	11	19	13	11	4	15	17	9	11	11	9	15	13	15	15	15	9	17	6	7	9	13	19	13
2100-2130	13	11	7	9	17	9	17	11	17	11	11	0	17	17	9	11	9	0	11	11	15	7	13	9	17	9	7	13	9	19	13
2130-2200	20	6	9	9	13	11	15	7	17	13	9	0	13	17	11	2	9	2	9	13	11	7	11	9	15	0	4	11	13	11	9
2200-2230	19	9	2	9	13	11	15	7	13	15	9	13	13	20	11	6	7	6	7	9	9	7	11	9	13	4	6	7	7	9	7
2230-2300	17	7	7	11	6	9	17	7	15	11	9	7	13	20	9	6	6	9	2	11	13	4	7	6	9	0	4	0	11	17	7
2300-2330	13	2	13	9	7	9	17	7	11	7	4	9	9	6	9	7	9	7	11	11	13	9	7	6	9	9	7	9	9	19	9
2330-0000	19	7	6	9	9	2	13	4	9	9	9	9	4	15	6	9	9	4	11	11	7	9	7	0	9	0	4	9	7	2	7

Amberley (040004) Wind Data – Km/hr

April	Day																														
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
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0030-0100	0	0	13	9	13	9	2	0	7	4	0	6	9	13	6	11	0	0	4	2	9	0	4	9	11	4	0	0	0	0	
0100-0130	0	0	11	0	11	7	7	0	0	6	0	9	7	11	0	11	0	0	0	9	7	7	9	11	7	6	0	0	0	0	
0130-0200	0	0	9	9	6	4	6	0	2	0	7	7	0	6	0	6	0	0	0	9	13	0	9	1	9	7	7	0	0	0	
0200-0230	0	0	9	6	0	0	0	0	0	7	9	9	2	9	0	4	6	0	0	9	9	2	11	13	0	6	0	0	0	0	
0230-0300	0	0	7	7	0	7	0	0	0	7	7	6	0	7	0	0	2	0	0	11	11	9	9	9	4	0	0	0	0	0	
0300-0330	0	0	9	7	0	0	0	0	0	0	7	4	7	9	0	0	0	0	0	9	11	9	7	9	4	0	0	0	0	0	
0330-0400	0	6	7	0	0	6	0	0	0	0	0	0	9	7	6	9	0	0	0	11	11	9	4	7	9	0	0	0	0	7	
0400-0430	6	0	0	7	6	0	4	0	0	2	0	0	0	7	0	0	0	0	0	11	9	11	4	9	11	0	4	0	0	0	
0430-0500	0	0	6	0	4	6	6	0	0	15	7	6	0	2	6	4	0	4	0	9	7	11	0	9	7	0	0	9	0	6	
0500-0530	0	7	7	11	6	0	0	0	0	6	6	0	0	7	9	7	0	0	0	9	9	13	0	9	6	0	4	0	0	0	
0530-0600	0	7	0	11	0	0	4	0	0	9	6	7	0	9	0	6	0	4	0	4	9	9	0	9	7	6	6	9	0	0	
0600-0630	0	7	0	9	7	7	0	0	0	9	9	0	0	2	0	7	0	9	0	9	11	0	11	9	4	0	0	6	0	0	
0630-0700	6	0	0	4	0	0	0	0	0	6	2	0	0	0	0	0	0	0	0	11	9	0	9	6	2	0	0	0	0	0	
0700-0730	0	2	0	0	9	0	0	0	0	0	2	0	0	0	6	2	0	0	0	11	13	0	7	7	6	0	2	0	0	0	
0730-0800	0	0	9	6	11	0	0	0	0	0	11	7	0	0	9	0	0	0	0	9	13	13	9	7	6	0	0	0	7	0	
0800-0830	9	6	6	9	13	6	2	0	0	2	13	15	6	6	11	0	9	9	0	13	13	11	11	9	6	0	4	9	9	0	
0830-0900	9	7	15	11	15	6	7	6	6	7	19	17	13	9	13	7	11	11	9	13	17	9	11	9	7	6	2	9	9	6	
0900-0930	9	9	13	11	11	11	7	6	15	13	17	19	11	11	13	17	19	13	13	20	17	13	13	9	9	6	7	7	7	4	
0930-1000	9	17	19	13	20	9	7	6	15	11	11	13	11	11	11	17	17	17	28	17	19	26	17	19	6	9	7	7	11	7	
1000-1030	13	17	22	17	22	7	9	9	15	6	11	22	17	11	13	13	15	13	24	20	22	35	22	15	7	9	9	6	17	19	
1030-1100	17	17	26	20	20	7	7	9	13	9	15	22	19	7	15	11	17	13	24	24	26	26	24	17	9	4	7	7	17	9	
1100-1130	17	17	28	20	20	9	4	9	9	13	20	17	20	13	9	11	17	11	20	26	26	28	20	15	13	9	9	9	13	17	
1130-1200	9	17	19	15	19	7	7	9	13	13	26	20	15	17	15	15	17	15	17	15	20	32	20	19	15	7	11	11	11	20	
1200-1230	15	20	20	15	15	9	9	9	15	11	20	20	19	15	13	15	11	9	28	20	22	32	24	19	17	9	9	7	20	17	
1230-1300	13	19	24	13	15	11	9	11	11	11	17	22	19	13	15	7	15	13	22	24	26	28	22	20	13	7	11	11	13	13	
1300-1330	17	26	20	13	15	6	7	9	11	17	22	30	15	17	15	19	17	13	24	20	26	28	20	20	13	6	11	9	15	17	
1330-1400	11	13	26	20	11	6	7	9	11	22	13	22	11	13	11	20	11	15	22	20	28	30	22	22	15	11	9	15	13	11	
1400-1430	13	7	24	15	19	6	7	7	13	17	17	15	15	11	13	13	13	13	28	17	26	33	22	22	15	7	9	9	15	7	
1430-1500	9	24	24	19	13	9	11	11	15	20	17	15	13	17	13	11	13	15	17	33	28	28	26	20	13	7	7	13	15	7	
1500-1530	13	19	20	19	13	9	11	9	13	22	19	11	19	11	13	28	26	9	24	13	26	35	22	19	20	6	13	11	15	9	
1530-1600	17	20	20	20	13	6	4	13	13	19	20	24	20	6	13	13	15	13	24	20	26	33	22	19	22	9	24	11	17	13	
1600-1630	13	15	26	26	13	15	24	7	11	20	15	15	30	7	9	9	19	19	17	28	26	30	20	20	24	9	24	9	17	17	
1630-1700	17	19	15	17	22	19	24	13	11	24	22	9	22	9	7	2	20	17	20	22	26	20	24	22	19	11	20	13	20	17	
1700-1730	17	22	17	22	22	20	20	17	9	22	17	11	17	13	11	7	20	17	13	17	20	26	20	22	22	7	24	13	19	13	
1730-1800	13	13	17	19	24	17	22	17	7	19	15	9	17	15	9	2	15	20	11	11	19	26	17	22	15	7	19	13	15	19	
1800-1830	17	9	17	20	17	19	20	19	13	17	19	17	11	11	13	7	13	22	7	9	20	20	17	15	13	7	15	22	13	15	
1830-1900	17	2	15	24	20	13	19	19	13	19	17	11	9	15	11	9	11	18	7	13	15	26	11	15	11	7	15	15	15	13	
1900-1930	13	17	13	19	17	13	17	15	13	20	7	6	11	13	11	9	9	17	15	13	11	13	13	11	11	7	13	9	11	7	
1930-2000	9	9	13	15	13	13	17	13	11	11	11	11	7	7	9	7	9	11	15	13	11	7	13	13	9	6	13	9	7	0	
2000-2030	7	9	11	17	2	11	19	11	11	22	9	13	20	7	9	6	7	6	9	13	7	9	11	11	4	6	9	15	0	7	
2030-2100	9	11	9	13	7	7	17	9	9	20	11	13	0	6	9	9	4	7	13	13	11	7	13	9	0	0	7	11	6	6	
2100-2130	7	7	9	11	9	7	11	11	9	17	7	13	9	0	6	7	7	9	15	9	7	13	11	11	6	0	9	9	0	6	
2130-2200	6	7	7	9	7	4	9	9	7	11	7	13	7	7	0	9	6	9	13	0	9	15	13	4	0	0	9	9	2	7	
2200-2230	0	11	4	11	6	9	9	7	2	11	7	9	0	7	0	7	6	6	15	7	2	17	11	7	6	6	7	0	0	0	
2230-2300	4	13	7	11	7	7	6	9	6	11	2	9	0	6	7	6	9	0	9	13	0	17	11	7	9	0	9	15	0	2	
2300-2330	7	13	9	11	6	9	6	0	0	9	4	9	2	7	0	0	6	0	11	9	7	9	11	7	9	2	7	7	0	0	
2330-0000	0	13	9	15	0	0	7	2	0	7	9	9	0	6	0	0	0	2	9	11	11	11	7	11	0	0	7	9	0	6	

Amberley (040004) Wind Data – Km/hr

May	Day																													
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	0	7	0	2	15	0	9	0	0	9	26	4	0	6	9	2	9	0	0	9	0	0	7	0	0	9	0	2	17	11	17
0030-0100	0	7	0	7	4	2	0	0	0	6	22	6	4	9	9	9	7	0	9	7	6	0	7	6	0	2	0	0	15	13	9
0100-0130	2	2	2	7	4	7	0	2	0	0	24	6	4	6	0	9	13	0	0	4	4	4	9	0	7	0	0	0	20	13	6
0130-0200	0	0	7	0	7	9	0	0	0	0	22	9	0	7	2	2	11	0	0	7	0	0	6	0	0	4	0	7	22	15	6
0200-0230	7	13	7	0	0	7	0	0	9	0	26	9	0	13	7	0	0	6	0	4	0	0	0	0	0	0	0	11	20	15	9
0230-0300	6	7	9	0	0	0	0	4	0	0	28	6	0	13	7	0	0	2	0	6	6	0	7	0	0	0	0	11	22	13	2
0300-0330	9	11	7	6	6	0	0	0	0	0	24	6	0	6	9	0	7	0	0	0	0	0	7	0	4	0	0	7	20	15	0
0330-0400	7	7	0	6	9	0	7	0	0	0	28	9	2	0	9	9	4	0	0	7	0	0	7	0	2	0	0	9	17	13	0
0400-0430	11	7	0	7	2	4	0	0	0	0	26	4	0	2	9	0	0	0	0	0	0	6	0	9	0	0	0	0	17	2	7
0430-0500	0	9	9	9	7	9	0	0	4	0	13	0	2	9	6	0	7	0	0	9	0	0	6	0	6	0	7	0	13	0	7
0500-0530	7	9	0	4	0	9	0	0	0	0	17	0	0	13	11	2	2	0	0	7	0	0	0	0	2	0	7	2	9	7	4
0530-0600	0	0	0	6	0	0	0	6	0	0	17	6	11	11	7	11	4	0	0	6	0	0	0	0	0	0	4	6	13	7	0
0600-0630	0	4	6	6	0	0	7	0	0	0	11	11	13	13	4	11	7	0	2	0	0	2	7	0	0	0	0	7	20	9	4
0630-0700	11	2	2	0	0	6	7	0	0	0	9	0	13	11	7	4	9	9	9	0	0	6	9	0	0	7	0	7	19	2	0
0700-0730	7	0	0	6	0	0	0	7	2	0	19	7	13	11	9	0	6	0	0	4	0	2	9	0	6	0	0	7	17	0	0
0730-0800	11	0	0	4	0	6	0	4	0	0	17	0	9	9	7	0	4	0	7	7	0	0	7	0	6	11	0	0	17	0	7
0800-0830	11	0	0	9	9	0	0	0	0	0	11	0	19	7	6	0	9	9	7	4	0	0	0	0	0	7	6	7	19	4	0
0830-0900	11	0	0	9	9	7	9	0	0	0	13	9	15	9	7	7	7	9	6	0	0	7	7	0	7	7	7	9	22	9	9
0900-0930	11	4	6	6	7	9	7	9	6	2	28	9	15	9	6	9	7	7	7	7	7	0	4	4	7	9	7	11	26	11	13
0930-1000	6	7	7	13	9	11	9	15	6	6	30	7	17	11	9	9	7	7	13	7	9	4	4	7	9	9	9	11	24	15	13
1000-1030	11	17	6	11	7	9	9	20	6	4	26	7	19	13	17	11	7	7	17	6	7	6	7	6	7	11	11	13	28	13	15
1030-1100	15	17	4	13	7	7	9	15	6	9	22	9	19	19	17	17	2	13	17	2	6	6	11	6	9	9	13	17	26	13	11
1100-1130	15	15	6	15	9	7	11	19	6	9	22	13	22	19	20	17	6	17	22	9	13	9	13	9	9	9	17	15	22	20	6
1130-1200	17	17	11	15	9	7	11	17	6	7	24	11	19	15	20	19	6	15	19	13	9	11	13	7	9	11	13	13	24	26	9
1200-1230	17	19	11	15	9	9	13	19	7	7	22	13	20	17	20	20	6	15	19	15	13	17	19	13	9	11	19	19	28	30	9
1230-1300	13	20	9	15	9	9	13	24	9	9	20	13	26	15	17	13	7	17	20	13	13	17	11	9	9	11	24	19	28	30	9
1300-1330	15	19	9	11	13	11	11	22	11	11	20	11	22	17	15	17	6	17	22	15	9	22	15	6	9	9	28	20	26	30	9
1330-1400	17	17	11	7	11	6	15	19	9	7	19	19	24	11	15	20	9	19	19	17	6	22	11	11	6	11	26	22	28	30	11
1400-1430	17	22	15	22	11	7	15	20	9	13	19	17	24	11	17	20	11	19	19	20	15	20	17	7	9	9	32	22	24	26	9
1430-1500	17	24	9	11	7	7	15	20	11	15	19	15	20	15	17	20	20	17	24	15	9	17	15	7	7	9	35	19	20	28	11
1500-1530	22	17	7	20	13	7	13	19	6	13	20	17	17	13	17	17	13	24	22	15	11	17	11	11	9	6	30	24	26	22	6
1530-1600	19	17	6	11	9	7	15	22	9	15	19	15	15	15	17	22	7	20	20	11	9	17	17	7	11	9	30	24	22	24	7
1600-1630	20	15	9	9	6	11	13	15	11	17	20	13	15	13	15	24	9	22	24	13	15	13	17	17	11	4	30	22	22	24	7
1630-1700	17	13	9	15	9	9	11	19	11	13	20	13	17	17	13	19	9	13	17	15	13	17	19	17	11	9	28	24	15	20	2
1700-1730	19	17	4	13	6	7	9	15	17	15	17	13	15	13	13	15	11	11	15	15	15	15	17	13	7	7	22	20	13	19	7
1730-1800	17	20	0	11	0	9	7	11	13	15	13	11	15	11	11	17	9	11	11	13	13	13	15	13	15	7	26	17	13	17	7
1800-1830	13	9	9	2	13	13	6	9	11	15	13	9	15	11	13	15	9	15	9	7	13	13	13	9	13	6	20	17	13	19	9
1830-1900	11	9	9	0	9	13	6	11	11	7	15	11	13	9	13	13	6	15	9	7	13	11	9	9	11	9	15	17	9	19	6
1900-1930	9	9	11	13	4	11	7	0	9	17	11	9	17	13	19	11	0	13	13	11	6	9	7	9	9	6	17	17	2	19	2
1930-2000	7	9	11	7	0	13	6	0	9	19	9	7	17	13	13	13	6	13	13	9	6	7	0	9	9	6	11	17	2	19	0
2000-2030	7	9	11	11	7	9	2	6	6	19	9	4	13	9	11	15	0	11	9	9	0	4	6	6	2	0	15	15	9	17	0
2030-2100	13	9	13	15	13	9	0	7	7	17	9	7	11	7	9	15	0	7	6	4	0	7	7	0	0	2	33	13	11	15	0
2100-2130	11	6	11	13	4	7	0	0	0	20	13	7	6	6	9	11	9	6	0	9	2	0	6	4	0	0	35	15	9	17	0
2130-2200	11	0	11	15	6	0	6	6	0	17	6	7	0	2	11	13	2	9	4	7	0	6	7	7	0	0	24	15	9	15	4
2200-2230	6	0	9	9	7	0	7	6	9	19	6	6	2	6	9	9	0	4	0	9	0	0	0	0	6	0	26	6	9	13	0
2230-2300	7	0	6	15	9	0	0	2	0	19	0	2	7	0	7	9	0	4	0	7	0	4	0	0	0	2	11	11	7	17	6
2300-2330	7	0	0	13	7	0	4	9	0	17	11	6	7	0	9	9	0	0	0	7	0	2	0	0	0	2	9	9	9	11	0
2330-0000	7	0	0	11	6	6	0	6	2	20	6	2	2	9	9	9	0	7	0	6	0	6	0	0	0	0	15	17	13	11	0

Amberley (040004) Wind Data – Km/hr

June	Day																													
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0000-0030	0	7	9	13	17	11	9	0	0	0	0	2	0	0	6	0	0	0	9	6	0	7	0	9	9	7	0	11	6	7
0030-0100	0	7	7	19	11	0	4	0	7	6	6	7	2	0	4	0	2	0	2	0	0	7	6	7	4	6	4	0	7	0
0100-0130	6	0	7	22	13	0	6	11	7	2	0	4	0	0	0	0	7	7	7	2	0	9	0	7	7	0	0	7	7	6
0130-0200	4	0	7	17	7	4	7	9	0	9	0	4	2	6	0	2	4	7	0	0	7	6	2	7	9	6	0	11	7	7
0200-0230	0	4	9	17	9	4	9	0	6	6	0	0	0	9	6	2	7	0	0	0	7	7	9	7	0	2	0	2	0	0
0230-0300	0	2	6	20	9	4	7	9	7	0	0	0	0	9	7	0	9	0	0	0	6	0	0	0	0	4	0	7	0	7
0300-0330	0	9	6	19	0	2	9	7	0	0	0	0	0	2	0	0	2	9	6	4	0	4	0	7	7	0	0	7	0	2
0330-0400	2	0	0	20	0	7	9	0	0	9	0	0	4	9	0	0	9	9	0	0	7	4	0	6	7	6	0	9	0	0
0400-0430	0	0	6	17	4	9	2	0	0	0	7	6	4	11	0	0	7	7	0	0	0	6	0	4	0	6	11	0	0	6
0430-0500	0	0	0	15	4	9	0	0	9	0	0	4	4	7	0	0	7	9	0	2	0	0	0	7	6	4	7	6	6	9
0500-0530	0	0	7	17	0	0	2	11	2	0	4	0	0	7	0	0	0	0	0	0	0	7	0	11	0	7	13	0	2	7
0530-0600	0	0	0	17	0	11	6	7	0	0	0	0	0	0	0	0	6	0	0	2	0	9	9	2	0	6	11	6	7	2
0600-0630	0	0	0	15	0	0	9	2	0	0	6	0	0	9	0	0	0	0	0	7	0	9	0	9	0	2	6	6	2	6
0630-0700	0	0	7	13	0	9	0	0	0	0	0	0	9	0	0	7	2	6	7	7	6	9	0	9	0	13	13	7	0	9
0700-0730	0	6	0	9	7	2	7	0	0	0	7	0	6	6	0	6	2	0	0	2	7	0	0	7	4	9	7	2	0	9
0730-0800	4	7	0	17	6	9	0	0	0	0	7	0	0	0	0	0	6	0	9	7	9	0	6	2	0	7	9	0	0	6
0800-0830	7	9	13	20	9	6	0	0	0	0	6	0	6	0	7	0	7	7	4	7	4	7	0	7	0	9	4	0	0	0
0830-0900	2	11	15	28	7	7	0	0	0	7	4	2	4	4	7	0	11	2	6	9	7	7	11	11	7	13	13	7	2	7
0900-0930	2	15	17	20	11	7	17	0	6	7	2	7	4	6	2	6	15	6	0	9	6	11	7	13	4	11	15	9	7	0
0930-1000	7	15	13	35	11	13	24	0	4	7	4	6	6	13	7	0	17	2	6	9	6	11	9	19	11	11	17	11	9	7
1000-1030	9	15	11	24	13	11	24	0	6	7	6	6	6	13	4	6	17	9	6	13	9	19	9	22	11	9	17	15	9	7
1030-1100	7	19	19	26	11	11	22	9	4	9	9	7	9	15	6	0	17	9	11	13	11	15	7	26	26	13	26	15	9	9
1100-1130	7	17	30	28	17	7	26	0	7	9	6	7	15	11	6	2	17	9	11	13	11	13	6	32	28	15	24	22	9	9
1130-1200	9	20	28	30	15	9	20	7	7	11	7	9	13	11	9	4	17	7	9	15	13	17	9	28	24	17	28	26	11	11
1200-1230	9	20	30	30	15	15	13	7	9	9	7	11	13	13	6	9	17	9	9	13	17	15	7	26	30	15	17	26	17	11
1230-1300	9	15	24	44	15	9	15	2	7	9	6	9	15	15	7	6	13	11	6	13	24	15	9	28	24	13	24	32	7	9
1300-1330	7	6	30	32	19	9	13	11	7	13	6	11	13	15	9	0	13	11	7	11	28	17	11	26	20	11	17	24	22	9
1330-1400	9	11	28	41	9	13	20	9	9	13	9	15	17	13	7	7	11	9	7	9	26	13	9	24	20	11	28	26	20	11
1400-1430	9	13	28	33	17	11	17	9	7	15	6	9	17	7	9	7	13	6	11	9	22	13	9	30	24	15	20	22	20	11
1430-1500	7	13	26	33	17	9	0	7	7	11	6	13	13	6	7	4	9	7	9	7	22	15	11	32	17	20	26	22	17	7
1500-1530	7	13	24	33	20	2	15	9	6	13	13	15	13	9	7	9	6	7	11	9	19	11	7	32	13	22	24	24	19	7
1530-1600	7	15	28	35	13	9	2	0	6	13	13	15	6	11	17	9	9	7	7	9	19	15	9	30	13	17	22	20	17	7
1600-1630	9	11	24	32	15	9	9	0	4	13	13	13	13	11	19	7	15	7	11	11	19	13	11	26	15	13	24	22	19	9
1630-1700	11	9	20	28	17	4	9	0	7	7	17	7	15	11	17	11	13	7	7	9	19	11	17	22	20	11	30	13	13	6
1700-1730	11	9	24	22	13	7	11	7	7	7	15	9	11	7	13	9	9	11	7	6	17	9	11	22	17	11	15	13	11	2
1730-1800	6	13	17	20	9	0	9	0	15	4	17	11	6	9	15	2	9	9	7	0	17	9	9	26	15	11	9	19	9	2
1800-1830	6	11	17	20	9	0	11	0	13	7	13	13	6	20	15	9	11	9	13	0	17	9	17	19	15	7	11	11	7	6
1830-1900	11	9	13	20	9	0	9	0	11	6	13	11	2	20	13	4	9	2	13	0	13	11	17	15	13	7	9	11	6	0
1900-1930	6	7	17	15	9	7	0	0	11	4	13	9	2	17	4	7	6	0	13	0	6	11	11	11	13	0	7	15	9	0
1930-2000	4	7	15	13	11	7	2	7	11	7	9	7	9	17	9	11	6	6	15	0	4	0	9	11	17	9	11	11	4	0
2000-2030	9	7	13	11	9	0	9	7	9	0	7	0	7	19	7	13	4	0	13	0	11	9	7	7	11	11	0	9	7	0
2030-2100	0	7	13	11	6	7	0	9	9	0	4	0	7	17	7	11	0	0	11	0	7	13	0	7	19	9	11	11	7	0
2100-2130	0	7	19	6	6	9	0	7	9	0	0	7	0	15	6	0	0	7	7	0	9	11	7	6	11	9	11	9	0	0
2130-2200	7	9	20	9	0	7	2	9	7	0	0	7	6	11	4	11	0	6	6	0	11	6	4	0	9	11	7	6	9	6
2200-2230	7	6	22	7	0	0	0	6	0	0	0	0	0	13	0	6	0	0	4	4	9	0	0	6	7	11	4	9	4	4
2230-2300	0	9	22	13	7	2	0	4	7	6	2	6	0	7	6	0	2	7	0	0	11	0	2	13	11	7	0	13	0	6
2300-2330	0	9	20	13	9	0	6	7	0	2	2	7	6	11	0	0	2	2	2	0	11	9	9	0	6	0	2	9	0	0
2330-0000	0	11	17	13	11	0	7	6	0	4	6	0	0	11	0	0	2	0	6	7	9	4	4	0	4	0	6	2	9	4

Amberley (040004) Wind Data – Km/hr

July	Day																														
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	6	4	0	7	11	19	6	6	0	0	0	7	0	7	0	0	0	0	0	0	0	0	0	0	2	0	0	4	0	0	11
0030-0100	6	4	0	7	6	13	9	6	7	7	0	0	0	17	0	0	0	0	0	0	7	0	7	0	0	0	0	9	0	0	11
0100-0130	0	0	0	6	0	19	9	0	4	7	0	6	0	13	0	0	2	7	0	0	0	0	0	4	0	6	0	9	7	6	11
0130-0200	4	0	0	9	0	9	9	7	9	0	0	0	0	11	0	9	0	6	2	0	2	0	6	0	4	0	0	6	9	0	11
0200-0230	0	0	0	0	0	11	13	7	9	0	0	11	13	20	0	0	0	6	6	0	4	0	0	4	0	0	0	2	6	0	6
0230-0300	4	4	0	0	9	7	9	0	7	0	0	19	15	9	4	7	0	0	7	0	0	0	0	4	9	0	2	0	0	0	0
0300-0330	0	7	0	0	4	11	9	0	0	4	0	13	20	4	7	0	9	9	0	0	0	0	0	0	0	0	0	9	9	0	2
0330-0400	13	0	0	0	9	11	4	9	0	2	9	7	19	11	2	0	9	7	0	4	0	0	0	0	0	0	6	9	0	0	11
0400-0430	11	9	0	0	9	9	0	7	0	6	7	20	15	7	0	0	9	4	7	0	6	0	0	6	0	0	0	11	0	0	13
0430-0500	7	2	9	0	9	9	0	7	0	0	0	4	15	9	9	0	4	6	0	9	0	9	0	4	0	9	0	11	0	7	0
0500-0530	4	0	0	0	13	9	7	0	6	7	0	0	17	15	9	7	0	9	0	2	0	0	7	7	0	6	0	9	9	0	0
0530-0600	2	0	0	9	0	13	11	9	0	2	0	0	26	7	11	0	6	9	6	0	2	7	0	7	7	0	0	7	7	0	0
0600-0630	0	0	0	11	13	6	0	7	0	0	0	7	19	2	7	0	0	9	0	0	7	0	0	0	0	0	0	0	0	0	0
0630-0700	7	0	7	9	17	19	4	7	7	0	0	9	17	4	2	0	2	4	9	0	2	2	4	2	0	7	0	6	0	7	0
0700-0730	0	0	0	9	11	13	7	4	6	7	0	9	17	0	7	0	0	0	0	0	7	6	0	0	0	0	0	0	9	9	0
0730-0800	0	0	0	2	9	15	13	11	4	7	7	2	17	0	9	0	0	4	6	0	0	7	2	7	0	0	0	0	7	0	0
0800-0830	6	0	0	6	7	13	2	9	9	7	4	6	17	7	11	9	9	2	0	0	0	6	0	9	0	2	0	0	0	0	0
0830-0900	2	2	2	9	13	13	9	2	7	7	0	7	20	11	22	7	4	11	0	2	7	0	0	9	2	6	4	7	6	6	13
0900-0930	11	7	7	15	19	11	11	6	7	2	7	22	20	9	22	7	6	17	4	7	2	4	7	6	2	6	4	6	6	7	17
0930-1000	11	6	7	13	24	11	11	7	7	6	9	30	24	11	26	22	6	15	7	2	7	2	6	6	7	6	6	7	7	9	13
1000-1030	7	9	7	13	28	13	7	9	7	13	7	28	26	11	26	24	7	11	6	7	9	6	9	9	7	7	9	7	7	9	17
1030-1100	9	6	6	30	30	9	9	7	4	9	19	24	33	13	24	19	7	11	7	6	9	7	9	7	9	9	7	6	7	9	22
1100-1130	15	9	7	28	28	11	11	0	9	13	22	24	35	15	28	19	9	11	7	6	6	7	9	9	11	6	13	4	9	11	19
1130-1200	13	4	24	22	22	20	15	9	9	13	24	20	33	15	24	17	9	11	6	9	7	6	9	13	15	7	11	7	6	11	13
1200-1230	15	7	17	32	26	26	15	4	9	20	19	22	32	13	28	19	9	13	7	9	11	11	11	17	11	9	13	11	7	11	13
1230-1300	17	7	19	30	30	28	17	4	13	19	30	22	35	9	28	17	9	9	13	7	9	7	9	22	9	9	17	11	7	7	19
1300-1330	26	7	20	33	28	26	20	2	9	26	24	26	41	7	35	17	9	17	11	11	11	7	9	24	11	13	13	9	9	6	17
1330-1400	22	7	20	26	20	20	19	6	4	20	28	22	37	9	24	17	9	19	11	13	11	11	11	24	6	13	11	11	13	11	19
1400-1430	17	11	22	30	30	28	24	6	11	24	30	19	30	11	26	15	11	17	11	11	11	11	13	30	9	11	15	7	11	13	19
1430-1500	19	6	26	28	22	28	22	4	9	26	33	17	32	7	28	13	9	19	7	17	11	6	11	28	9	11	17	9	9	13	17
1500-1530	19	15	28	28	20	24	20	2	9	28	24	15	33	6	32	17	6	20	11	17	13	9	11	28	17	11	19	9	6	13	19
1530-1600	17	11	26	32	17	24	19	2	9	19	28	20	32	6	22	13	11	15	9	17	11	7	11	24	17	13	13	13	0	13	24
1600-1630	11	11	15	17	22	20	17	7	9	24	28	19	32	4	24	15	11	15	9	17	20	11	13	30	24	9	17	17	6	20	17
1630-1700	19	11	19	15	20	20	11	0	9	17	22	15	33	9	20	15	9	15	9	13	19	11	11	24	24	7	15	28	0	17	22
1700-1730	15	17	17	9	22	19	11	0	9	13	15	17	32	9	22	13	9	13	7	13	19	19	13	19	22	9	11	24	7	22	22
1730-1800	13	11	15	7	17	15	11	0	4	9	11	13	32	9	19	9	7	13	6	17	17	15	7	19	24	11	13	19	13	19	15
1800-1830	13	11	19	0	17	19	11	0	2	9	13	13	20	4	17	9	9	11	2	13	15	15	2	17	19	17	11	19	19	19	11
1830-1900	13	6	13	9	24	11	13	0	0	9	15	11	11	13	13	15	2	17	9	11	15	11	13	19	19	19	11	19	19	17	13
1900-1930	13	6	11	9	19	13	15	7	9	4	13	7	15	17	13	15	0	9	6	11	11	9	13	17	19	11	11	17	19	13	17
1930-2000	11	4	9	9	19	11	13	9	9	9	15	9	22	15	11	2	0	0	0	9	7	17	9	15	13	11	6	15	15	9	11
2000-2030	11	0	4	11	15	9	11	6	11	0	17	11	22	7	11	6	6	0	0	9	6	13	0	4	13	7	0	13	13	13	7
2030-2100	15	0	0	9	17	9	11	0	11	0	15	9	20	7	13	6	2	9	0	9	7	11	4	9	9	7	0	0	13	13	11
2100-2130	9	0	0	7	20	7	9	0	7	7	15	17	15	9	9	7	7	6	0	4	11	11	4	13	7	0	6	0	13	0	7
2130-2200	9	0	7	4	24	0	2	0	2	6	11	9	19	4	0	9	0	6	7	0	0	2	4	11	2	2	4	6	4	6	7
2200-2230	11	0	7	9	17	6	6	0	11	0	9	13	13	11	2	9	0	0	4	6	0	4	7	7	0	6	2	0	2	6	7
2230-2300	7	0	9	9	15	2	9	0	0	9	11	13	6	11	7	0	0	2	4	6	6	0	0	7	0	0	0	6	9	9	6
2300-2330	0	0	11	13	17	4	9	0	6	2	9	7	13	0	2	4	4	6	0	0	4	0	6	15	0	2	2	2	0	4	0
2330-0000	6	0	9	9	20	11	11	2	9	0	13	0	17	7	0	0	0	9	6	0	0	0	7	7	0	2	4	0	0	11	0

Amberley (040004) Wind Data – Km/hr

Aug	Day																														
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	0	0	0	4	2	0	7	2	11	15	26	20	9	7	0	0	0	9	0	0	6	13	2	4	0	0	0	17	0	0	9
0030-0100	0	7	0	0	0	7	0	0	15	15	33	19	0	0	2	6	0	7	0	6	4	9	0	0	0	0	2	0	6	9	9
0100-0130	0	13	4	0	0	0	2	0	17	17	33	17	0	0	2	0	4	7	2	9	7	11	0	0	0	6	11	9	0	4	9
0130-0200	4	9	0	0	0	0	2	0	20	17	26	17	7	2	0	0	0	2	0	4	2	17	2	7	0	0	4	9	11	7	9
0200-0230	0	13	0	0	0	0	0	0	21	17	13	15	0	0	0	6	0	7	0	13	0	13	6	4	0	0	0	7	6	0	13
0230-0300	0	7	0	0	0	0	0	0	22	19	17	15	2	0	0	0	0	0	0	7	0	17	0	7	0	0	0	9	0	4	7
0300-0330	0	7	0	0	0	0	0	0	22	17	9	22	0	0	0	0	0	0	0	7	0	17	7	0	0	0	4	11	0	0	9
0330-0400	0	0	0	0	6	2	0	0	22	20	13	24	0	0	0	0	0	2	0	0	2	19	9	0	0	7	0	9	7	6	9
0400-0430	0	0	0	0	0	6	0	0	19	20	9	17	0	0	0	0	0	6	0	6	6	17	9	7	0	0	7	0	0	0	2
0430-0500	2	0	0	0	7	0	0	0	21	19	11	15	7	0	0	0	9	0	2	2	4	17	15	0	0	0	6	0	11	0	0
0500-0530	4	0	0	7	0	0	6	2	25	19	15	15	0	0	0	0	7	0	4	4	2	19	15	0	0	0	0	2	11	4	0
0530-0600	7	0	0	7	0	0	0	2	28	20	15	15	7	0	0	0	4	0	6	0	13	17	9	0	6	0	0	11	17	6	0
0600-0630	0	0	0	7	0	0	0	0	26	19	17	17	6	0	0	4	7	0	0	0	19	7	9	6	0	0	0	9	7	0	0
0630-0700	6	7	0	0	4	0	0	9	24	19	17	15	0	9	0	4	0	0	0	0	17	7	9	0	0	0	0	9	6	0	0
0700-0730	0	7	0	2	0	0	0	0	24	19	22	11	0	0	0	0	0	0	9	0	9	9	11	0	0	9	2	9	6	2	6
0730-0800	0	0	0	0	0	0	0	2	28	22	24	9	0	0	0	0	9	0	2	0	17	2	2	0	0	0	7	11	7	0	7
0800-0830	9	0	9	2	0	0	0	4	22	22	22	6	2	2	2	0	9	0	2	4	17	11	9	0	6	0	2	9	7	0	6
0830-0900	19	7	6	7	6	0	0	9	22	22	22	13	7	4	0	2	9	2	9	7	9	17	17	2	7	4	6	13	2	9	9
0900-0930	22	9	4	2	7	7	0	11	30	28	28	15	6	4	6	6	7	6	9	9	24	24	19	6	7	7	4	13	7	9	7
0930-1000	20	20	2	7	6	9	6	11	30	32	32	13	7	6	4	6	6	4	17	9	20	22	17	7	7	6	6	11	17	7	7
1000-1030	15	19	7	6	6	6	0	11	24	32	35	13	9	6	6	6	9	13	20	9	20	30	19	9	13	9	4	9	19	6	6
1030-1100	13	15	7	7	7	7	11	9	35	35	33	13	9	7	7	13	11	19	17	9	15	30	15	9	13	7	7	13	19	7	9
1100-1130	11	15	6	7	6	6	6	9	33	33	35	20	9	11	7	15	11	17	17	9	17	33	11	7	15	7	7	13	15	6	7
1130-1200	13	17	7	6	11	6	9	6	41	39	37	20	9	11	6	11	11	19	22	11	22	35	17	7	13	7	11	11	15	11	9
1200-1230	13	15	9	6	9	7	6	17	30	39	37	15	9	15	9	11	13	17	30	9	24	32	13	11	17	9	11	13	15	9	9
1230-1300	15	15	9	2	11	7	9	24	37	39	33	9	6	13	7	11	15	15	32	9	24	35	11	13	9	9	13	11	13	9	11
1300-1330	11	15	11	9	15	9	13	30	32	32	35	13	11	9	9	9	13	7	32	9	28	33	15	9	15	7	13	9	13	9	9
1330-1400	9	7	9	9	9	9	11	32	37	39	37	13	9	13	2	15	11	17	32	13	28	33	17	9	13	9	9	7	11	11	11
1400-1430	19	11	9	11	13	7	17	26	41	33	33	11	9	13	11	15	9	17	32	9	28	30	15	11	11	7	11	11	13	13	15
1430-1500	15	6	9	9	15	11	13	32	37	37	33	9	13	28	9	15	13	17	33	9	30	28	13	7	6	9	17	13	9	7	13
1500-1530	7	7	9	9	15	9	20	30	32	35	33	11	11	20	7	19	15	19	33	9	32	28	7	9	9	6	15	17	11	7	13
1530-1600	9	4	15	9	13	15	13	32	35	35	33	11	11	20	7	11	13	17	30	11	33	32	13	9	7	6	17	9	11	9	13
1600-1630	11	9	17	13	15	17	15	30	33	37	33	9	22	19	11	7	17	22	32	9	28	30	9	6	6	9	22	9	9	22	13
1630-1700	17	13	13	13	15	20	13	24	30	39	33	0	20	20	20	7	7	24	30	9	28	26	11	20	19	28	17	2	11	26	24
1700-1730	17	15	24	24	20	20	17	22	24	32	28	7	20	17	17	9	11	22	24	7	24	30	11	22	19	28	20	9	11	26	24
1730-1800	17	9	20	17	17	20	11	30	17	24	20	6	15	15	17	13	6	24	24	4	17	28	11	20	17	20	19	7	11	20	24
1800-1830	11	7	19	19	13	17	15	20	13	28	17	20	13	13	15	13	0	24	30	9	15	22	20	22	15	24	19	0	7	26	22
1830-1900	7	0	17	19	9	15	9	20	13	28	15	19	17	9	11	11	13	20	17	7	19	26	15	17	11	24	13	0	2	26	24
1900-1930	7	11	15	17	9	13	2	17	15	28	13	17	15	7	11	7	13	17	17	0	13	22	15	13	9	19	13	0	4	20	19
1930-2000	7	7	13	17	9	11	2	15	13	24	13	13	11	2	9	6	7	15	17	9	17	15	17	13	9	19	11	0	9	19	17
2000-2030	9	7	11	13	7	13	17	15	9	24	15	13	11	2	7	7	7	13	20	7	15	13	15	11	9	17	15	6	7	11	13
2030-2100	0	2	0	11	6	11	13	13	11	32	17	11	9	4	0	0	0	13	17	2	15	9	11	9	6	15	17	2	6	7	11
2100-2130	0	0	6	7	7	7	7	17	11	35	22	2	6	6	9	0	6	11	13	0	19	7	7	6	7	13	11	0	0	0	0
2130-2200	9	7	6	9	0	9	0	19	13	28	22	2	9	0	0	0	0	7	15	0	17	13	7	9	9	13	9	0	0	7	2
2200-2230	7	0	0	0	7	9	7	21	13	28	22	11	7	0	0	0	0	4	11	0	13	13	6	0	13	13	7	0	0	0	9
2230-2300	9	4	0	0	0	2	7	13	15	24	22	9	0	0	6	11	2	0	15	0	15	7	9	7	4	4	9	0	6	2	7
2300-2330	6	7	9	7	0	7	6	13	13	28	26	7	0	0	0	6	0	0	7	0	13	7	6	7	4	0	7	6	2	9	0
2330-0000	6	0	9	7	0	2	7	11	13	22	26	7	6	4	0	6	7	0	0	7	19	2	7	0	0	6	6	0	0	11	2

Kingaroy

Kingaroy (040922) Wind Data – Km/hr

January Day

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	2	5	8	4	9	5	9	9	5	0	5	8	5	11	8	8	8	5	2	5	0	5	8	8	-	2	4	8	-	9	9
0030-0100	8	2	5	2	8	8	9	11	9	5	5	8	5	9	8	11	-	0	0	0	5	5	2	5	8	2	4	9	9	11	5
0100-0130	9	8	5	8	9	5	11	11	9	0	8	8	8	11	5	9	8	5	0	0	2	0	0	5	-	2	4	11	5	9	0
0130-0200	9	4	0	5	0	2	11	8	8	0	8	5	0	9	8	4	-	0	5	0	8	8	0	5	0	8	11	11	8	4	0
0200-0230	0	4	0	8	9	5	13	9	5	0	2	8	0	11	8	5	0	0	2	0	8	0	2	4	-	9	8	8	8	8	5
0230-0300	2	5	11	2	8	0	11	9	4	8	0	9	0	11	9	8	5	0	8	5	5	0	4	9	4	5	9	8	-	8	5
0300-0330	0	5	9	0	8	0	8	8	5	9	5	8	5	0	8	0	8	8	5	8	5	0	0	8	4	2	9	9	-	8	5
0330-0400	4	5	8	0	8	0	9	11	0	13	4	5	9	5	0	0	-	9	0	0	0	0	0	13	4	5	2	9	-	9	4
0400-0430	5	8	8	2	8	0	11	11	11	11	5	9	5	9	9	0	-	4	0	0	8	0	0	9	5	0	5	9	5	8	0
0430-0500	2	0	9	0	8	5	9	9	13	5	9	9	4	9	5	2	5	5	2	5	11	0	8	5	0	5	8	11	-	9	0
0500-0530	2	0	8	2	5	9	9	9	13	9	9	9	2	5	11	4	4	0	8	8	9	2	8	2	2	0	5	5	-	9	4
0530-0600	4	0	5	5	5	8	9	15	9	8	5	8	5	8	8	0	5	0	2	8	4	9	0	5	2	0	8	8	2	9	5
0600-0630	0	0	8	8	9	11	11	9	5	5	5	9	5	8	5	0	8	4	0	0	5	4	0	5	5	0	8	8	11	8	0
0630-0700	8	0	9	8	9	11	9	8	9	8	9	13	8	5	5	5	8	0	8	5	11	5	0	9	-	5	8	11	11	5	4
0700-0730	9	0	11	13	9	-	11	13	8	13	13	11	13	11	9	13	13	2	8	8	9	9	2	9	0	2	9	11	11	5	11
0730-0800	13	9	13	9	15	11	13	13	11	11	15	17	17	15	11	9	13	11	4	9	13	13	11	8	2	11	13	9	13	9	15
0800-0830	11	13	11	15	9	13	15	21	13	8	21	21	17	21	11	11	13	11	8	8	13	15	13	11	9	9	13	13	9	11	15
0830-0900	11	11	15	13	18	15	13	13	17	8	18	22	21	18	11	11	15	11	9	17	15	15	11	8	9	8	15	15	9	11	17
0900-0930	13	11	13	13	18	15	21	15	9	9	17	24	24	21	9	8	11	9	9	13	17	15	11	4	11	11	13	11	17	13	13
0930-1000	13	11	15	17	18	15	18	17	11	9	18	18	17	24	8	9	11	11	8	17	15	15	13	8	11	13	13	15	17	15	13
1000-1030	9	13	13	15	13	17	21	15	9	9	17	13	17	21	5	9	11	17	5	21	17	8	9	5	13	8	15	17	13	17	15
1030-1100	15	11	13	22	13	18	17	17	8	13	17	17	17	24	9	11	9	11	9	17	13	11	8	9	11	15	13	15	11	13	15
1100-1130	11	11	15	22	13	18	18	15	5	13	-	15	15	22	11	11	9	13	13	18	15	9	11	8	9	9	13	15	18	21	18
1130-1200	5	17	17	13	15	15	18	17	11	13	-	15	21	24	9	11	11	17	9	15	15	17	9	11	9	5	13	15	17	18	15
1200-1230	9	13	15	15	17	13	13	11	11	13	15	15	24	24	15	9	-	15	11	15	13	11	9	13	13	19	15	18	18	22	17
1230-1300	11	13	13	17	13	15	15	17	13	15	15	17	17	17	9	9	-	17	9	15	-	9	11	9	11	9	15	15	18	26	18
1300-1330	13	13	15	15	13	15	21	15	13	18	17	17	13	18	9	9	13	21	11	15	13	15	11	9	11	15	18	13	18	24	13
1330-1400	13	15	17	15	15	18	21	15	11	9	15	15	18	18	11	9	13	15	13	15	13	15	9	9	11	13	17	15	17	17	15
1400-1430	9	9	13	17	13	17	24	13	8	8	13	15	26	11	18	15	11	17	11	8	13	17	9	18	9	18	17	13	17	17	13
1430-1500	17	15	15	18	13	17	17	13	5	8	17	18	21	17	11	5	11	11	13	13	18	11	9	11	11	15	17	17	21	15	13
1500-1530	17	11	13	15	11	17	17	13	11	18	17	17	21	11	15	8	15	18	13	15	17	17	9	24	13	11	18	18	15	17	17
1530-1600	13	13	13	15	13	15	21	15	8	9	15	15	18	15	9	21	18	18	11	17	13	17	11	9	11	18	18	-	21	21	13
1600-1630	15	15	13	21	13	21	18	17	13	9	21	18	21	17	9	18	11	18	13	15	17	15	15	9	13	13	15	17	21	21	15
1630-1700	15	13	13	18	15	21	21	13	11	5	18	21	18	17	17	15	13	11	13	15	15	13	11	11	9	11	18	17	15	21	15
1700-1730	13	17	18	15	11	21	18	15	18	4	21	17	24	18	17	17	11	13	13	17	24	13	9	13	11	13	18	15	15	17	13
1730-1800	13	17	11	15	13	22	17	11	17	17	22	18	21	18	17	15	13	11	15	17	21	13	18	11	11	11	17	17	15	18	13
1800-1830	11	13	11	17	15	22	21	11	9	18	22	18	22	17	15	15	11	18	13	17	22	13	13	9	17	15	17	17	13	17	13
1830-1900	11	15	9	13	13	21	17	13	11	17	21	17	21	22	13	15	15	15	15	13	21	11	13	11	11	13	17	15	17	15	17
1900-1930	9	13	9	11	9	17	22	11	11	17	18	13	15	17	15	17	15	13	13	11	13	13	13	9	13	15	13	13	17	13	17
1930-2000	9	13	11	9	5	13	17	11	9	11	17	13	13	17	11	13	15	11	9	13	15	11	13	11	13	17	17	13	15	13	13
2000-2030	9	13	13	11	11	13	13	11	11	8	13	9	15	9	11	13	15	9	8	9	13	13	13	17	13	13	13	13	13	9	13
2030-2100	11	11	9	13	9	15	15	11	9	9	13	9	13	9	9	13	15	9	8	9	9	11	13	15	9	15	11	15	17	13	11
2100-2130	9	13	8	9	13	13	13	11	9	5	13	9	11	8	11	8	13	11	2	8	11	15	11	9	8	13	15	13	17	11	11
2130-2200	9	11	8	8	8	13	15	11	8	5	17	5	13	9	11	9	13	13	5	5	9	13	9	8	5	13	11	13	15	9	5
2200-2230	9	9	5	8	5	9	15	11	9	8	9	8	13	11	9	9	11	9	9	4	9	9	8	9	22	11	11	11	17	9	0
2230-2300	8	8	8	9	5	13	13	8	9	8	9	4	13	11	4	8	9	9	5	4	13	9	5	5	8	9	8	9	15	9	5
2300-2330	8	9	9	8	5	9	13	9	2	5	9	8	9	5	5	2	5	5	2	0	9	9	5	-	8	9	9	11	11	11	4
2330-0000	5	8	9	9	2	8	13	9	2	5	9	4	13	5	5	8	4	4	9	2	5	8	9	-	5	5	9	9	11	9	9

Kingaroy (040922) Wind Data – Km/hr

February Day

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28			
0000-0030	5	9	13	11	9	13	13	-	5	2	15	9	9	18	21	11	8	9	5	0	13	18	24	18	11	13	9	8			
0030-0100	4	11	9	9	13	15	15	15	0	5	9	5	9	18	22	13	8	8	5	4	15	18	22	17	13	11	8	8			
0100-0130	8	8	8	8	9	13	15	13	0	0	11	2	8	-	18	13	9	8	9	5	11	15	17	21	15	9	8	5			
0130-0200	5	5	9	11	9	11	15	15	8	4	-	8	5	-	13	15	9	9	5	5	11	15	17	15	17	11	8	5			
0200-0230	5	8	5	9	9	13	13	15	2	4	9	2	5	22	15	13	9	11	5	9	13	18	15	9	13	9	5	5			
0230-0300	0	8	8	5	9	9	13	13	0	0	8	4	8	-	13	13	11	9	5	0	11	21	13	11	13	5	8	4			
0300-0330	5	5	9	8	9	13	17	-	-	0	11	0	9	21	13	15	11	11	0	0	13	21	15	9	13	9	9	8			
0330-0400	5	2	13	9	9	13	17	15	8	0	-	0	13	-	17	15	13	8	0	2	13	22	13	11	11	11	0	9			
0400-0430	5	8	9	5	9	13	13	15	2	0	9	0	11	17	17	13	9	9	0	0	5	17	15	11	11	11	8	5			
0430-0500	4	9	9	9	13	8	13	13	0	5	9	0	8	15	15	9	9	9	2	0	9	17	17	9	11	9	8	5			
0500-0530	4	9	5	5	13	8	21	13	0	-	8	8	9	13	15	11	11	9	8	0	9	17	13	11	9	11	8	5			
0530-0600	4	9	9	5	13	8	11	17	0	5	4	8	11	17	17	11	8	8	5	9	9	15	8	9	11	11	0	8			
0600-0630	0	-	9	11	11	9	13	13	0	0	5	5	13	11	15	11	9	8	5	11	9	18	8	9	9	15	0	9			
0630-0700	5	9	9	11	11	8	11	15	0	0	9	8	13	13	17	9	9	9	0	11	9	18	9	11	9	13	0	9			
0700-0730	4	17	11	9	13	11	13	13	-	0	11	13	13	11	17	13	13	9	5	9	9	26	13	13	11	13	4	13			
0730-0800	4	13	15	13	13	13	17	13	8	5	11	18	15	-	18	17	17	13	4	9	15	24	18	18	13	11	13	13			
0800-0830	9	21	17	13	15	13	18	17	9	9	13	21	17	17	21	18	17	13	9	13	17	33	21	22	15	15	17	13			
0830-0900	11	15	18	15	17	15	17	18	11	8	15	18	15	21	24	21	17	9	9	13	15	28	21	24	18	15	18	13			
0900-0930	15	15	21	21	22	11	24	17	9	11	11	15	17	21	22	24	18	15	9	11	17	28	28	24	21	18	18	18			
0930-1000	9	18	21	21	18	9	24	-	-	9	9	13	-	22	21	22	17	18	8	13	21	39	24	24	18	21	24	17			
1000-1030	11	18	18	13	22	11	22	-	11	9	8	17	15	21	28	22	17	18	8	11	17	30	21	28	17	22	18	17			
1030-1100	11	21	17	21	22	13	22	15	13	8	5	21	11	18	24	17	13	17	5	9	17	31	26	26	22	21	17	15			
1100-1130	15	28	17	21	24	13	21	15	11	11	5	17	11	17	24	15	13	15	8	13	15	31	22	24	26	21	15	21			
1130-1200	13	24	21	24	24	18	26	-	11	-	8	15	11	17	18	13	11	15	9	11	17	28	26	21	26	21	18	21			
1200-1230	17	26	17	18	24	22	-	24	-	9	8	15	15	21	15	17	11	15	8	11	17	30	21	21	21	15	17	21			
1230-1300	22	17	21	24	24	21	-	17	-	9	18	13	17	15	18	13	9	17	11	13	17	30	15	22	22	17	18	22			
1300-1330	31	22	22	11	22	24	-	13	11	9	5	11	15	15	21	21	11	13	11	15	22	28	24	24	26	21	21	17			
1330-1400	21	24	21	9	21	24	-	18	-	11	9	18	21	18	17	21	11	15	15	13	17	30	24	22	22	17	18	18			
1400-1430	21	21	22	18	22	13	-	18	9	8	11	18	24	17	15	22	13	17	18	13	22	26	-	21	24	18	17	21			
1430-1500	18	18	21	17	22	18	-	18	9	8	4	21	24	-	17	17	11	22	9	11	21	28	-	24	21	24	24	22			
1500-1530	28	24	18	21	21	18	18	18	4	9	4	17	18	18	21	21	13	18	15	13	22	24	-	21	21	17	26	21			
1530-1600	24	24	8	15	21	21	22	18	9	5	13	-	13	18	17	21	15	17	18	17	21	24	-	18	17	21	21	21			
1600-1630	24	28	18	17	26	15	22	13	9	21	9	17	18	22	18	21	17	15	15	17	22	26	-	22	21	21	26	21			
1630-1700	26	22	17	24	26	28	28	-	13	13	4	-	5	24	21	21	17	15	13	17	28	21	-	18	21	22	21	21			
1700-1730	22	22	18	11	26	21	28	13	9	17	13	28	11	28	21	18	18	18	22	21	22	22	-	24	17	22	26	18			
1730-1800	22	24	17	13	22	22	26	13	-	18	11	8	15	28	22	15	21	17	21	21	13	17	-	21	21	24	22	22			
1800-1830	24	22	17	11	28	18	17	-	-	9	11	0	11	26	22	18	21	18	15	21	24	18	-	15	21	21	24	21			
1830-1900	21	21	5	9	22	17	18	-	9	9	17	2	13	26	21	15	17	15	9	17	18	21	-	17	18	17	24	21			
1900-1930	22	22	5	5	22	17	22	13	11	9	-	8	2	30	21	21	15	11	9	15	17	21	-	17	22	18	21	17			
1930-2000	15	22	9	5	13	18	15	-	11	9	17	8	13	30	21	21	21	15	2	15	18	18	-	17	17	11	15	21			
2000-2030	22	13	9	9	13	17	17	-	13	11	15	13	13	26	21	18	18	17	5	17	17	18	-	13	17	15	13	15			
2030-2100	18	17	13	9	17	21	13	-	15	9	11	-	5	26	21	18	15	9	5	9	15	21	-	13	15	13	15	17			
2100-2130	11	13	11	15	21	15	15	9	-	15	24	13	8	21	21	18	21	9	8	4	15	21	-	15	17	8	21	13			
2130-2200	15	17	9	11	17	17	13	8	-	13	21	13	13	24	17	13	13	4	5	18	17	18	-	13	17	4	17	11			
2200-2230	15	21	13	9	17	13	13	8	5	13	13	11	21	24	17	9	9	5	0	21	15	21	-	13	15	0	11	13			
2230-2300	11	15	11	5	17	15	13	5	2	13	0	-	22	24	17	11	11	5	5	9	13	21	-	11	13	8	11	13			
2300-2330	8	13	13	0	15	13	15	4	-	-	0	13	26	22	15	11	9	8	5	8	13	26	-	15	11	8	9	17			
2330-0000	9	15	11	4	17	15	17	0	9	9	5	9	18	24	9	9	8	8	0	9	15	21	26	13	11	9	9	13			

Kingaroy (040922) Wind Data – Km/hr

March	Day																														
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	9	11	9	13	9	6	0	17	7	9	9	0	6	0	11	7	4	9	0	0	1	9	-	0	7	17	4	13	11	7	9
0030-0100	17	9	9	9	11	0	9	11	6	11	9	0	2	7	9	6	7	4	7	0	2	9	-	0	7	11	0	13	13	9	13
0100-0130	9	11	7	11	9	7	11	13	-	9	7	0	0	7	4	2	4	2	9	9	7	7	-	0	9	11	6	13	11	7	15
0130-0200	7	9	9	15	7	7	9	15	9	13	11	0	0	9	9	7	6	2	6	7	0	6	6	0	2	11	4	13	9	7	9
0200-0230	9	7	9	15	7	7	9	17	7	11	13	6	0	7	15	2	2	0	0	7	0	6	6	0	2	9	7	20	9	6	13
0230-0300	9	7	13	13	7	2	4	-	4	9	15	2	0	6	13	11	6	11	0	0	0	6	0	0	9	11	7	20	13	7	17
0300-0330	9	9	9	13	7	0	9	15	-	11	11	9	0	9	9	9	6	11	0	0	0	0	0	0	15	9	9	20	13	7	15
0330-0400	7	11	11	15	7	7	9	11	4	9	11	4	0	9	-	9	0	7	0	0	0	0	0	0	11	9	4	20	13	11	13
0400-0430	7	9	13	13	11	6	9	-	7	7	11	9	0	11	6	7	6	2	0	0	0	0	0	2	9	6	7	20	9	9	15
0430-0500	7	7	11	13	13	0	7	11	9	11	9	7	0	9	0	6	6	4	0	0	0	0	4	0	7	2	0	17	9	9	7
0500-0530	7	6	11	13	11	6	6	11	9	6	11	9	0	4	0	0	2	6	0	0	0	0	4	2	7	0	6	19	9	11	13
0530-0600	9	0	11	13	11	11	4	11	9	0	11	6	0	7	7	4	0	7	0	0	0	2	6	0	0	0	11	15	6	11	24
0600-0630	7	6	11	13	9	9	6	11	9	2	13	4	7	11	6	2	2	7	0	0	4	0	0	6	0	0	7	13	7	13	22
0630-0700	7	9	9	15	13	9	4	7	-	0	11	11	0	9	0	7	0	2	0	0	0	0	0	0	0	7	7	11	11	13	26
0700-0730	9	11	13	15	11	7	6	11	9	0	13	6	0	11	0	7	0	6	0	0	7	0	0	0	0	0	9	13	13	13	24
0730-0800	13	9	17	15	15	7	6	13	15	6	17	6	0	9	0	9	7	0	0	0	11	0	6	0	6	0	9	13	11	19	28
0800-0830	15	13	19	19	17	11	7	15	13	4	17	6	6	9	-	0	7	2	0	0	9	2	6	0	11	6	17	13	11	20	30
0830-0900	20	13	20	22	19	9	6	15	13	7	15	11	9	9	15	0	2	7	0	0	11	0	0	4	13	9	17	15	15	19	28
0900-0930	22	15	24	24	17	11	11	19	15	11	17	9	7	11	17	6	15	11	4	6	11	4	6	9	13	9	15	13	13	22	32
0930-1000	24	15	22	20	22	7	9	19	15	11	19	6	6	11	17	9	13	17	7	11	11	4	4	7	15	7	20	19	15	24	20
1000-1030	22	15	24	26	17	9	13	26	13	9	20	4	4	13	17	9	13	11	11	11	11	6	6	9	13	9	24	19	15	22	22
1030-1100	20	17	26	20	19	7	13	17	-	9	17	11	9	13	17	9	17	9	15	11	-	6	9	6	15	6	20	20	13	20	22
1100-1130	15	20	26	22	13	6	13	22	11	13	17	13	15	13	15	6	13	11	11	11	-	0	11	9	15	11	17	19	13	24	22
1130-1200	15	20	24	24	13	7	13	20	13	9	17	19	17	9	17	6	13	13	17	17	-	7	11	7	13	11	22	20	15	17	19
1200-1230	20	20	20	20	15	9	13	19	11	9	15	20	20	19	19	6	17	15	17	15	-	6	7	6	13	7	17	24	13	19	19
1230-1300	20	20	20	22	17	9	13	20	13	15	11	9	22	13	20	6	11	15	17	17	-	7	7	7	13	6	17	20	17	20	15
1300-1330	19	19	17	24	17	9	17	17	9	11	13	17	17	19	17	6	15	15	17	19	13	9	7	6	13	7	19	22	15	17	15
1330-1400	19	20	19	22	15	7	15	15	11	11	17	22	17	15	13	11	13	15	13	19	-	6	2	11	13	7	17	22	15	15	15
1400-1430	22	22	22	22	17	4	19	20	11	9	22	20	13	19	19	9	17	6	13	13	7	11	2	9	7	11	17	19	17	19	17
1430-1500	19	24	24	22	9	9	19	26	15	7	22	20	15	19	19	7	11	9	13	13	-	6	4	2	13	0	17	15	9	13	17
1500-1530	20	24	28	22	17	11	20	20	11	13	15	20	15	17	17	6	15	6	17	15	-	6	2	11	9	6	20	20	17	15	19
1530-1600	24	26	24	20	11	13	22	26	9	9	24	22	13	17	22	4	24	4	17	17	-	4	0	6	9	6	20	19	13	9	19
1600-1630	19	24	22	20	11	11	24	24	13	7	22	17	15	15	19	9	20	6	11	20	6	17	0	9	7	11	19	20	9	9	19
1630-1700	28	22	26	20	15	11	24	24	13	13	17	19	11	15	19	7	13	0	13	22	6	-	2	9	9	24	15	15	9	6	19
1700-1730	22	24	19	26	15	13	22	22	9	9	17	20	20	-	11	7	9	7	9	22	2	-	0	13	9	20	13	13	15	6	15
1730-1800	24	22	13	20	17	13	22	22	11	15	13	17	24	13	9	7	4	0	2	17	7	-	0	13	6	20	15	19	9	7	13
1800-1830	22	24	9	24	17	6	26	22	11	15	13	9	17	-	32	9	0	6	0	11	4	-	0	9	9	20	20	17	9	0	11
1830-1900	15	17	9	15	15	11	22	15	9	11	17	9	15	19	19	13	6	9	2	9	6	-	0	4	9	19	15	17	9	0	9
1900-1930	15	17	13	17	13	11	24	15	9	7	7	7	17	11	17	11	13	7	7	9	13	-	0	7	11	19	15	17	13	4	9
1930-2000	19	13	17	15	11	6	22	11	9	6	6	15	9	4	19	11	11	9	0	0	15	-	2	9	9	15	17	11	9	6	11
2000-2030	17	11	20	15	7	4	20	13	7	9	13	20	7	-	20	9	11	6	7	19	13	-	2	9	6	20	17	15	11	6	6
2030-2100	13	15	19	15	9	0	22	7	9	13	7	15	9	2	22	6	7	4	2	7	13	-	9	9	20	9	19	11	11	0	0
2100-2130	15	13	17	11	11	0	17	-	9	15	6	11	9	17	17	9	6	6	4	-	9	-	13	13	17	7	19	15	7	2	7
2130-2200	13	15	17	13	7	7	15	6	11	7	7	11	7	11	13	11	6	0	0	-	13	-	11	15	15	9	20	13	7	0	0
2200-2230	9	11	15	13	6	2	17	2	9	6	7	6	6	15	19	11	2	9	6	-	15	-	9	13	13	9	17	13	11	2	6
2230-2300	11	15	13	7	2	2	15	2	6	9	2	7	9	13	17	7	9	11	2	-	13	-	7	11	17	2	17	13	13	2	4
2300-2330	11	11	11	9	6	0	15	6	11	7	4	2	7	13	19	7	6	6	2	-	9	-	4	9	9	7	17	11	9	13	11
2330-0000	9	9	13	7	9	0	17	9	6	11	0	6	7	7	13	4	7	0	2	-	-	-	0	9	15	7	15	13	7	13	6

Kingaroy (040922) Wind Data – Km/hr

April	Day																													
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0000-0030	0	6	13	15	7	7	0	0	4	2	13	9	19	7	6	7	7	11	7	13	15	11	11	17	-	-	0	7	0	0
0030-0100	6	7	15	13	7	9	7	0	0	9	11	11	15	4	0	7	7	2	9	11	17	11	17	13	-	-	0	6	0	11
0100-0130	2	11	17	13	9	9	0	4	4	9	7	9	13	0	6	7	7	0	9	13	20	15	15	13	9	-	0	2	0	
0130-0200	6	9	15	11	9	6	0	7	0	4	7	9	13	0	6	6	9	9	11	11	20	15	13	13	13	-	0	7	0	7
0200-0230	4	7	15	9	11	0	0	0	0	0	6	11	9	0	7	11	9	9	15	11	19	13	17	13	7	-	0	7	0	0
0230-0300	6	7	15	17	11	2	0	0	0	0	9	11	11	6	7	11	9	9	13	13	19	15	17	15	-	-	0	9	6	0
0300-0330	2	0	15	11	9	0	0	0	0	0	11	9	11	6	0	6	11	9	13	13	17	13	15	13	-	7	0	2	0	7
0330-0400	0	0	15	13	7	0	0	0	0	4	11	9	15	0	6	7	11	6	11	15	19	11	15	13	-	7	0	2	0	0
0400-0430	0	0	13	11	7	2	0	0	0	0	9	11	9	0	13	6	13	0	9	17	15	11	15	9	-	13	0	0	0	-
0430-0500	0	7	15	13	6	4	0	0	6	0	7	11	20	0	13	9	15	7	9	13	15	9	13	9	-	-	0	7	6	-
0500-0530	0	6	15	13	2	0	0	0	0	0	6	9	11	0	13	4	9	6	9	17	15	11	13	9	-	-	0	4	4	-
0530-0600	0	4	17	15	2	0	0	0	0	0	7	6	9	2	15	6	9	0	15	17	15	11	13	9	-	-	0	0	6	-
0600-0630	0	6	19	11	9	4	0	0	0	4	6	2	7	0	13	7	9	2	11	19	15	11	13	7	-	-	0	7	0	-
0630-0700	0	7	15	11	9	2	0	0	0	0	4	11	7	2	15	7	6	2	9	17	19	11	9	11	-	-	0	7	0	-
0700-0730	0	0	17	9	7	0	0	0	0	0	7	15	0	0	13	7	6	0	13	19	15	11	13	9	-	2	0	7	0	-
0730-0800	0	15	17	11	9	4	0	0	0	2	9	17	0	4	15	9	13	7	15	17	17	11	13	6	-	-	0	6	0	-
0800-0830	13	17	20	11	17	7	0	0	2	7	15	17	7	6	17	13	11	9	20	20	17	13	17	13	-	11	0	9	2	-
0830-0900	15	13	20	11	19	17	0	0	0	4	22	17	0	13	17	13	15	15	19	20	19	15	17	13	-	-	0	11	19	-
0900-0930	15	17	19	13	17	17	4	6	7	17	24	20	20	15	19	15	15	17	19	17	19	15	17	17	-	-	0	13	19	-
0930-1000	19	20	22	13	19	17	4	4	11	15	24	20	24	22	17	17	19	17	20	17	20	19	17	15	-	-	17	13	17	-
1000-1030	19	20	22	22	17	17	2	6	9	19	20	24	30	22	17	17	17	13	20	26	17	15	17	15	-	9	17	11	13	-
1030-1100	22	20	20	20	13	15	4	6	11	19	15	19	35	20	19	17	22	17	22	24	20	17	19	13	-	6	19	9	13	-
1100-1130	19	24	17	24	17	17	2	0	9	17	15	26	37	22	17	17	20	17	22	24	20	17	17	17	-	9	19	9	13	-
1130-1200	17	19	22	19	22	15	2	7	9	17	19	22	37	17	15	19	15	19	24	24	24	17	15	11	-	-	-	6	15	17
1200-1230	15	20	17	19	19	13	7	6	6	13	19	26	35	19	17	15	15	17	24	24	20	17	17	13	-	11	19	9	17	17
1230-1300	13	24	15	19	17	11	2	11	6	13	19	17	39	20	15	17	15	17	19	24	20	19	13	17	-	7	19	7	17	15
1300-1330	13	20	15	20	13	9	7	7	6	15	15	19	35	17	13	13	15	19	22	28	20	20	19	17	-	6	17	9	15	13
1330-1400	11	22	17	17	13	13	7	4	6	13	15	19	30	17	9	15	15	19	20	20	20	19	15	15	-	-	-	13	20	13
1400-1430	13	19	20	19	17	9	9	4	6	13	19	19	30	13	15	17	20	17	20	20	24	20	17	19	13	4	17	7	19	15
1430-1500	15	17	22	20	13	7	11	9	2	13	22	19	28	11	15	13	17	13	24	20	26	19	19	19	11	7	9	9	19	17
1500-1530	13	19	20	17	17	13	6	7	11	17	20	19	28	11	13	13	19	17	19	20	22	19	19	17	13	9	9	9	20	13
1530-1600	17	17	24	19	17	6	6	13	9	13	24	24	17	11	11	11	19	17	28	28	17	17	20	19	17	9	15	4	22	11
1600-1630	13	19	22	17	17	11	0	9	7	11	28	20	15	13	13	13	15	15	22	15	15	22	22	15	-	7	13	2	24	11
1630-1700	13	19	19	19	20	13	0	9	7	15	17	19	9	17	13	15	15	15	17	19	17	17	20	17	-	9	13	6	20	9
1700-1730	17	19	17	20	13	11	0	11	11	15	19	19	19	13	11	15	17	13	13	15	13	13	17	17	-	7	9	77	20	9
1730-1800	15	19	17	19	17	7	9	6	7	19	15	13	15	9	9	15	13	11	13	15	15	13	17	13	-	2	7	7	15	7
1800-1830	17	13	17	13	13	7	4	7	4	17	13	13	11	9	9	17	13	11	11	20	15	11	13	11	-	0	7	7	9	4
1830-1900	13	17	17	13	11	7	2	7	2	17	9	20	9	7	1	13	11	13	19	20	9	11	17	-	-	0	6	4	7	7
1900-1930	11	19	11	11	11	9	0	6	0	15	9	24	9	6	9	13	11	13	15	17	7	13	20	-	-	0	11	0	4	6
1930-2000	11	19	11	9	9	9	2	2	0	13	11	19	9	9	9	13	11	13	13	20	6	9	24	-	-	0	7	4	6	6
2000-2030	11	13	11	17	9	11	2	0	0	19	13	20	7	9	9	15	9	9	11	15	9	11	19	-	-	0	7	0	6	6
2030-2100	11	13	15	11	9	4	2	0	0	17	7	26	6	7	6	9	9	11	9	17	13	9	19	-	-	0	7	0	9	9
2100-2130	11	15	17	11	7	6	2	0	0	11	7	19	0	7	6	7	7	13	17	17	16	7	17	-	-	0	7	7	9	11
2130-2200	9	15	22	13	7	7	0	0	0	17	7	19	4	0	7	7	9	11	11	17	13	13	19	-	-	0	9	2	9	-
2200-2230	9	15	22	17	0	0	0	6	4	22	7	13	6	4	7	7	7	11	13	15	13	13	17	-	-	0	9	7	6	-
2230-2300	6	17	20	15	7	0	0	7	0	17	1	17	9	0	6	9	7	9	11	17	13	11	17	-	-	0	0	7	6	-
2300-2330	7	17	19	15	9	0	0	7	0	17	9	13	4	7	2	9	7	9	15	17	11	13	17	-	-	0	13	7	7	7
2330-0000	4	19	19	7	7	0	0	0	0	17	13	17	7	9	2	9	2	9	9	19	11	13	-	-	-		13	2	7	-

Kingaroy (040922) Wind Data – Km/hr

May	Day																														
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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0030-0100	-	6	11	6	15	0	6	0	0	0	20	22	9	17	7	6	4	6	9	7	13	6	0	6	0	7	0	0	0	0	7
0100-0130	-	7	7	9	15	0	2	0	0	9	20	15	13	13	2	6	06	4	6	9	6	0	0	7	0	0	0	0	0	0	9
0130-0200	-	6	6	11	11	0	0	0	0	0	20	7	13	11	7	7	7	2	7	7	4	4	6	6	4	0	0	6	0	0	7
0200-0230	9	6	7	11	7	0	0	0	0	7	20	6	19	11	13	9	9	4	7	9	4	7	6	9	0	0	0	7	0	0	9
0230-0300	11	9	0	13	0	0	0	0	7	3	15	11	17	7	11	7	11	6	7	2	7	13	6	9	0	0	0	4	0	0	7
0300-0330	9	9	6	9	13	0	0	0	0	6	19	11	11	6	9	11	11	7	11	0	0	2	7	7	0	0	0	0	9	0	11
0330-0400	13	6	9	9	11	0	0	0	0	0	15	7	9	7	7	7	9	7	9	11	2	2	0	7	0	0	0	0	0	0	7
0400-0430	9	6	11	7	11	0	0	0	0	0	20	7	13	7	9	7	13	7	7	7	0	0	6	9	0	0	0	0	0	0	2
0430-0500	13	7	9	9	7	0	0	0	7	4	22	6	11	9	9	7	13	4	7	9	0	0	9	9	0	0	0	0	0	0	7
0500-0530	13	0	0	4	0	4	0	0	6	0	20	0	11	13	9	7	11	6	0	7	7	0	7	13	0	0	0	0	0	9	7
0530-0600	9	0	0	9	7	0	0	6	0	2	17	0	13	11	7	9	13	2	0	9	6	0	2	9	0	0	0	0	0	7	4
0600-0630	11	7	0	9	6	2	7	2	0	9	22	6	13	13	9	9	15	6	7	7	7	0	2	9	0	6	0	6	0	6	2
0630-0700	15	0	0	4	6	4	0	2	4	6	15	6	13	19	11	7	11	6	7	0	4	2	6	0	0	0	0	0	0	0	0
0700-0730	11	7	0	4	7	2	0	0	6	4	15	0	15	13	15	9	13	6	2	6	0	0	7	0	0	0	4	0	0	0	7
0730-0800	13	11	0	7	7	6	0	0	0	0	17	2	17	9	13	9	13	2	13	11	9	0	11	0	0	0	0	0	0	0	2
0800-0830	15	9	0	9	11	2	0	0	0	0	26	7	15	13	11	15	15	9	17	13	13	0	13	0	2	7	4	7	0	0	2
0830-0900	11	9	7	9	15	6	0	2	0	4	26	19	15	13	17	19	15	13	15	13	11	9	11	13	6	4	0	0	6	0	7
0900-0930	11	15	9	15	15	11	0	17	0	0	28	20	17	13	19	20	17	17	15	13	15	11	15	13	2	9	0	17	7	6	20
0930-1000	13	13	9	17	22	13	4	19	11	19	26	17	22	13	19	19	17	20	15	15	13	13	15	13	15	7	4	13	11	2	24
1000-1030	19	17	13	17	22	13	9	17	9	17	28	19	20	17	20	19	17	19	22	13	13	15	19	13	13	11	7	13	7	15	22
1030-1100	11	17	13	15	20	13	15	15	7	19	26	13	20	17	20	20	13	19	19	15	13	13	19	13	13	15	9	15	17	24	24
1100-1130	13	15	13	15	19	11	17	22	7	20	26	15	22	15	19	20	17	19	20	17	13	13	17	15	17	11	17	13	20	22	22
1130-1200	17	17	13	19	22	13	17	19	6	24	32	20	20	19	17	20	17	22	22	15	11	15	15	13	17	6	22	22	20	22	24
1200-1230	19	13	11	19	22	7	13	17	9	24	24	19	20	17	19	19	15	19	19	17	15	13	15	11	17	15	19	20	20	20	24
1230-1300	17	15	13	13	15	7	15	17	6	24	28	17	19	20	15	20	15	20	22	13	13	15	17	15	11	15	24	22	24	24	22
1300-1330	15	17	13	11	20	9	13	19	9	26	28	17	22	19	17	20	17	19	20	11	13	15	15	9	19	18	24	20	20	24	20
1330-1400	20	19	11	24	17	9	13	17	9	28	22	17	22	17	17	17	17	17	22	13	11	17	11	7	17	9	30	20	24	22	22
1400-1430	22	17	11	13	22	13	15	17	11	22	24	17	24	15	17	15	11	17	17	13	13	17	13	9	20	11	28	19	20	24	20
1430-1500	22	13	17	4	20	7	11	15	7	20	28	17	19	13	17	19	19	19	22	17	15	15	13	7	15	13	24	24	24	20	20
1500-1530	19	15	11	6	22	7	11	13	15	20	24	17	15	17	17	20	22	19	24	17	11	15	11	9	9	9	22	19	20	24	15
1530-1600	20	15	11	9	17	11	6	11	11	22	20	19	19	13	17	19	20	19	24	11	13	15	11	11	9	9	24	20	19	17	13
1600-1630	19	19	13	13	17	4	13	13	13	19	20	19	15	20	19	17	20	20	20	13	15	15	11	9	13	9	24	19	17	17	17
1630-1700	17	15	9	15	20	7	9	13	9	20	20	15	20	15	17	19	15	24	20	11	15	13	7	11	13	6	19	17	13	20	17
1700-1730	13	17	6	9	17	7	9	7	7	17	20	11	20	11	17	15	17	20	15	9	7	11	13	11	9	7	15	9	13	17	13
1730-1800	13	15	0	7	9	6	0	0	4	9	15	7	17	13	15	15	11	19	15	11	6	7	7	9	11	2	15	11	7	17	9
1800-1830	9	9	0	9	0	7	4	7	4	19	15	7	17	11	9	9	11	13	13	11	2	9	6	9	9	4	15	13	7	15	9
1830-1900	13	13	0	13	0	6	0	4	6	11	17	0	13	7	9	13	11	11	11	9	7	11	6	9	7	0	11	9	4	11	6
1900-1930	6	9	6	13	2	4	0	4	6	20	19	0	11	0	9	13	11	13	9	9	7	11	7	9	6	0	11	7	2	11	7
1930-2000	6	9	0	13	11	2	0	2	7	19	17	0	11	7	7	11	11	11	7	9	6	11	2	6	4	0	11	6	0	9	11
2000-2030	9	6	9	9	7	0	0	0	11	24	13	0	11	7	7	13	11	9	7	7	6	11	0	6	6	2	15	6	6	9	11
2030-2100	7	9	2	13	9	6	7	0	7	20	17	9	9	7	4	13	9	9	6	11	7	9	7	6	0	6	15	6	2	9	7
2100-2130	2	7	0	13	6	6	7	0	6	17	20	11	7	7	7	11	7	7	9	9	6	7	7	7	2	0	11	6	6	7	0
2130-2200	7	7	0	13	0	0	2	0	7	17	20	11	9	2	9	13	9	11	7	11	6	9	7	0	2	0	13	0	0	9	9
2200-2230	7	9	9	9	6	0	6	6	7	20	24	9	15	7	9	15	7	9	9	2	11	11	6	2	0	0	9	6	0	11	9
2230-2300	13	11	6	17	2	0	4	0	6	15	22	9	13	9	11	15	6	9	7	7	15	13	6	6	0	0	6	0	9	13	7
2300-2330	9	7	7	15	0	0	4	0	4	20	24	11	13	13	11	11	7	9	7	6	11	9	7	0	0	0	2	0	0	13	6
2330-0000	9	7	9	9	0	9	0	0	0	19	26	9	7	9	9	11	0	9	0	9	7	6	6	2	0	0	9	2	0	17	6

Kingaroy (040922) Wind Data – Km/hr

June	Day																													
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0000-0030	6	4	4	17	11	11	-	11	0	0	0	0	0	0	7	4	11	4	2	9	13	2	9	7	0	15	19	11	2	9
0030-0100	0	6	0	-	-	7	-	6	0	0	0	0	7	2	6	2	7	9	0	13	11	2	9	9	2	15	17	11	0	0
0100-0130	0	7	0	-	20	4	-	9	7	0	0	0	0	0	0	7	9	6	0	15	13	0	0	9	0	17	17	11	0	0
0130-0200	0	11	6	-	15	6	-	11	7	0	0	0	6	0	0	4	7	0	0	2	11	7	0	9	0	17	17	11	4	0
0200-0230	0	11	4	13	17	0	6	11	7	0	0	0	7	0	0	0	9	0	0	2	13	9	0	9	0	13	15	11	6	0
0230-0300	0	11	6	17	17	2	-	11	7	0	0	0	7	0	0	0	7	2	0	0	15	0	6	11	9	13	13	17	0	0
0300-0330	0	4	6	17	15	0	0	9	11	0	0	0	9	0	7	0	9	2	0	6	19	7	0	9	13	17	13	17	0	0
0330-0400	0	7	6	17	13	0	7	9	11	0	0	0	6	0	6	7	2	6	0	0	19	2	0	9	13	17	11	17	0	2
0400-0430	0	7	0	15	9	6	15	9	9	0	0	2	2	0	0	11	0	0	6	0	15	0	0	0	17	15	17	11	6	0
0430-0500	6	9	0	17	7	-	15	13	13	0	0	0	0	0	0	7	0	0	6	0	11	0	0	4	17	19	15	13	0	0
0500-0530	0	9	6	15	9	2	13	7	6	0	0	0	6	0	0	6	4	0	6	0	11	0	0	6	15	17	17	9	0	6
0530-0600	0	7	0	-	15	2	-	7	7	0	0	0	0	0	2	2	0	2	7	0	13	0	0	6	17	17	19	11	6	6
0600-0630	0	9	4	19	13	6	4	7	7	0	0	0	0	0	0	0	0	0	2	0	13	0	2	7	17	19	20	9	0	7
0630-0700	0	11	0	20	6	-	-	7	4	0	0	0	0	0	0	0	4	0	0	0	6	7	0	2	15	17	15	11	6	6
0700-0730	0	7	0	20	0	2	11	9	7	0	0	6	7	0	0	0	7	0	0	0	7	9	0	2	15	15	15	13	0	7
0730-0800	0	13	0	22	4	0	6	13	9	0	0	6	7	0	0	0	7	4	2	0	0	9	0	0	13	20	13	13	0	9
0800-0830	0	9	4	26	6	0	7	9	7	0	0	11	4	0	0	0	15	0	6	0	0	6	6	0	13	19	15	19	0	7
0830-0900	11	11	4	28	22	13	15	9	9	0	0	11	2	0	0	7	11	0	7	6	9	9	9	0	13	20	17	17	11	9
0900-0930	13	13	9	33	20	17	19	9	9	0	0	15	2	0	2	9	11	0	6	4	9	11	9	9	17	19	17	19	11	7
0930-1000	20	13	13	28	19	19	20	9	6	4	2	11	0	7	9	13	4	4	17	11	13	9	11	13	15	20	19	20	11	7
1000-1030	19	11	15	30	17	17	19	9	4	2	4	13	6	9	17	15	11	6	20	9	9	15	13	20	19	19	20	22	15	7
1030-1100	19	13	13	35	17	17	20	7	6	0	11	13	9	9	15	19	13	9	17	13	9	15	19	17	20	24	26	28	15	7
1100-1130	13	15	13	37	13	17	19	11	7	2	15	15	7	7	9	19	20	9	17	9	13	17	15	17	22	20	26	28	13	7
1130-1200	17	15	19	33	13	15	15	7	7	0	13	11	11	9	13	17	19	11	15	13	20	15	17	17	19	22	26	24	15	9
1200-1230	13	13	19	32	11	17	20	9	6	2	13	11	13	9	13	15	19	11	13	17	22	13	17	22	24	22	26	26	19	9
1230-1300	11	17	20	33	13	15	-	15	2	2	11	9	15	11	11	15	19	9	13	19	22	17	13	22	20	24	26	22	17	9
1300-1330	15	13	20	32	13	15	-	19	4	6	15	7	17	9	13	13	19	11	15	15	26	11	13	28	20	22	20	26	15	11
1330-1400	19	11	20	35	7	15	-	15	4	7	15	7	9	6	9	13	17	15	15	13	24	13	9	26	24	22	20	32	19	11
1400-1430	15	9	19	41	11	13	20	9	6	6	15	11	9	4	7	15	17	7	15	15	20	11	11	24	22	20	24	22	13	7
1430-1500	19	11	19	30	11	15	-	11	2	6	13	9	11	2	9	17	17	9	13	13	17	9	9	30	22	20	20	20	17	9
1500-1530	19	13	24	37	9	15	20	11	0	7	13	9	7	7	15	17	17	9	13	17	17	9	9	28	19	17	24	17	19	9
1530-1600	17	11	17	30	17	13	20	9	0	6	13	9	11	4	15	15	17	7	15	11	17	11	11	26	20	17	20	22	15	9
1600-1630	13	6	17	20	17	13	17	11	0	7	15	7	11	2	13	13	19	15	19	13	19	11	9	19	17	20	26	19	17	9
1630-1700	13	6	15	22	-	9	-	15	0	4	13	7	9	0	9	13	15	11	17	13	15	11	9	19	19	15	20	15	9	11
1700-1730	7	9	13	28	-	6	17	17	0	0	9	2	7	0	4	11	11	13	13	7	13	11	7	13	13	15	15	13	6	7
1730-1800	11	7	9	24	-	7	15	-	0	0	9	7	0	0	4	9	7	9	9	9	11	7	11	11	11	15	13	11	2	7
1800-1830	11	7	9	22	-	9	13	-	0	0	9	6	2	0	2	11	4	9	7	6	6	7	6	9	9	13	13	11	7	0
1830-1900	9	7	7	22	11	7	13	9	0	0	9	0	9	0	4	6	7	7	7	6	9	0	0	9	9	15	15	13	7	0
1900-1930	4	9	7	24	7	0	13	6	0	0	9	6	6	0	4	6	6	2	4	6	2	0	0	13	13	15	15	11	6	0
1930-2000	2	11	9	24	6	-	9	7	0	0	9	0	9	0	4	7	7	6	0	9	0	0	9	15	15	17	11	9	6	0
2000-2030	0	7	9	26	7	-	13	7	0	0	9	6	2	0	6	0	11	2	2	2	11	4	13	13	17	15	11	9	7	0
2030-2100	7	9	-	20	11	-	11	6	0	0	9	6	0	0	9	0	7	7	9	2	9	0	9	9	13	17	13	7	6	0
2100-2130	0	9	-	19	13	-	11	9	0	0	9	2	0	0	4	0	0	0	9	7	6	7	6	13	15	17	13	6	0	0
2130-2200	7	7	-	19		-	11	13	0	0	11	2	2	9	6	7	13	6	6	7	4	0	6	11	15	15	9	0	6	0
2200-2230	6	7	-	13	15	-	9	7	0	0	9	0	0	0	6	7	9	0	6	6	7	0	6	4	17	11	9	4	7	0
2230-2300	7	7	-	11	9	-	13	7	0	0	7	0	0	0	0	4	6	-	0	0	19	6	7	0	15	15	9	6	0	0
2300-2330	13	0	17	-	11	0	9	9	0	0	0	0	0	7	0	9	0	0	9	0	17	7	7	6	17	19	9	2	2	0
2330-0000	11	7	-	-	-	-	9	9	0	0	0	0	0	0	0	11	0	0	6	0	11	7	6	0	17	17	11	2	13	0

Kingaroy (040922) Wind Data – Km/hr

July	Day																													
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	0	13	0	11	17	19	15	7	0	2	2	0	0	26	4	9	0	4	0	7	11	9	7	0	2	6	0	0	0	4	7
0030-0100	0	9	0	11	13	22	13	2	0	6	9	0	0	22	6	13	0	0	0	0	7	4	2	2	0	0	6	0	0	0	7
0100-0130	0	9	0	11	13	19	13	2	0	2	7	0	0	32	2	9	0	0	0	0	6	6	0	6	0	0	0	0	0	0	9
0130-0200	6	11	0	11	17	19	13	0	0	0	0	0	0	19	6	7	0	0	2	0	0	2	0	2	0	0	0	0	0	0	13
0200-0230	0	9	0	17	15	20	15	4	0	7	0	0	0	26	6	0	0	0	0	0	0	0	9	0	6	0	9	0	0	0	11
0230-0300	6	9	0	11	17	19	15	7	0	0	0	0	0	26	2	0	0	0	4	0	0	0	2	0	6	0	0	0	4	0	6
0300-0330	6	9	0	15	20	22	13	4	0	6	7	0	0	24	2	2	7	0	6	0	0	4	2	0	6	4	0	0	0	0	0
0330-0400	4	0	0	11	20	19	11	2	-	4	0	0	0	26	4	4	0	0	0	0	4	2	0	0	2	0	0	0	0	0	7
0400-0430	0	9	0	13	15	17	13	0	-	6	6	0	0	19	7	2	0	0	0	0	0	0	0	2	2	2	0	0	0	0	7
0430-0500	0	9	0	11	17	13	13	0	-	0	0	0	0	19	2	7	0	4	0	0	0	6	0	0	6	2	0	0	0	0	0
0500-0530	0	6	0	9	19	17	11	0	-	6	0	0	0	19	0	0	0	4	0	0	0	6	0	0	6	7	0	0	2	0	0
0530-0600	0	6	0	9	17	15	13	6	-	2	0	0	0	17	0	0	0	0	0	0	0	2	0	0	0	7	0	0	6	0	9
0600-0630	0	6	6	11	19	19	-	9	0	0	0	0	0	19	4	0	2	13	0	0	0	0	0	2	0	6	0	0	0	0	4
0630-0700	0	0	4	9	17	17	-	6	-	6	2	0	0	17	6	0	7	7	0	0	0	2	0	0	2	0	6	0	0	0	0
0700-0730	0	2	0	17	19	17	-	0	7	0	0	0	0	19	6	2	0	7	0	0	0	9	0	0	0	2	0	0	0	0	6
0730-0800	0	0	0	17	17	19	-	7	0	6	0	0	0	20	4	6	6	7	0	0	0	0	2	0	2	0	0	0	0	0	7
0800-0830	0	4	0	17	19	17	-	9	0	0	0	0	0	30	0	0	7	9	0	0	0	0	0	2	4	0	0	0	0	0	13
0830-0900	4	2	13	20	20	19	-	9	0	0	0	0	6	33	4	0	19	15	0	0	0	0	0	0	9	9	0	4	0	0	15
0900-0930	6	7	19	20	20	24	-	13	0	2	4	0	7	32	4	6	22	20	15	0	0	0	0	0	13	9	0	6	7	2	17
0930-1000	13	11	17	28	20	17	-	-	4	7	6	0	22	30	19	6	22	11	11	6	0	2	0	6	17	4	11	13	6	7	15
1000-1030	17	11	22	26	19	19	20	11	4	0	11	7	20	33	17	4	20	11	9	9	9	7	9	6	19	7	17	13	9	6	19
1030-1100	17	13	22	35	22	19	-	13	-	7	17	15	24	33	15	7	24	17	9	9	13	13	9	6	19	6	17	15	9	7	17
1100-1130	15	15	15	32	24	19	-	9	13	13	22	15	24	28	15	9	15	17	11	13	13	13	11	9	22	11	17	13	13	7	17
1130-1200	17	13	22	32	20	20	-	11	17	17	19	20	26	26	19	11	13	15	7	13	13	15	9	17	17	9	17	9	9	11	17
1200-1230	13	13	22	32	22	17	-	13	15	17	19	19	26	24	17	9	9	17	9	11	13	13	6	20	15	7	17	7	6	13	19
1230-1300	15	15	17	33	19	17	17	7	15	22	22	22	26	20	22	7	13	17	9	9	17	9	7	20	13	7	17	11	2	13	15
1300-1330	15	15	17	24	22	17	19	4	17	15	20	20	30	24	20	9	13	24	7	11	9	11	11	20	9	7	13	9	7	9	15
1330-1400	15	13	24	28	24	20	19	6	19	17	22	20	28	22	19	11	15	28	6	13	7	9	11	20	11	6	17	7	11	9	15
1400-1430	19	13	24	30	24	19	17	7	17	22	22	19	26	24	24	9	13	30	7	13	13	9	9	20	11	6	19	9	15	11	15
1430-1500	13	11	20	26	24	22	17	2	17	19	17	15	26	22	20	11	1	22	7	11	9	20	9	20	9	4	22	9	9	7	-
1500-1530	17	11	22	26	24	19	15	2	13	20	19	17	24	19	22	17	7	22	9	11	7	13	15	19	11	11	20	6	17	11	17
1530-1600	13	11	17	24	24	17	15	0	17	19	22	15	22	20	20	15	13	24	7	9	9	13	9	17	11	13	17	13	17	9	17
1600-1630	17	11	17	26	20	15	13	0	17	17	20	-	22	20	20	13	13	24	2	11	7	11	13	15	13	9	19	7	11	6	17
1630-1700	11	9	13	26	22	20	15	0	13	15	19	-	24	22	20	17	17	20	2	9	7	9	11	19	11	9	17	7	7	9	11
1700-1730	11	6	13	20	24	17	13	0	9	13	17	6	19	15	24	13	19	15	7	6	6	6	9	17	11	6	13	6	7	6	13
1730-1800	7	6	11	20	22	17	9	-	7	7	13	-	17	11	11	9	13	11	6	6	0	2	6	13	11	6	7	9	2	13	11
1800-1830	6	2	13	22	24	17	9	7	2	6	7	2	20	9	19	7	6	11	4	6	7	7	2	9	11	9	6	0	0	13	11
1830-1900	6	0	15	15	22	20	7	0	0	0	0	-	17	4	9	7	6	11	0	9	7	9	6	9	9	4	4	0	6	9	13
1900-1930	7	0	17	15	28	19	9	0	0	0	6	4	11	4	2	7	0	0	11	9	0	9	6	9	15	6	6	7	2	9	13
1930-2000	9	0	17	17	24	17	9	-	0	0	6	7	11	6	17	0	0	9	13	9	9	11	7	9	7	4	0	2	2	9	13
2000-2030	0	6	15	13	26	15	9	0	0	0	4	4	11	2	9	0	0	6	4	13	9	6	4	9	4	4	0	9	0	7	13
2030-2100	6	4	15	17	22	13	13	0	0	0	7	-	13	0	4	0	6	0	0	13	9	2	4	9	6	0	0	7	0	6	13
2100-2130	11	6	13	15	22	17	7	0	0	0	0	4	11	0	11	0	0	0	0	11	9	2	6	7	0	9	0	9	6	11	6
2130-2200	9	0	11	17	24	17	6	0	0	2	0	0	20	4	9	0	0	4	0	11	9	9	4	4	6	6	0	9	6	-	11
2200-2230	2	0	13	17	20	17	9	0	2	9	0	2	22	7	15	0	0	6	7	9	7	4	2	6	7	7	0	7	0	11	9
2230-2300	7	0	9	13	22	13	7	0	0	0	0	0	24	6	17	2	0	0	0	7	0	6	0	0	2	6	0	7	0	9	15
2300-2330	9	0	11	13	22	15	6	0	4	0	0	0	24	0	17	9	0	4	9	7	0	6	4	0	0	2	6	4	0	6	9
2330-0000	9	0	11	15	19	17	6	0	2	0	0	0	33	6	7	0	0	4	7	11	7	0	0	7	2	0	0	4	0	6	6

Kingaroy (040922) Wind Data – Km/hr

Aug	Day																													
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0000-0030	6	0	9	0	9	0	0	0	2	0	17	17	0	9	6	4	0	2	6	13	6	9	22	4	4	0	7	2	0	0	7
0030-0100	7	0	9	2	7	9	2	0	0	0	15	11	6	6	6	0	6	9	2	19	0	15	20	7	7	0	7	4	7	0	6
0100-0130	9	4	9	0	0	2	9	0	0	0	15	13	0	2	9	0	7	7	9	20	2	20	17	7	4	0	9	9	9	0	6
0130-0200	9	2	0	0	0	6	9	6	0	0	15	17	0	0	6	0	4	0	6	22	0	19	19	6	7	0	6	0	0	7	7
0200-0230	9	6	9	0	0	0	0	9	0	0	13	17	0	6	7	0	9	0	4	15	2	13	19	4	0	6	4	9	9	0	7
0230-0300	15	9	0	9	0	0	0	0	0	0	17	15	0	0	7	0	6	0	0	15	9	9	19	6	0	7	6	2	9	0	0
0300-0330	7	11	6	7	0	0	6	0	0	0	15	20	0	4	6	6	9	7	6	13	7	13	9	0	4	11	0	0	6	0	0
0330-0400	7	6	11	0	0	0	2	0	0	0	13	15	0	0	6	2	4	6	0	11	15	9	11	0	0	0	0	9	13	6	4
0400-0430	9	6	11	0	0	0	0	0	2	4	11	17	0	0	2	0	0	9	0	13	20	15	11	0	0	0	0	2	6	0	0
0430-0500	13	0	13	0	0	0	0	0	4	0	11	19	0	0	0	0	0	2	0	15	17	6	11	0	6	0	2	2	6	0	9
0500-0530	9	0	7	0	0	0	0	0	0	0	9	17	0	0	4	6	0	0	0	15	22	22	11	0	0	0	0	0	7	0	0
0530-0600	9	9	6	0	0	0	6	0	4	0	11	13	2	6	4	0	9	0	0	17	9	7	11	0	6	6	2	7	13	0	7
0600-0630	9	9	6	0	0	0	0	4	2	0	11	7	0	0	0	4	0	0	6	19	13	7	13	0	7	6	0	0	4	0	7
0630-0700	9	4	7	0	0	0	0	6	2	6	7	13	0	0	6	6	4	0	7	13	13	4	9	0	7	7	0	0	7	0	7
0700-0730	13	6	2	0	0	0	7	7	6	9	6	0	0	0	0	0	0	0	13	15	17	15	13	0	0	7	7	0	2	0	7
0730-0800	17	4	0	0	0	0	4	7	0	9	15	2	0	0	0	0	0	2	6	22	33	7	13	0	6	0	6	0	4	0	9
0800-0830	11	15	0	0	0	0	0	7	9	9	15	13	0	0	2	0	4	0	6	32	30	17	20	4	2	0	2	0	6	7	11
0830-0900	15	15	13	0	0	0	2	9	17	11	15	26	2	4	6	0	4	13	13	22	33	30	20	0	7	0	2	0	4	7	11
0900-0930	15	17	13	2	11	4	2	11	19	15	24	20	2	7	11	4	11	13	17	28	32	19	20	4	9	13	7	0	7	11	11
0930-1000	19	19	17	4	13	9	15	15	28	28	28	28	2	9	11	9	17	11	20	24	35	28	20	11	19	13	11	6	6	15	13
1000-1030	17	17	15	7	15	9	17	20	28	24	30	26	13	7	7	9	19	9	26	26	32	32	22	9	15	13	13	7	7	15	13
1030-1100	19	20	15	13	17	9	13	24	24	26	32	26	13	11	7	15	15	6	20	22	22	26	22	11	13	9	17	9	7	11	13
1100-1130	20	20	17	9	17	9	15	28	28	30	30	22	11	11	9	13	17	9	22	17	28	33	19	13	13	9	11	6	11	9	11
1130-1200	19	19	15	9	11	11	17	22	22	30	33	19	9	11	6	13	15	11	22	17	26	33	17	15	11	11	11	2	11	7	13
1200-1230	15	17	15	11	15	9	19	26	24	30	30	20	9	15	11	9	15	11	22	15	28	26	13	13	9	15	15	4	19	11	9
1230-1300	17	17	15	9	9	9	17	32	26	33	35	15	15	11	9	6	15	15	24	15	24	24	15	7	9	15	13	4	11	9	13
1300-1330	11	15	15	9	9	7	17	26	26	26	30	19	15	9	7	13	11	9	26	15	24	30	11	11	9	4	17	13	11	4	13
1330-1400	13	13	13	13	9	9	20	32	28	35	32	19	13	9	11	15	17	7	20	11	24	26	11	9	7	4	13	11	9	11	9
1400-1430	15	17	15	9	15	9	20	26	24	32	30	22	11	9	11	9	11	9	26	22	30	28	13	11	4	4	15	15	9	17	17
1430-1500	15	19	13	11	6	13	17	22	24	26	26	17	9	13	7	9	15	7	22	20	30	30	9	13	9	11	15	11	11	19	13
1500-1530	15	17	13	11	9	9	22	26	22	30	28	20	9	11	13	7	17	9	24	19	26	26	9	9	7	13	15	15	11	20	9
1530-1600	13	19	6	11	13	9	13	28	22	32	30	11	9	11	15	7	15	11	22	20	22	28	11	11	9	6	13	19	13	20	11
1600-1630	11	19	22	9	13	6	9	28	22	33	24	17	6	7	11	7	13	9	24	24	24	28	13	9	9	15	13	13	9	17	9
1630-1700	11	15	7	13	9	6	9	26	19	28	24	-	9	9	13	17	13	11	26	17	17	20	9	7	6	9	15	19	7	19	11
1700-1730	9	15	13	9	11	0	9	28	19	28	20	-	7	9	7	13	13	11	20	17	22	26	7	9	4	0	15	13	6	15	7
1730-1800	9	13	9	6	11	7	6	22	9	22	20	-	11	9	9	9	11	9	17	15	17	15	7	7	0	0	19	13	2	13	15
1800-1830	11	13	6	9	11	6	6	20	7	20	13	4	9	15	2	6	13	9	20	11	17	19	9	7	6	7	17	7	6	9	7
1830-1900	11	13	0	6	11	11	2	17	7	19	13	0	7	15	6	6	13	9	19	11	15	13	9	6	0	7	15	4	6	11	9
1900-1930	13	11	7	2	11	11	4	17	4	19	13	0	9	13	7	0	13	9	15	9	15	15	9	4	0	0	7	7	0	9	7
1930-2000	7	11	0	0	13	15	2	19	0	17	11	0	11	7	9	4	15	6	15	9	13	13	9	6	0	6	4	0	0	13	2
2000-2030	6	9	0	7	11	13	4	15	0	19	11	0	9	4	9	0	13	6	11	9	13	19	11	11	0	6	77	0	6	11	2
2030-2100	7	7	0	7	11	13	7	15	0	20	11	0	2	4	9	2	15	6	17	11	15	28	9	11	2	4	7	0	4	11	9
2100-2130	7	6	0	2	11	13	2	13	0	26	11	0	7	4	4	9	13	7	11	7	19	24	7	9	7	6	9	4	0	11	6
2130-2200	7	7	4	7	11	11	0	13	0	28	11	2	7	0	0	7	9	0	19	2	15	22	7	9	11	9	2	6	0	9	0
2200-2230	6	6	0	2	9	2	9	13	0	22	13	0	6	4	7	6	8	2	13	4	15	24	6	7	2	7	11	0	0	7	6
2230-2300	2	2	0	0	2	7	6	11	0	20	13	0	4	7	7	0	8	6	11	0	13	19	6	9	6	6	7	4	0	6	9
2300-2330	0	2	4	6	6	4	0	11	0	17	19	0	9	6	6	0	2	0	19	11	20	19	6	9	6	7	6	0	0	7	7
2330-0000	4	2	4	9	7	6	0	9	0	17	20	2	6	6	4	0	5	2	13	6	11	24	7	9	0	7	6	0	0	4	0

Appendix D Power Calculations

Sunshine Coast

January	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	2.3	2.0	5.5	3.8	2.5	3.0	7.0	8.2	5.1	1.3	4.0	5.5	8.9	11.4	2.4	4.6	2.2	2.6	1.8	1.5	1.9	1.3	6.0	3.0	4.1	4.3	6.3	2.5	3.4	3.2	1.3	122.9	4.0
Ampair 5 x 600 W HAWT	8.0	6.5	14.7	11.0	8.5	9.1	18.0	21.6	14.7	5.1	12.0	13.4	23.0	29.0	7.7	12.5	7.2	8.0	5.2	5.3	6.5	5.2	15.2	8.6	10.8	11.8	16.3	7.9	10.0	8.4	4.6	345.8	11.2
R3K 3kW VAWT	3.3	2.6	6.0	4.7	3.3	3.7	7.3	8.3	5.6	2.0	4.8	6.1	8.9	11.0	3.1	4.7	2.9	3.2	2.0	2.1	2.7	2.0	5.9	3.2	4.2	4.5	6.3	3.2	4.1	4.0	1.9	137.6	4.4
Q4 5 x 600 W VAWT	3.2	2.3	6.4	4.9	3.7	4.0	8.3	9.5	6.4	2.2	5.2	6.7	10.3	13.0	3.5	5.5	3.2	3.5	2.3	2.3	2.8	2.2	6.9	3.7	4.9	5.2	7.3	3.4	4.4	4.3	2.0	153.5	5.0
EOLO 3 kW VAWT	17.2	13.6	23.0	23.2	17.4	18.3	33.9	36.4	25.6	10.9	24.2	28.9	33.9	40.8	14.0	21.4	15.3	15.8	10.5	11.3	14.1	11.2	20.0	15.0	14.5	20.2	24.5	16.6	19.0	14.8	10.0	615.5	19.9

February	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28				Total	Mean
Windpower 3 kW HAWT	4.5	9.6	5.9	7.0	9.0	13.0	12.5	5.2	1.3	6.6	3.2	9.2	9.4	26.5	35.0	18.9	10.0	3.4	0.8	4.3	26.9	37.1	29.6	32.9	28.8	9.6	6.7	12.9				379.8	13.6
Ampair 5 x 600 W HAWT	12.0	24.3	16.0	18.1	23.7	32.7	30.6	14.2	4.6	16.7	9.9	21.7	22.7	53.5	71.6	45.0	25.9	10.2	3.1	11.8	48.8	63.8	55.6	60.8	60.6	24.6	18.0	32.0				832.5	29.7
R3K 3kW VAWT	4.6	9.7	6.4	7.0	9.3	12.6	12.4	5.4	1.9	6.3	4.0	10.0	10.4	30.5	40.8	19.6	9.8	4.0	1.3	4.5	24.4	41.7	34.3	37.3	32.7	10.2	6.9	12.9				410.9	14.7
Q4 5 x 600 W VAWT	5.3	11.1	7.2	8.6	10.7	14.6	14.2	6.3	2.0	7.4	4.3	11.2	11.6	32.1	42.9	22.2	11.4	4.4	1.4	5.2	26.7	42.0	35.2	38.6	35.0	11.6	8.0	14.8				446.0	15.9
EOLO 3 kW VAWT	21.6	37.9	27.5	27.6	35.8	43.9	40.1	24.8	9.7	24.3	20.3	24.0	25.2	49.1	62.3	49.6	39.5	20.0	6.9	21.1	50.0	58.2	52.6	56.7	56.9	35.1	28.9	44.1				993.7	35.5

March	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	12.0	11.3	13.4	14.7	6.3	1.2	6.4	6.1	1.8	3.5	7.0	6.0	3.1	1.1	10.0	1.1	1.0	2.3	1.6	0.9	2.5	1.0	2.7	4.4	4.2	0.7	9.9	14.6	5.4	3.0	1.8	161.0	5.2
Ampair 5 x 600 W HAWT	30.2	28.6	33.4	36.3	17.0	4.2	16.3	16.7	6.8	9.5	16.9	15.7	9.4	4.2	22.8	3.8	3.3	6.4	4.9	3.7	7.7	3.9	7.3	12.0	11.1	2.7	24.8	34.8	15.0	8.7	6.2	424.3	13.7
R3K 3kW VAWT	11.6	10.8	12.7	14.2	6.5	1.6	6.5	6.6	2.7	3.6	8.2	6.5	3.6	1.7	11.5	1.4	1.3	2.4	1.9	1.4	2.9	1.5	2.8	4.5	4.4	1.0	10.0	15.4	6.0	3.4	2.4	171.0	5.5
Q4 5 x 600 W VAWT	13.6	12.7	15.0	16.7	7.5	1.8	7.5	7.3	2.9	4.2	8.9	7.4	4.1	1.8	12.4	1.6	1.5	2.8	2.1	1.6	3.4	1.7	3.2	5.3	5.1	1.2	11.6	17.3	6.7	3.9	2.7	195.5	6.3
EOLO 3 kW VAWT	42.9	42.2	45.7	47.3	30.3	8.3	22.7	31.6	14.5	15.9	21.0	21.2	17.2	8.9	25.5	6.7	6.8	10.5	9.4	7.5	14.0	8.2	12.7	18.2	15.7	5.5	32.8	42.4	26.8	15.2	12.4	640.0	20.6

April	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		Total	Mean
Windpower 3 kW HAWT	7.5	8.8	7.8	7.8	5.3	1.1	0.2	0.5	1.9	10.6	7.0	4.5	7.9	4.7	3.9	3.7	6.4	7.2	8.9	16.1	14.3	11.5	14.8	8.7	1.8	0.0	6.4	0.7	4.6	7.5		192.1	6.4
Ampair 5 x 600 W HAWT	19.5	22.9	20.5	20.5	14.4	4.2	1.4	2.2	5.6	25.9	18.9	13.0	20.6	13.0	11.6	11.0	17.3	19.4	23.1	39.0	35.6	29.0	36.5	22.7	6.3	0.3	16.4	3.2	12.1	19.5		505.6	16.9
R3K 3kW VAWT	7.3	8.8	8.2	8.0	5.7	1.6	0.5	0.9	2.2	10.7	7.3	5.1	8.0	5.1	4.5	4.4	6.7	7.4	9.1	15.8	14.0	11.0	14.3	8.7	2.5	0.1	6.4	1.2	4.7	8.0		198.2	6.6
Q4 5 x 600 W VAWT	8.7	10.2	9.3	9.2	6.5	1.8	0.6	1.0	2.5	12.4	8.5	5.7	9.2	5.7	5.0	4.9	7.6	8.6	15.5	18.4	16.4	13.1	16.8	10.1	2.7	0.1	7.4	1.4	4.5	9.1		232.9	7.8
EOLO 3 kW VAWT	28.0	34.9	32.9	31.8	24.1	7.9	0.9	4.7	10.2	30.7	28.2	23.8	31.4	23.9	22.1	18.2	28.9	31.8	33.9	48.8	45.9	41.4	47.4	35.6	13.0	0.5	22.9	6.3	19.0	28.3		757.4	25.2

May	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	9.3	6.1	0.2	0.1	0.6	0.8	0.2	0.8	0.2	1.5	2.2	6.4	12.3	3.7	5.1	5.0	3.7	4.9	7.3	1.8	1.4	2.4	1.8	2.5	0.4	0.7	0.1	0.7	0.3	0.2	1.6	84.3	2.7
Ampair 5 x 600 W HAWT	24.0	16.8	1.1	0.7	2.4	2.8	1.4	3.0	1.4	4.3	7.1	17.1	30.4	10.6	14.2	13.7	10.7	13.8	19.4	6.0	4.5	7.3	6.1	7.4	1.6	2.5	1.1	2.7	2.0	1.2	5.7	243.0	7.8
R3K 3kW VAWT	9.4	6.4	0.4	0.2	9.0	1.1	0.5	1.2	0.5	1.8	2.8	6.5	12.6	4.1	5.7	5.3	4.1	5.4	7.4	2.4	1.8	2.9	2.4	2.9	0.6	1.0	0.4	1.0	0.7	0.4	2.2	103.1	3.3
Q4 5 x 600 W VAWT	10.8	7.3	0.5	0.3	1.0	1.2	0.6	1.3	0.6	2.0	3.1	7.6	14.4	4.8	6.5	6.0	4.7	6.2	8.6	2.6	2.0	3.2	2.7	3.3	0.7	1.0	0.5	1.2	0.9	0.5	2.5	108.6	3.5
EOLO 3 kW VAWT	37.1	30.3	2.2	1.2	5.0	5.8	2.9	6.2	2.7	6.6	13.4	26.0	39.0	17.9	24.0	24.4	20.0	23.7	32.6	12.3	9.5	14.0	12.6	14.3	3.4	5.2	2.1	5.5	4.0	2.4	11.6	417.9	13.5

June	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		Total	Mean
Windpower 3 kW HAWT	2.0	2.3	0.4	10.2	3.0	5.6	7.3	2.2	0.7	0.1	0.7	0.1	0.6	0.3	0.5	2.0	2.0	0.0	0.4	4.0	2.2	7.7	3.8	5.7	6.5	13.5	13.7	10.4	1.6	1.6		111.1	3.7
Ampair 5 x 600 W HAWT	6.0	7.4	1.5	24.3	8.7	15.4	19.5	7.0	2.6	0.9	2.6	1.0	3.0	1.2	2.0	6.0	5.5	0.6	2.1	11.8	7.2	17.6	11.2	15.9	17.6	33.1	33.3	26.3	5.9	5.9		303.1	10.1
R3K 3kW VAWT	2.4	3.0	0.6	11.0	3.4	5.9	7.5	2.8	1.0	0.3	1.0	0.3	1.0	0.5	0.8	2.3	2.2	0.2	0.8	4.7	2.7	6.8	4.4	6.2	6.8	14.0	14.4	10.6	2.3	2.3		122.2	4.1
Q4 5 x 600 W VAWT	2.6	3.3	0.7	12.2	3.8	6.8	8.7	3.0	1.1	0.4	1.1	0.4	1.3	0.5	0.9	2.6	4.4	0.3	0.9	5.2	3.1	7.9	4.9	7.0	7.7	16.0	16.3	12.3	2.6	2.6		140.6	4.7
EOLO 3 kW VAWT	12.2	14.4	3.0	31.6	16.5	25.9	29.5	14.3	5.4	1.7	5.3	1.9	5.6	2.6	4.3	10.9	9.2	1.0	4.4	22.8	13.9	27.0	20.8	26.9	30.5	41.5	39.6	36.0	11.1	11.1		480.9	16.0

July	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	3.6	1.6	11.2	18.9	29.3	19.1	6.7	6.7	0.2	1.2	0.6	0.5	1.1	4.0	3.2	0.1	0.1	0.3	0.0	0.1	0.6	0.2	0.4	0.2	2.1	0.0	1.3	1.1	0.2	0.6	7.1	122.3	3.9
Ampair 5 x 600 W HAWT	10.1	5.7	28.1	43.6	62.1	44.6	17.9	17.9	1.1	3.6	2.3	2.5	4.6	10.9	8.8	1.1	1.0	1.4	0.6	1.0	2.5	1.2	1.8	1.0	6.8	0.3	3.8	4.0	1.3	2.4	19.3	313.3	10.1
R3K 3kW VAWT	4.0	2.3	11.4	21.0	33.4	20.0	6.9	6.9	0.4	1.4	0.9	0.9	1.6	4.7	3.7	0.4	0.3	0.5	0.2	0.4	1.0	0.4	0.7	0.4	2.8	0.1	1.5	1.6	0.5	0.9	7.3	138.5	4.5
Q4 5 x 600 W VAWT	4.4	2.5	13.1	23.2	35.7	22.5	7.9	7.9	0.5	1.6	1.0	1.0	2.0	5.2	3.9	0.5	0.5	0.6	0.2	0.4	1.0	0.5	0.8	0.5	3.0	0.1	1.7	1.7	0.6	1.0	8.5	154.0	5.0
EOLO 3 kW VAWT	19.7	12.2	37.7	45.9	58.2	50.2	30.6	30.6	2.4	6.2	4.5	5.0	5.6	16.3	14.0	2.1	1.9	2.8	1.0	2.0	5.2	2.4	3.9	2.0	14.3	0.5	7.5	8.4	2.6	4.9	30.2	430.8	13.9

Aug	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	5.6	6.0	2.4	0.2	0.4	0.8	0.1	2.4	1.4	7.6	8.0	3.2	1.6	0.4	0.0	2.6	2.6	1.7	0.5	4.2	2.1	3.8	9.8	0.4	2.2	0.7	0.6	0.4	0.5	4.7	5.4	82.3	2.7
Ampair 5 x 600 W HAWT	15.4	16.2	7.3	1.6	2.0	3.3	1.0	6.7	4.4	19.0	21.0	9.2	5.1	1.6	0.4	7.2	7.2	5.4	2.6	11.8	6.9	10.4	24.6	2.1	6.4	2.9	2.4	1.8	2.2	12.8	15.0	235.9	7.6
R3K 3kW VAWT	6.0	6.2	2.8	0.7	0.7	1.3	0.3	2.6	1.7	8.1	8.3	3.6	2.0	0.6	0.1	2.7	2.7	2.1	1.0	4.6	2.7	4.1	10.7	0.8	2.4	1.1	0.9	0.7	0.8	5.0	5.8	93.1	3.0
Q4 5 x 600 W VAWT	6.9	7.2	3.2	0.7	0.9	1.4	0.4	3.0	2.0	9.3	9.6	4.0	2.2	0.7	0.2	3.2	3.2	2.3	1.1	5.2	3.0	4.7	12.0	0.9	2.8	1.3	1.0	0.7	1.0	5.6	6.6	106.3	3.4
EOLO 3 kW VAWT	26.4	25.4	13.8	3.2	4.1	6.8	1.9	11.0	9.0	22.9	30.3	15.3	10.2	3.3	0.8	12.3	12.3	10.5	5.4	20.6	14.1	15.9	32.5	4.3	11.6	6.0	5.1	3.7	4.3	22.2	26.6	391.8	12.6

Amberley

January	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	2.2	3.3	3.3	3.8	1.8	4.6	4.1	1.7	0.2	2.0	4.1	3.3	5.0	4.8	3.7	5.0	3.0	2.5	2.0	3.1	6.0	3.0	2.2	3.2	4.1	4.8	5.0	4.8	4.4	6.7	3.5	111.2	3.6
Ampair 5 x 600 W HAWT	6.2	8.6	9.0	10.3	5.3	12.1	11.1	5.5	1.2	5.9	10.9	9.1	14.9	13.0	9.5	12.6	8.3	7.1	6.1	8.9	15.5	8.2	6.0	9.1	10.7	12.3	12.7	12.6	11.7	17.0	9.3	300.7	9.7
R3K 3kW VAWT	2.4	3.3	3.5	3.9	2.0	4.6	4.2	2.2	0.4	2.3	4.2	3.4	5.8	4.9	3.8	5.2	3.2	2.7	2.3	3.3	6.2	3.1	2.4	3.5	4.2	4.9	5.2	4.9	4.0	6.8	3.6	116.4	3.8
Q4 5 x 600 W VAWT	2.2	3.2	3.3	4.0	2.3	5.4	5.0	2.4	0.5	2.6	4.9	4.0	6.7	5.8	4.4	6.0	3.7	3.1	2.7	3.9	7.2	3.6	2.7	4.0	4.9	5.6	6.0	5.7	5.2	7.9	4.1	133.0	4.3
EOLO 3 kW VAWT	10.5	11.7	14.1	17.4	9.1	18.0	17.7	11.4	2.3	10.0	17.3	5.2	21.9	19.7	11.6	14.9	13.3	12.2	9.0	14.5	22.3	13.7	8.5	15.2	14.5	16.0	15.5	17.8	18.0	21.4	14.0	438.7	14.2

February	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28				Total	Mean
Windpower 3 kW HAWT	7.0	7.5	4.7	4.5	9.5	7.3	4.7	1.7	3.2	6.9	3.6	2.7	3.8	5.5	3.2	3.5	4.7	2.5	2.8	3.1	5.4	23.5	15.9	12.3	6.5	4.0	5.1	2.0				167.1	6.0
Ampair 5 x 600 W HAWT	17.4	18.7	12.1	11.8	23.1	18.7	12.2	5.1	8.5	15.8	9.6	7.7	9.9	14.9	9.2	9.6	12.5	7.2	7.2	8.7	14.0	47.5	35.5	30.5	17.5	11.0	13.1	5.9				414.9	14.8
R3K 3kW VAWT	7.0	7.6	14.7	4.6	10.0	7.7	4.7	2.1	3.2	7.7	4.0	3.0	3.8	5.7	3.6	3.8	5.1	2.8	2.9	3.5	5.7	26.3	17.7	12.7	6.8	4.3	5.4	2.3				188.7	6.7
Q4 5 x 600 W VAWT	8.2	8.9	5.5	5.4	11.0	8.9	5.5	2.6	3.8	8.4	4.6	3.5	4.4	6.6	4.0	4.3	6.0	3.2	3.4	4.0	6.6	27.8	19.2	14.6	8.0	4.9	6.2	2.6				202.1	7.2
EOLO 3 kW VAWT	21.4	22.5	17.8	17.2	28.0	23.3	17.2	10.6	12.8	18.8	13.8	12.5	13.4	23.3	15.3	16.4	16.3	11.6	9.6	12.5	18.4	49.3	38.8	38.3	24.3	18.2	18.0	10.4				550.0	19.6

March	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	3.6	4.3	3.8	6.0	2.4	2.2	4.2	5.2	2.0	1.9	2.4	5.4	5.3	4.2	3.3	0.0	0.8	0.8	0.2	3.0	2.1	1.9	0.2	0.4	1.1	0.1	2.0	1.0	1.8	1.8	0.7	74.1	2.4
Ampair 5 x 600 W HAWT	10.5	11.4	10.0	15.3	7.2	5.9	11.4	13.3	7.2	5.4	6.6	13.7	13.1	11.3	8.0	0.4	2.3	2.4	0.8	7.4	6.0	5.0	1.3	1.0	4.1	0.6	6.0	3.7	5.5	5.6	2.4	204.8	6.6
R3K 3kW VAWT	4.0	4.7	3.9	5.9	2.9	2.4	4.5	5.3	2.7	2.0	2.5	0.6	5.9	4.4	3.4	0.1	0.9	1.0	0.3	3.1	2.4	2.0	0.4	0.6	1.6	0.2	2.3	1.5	2.1	2.2	0.9	76.7	2.5
Q4 5 x 600 W VAWT	4.6	5.4	4.5	6.9	3.2	2.7	5.2	6.1	3.1	2.4	2.9	6.5	6.7	5.0	3.9	0.2	1.0	1.2	0.4	3.6	2.8	2.2	0.6	0.7	1.8	0.3	2.7	1.6	2.4	2.4	1.0	94.0	3.0
EOLO 3 kW VAWT	17.1	16.6	14.2	21.2	14.2	8.0	16.8	18.9	11.9	8.2	10.3	17.7	14.8	17.6	9.8	0.7	3.7	3.6	1.7	9.4	8.8	8.1	2.5	3.2	8.5	1.3	10.0	7.6	10.3	10.8	4.5	312.0	10.1

April	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		Total	Mean
Windpower 3 kW HAWT	0.3	1.3	2.7	1.6	1.3	0.3	1.0	0.2	0.1	1.5	1.3	1.6	1.3	0.2	0.1	0.6	0.9	0.6	2.8	2.5	4.1	7.7	2.3	1.5	0.7	0.0	0.8	0.2	0.5	0.4		40.4	1.3
Ampair 5 x 600 W HAWT	1.7	4.0	7.6	5.0	4.3	1.1	2.9	1.0	0.9	4.7	4.2	5.0	4.0	1.0	0.9	2.0	3.0	2.3	7.7	7.1	10.8	18.7	6.7	4.7	2.6	0.0	2.5	1.0	2.2	1.8		121.4	4.0
R3K 3kW VAWT	0.6	16.0	2.9	2.0	1.7	0.4	1.3	0.4	0.3	1.9	1.7	2.0	1.6	0.4	0.3	0.8	1.2	0.9	2.9	2.8	4.1	8.1	2.6	1.9	1.0	0.0	0.9	0.4	0.8	0.7		62.6	2.1
Q4 5 x 600 W VAWT	0.7	1.8	3.3	2.2	1.9	0.5	1.3	0.4	0.4	2.0	1.9	2.2	1.8	0.5	0.4	0.9	1.3	1.0	3.4	3.2	4.8	9.3	2.9	2.0	1.1	0.0	1.0	0.4	0.9	0.8		54.3	1.8
EOLO 3 kW VAWT	3.5	7.8	12.8	9.7	8.5	2.4	5.6	2.1	1.8	9.3	8.4	8.8	7.3	2.1	1.6	3.5	5.8	4.7	12.3	11.3	16.5	21.7	12.3	9.6	5.0	0.0	4.3	1.9	4.9	3.8		209.3	7.0

May	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	0.7	1.0	0.1	0.4	0.0	0.0	0.1	1.2	0.0	0.7	5.0	0.2	1.7	0.3	0.7	1.1	0.0	0.8	1.4	0.2	0.1	0.6	0.3	0.1	0.0	0.0	6.3	1.8	4.8	40.0	0.0	69.6	2.2
Ampair 5 x 600 W HAWT	2.6	3.2	0.2	1.8	0.3	0.2	0.6	3.8	0.2	2.8	13.5	1.0	6.7	1.9	2.7	3.8	0.4	2.8	4.3	1.2	0.7	2.2	1.5	0.5	0.2	0.0	15.4	5.6	13.3	11.3	0.4	105.1	3.4
R3K 3kW VAWT	1.0	1.3	0.1	0.6	0.1	0.1	0.2	1.5	0.1	1.1	5.2	0.4	2.1	0.7	1.0	1.5	0.1	1.1	1.7	0.4	0.2	0.9	0.6	0.2	0.1	0.0	6.7	2.2	5.0	4.4	0.1	40.7	1.3
Q4 5 x 600 W VAWT	1.1	1.4	0.1	0.8	0.1	0.1	2.0	1.6	0.1	1.2	6.0	0.5	2.5	0.8	1.2	1.7	0.2	1.2	1.9	0.5	0.3	0.9	0.7	0.2	0.1	0.0	7.6	2.4	5.9	5.1	0.2	48.4	1.6
EOLO 3 kW VAWT	5.5	6.6	0.3	3.4	0.6	0.3	1.2	7.6	0.5	6.0	21.9	2.1	11.0	3.7	5.6	7.7	0.8	5.6	8.5	0.4	1.2	4.4	3.2	1.0	0.3	0.1	18.7	10.8	21.7	16.9	0.7	178.3	5.8

June	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		Total	Mean
Windpower 3 kW HAWT	0.0	0.4	4.9	10.4	0.4	0.0	1.1	0.0	0.0	0.0	0.1	0.0	0.1	0.4	0.2	0.0	0.3	0.0	0.0	0.0	1.6	0.2	0.1	5.4	2.2	0.4	3.0	2.5	0.6	0.0		34.3	1.1
Ampair 5 x 600 W HAWT	0.0	1.6	12.9	23.9	1.9	0.2	3.3	0.0	0.2	0.4	0.7	0.5	0.9	1.9	0.8	0.1	1.3	0.0	0.3	0.4	4.5	1.3	0.5	13.6	6.3	1.6	8.0	6.9	1.9	0.0		95.9	3.2
R3K 3kW VAWT	0.0	0.6	5.0	11.7	0.7	0.0	1.2	0.0	0.0	0.1	0.2	0.2	0.3	0.7	0.3	0.0	0.5	0.0	0.1	0.1	1.8	0.4	0.2	5.5	2.4	0.6	3.0	2.7	0.8	0.0		39.1	1.3
Q4 5 x 600 W VAWT	0.0	0.7	5.8	12.8	0.8	0.1	1.4	0.0	0.1	0.2	0.3	0.2	0.4	0.8	0.4	0.0	0.6	0.0	0.1	0.2	2.0	0.6	0.2	6.4	2.8	0.7	3.6	3.1	0.8	0.0		45.1	1.5
EOLO 3 kW VAWT	0.0	3.3	18.9	28.6	3.9	0.4	5.8	0.0	0.3	0.7	1.4	0.9	1.8	3.9	1.7	0.1	2.8	0.0	0.6	0.7	7.9	2.6	1.0	17.6	9.9	3.0	12.1	10.8	3.9	0.0		144.6	4.8

July	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	0.8	0.0	1.8	4.6	4.9	2.8	0.8	0.0	0.0	1.7	3.7	2.7	11.3	0.2	5.1	0.8	0.0	0.4	0.0	0.2	0.3	0.1	0.1	3.0	1.0	0.1	0.2	0.9	0.2	0.5	1.2	49.4	1.6
Ampair 5 x 600 W HAWT	2.9	0.3	5.0	11.4	13.2	8.0	2.7	0.0	0.1	4.7	9.8	7.7	26.7	1.2	12.9	3.0	0.0	1.9	0.0	1.0	1.1	0.7	0.3	7.9	3.1	0.6	1.1	2.6	1.0	1.8	4.1	136.8	4.4
R3K 3kW VAWT	1.1	0.1	1.9	4.8	5.2	3.0	1.0	0.0	0.0	1.8	3.9	3.0	12.8	0.4	5.2	1.1	0.0	0.7	0.0	0.4	0.5	0.2	0.1	3.0	1.2	0.2	0.4	1.0	0.4	0.7	1.6	55.7	1.8
Q4 5 x 600 W VAWT	1.3	0.1	2.2	5.5	5.9	3.5	1.2	0.0	0.0	2.0	4.6	3.4	14.2	0.5	6.0	1.3	0.0	0.8	0.0	0.4	0.5	0.3	0.1	3.6	1.4	0.2	0.5	1.1	0.4	0.8	1.8	63.6	2.1
EOLO 3 kW VAWT	5.5	0.6	8.4	13.2	20.5	12.8	5.4	0.0	0.1	7.6	13.5	12.9	30.7	2.4	17.9	5.9	0.0	3.9	0.1	2.0	2.4	1.4	0.5	11.7	5.8	1.1	2.3	4.5	2.1	3.6	8.3	207.1	6.7

Aug	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	0.5	0.3	0.5	0.5	0.2	0.4	0.2	4.6	13.4	17.9	14.3	1.2	0.4	0.8	0.2	0.1	0.1	1.5	6.7	0.0	5.2	9.1	0.5	0.5	0.3	1.4	0.6	0.1	0.2	1.5	1.1	84.3	2.7
Ampair 5 x 600 W HAWT	2.0	1.4	1.6	1.6	1.0	1.4	1.2	12.2	30.2	39.7	33.5	4.4	1.4	2.5	0.7	0.8	0.7	4.7	16.7	0.1	13.9	22.4	2.5	1.6	1.3	4.0	2.1	0.6	1.0	4.0	3.3	214.5	6.9
R3K 3kW VAWT	0.8	0.5	0.6	0.6	0.4	0.6	0.4	5.0	15.0	20.1	16.0	1.7	0.5	1.0	0.3	0.3	0.2	1.8	7.3	0.0	5.6	9.8	0.9	0.6	0.5	1.5	0.8	0.2	0.4	1.5	1.2	96.1	3.1
Q4 5 x 600 W VAWT	0.9	0.6	0.7	0.7	0.5	0.6	0.5	5.8	16.3	21.7	17.7	1.9	0.6	1.0	0.3	0.4	0.3	2.0	8.2	0.1	6.4	11.1	1.0	0.7	0.6	1.8	0.9	0.3	0.5	1.8	1.5	107.4	3.5
EOLO 3 kW VAWT	4.1	2.8	3.1	3.1	2.2	3.0	2.4	15.8	34.4	43.6	37.2	8.8	2.8	4.4	1.5	1.6	1.3	9.0	19.8	0.2	20.0	26.6	5.0	3.2	2.7	6.2	4.4	1.3	2.2	6.4	5.8	284.9	9.2

Kingaroy

January	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	0.0	0.2	0.2	0.7	0.3	1.2	1.6	0.4	0.1	0.3	1.3	1.1	2.2	1.9	0.2	0.3	0.2	0.5	0.0	0.5	0.9	0.3	0.1	0.3	0.2	0.3	0.6	0.5	1.0	1.5	0.4	19.3	0.6
Ampair 5 x 600 W HAWT	1.0	1.5	1.6	3.2	18.0	4.1	5.8	2.3	0.8	1.4	4.8	4.0	7.1	5.8	1.1	1.5	1.4	2.1	0.7	2.5	3.5	1.8	0.7	1.1	0.9	1.8	3.0	2.9	4.0	4.7	2.5	97.6	3.1
R3K 3kW VAWT	0.3	0.5	0.5	1.2	0.6	1.7	2.3	0.8	0.3	0.5	1.9	1.5	2.8	2.2	0.4	0.6	0.5	0.8	0.2	0.9	1.3	0.6	0.2	0.4	0.3	0.6	1.1	1.0	1.6	1.8	0.9	30.3	1.0
Q4 5 x 600 W VAWT	0.2	0.7	0.8	1.5	0.8	1.9	2.5	1.0	0.4	0.6	2.0	1.7	3.1	2.5	0.5	0.7	0.6	0.9	0.3	1.0	1.6	0.8	0.3	0.5	0.4	0.7	1.0	1.2	1.8	2.0	1.1	35.1	1.1
EOLO 3 kW VAWT	2.0	2.9	3.2	6.4	3.6	9.0	11.8	4.6	1.6	2.9	10.0	8.2	13.6	11.2	2.3	3.0	2.7	4.5	1.2	5.2	6.9	3.6	1.4	2.1	1.8	3.5	6.3	5.8	8.6	9.0	5.0	163.9	5.3

February	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28				Total	Mean
Windpower 3 kW HAWT	3.0	3.8	1.5	1.4	4.0	2.0	3.5	0.9	0.0	0.2	0.5	1.2	1.4	6.0	3.8	2.2	1.0	1.4	0.4	0.8	2.2	10.0	7.0	3.8	3.0	2.1	2.9	2.0				72.0	2.6
Ampair 5 x 600 W HAWT	8.2	10.6	4.9	4.8	11.1	6.7	10.6	4.3	0.3	1.0	2.0	4.2	5.0	16.4	11.5	7.2	3.7	3.2	1.5	3.0	7.4	25.0	18.5	10.8	9.1	6.6	8.4	6.6				212.6	7.6
R3K 3kW VAWT	3.2	4.1	2.0	1.7	4.3	2.6	4.0	1.6	0.1	0.4	0.8	1.6	1.8	6.4	4.5	2.8	1.5	1.2	0.6	1.1	2.8	10.6	6.9	4.1	3.6	2.6	3.2	2.7				82.8	3.0
Q4 5 x 600 W VAWT	3.7	4.7	2.1	1.9	4.9	3.0	4.6	1.9	0.1	0.4	0.9	1.8	2.2	7.3	5.0	3.2	1.6	1.4	0.7	1.3	3.2	11.9	8.2	4.7	4.0	2.9	3.7	2.9				94.2	3.4
EOLO 3 kW VAWT	13.7	18.6	10.3	8.3	19.5	12.6	18.9	8.5	0.6	2.0	3.9	8.0	9.2	27.3	22.3	14.7	7.7	6.7	3.1	6.0	14.2	35.1	30.6	19.2	17.2	13.0	15.2	13.6				380.0	13.6

March	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	2.7	2.5	3.5	3.3	0.7	0.0	2.3	2.7	0.0	0.0	1.2	1.1	0.8	0.6	21.0	0.0	0.5	0.0	0.3	0.8	0.0	0.6	0.0	0.0	0.3	0.8	1.7	2.1	0.2	1.4	3.7	54.8	1.8
Ampair 5 x 600 W HAWT	7.9	7.4	10.0	10.0	3.0	0.2	6.9	8.0	0.9	0.7	4.5	3.5	2.8	2.5	6.6	0.0	1.9	0.6	1.2	2.6	0.6	2.3	0.0	0.3	1.7	2.3	6.0	7.4	1.8	4.3	10.5	118.4	3.8
R3K 3kW VAWT	3.0	2.8	3.8	3.8	1.2	0.0	2.6	3.0	0.3	0.2	1.7	1.4	1.1	0.9	2.7	0.0	0.7	0.2	0.5	1.0	0.2	0.9	0.0	0.1	0.6	0.9	2.4	2.9	0.6	1.7	4.1	45.3	1.5
Q4 5 x 600 W VAWT	3.4	3.2	4.4	4.4	1.3	0.0	3.0	3.5	0.4	0.3	1.9	1.5	1.2	1.0	3.0	0.0	0.8	0.3	0.5	1.1	0.3	0.9	0.0	0.1	0.7	1.0	2.6	3.3	0.8	1.9	4.8	51.6	1.7
EOLO 3 kW VAWT	14.7	13.4	17.3	18.2	6.4	0.3	12.7	14.6	1.6	1.3	8.9	7.3	5.5	5.1	12.4	0.1	3.7	1.2	2.6	5.4	1.1	5.0	0.1	0.6	3.3	4.7	12.5	15.1	3.5	8.4	16.5	223.5	7.2

April	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		Total	Mean
Windpower 3 kW HAWT	0.6	2.0	2.7	1.5	0.8	0.2	0.0	0.0	0.0	0.9	2.0	3.1	7.4	0.4	0.5	0.4	0.8	0.6	2.5	3.7	2.5	1.0	1.9	0.6	0.1	0.0	0.6	0.0	1.1	0.2		38.1	1.3
Ampair 5 x 600 W HAWT	2.6	6.7	9.0	5.4	3.1	1.2	0.0	0.1	0.0	3.8	5.9	9.1	16.6	2.8	2.5	2.5	3.3	2.7	7.6	11.3	8.3	4.1	7.2	3.0	0.7	0.1	2.2	0.2	3.8	0.9		126.7	4.2
R3K 3kW VAWT	1.0	2.7	3.5	2.1	1.2	0.4	0.0	0.0	0.0	1.5	2.2	3.6	8.4	1.1	0.9	0.9	1.2	1.0	3.0	4.4	3.2	1.6	2.8	1.3	0.2	0.0	0.9	0.0	1.5	0.3		50.9	1.7
Q4 5 x 600 W VAWT	1.1	2.9	3.9	2.4	1.4	0.5	0.0	0.0	0.0	1.6	2.6	4.0	9.1	1.2	1.0	1.1	1.4	1.2	3.4	5.0	3.6	1.8	3.1	1.3	0.3	0.1	0.9	0.0	1.6	0.4		56.9	1.9
EOLO 3 kW VAWT	5.2	13.6	18.3	11.0	6.6	2.4	0.0	0.1	0.0	7.9	10.6	17.0	17.9	5.7	5.1	5.0	6.6	5.7	14.2	20.5	16.4	8.4	14.9	6.1	1.3	0.3	4.7	0.3	7.6	1.9		235.3	7.8

May

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	0.9	0.4	0.1	0.6	1.5	0.0	0.1	0.6	0.0	3.0	7.2	1.0	1.9	0.7	1.0	1.3	0.8	1.5	1.8	0.2	0.1	0.2	0.3	0.0	0.4	0.1	2.4	1.2	1.3	2.0	1.9	34.5	1.1
Ampair 5 x 600 W HAWT	3.5	2.2	0.5	2.4	4.8	0.2	0.8	2.3	0.2	8.7	19.4	3.7	6.4	3.1	3.6	4.6	3.3	4.6	5.4	1.4	1.1	1.5	1.5	0.6	1.5	0.5	6.6	3.6	3.8	5.6	5.3	112.7	3.6
R3K 3kW VAWT	1.4	0.9	0.2	0.9	1.9	0.1	0.3	0.9	0.1	3.4	7.5	1.5	2.5	1.2	1.4	1.8	1.3	1.9	2.1	0.5	0.4	0.5	0.5	0.2	0.6	0.2	2.5	1.4	1.5	2.2	2.0	43.8	1.4
Q4 5 x 600 W VAWT	1.5	1.0	0.2	1.1	2.0	0.1	0.4	1.0	0.1	3.8	8.7	1.6	2.8	1.3	1.5	2.0	1.4	2.0	2.3	0.6	0.5	0.7	0.6	0.3	0.7	0.2	3.0	1.6	1.7	2.5	2.3	49.5	1.6
EOLO 3 kW VAWT	7.1	4.7	1.0	4.7	9.6	0.4	1.6	4.8	0.3	16.0	31.0	7.8	12.8	6.4	7.7	9.7	6.8	9.5	10.4	2.7	2.1	2.9	3.0	1.0	3.1	1.1	10.4	7.3	7.3	10.5	9.8	213.5	6.9

June

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		Total	Mean
Windpower 3 kW HAWT	0.6	0.1	1.0	12.0	0.8	0.3	1.2	0.2	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.3	0.7	0.0	0.3	0.2	1.4	0.1	0.2	2.6	2.0	2.5	3.3	3.2	0.4	0.0		33.7	1.1
Ampair 5 x 600 W HAWT	2.2	0.8	3.2	28.4	3.5	1.8	4.4	1.2	0.6	0.0	0.8	0.3	0.3	0.0	0.7	1.7	2.5	0.3	1.8	1.2	4.8	0.7	0.8	7.1	6.9	8.7	10.0	8.9	1.8	0.0		105.4	3.5
R3K 3kW VAWT	0.9	0.2	1.3	13.4	1.3	0.7	1.7	0.4	0.0	0.0	0.3	0.1	0.1	0.0	0.2	0.6	1.0	0.0	0.7	0.4	1.8	0.2	0.3	2.7	2.7	3.4	3.8	3.5	0.7	0.0		42.4	1.4
Q4 5 x 600 W VAWT	1.0	0.3	1.4	14.8	1.5	0.8	1.9	0.5	0.0	0.0	0.4	0.1	0.1	0.0	0.3	0.7	1.0	0.1	0.6	0.5	2.0	0.3	0.4	3.2	3.0	3.8	4.4	4.0	0.8	0.0		47.9	1.6
EOLO 3 kW VAWT	4.6	1.4	6.6	34.3	7.2	3.7	9.2	2.4	0.1	0.0	1.5	0.6	0.6	0.0	1.3	3.4	5.2	0.5	3.7	2.4	9.1	1.5	1.7	10.8	13.7	17.7	17.6	14.1	3.7	0.0		178.6	6.0

July

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	0.3	0.1	1.6	6.8	5.7	2.8	0.8	0.0	0.3	0.7	1.3	0.7	5.0	7.8	1.7	0.1	0.8	2.0	0.0	0.0	0.1	0.1	0.0	0.8	0.4	0.0	0.7	0.0	0.1	0.0	0.5	41.2	1.3
Ampair 5 x 600 W HAWT	1.6	0.6	5.3	17.6	15.8	9.4	3.8	0.2	1.5	2.4	3.8	2.4	13.0	19.8	5.1	0.6	2.7	5.8	0.2	0.3	0.4	0.6	0.2	2.7	1.5	0.1	2.5	0.3	0.5	0.2	2.7	123.6	4.0
R3K 3kW VAWT	0.6	0.2	2.0	7.3	6.1	3.8	1.4	0.1	0.6	0.9	1.5	0.9	5.0	8.2	2.0	0.2	1.0	2.2	0.1	0.1	0.1	0.2	0.1	1.0	0.6	0.0	1.0	0.1	0.2	0.1	1.0	48.6	1.6
Q4 5 x 600 W VAWT	0.7	0.3	2.3	8.4	6.9	4.0	1.6	0.1	0.6	1.0	1.7	1.0	5.9	9.4	2.2	0.2	1.2	2.6	0.1	0.2	0.2	0.3	0.1	1.1	0.7	0.0	1.1	0.1	0.2	0.1	1.2	55.5	1.8
EOLO 3 kW VAWT	3.3	1.1	10.4	23.3	28.8	19.6	7.6	0.4	3.1	4.9	7.8	4.9	19.5	27.5	10.2	1.2	5.2	9.5	0.3	0.6	0.8	1.2	0.3	5.6	3.0	0.1	5.4	0.6	1.0	0.4	5.6	213.2	6.9

Aug

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Mean
Windpower 3 kW HAWT	0.5	0.8	0.3	0.0	0.1	0.0	0.6	4.6	3.6	8.4	7.2	2.5	0.0	0.0	0.0	0.1	0.1	0.3	0.0	3.2	3.1	7.5	8.1	0.0	0.1	0.1	0.3	0.2	0.1	0.4	0.1	52.3	1.7
Ampair 5 x 600 W HAWT	2.4	3.3	1.7	0.2	0.9	0.1	2.1	12.0	9.4	20.8	18.4	7.7	0.4	0.4	0.2	0.6	0.6	2.0	0.2	9.1	9.2	19.2	20.9	0.3	0.4	0.5	1.7	0.8	0.4	1.7	0.6	148.2	4.8
R3K 3kW VAWT	0.9	1.3	0.6	0.1	0.3	0.1	0.9	4.7	3.6	8.8	7.6	3.0	0.1	0.1	0.1	0.2	0.2	0.7	0.1	3.5	3.6	8.1	8.4	0.1	0.2	1.2	0.6	0.3	0.1	0.7	0.2	60.4	1.9
Q4 5 x 600 W VAWT	1.0	1.4	0.7	0.1	0.4	0.1	1.0	5.5	4.2	10.0	8.9	3.4	0.2	0.2	0.1	0.2	0.2	0.9	0.1	4.0	4.1	9.3	9.7	0.1	0.2	0.2	0.7	0.4	0.1	0.7	0.3	68.4	2.2
EOLO 3 kW VAWT	4.9	6.9	3.4	0.3	1.7	0.6	4.6	16.9	14.5	25.9	22.7	14.0	0.7	0.8	0.4	1.0	1.0	4.1	0.4	16.2	15.6	25.2	28.3	0.5	0.9	1.0	3.3	1.7	0.8	3.6	1.2	223.1	7.2