KNOWLEDGE SHARING (FINCLOSE REPORT)

PROJECT: KENNEDY ENERGY PARK

LOCATION: QUEENSLAND

REPORT PREPARED FOR: ARENA (PUBLIC RELEASE)

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Contents

1 Introduction

1.1 Project Status

Kennedy Energy Park (KEP) is a 60.2MW hybrid wind/solar/storage project undert construction in North Queensland. The project reached financial close on 18th October 2017 and will receive an $18 million recoupable grant from ARENA (Australian Renewable Energy Agency).

The project is expected to reach commercial operation in late 2018 and as part of its funding agreement with ARENA will provide 'knowledge sharing' to ARENA, the renewables industry and the general public. This knowledge sharing will cover the spectrum of development, financing, construction and operations phases of the project with a focus on those aspects that are novel such as developing a hybrid project on a remote and weak part of the network.

This document has been prepared by Windlab Asset Managment Pty Ltd on behalf of the project owner, Kennedy Energy Park Pty Ltd.

1.2 Knowledge Sharing

This report focusses on activities undertaken upto and including the financial close process for KEP. The report provides

- An overview of the project including the key innovations and expected outcomes
- A summary of the development process and recommendations for future hybrid projects
- A summary of the project finance process and outcomes and key risks that may be encountered by future hybrid projects

2 PROJECT BACKGROUND

2.1 GENERAL

KEP is an innovative 60.2MW hybrid renewable energy facility located near Hughenden in northwest Queensland. It will consist of 19.3MW DC/15MWAC Solar PV, 43.2MW of Wind and 4MWh/2MW of Lithium Ion storage. The project is forecast to have an exceptional capacity factor of around 48%[1].

2.2 LOCATION

The project site is located approximately 22km southeast of the township of Hughenden and 290km southwest of Townsville as shown in Figure 1. The site location was selected by Windlab's WindScape Institute using its internal wind and solar modelling expertise as a site with one of the best combined solar and wind resources in the world.

FIGURE 2-1: LOCATION OF KENNEDY ENERGY PARK

2.3 PROJECT RATIONALE

A key rationale that underpins KEP is demonstrating that effective co-location of wind and solar resources is beneficial for the future optimal operation of Australia's National Electricity Market. Specifically in the case of KEP it is shown that the amount of storage required to deliver a certain

[1] Capacity Factor for Kennedy Energy Park is defined based on the maximum output (50MW) at the grid connection.

percentage of renewables at a local, State or National level can be minimised by optimising the relative contribution of high quality and highly complementary resources.

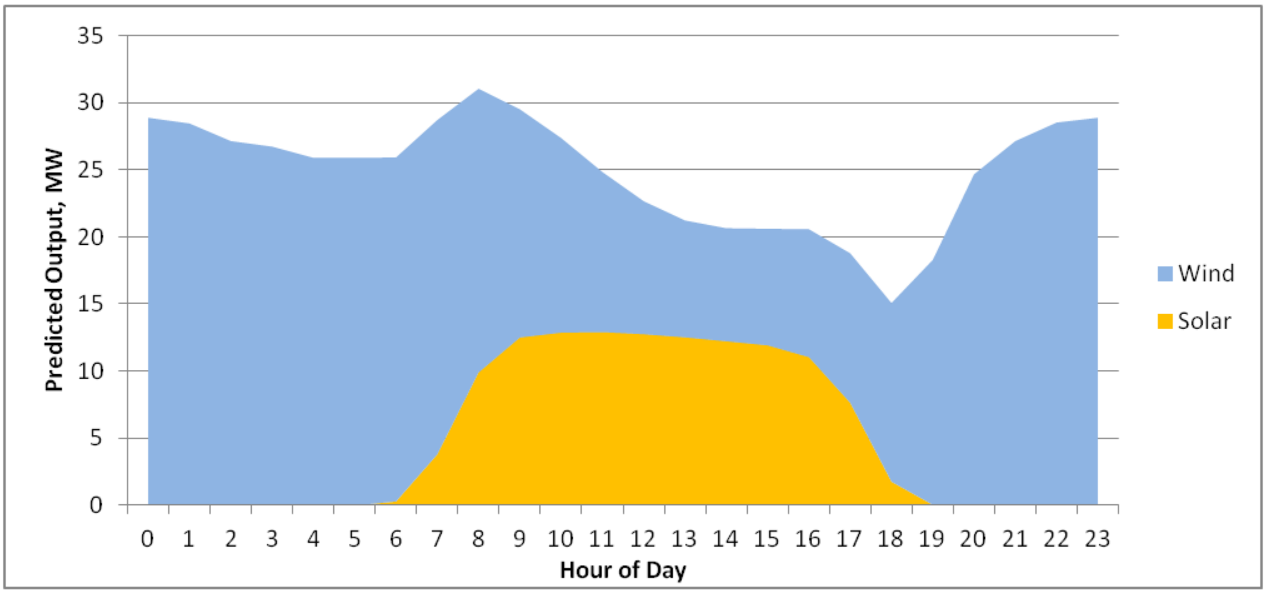

FIGURE 2-2: DIURNAL PROFILES OF THE WIND AND SOLAR GENERATION AT KENNEDY.

The complementary nature of the wind and solar resource at Kennedy is well illustrated in Figure 2-2. It shows that there is greatly reduced wind generation during the daylight hours when PV is productive, with the exception of early morning. During the night when there is no PV generation, the wind generation is elevated. The high degree of complementarity is demonstrated when comparing with other wind farms in Australia. In 2016 ARENA commission a report[2] from AECOM to investigate the potential for co-locating wind and solar farms in Australia. For each existing wind farm in Australia, the report assumed a hypothetical adjacent solar farm with the same capacity as the wind farm. It then assumed the generation of the combined wind and solar project was curtailed to a limit equal to the installed capacity of the wind farm. It then calculated the combined capacity factor of the project. The combined capacity factors ranged from 45% to 61%, with Alinta being the best performing wind farm in the study. By the equivalent measure, Kennedy is predicted to achieve a combined capacity factor of 73%, far in exceedance of the next best project.

A key benefit of Kennedy having a highly complementary wind and solar resource is that it enables the project to supply a high fraction of local demand without excessive levels of storage.

Figure 2-3 demonstrates the benefits of colocation of wind and solar at the local scale at Kennedy. When generation is sized so as to match local demand[3] (without oversizing), then it can be shown that with no storage, only 46% of demand can be met if generation comes from solar alone (Figure 2-3, LHS). This is due to the fact that most generation is created during the middle of the day, far above demand requirements and none at night. The renewable penetration limit rises to 65% if wind alone is used, as its generation is distributed more evenly throughout the day and night. But

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[2] "Co-location Investigation: a study into the potential for co-locating wind and solar farms in Australia", AECOM for ARENA, 15-Mar-2016

[3] Local demand is defined as demand required to supply Hughenden, Julia Ck, Richmond & Winton, with an average load of approximately 6 MW.

with an optimised mixture of wind and solar, then the renewable penetration can increase to 78% with no storage.

Figure 2-3 (RHS) indicates that a very modest amount of storage (2 MWh), allows the wind and solar to provide 80% of local demand. Much greater amounts of storage are required if the same is attempted using wind only (32 MWh), or solar only (48 MWh).

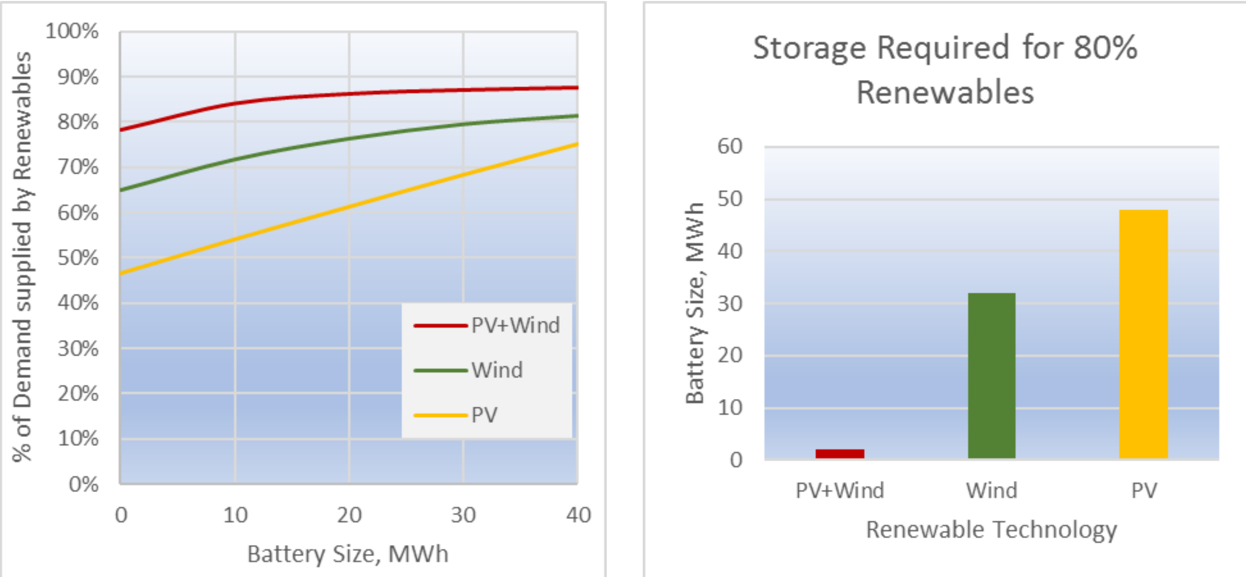

FIGURE 2-3: (L) POTENTIAL RENEWABLE PENETRATION RATE VERSUS BATTERY SIZE AT KENNEDY. (R) BATTERY SIZE REQUIRED TO ACHIEVE 80% RENEWABLE PENETRATION RATE AT KENNEDY.

A similar story is seen if we step up from the local level to the state level. Queensland has a 50% renewable electricity target for 2030. Figure 2-4 indicates that if more than about 40% of electricity comes from PV, then average residual demand will drop to zero around noon. It is clear that if this amount of PV is built without storage, then substantial curtailment will occur. Indeed, the high penetration rate of relatively inflexible coal generation in QLD means that curtailment is likely to occur well before residual demand gets anywhere near zero.

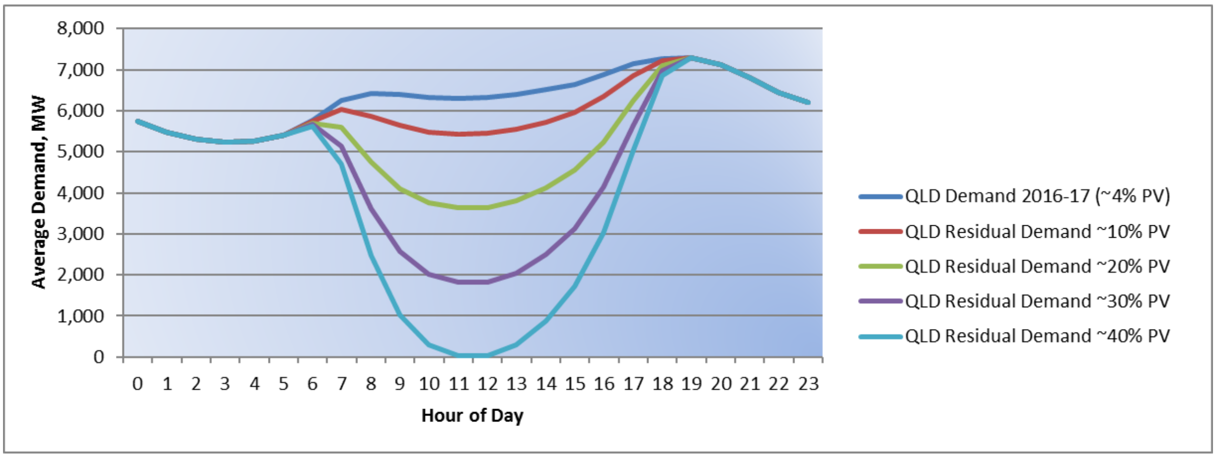

FIGURE 2-4: AVERAGE RESIDUAL QLD DEMAND AFTER VARYING PV GENERATION PENETRATION RATES.

Figure 2-5 indicates the results of an additional study[4] by Windlab using a year of 30 minute data traces of wind and solar geographically spread across QLD, and assuming that curtailment occurs when residual demand drops below 1500 MW. The study revealed that QLD could meet its 50% renewable target without any additional storage requirements provided at least 30% of the electricity came from wind power. If all of the 50% renewable generation came from PV, then QLD would require approximately 50 GWh of storage to keep curtailment levels to less than 10%

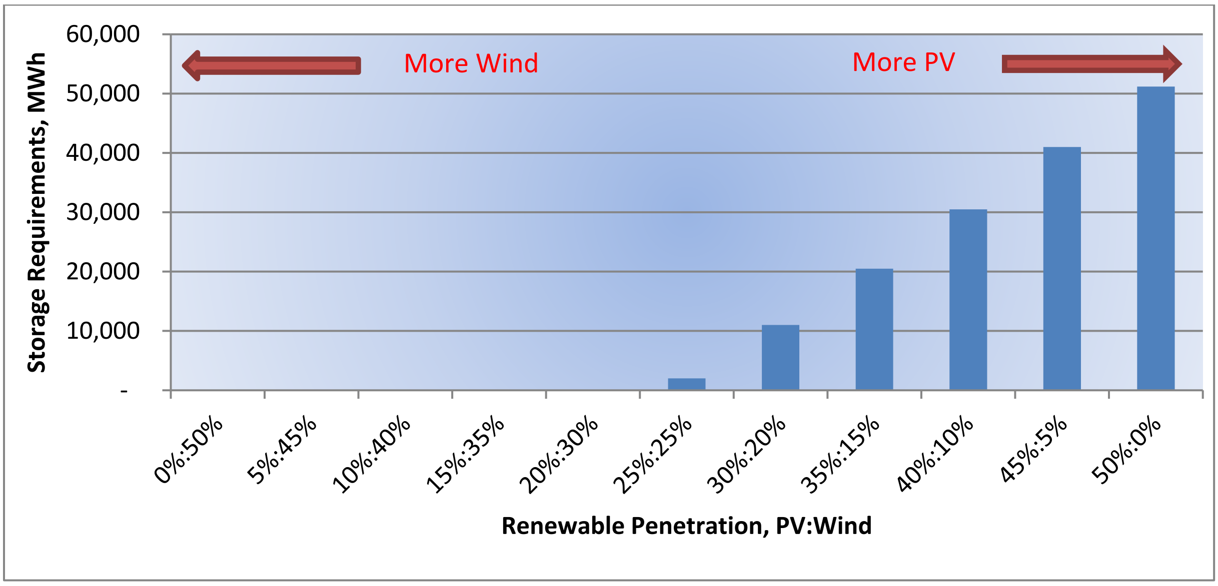

Figure 2-5: Storage requirements for a 50% renewable QLD for different Ratios of wind and PV, in order to keep curtailment to less than 10%. Note that it was assumed that when ever residual QLD demand dropped below 1500 MW then the renewable generation would be curtailed.

In summary, knowledge from the Kennedy project can serve as a useful test case for the state of QLD, and indeed for the entire National Electricity Market (NEM). It can demonstrate the complementary nature of a combined wind and solar project. It can also demonstrate the importance of getting an optimal mixture of wind and solar in order to reach a high renewable penetration rate while minimising grid storage requirements, which shall be critically important as QLD progresses towards its 50% renewable target.

[4] https://www.windlabinvestors.com/resources/pdf/20170830%20PNQ%20Summit%20V1.2.pdf

2.4 Project Design

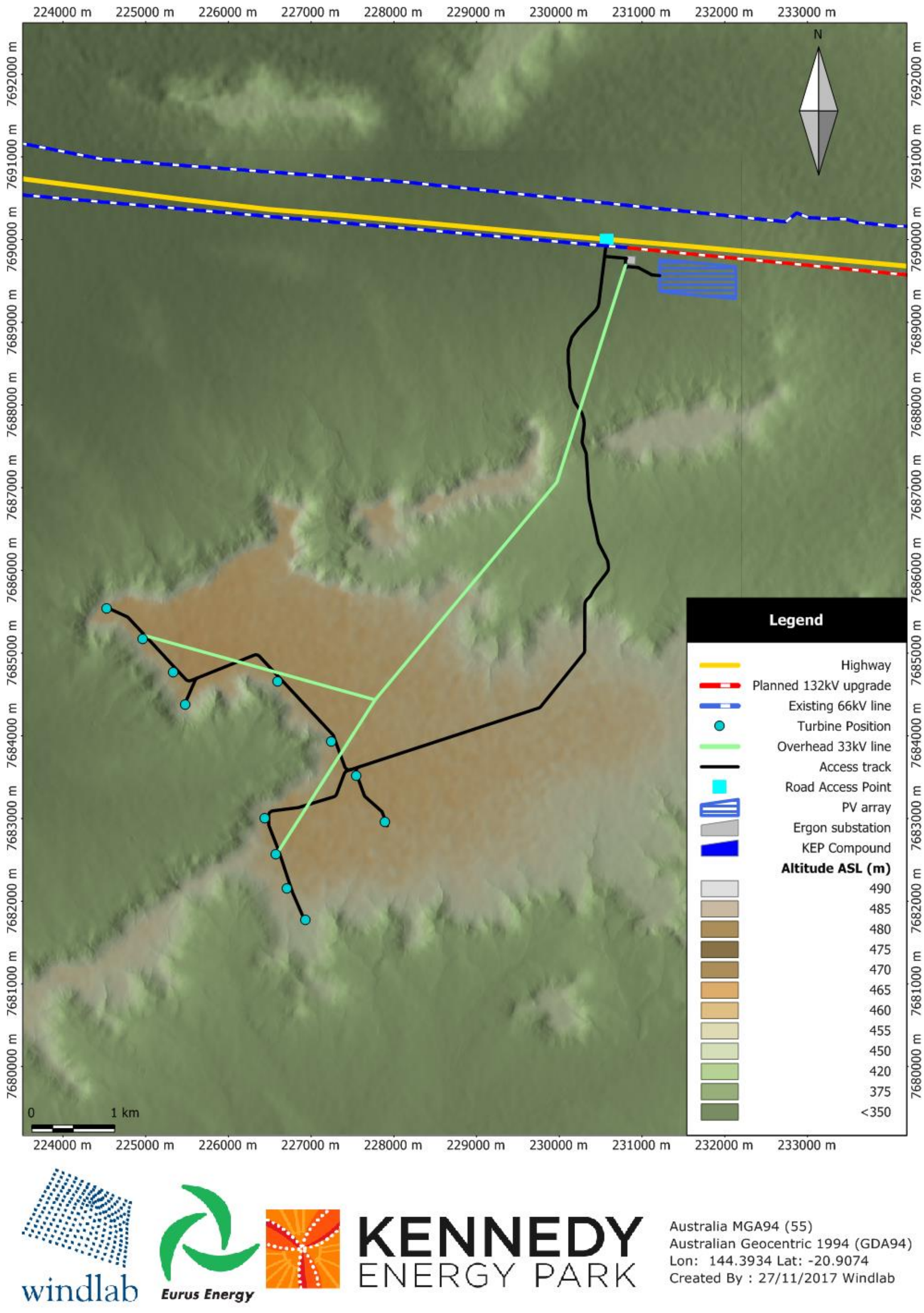

Figure 2-6: Layout of the Kennedy Energy Park site

The wind turbine locations were chosen through careful measurements and modelling conducted by Windlab's technical division, the WindScape Institute. The locations have been optimised to maximise returns for the project (by balancing energy output with cost).

Windlab's internal wind model, WindScape HDSM (Hybrid Deterministic Statistical Method) uses a combination of measurements, atmospheric modelling, and CFD (computational fluid dynamics) to accurately predict the wind resource at any point on the site. The output of this model was then used for the layout optimisation as well as the energy yield estimate.

Through the financing process, it was necessary to engage a third party to conduct an independent assessment of the wind resource. The party that Windlab contracted used a stability-enabled CFD model for its calculations. Both Windlab and the third-party made an assessment of the wind resource in January 2017. Through this process, it was noted that the two estimates differed in the assessment of the wind resource at the northern end of the site. Windlab's modelling showed a lower wind resource. If the third-party assessment was true, that would change the layout of the wind turbines. The different estimates are shown in Table 1.

To resolve this issue, further data was collected, including a new wind monitoring station (designated 239-163) installed at the northern end of the site. It measured at that location over a four month period. At that point, both Windlab and the third-party re-did the modelling with the new data. The results showed that Windlab's estimate was much closer to the final value than the third-party's (as demonstrated in Table 1).

	Windlab			Third Party		
Monitoring location	Jan 2017	May 2017	Difference	Jan 2017	May 2017	Difference
239-163	7.74	7.59	2.0%	8.09[5]	7.46	8.4%
Mast 1	8.01	7.90	1.4%	8.31	8.05	3.2%
266-142	7.49	7.47	0.3%	7.50	7.43	0.9%
376-353	7.90	7.83	-1.4%	7.86[5]	7.97	-1.4%

TABLE 1: THE CHANGE IN WIND SPEED ESTIMATES BEFORE AND AFTER THE FURTHER MEASUREMENTS WERE UNDERTAKED.

On the other hand, the third party 's stability-enabled CFD grossly overestimated the wind resource in that area, which would have resulted in turbines being placed in non-optimal locations and a very high overprediction in the financial returns for the project.

[5] Note that the 3rd party did not provide direct estimates of wind speed at these locations. These numbers are estimates based on the calculations they have provided at other locations adjusted to take into account their "wind speed-up" map.

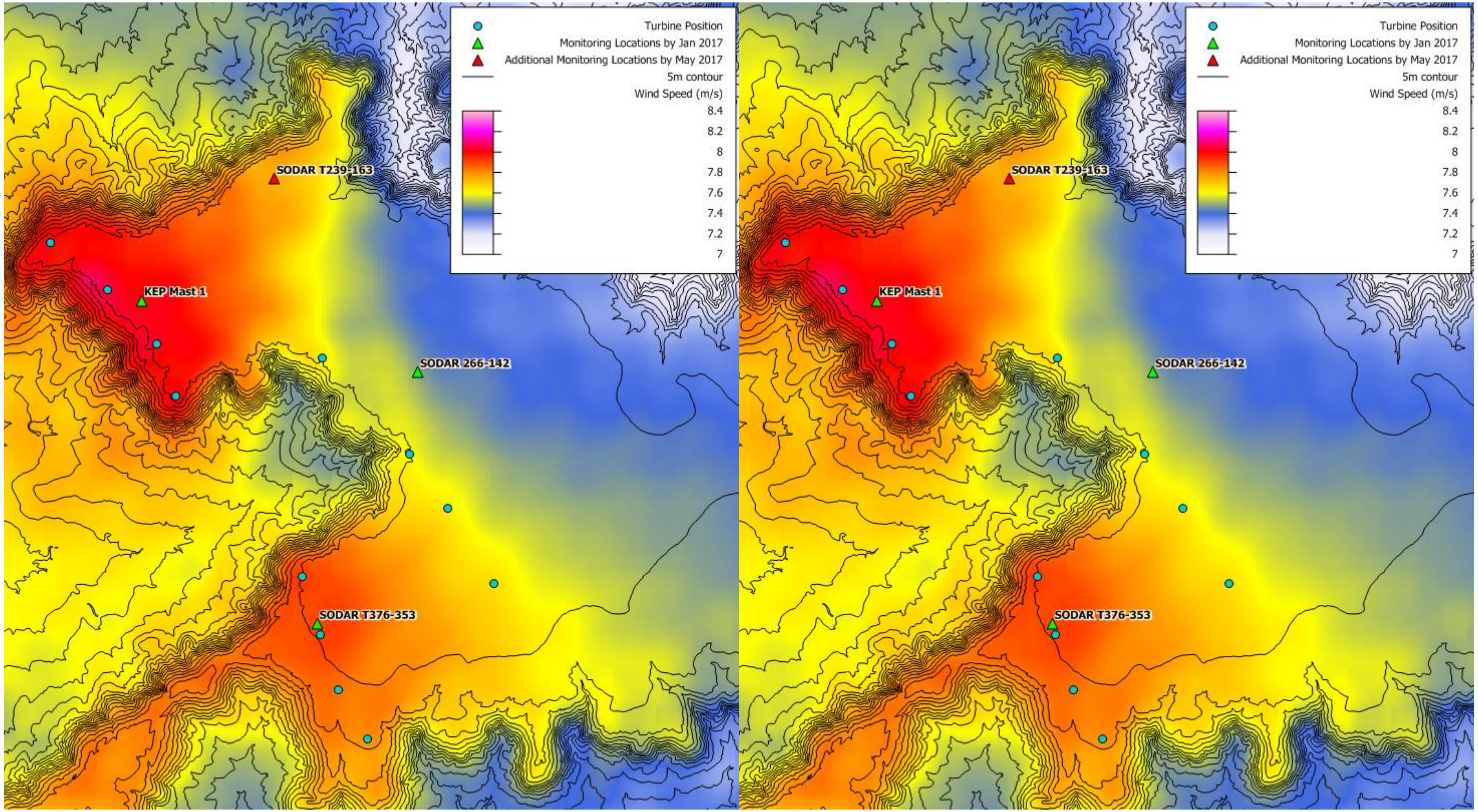

FIGURE 2-7: WINDLAB'S ESTIMATE OF THE WIND IN (L) JANUARY 2017, AND (R) IN MAY 2017 AFTER THE INSTALLATION OF SODAR T239-163. NOTE THAT THERE IS ONLY A MINOR DIFFERENCE IN THE ESTIMATES.

The solar array and site compound are located to the north of the turbines. The site compound contains the KEP switchyard, the battery storeage system and the maintenance office. The Ergon substation is located adjacent.

They are located closer to the highway to allow for easier access and maintenance.

2.4.1 KEY LEARNINGS (CFD)

CFD modelling must be used carefully. Although it can provide improvements to linear neutrally stratified CFD models (such as the industry standard model WASP) there are sound technical and scientific reasons why pure CFD models (even if ‘stability-enabled’) are not capable of modelling complex flows. The key reason is that the atmosphere is naturally dynamic - for example wind direction, wind shear and temperature shear, evolve on both a diurnal basis and in response to larger-scale weather. In contrast a CFD model only models a snapshot of the atmosphere (single wind direction and shear/stability state).

Windlab therefore recommends using more advanced models such as WindScape HDSM that employ a combination of mesoscale, CFD and statistical models and thereby include more of the natural atmospheric dynamics with in the overall solution.

3 Project Finance for KEP

3.1 Project Finance Arrangement for KEP

3.1.1 Equity

- Windlab Developments Pty Ltd, 50% shareholder, $29.7mil
- Eurus Energy Holdings Corporation, 50% shareholder, $29.7mil

3.1.2 Debt

- Clean Energy Finance Corporation (CEFC), $93.5mil senior debt

3.1.3 Grant

- Australian Renewable Energy Agency (ARENA), $18mil, recoupable grant funding

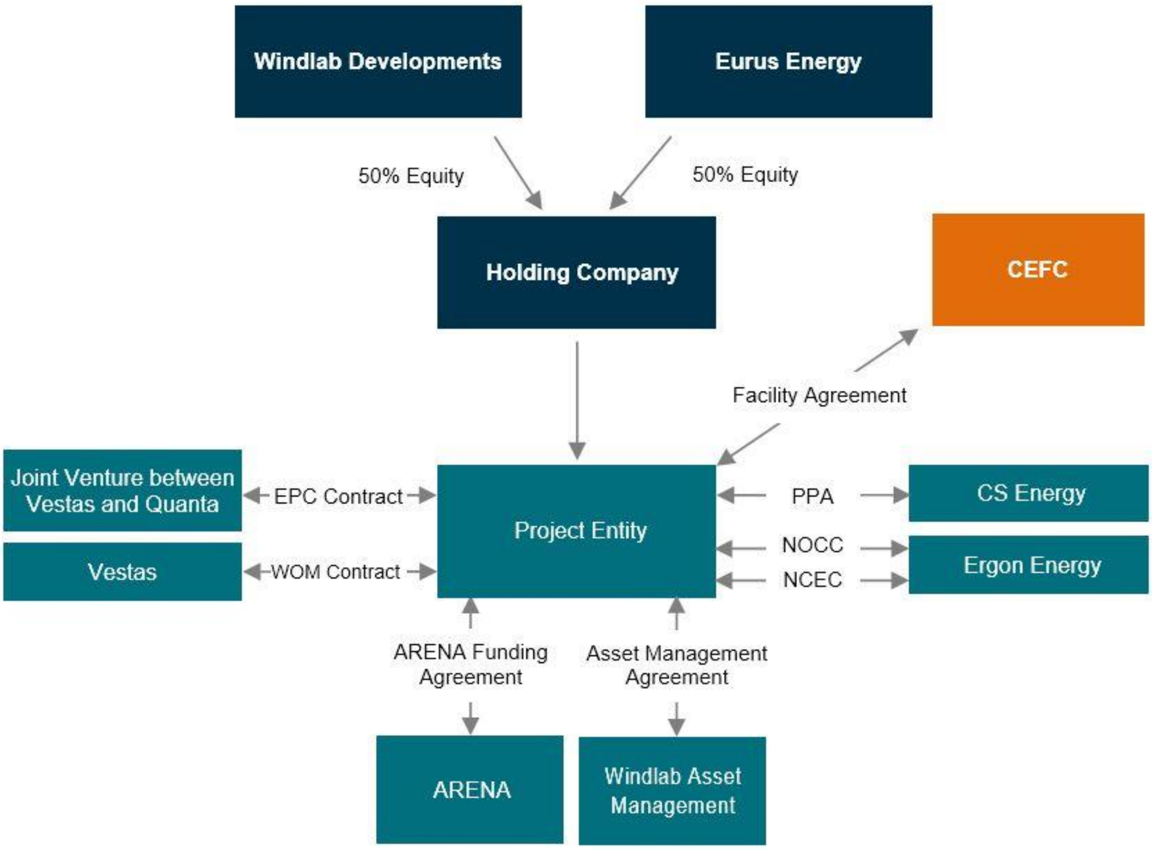

FIGURE 2 KEP Structure Diagram[6]

[6] NCEC/NOCC – Negotiated Connection Establishment/Ongoing Connection Contract

3.2 Lessons Learnt (Financial Due Diligence)

The legal, technical, insurance and financial due diligence for Kennedy Energy Park was complex for multiple reasons. Some key reasons and issues are listed below. A brief discussion follows on the learnings associated with each of these:

- Hybrid Energy Park – technical and insurance DD had to consider wind, solar and storage separately
- Grid Connection – remote fringe of grid network
- Delay Risk – specific analysis of delay risk for the project and how this interacts with offtake obligations
- Multiple Lenders – CEFC providing senior debt and ARENA providing a recoupable loan
- EPC JV Structure – although there is a single EPC Contract there were two contracting parties under the EPC JV structure
- Loss Factors – projected future variation of DLF and MLF
- Merchant Revenue – projected future value of energy, including time of day and seasonal analysis

3.2.1 Hybrid Energy Park (technical and Insurance DD)

Kennedy Energy Park is the first utility-scale hybrid wind/solar/storage project to be project financed anywhere in the world. The technical due-diligence process therefore paid considerable attention to the forecast energy for the hybrid plant as whole together with curtailment implications of grid connection limits and the Energy Park control system. In hindsight it is considered that combining the technical DD into a single process was beneficial for Kennedy Energy Park and was not significantly more expensive than typical tech DD for a single technology project.

The exception to this is the energy forecast part of the technical DD as a separate independent energy forecast was required for both the solar array and wind farm, together with additional analysis on how these are combined with the BESS into a single hybrid plant.

The insurance DD was slightly more complex than DD for a single technology but this is not considered a material cost or risk. The complex grid connection was a greater factor in increasing insurance DD costs and insurance risk analysis.

3.2.2 Grid Connection

The grid connection for Kennedy is complex. This is not considered unique to a hybrid plant and new regulatory requirements in Australia for grid connection mean that all new renewable energy plants connecting to the NEM will undergo similar processes to KEP.

As part of the technical DD associated with the financing process, KEP undertook a risk review of the grid connection to identify each risk associated with the grid connection. For each risk mitigation was proposed, either in the form of actions or cost contingency – for example a significant contingency is carried to allow for additional equipment (if required to enable connection in compliance with the GPS).

3.2.3 Delay Risk

It is normal to assess delay risk when financing any infrastructure project. In the case of KEP and due to the complex nature of the grid connection, the grid connection was considered the greatest potential delay risk to the project. Delay risk can be partially offset through insurances with uninsurable delays mitigated through contingency applied to the financial model.

The delay contingency for KEP is large compared with other projects financed by the proponents. A key learning that would apply to all new renewable energy projects is to advance the detailed design of the grid connection as far as practical prior to financial close. However, this must be balanced off against other factors such as:

- Time constraints of offtake deliverables;
- Ability of the Network Service Provider to agree/enter into detailed design prior to execution of a connection contract/project financial close

3.2.4 Multiple Lenders

KEP effectively has two lenders with CEFC providing the senior debt facility and ARENA providing a recoupable loan. The lenders were both focussed on ensuring that the projects were a sound investment legally, technically and financially but had some areas where the DD process was either duplicative or added complexity. Combined, the CEFC and ARENA had multiple (100's) of questions on the technical due diligence for example. In the case of CEFC this was primarily a result of the novel nature of the project and the technical complexity of the grid connection. In the case of ARENA this was also due to the importance of the R&D and Knowledge Sharing aspects of the project to ARENA's funding case.

3.2.5 Loss Factors - MLF/DLF

The loss factors (MLF and if relevant DLF) can have a significant impact on the revenue of NEM connected projects. KEP is located at a fringe-of-grid and network constrained location, and therefore engaged a consultant to conduct robust and extensive analysis to forecast both DLF and MLF for the life of the project.

The MLF or Marginal Loss Factor relates to losses in the transmission network and will vary with large changes to load or generation in the Queensland network. For the forecast period at KEP the MLF is expected to be relatively stable just above unity and therefore is not expected to have a material impact on project economics over the project life.

The DLF or Distribution Loss Factor relates to losses in the distribution network and will vary with changes to local load and generation. In the case of KEP it was therefore important to consider the potential for new generation and/or changes to load in the region. The key competing solar project located on the distribution network is Hughenden Sun Farm and this is assumed to be installed from the beginning of KEP's operational period. In addition it was important to tailor the mix of wind and solar at KEP to ensure that DLF[7] and therefore financial performance of the project were optimised.

[7] In the case of KEP, increasing the level of solar relative to wind further than the final project configuration results in both lower DLF and greater curtailment, which would negatively impact project economics.

4 Development Approval and Permitting

4.1 Development Approval

The development approval for Kennedy Energy Park was received on 21 July 2016. The assessment manager was the Flinders Shire Council and a single application was made to cover the key planning approvals, comprising:

- Material Change of Use
- Reconfiguration of a lot – lease of part of a lot for greater than 10 years
- Reconfiguration of a lot – creation of a 1 Ha parcel for the substation to be built as part of the project and transferred to Ergon

The development permit covered up to 50MW of solar PV and up to 16 wind turbines generating 50 MW, with the solar arrays installed on one parcel of land and the wind turbines on a second parcel.

The development approval was gained before two significant amendments to the Queensland planning regulations came into effect. These two amendments were the introduction of:

1. the State Wind Farm code into the development assessment provisions on 22 July 2016
2. replacement of the Sustainable Planning Act 2009 with the Planning Act 2016 in July 2017

Separate approvals are required under the Transport Infrastructure Act for new intersection and access point off a state controlled road and for crossing of the State controlled railway line.

Changes in scope or layout requires amendments to the development approval via the change request (minor change) process as the concurrence agency conditions are very specific on area and location of disturbance within the project footprint.

4.2 Key Learnings

4.2.1 Process

The approval process applied for Kennedy Energy Park will be different for new hybrid projects. Going forward it is likely that a hybrid project could require separate application for the wind farm component at State level to the Department of Infrastructure Local Government and Planning and to the local council for the solar arrays and other infrastructure.

4.2.2 Managing Change

At the time of the application for the development permit, there were a number of uncertainties that ultimately necessitated changes to the development approval conditions following more detailed engineering and optimisation of the respective wind and solar sizing and layouts. These uncertainties included:

- Electrical connection arrangement
- Project layout and optimal size for each of wind and solar within a constrained electrical network
- Wind resource (duration and extent of wind monitoring was limited at the time of development application)
- Underlying geology
- Other generation projects in the region

For Kennedy, the changes to the development conditions were managed in accordance with the Planning Regulations through the "change request" process to the Flinders Shire Council.

Changes that necessitate amendments to approval conditions, or additional approvals, bring potential delays and additional cost to the project development. In the future, this may become more complex for a hybrid project as it may have separate approvals for the wind component and solar components. The key learning from Kennedy was that front-end loading of engineering, concept design, layout and grid connection studies could have improved the efficiency of the development process and avoided the majority of the later changes to layout and configuration that occurred. However, this needs to be balanced against unknown development risks such as whether other regional projects proceed or not as this can impact the optimal project configuration and design.

4.3 Cultural Heritage

Managing duty of care obligations, conducting appropriate level of site assessment and principles of early engagement with the relevant cultural heritage body apply equally to a hybrid project such as Kennedy as to any other development project in Queensland.

4.4 Community Consultation

For Kennedy, the project team successfully implemented Windlab's community engagement strategy. No opposition to the project was encountered throughout the development process and feedback received was overwhelmingly positive. The primary areas of interest among the community were: the potential economic benefits and employment opportunities that Kennedy could bring to the region; and why a hybrid wind, solar and storage facility?

4.4.1 Key Learnings

The concept of a hybrid renewable energy facility was new and interesting. This enabled the project team to differentiate Kennedy from other (renewable energy) projects in north Queensland and to achieve a very high level of identification with the project at both the community and individual levels (i.e. buy-in). This identification could then be built upon through understanding of the local benefits (e.g. local jobs) and why Hughenden was the best location for this world leading renewable energy project.

5 Grid Connection

5.1 Connection Process

The application for connection must be made in accordance with the National Electricity Rules (NER). The connection process steps are set out in the NER. As Kennedy Energy Park will connect into the distribution network, the connection process is managed by the distribution network service provider (DNSP) from first enquiry through to completed connection agreements.

For Kenendy there are two connection agreements

1. Connection establishment contract
2. Ongoing connection contract

The connection establishment contract covers the term, conditions and charges for establishment of a point of connection for the generator. The ongoing connection contract relates to the terms, conditions and charges that will allow the generator to export energy into the network, including the required generator performance standards that must be met.

The development and negotiation of both contracts was particularly complex and time consuming for Kennedy. The key contributing factors to this were :

- There was no precedence for connection of wind, solar and battery storage at the one connection point in the NEM
- As a financed project the contract terms and conditions must be negotiated and acceptable to three parties: project financier; the proponent; and the DNSP
- The connection scope of work was split between the proponent and the DNSP, with the majority of the scope to be constructed by the proponent and transferred to the DNSP on completion
- Another generator (Hughenden Solar Farm) had recently executed a connection agreement in the same part of the network
- Kennedy is located in a fringe of grid location that is electrically very weak.

5.2 KEY LEARNINGS

5.2.1 CONNECTION PROCESS

The generator connection process in the NER was developed based on connection of conventional generation technology and does not necessarily work for a hybrid project such as Kennedy, especially where it is compounded by a complex connection arrangement. Connection of Kennedy introduced new issues and required new solutions for connection of generation into a distribution network. This took time and resulted in a number of delays and restarts, especially as the DNSP is restricted by regulatory timeframes within the NER. The regulatory process and timeframes were a continual stumbling block to progress between the project and DNSP. Consequently, one of the key learnings from Kennedy is that clear objectives, deliverables and timeframes must be set and agreed between the proponent and the DNSP in regard to the path and timing to a connection agreement at, or around, the time of detailed enquiry. This will provide both parties with more certainty and avoid a number of the connection process issues experienced on Kenendy.

5.2.2 GENERATOR PERFORMANCE STANDARDS – SIMULATION MODELLING

The ongoing connection contract requires generator performance standards that are agreed by both AEMO and the DNSP. A wind, solar and battery storage facility with a single point of connection makes this more complex for a number of reasons, including:

- One set of performance standards apply to all generating technologies, so the behaviour and control of the combined generating system is critical, rather than how any one of wind, solar or battery behaves alone
- Simulation models provided by each technology supplier are developed to run as a single generation technology on a network and not in combination with other generation technologies
- There is virtually no precedence and very limited experience within the industry

The key learning from Kennedy is that it is imperative to engage a party that understands the NER and AEMO requirements and has proven experience in overcoming the range of issues associated with combining multiple original equipment manufactrurer (OEM) simulation models and then being able to tune and optimise the whole setup to accurately demonstrate stable operation under the range of network conditions and faults.

5.2.3 Financier Involvement

On Kennedy the project debt financier was selected at a point in time when there had already been significant progress towards finalising the connection agreements. This opened up the contracts to several more rounds of review and negotiation. This situation is inefficient and can be avoided if the financier can be brought on board earlier and involved from the early stages of the negotiation of the connection contract.

6 Learning Summary

- Developing a hybrid project follows a similar process to the development of a single technology project – in Queensland and other markets this could become more complex if the solar and storage component goes through a local council based approval process and the wind component goes through a State based process
- A key benefit of co-location is shared grid connection – this will be most beneficial both to the project and the NEM if the resources are poorly correlated such as at Kennedy Energy Park, minimising the potential for curtailment and maximising the amount of energy that can be transmitted at a single connection point
- The grid connection process for all electricity generation projects is becoming more complex across the NEM. Early selection of technology and connection arrangement is recommended to ensure that the detailed studies required can be completed in a timely fashion. A degree of pragmatism is required to offset the temptation to find more optimal connection solutions. This recommendation is even more relevant for hybrid projects which increase the number of potential variables significantly (i.e. relative size of each technology, which OEM, what specifications, etc)
- CFD should be used carefully for wind modelling as these models do not effectively capture the real dynamics of the atmosphere and large errors in modelling are often present
- Given the volatility and risk associated with future merchant revenue streams a Battery Energy Storage System is not (currently) considered financeable as a merchant stand-alone plant
- The financing and due-diligence process for a hybrid project is similar to that of a single technology project and is not expected to be a material impediment to development of future hybrid projects
- Hybrid solar and storage projects are already quite common around the world. Adding wind (if the resource is sufficient) is highly desirable as at most sites this will significantly reduce the amount of storage required to achieve a certain penetration level. The challenge is finding the right sites.

APPENDIX A- KNOWLEDGE SHARING DATA

Description	Value	Units	Inclusions/Exclusions/Notes
Debt: Equity: Grant ratio	54.7% : 34.7% : 10.5%	%	
Cost of Finance	~5%		Guide value only, actual numbers are confidential

TABLE 2 PROJECT FINANCE DATA SUMMARY

Description	Value	Units	Inclusions/Exclusions/Notes
Total Project Capital Cost	~$160m	AUD($)	Includes full EPC price, interconnection costs

TABLE 3 SUMMARY OF CAPEX DATA

Description	Value	Units	Notes
PV array central/indicative latitude	-20.875	°	
PV array central/indicative longitude	144.421	°	
PV array rated installed peak capacity DC	19350	kW DC	Exact amount to be determined during detailed design / panels are mix of 345 and 350 Watt modules
PV array total area (module area only)	109751.000	m^2	exact area to be determined during detailed design
PV array orientation from True North	0.000	°	° West or East of True North
PV array tilt angle above horizontal	0.000	°	panels on horizontal single axis tracking
PV array fixed or tracking	single axis (horizontal)		single axis (horizontal)
PV array rated open circuit voltage	47.3/47.5	V	(at STC) mixture of 345 and 350 W modules
PV array rated short circuit current	9.31/9.38	A	(at STC) mixture of 345 and 350 W modules
Quantity of modules	55680		exact number to be determined during detailed design
Module manufacturer	Jinko		
Module model	JKM345M-72H-V / JKM350M-72H-V		
Module nominal/rated power at STC	345/350	W	
Quantity of modules per string	39		
Quantity of strings per inverter	9280		
Inverter continuous rated output power (AC)	2500	kW	
Quantity of inverters	6		
Total inverter continuous rated output (AC)	15000	kW	
Inverter manufacturer	SMA		
Inverter model	SC2500-EV		
PV module data sheet	EN Half Cell 72M 330-350W-V.PDF		EN Half Cell 72M 330-350W-V.PDF
Inverter data sheet	SC2500-EV-DEN1612-V26web.pdf		SC2500-EV-DEN1612-V26web.pdf

TABLE 4 STATIC PROJECT DATA (PV SYSTEM)

Description	Value	Units	Notes
Wind farm central/indicative latitude	-20.924	° (DDD.ddd)	wind farm central/indicative latitude
Wind farm central/indicative longitude	144.378	° (DDD.ddd)	wind farm central/indicative longitude
Turbine manufacturer	Vestas		Turbine manufacturer
Turbine model	V136		Turbine model
Turbine Rated Capacity	3.6	MW	Turbine Rated Capacity
Turbine IEC Class	IIIA		Turbine IEC Class
No of Turbines	12		No of Turbines
Installed Capacity of Wind Farm	43.2	MW	Installed Capacity of Wind Farm
Turbine Hub Height	132	m	Turbine Hub Height
Turbine Blade Length	68	m	Turbine Blade Length

TABLE 5 STATIC PROJECT DATA (WIND ENERGY SYSTEM)

Description	Value	Units	Notes
Storage central/indicative latitude	-20.873	° (DDD.ddd)	
Storage central/indicative longitude	144.413	° (DDD.ddd)	
Energy Storage System (ESS) manufacturer	Tesla		
Rated Energy Capacity	4.000	MWh	
Maximum Power Output	2.000	MW	
Roundtrip efficiency	87.000	%	Defined as discharge of the ESS from 100% SOE to 0% SOE at kWp immediately followed by charging the ESS from 0% SOE to 100% SOE at kWp
Partial duty cycle efficiency	87.000	%	Defined as discharge of the ESS from 75% SOE to 25% SOE at kWp immediately followed by charge of the ESS from 25% SOE to 75% SOE at kWp
Battery cell size	2170 cylindrical Li-ion		
No of cells per module	500		
No of modules per pod	2		
No of pods per pack	16		
Number of Battery Packs	24		
Inverter/Power Conversion System manufacturer	Tesla		
Inverter model	Tesla Powerpack Inverter		
Inverter continuous rated output power (AC)	500	kW	
Quantity of inverters	4		
Total inverter continuous rated output (AC)	2000	kW	
Battery system specification data sheet			Powerpack 2 System 2-Hour Specification.pdf
Inverter data sheet			Tesla_Powerpack_Inverter_Datasheet.pdf

TABLE 6 STATIC PROJECT DATA (BESS - BATTERY ENERGY STORAGE SYSTEM)

Description	Value	Units	Inclusions/Exclusions/Notes
Measured Wind Speed	7.5	m/s	Measured wind speed from 107m mast on-site
Turbine Wind Speed	7.9	m/s	Pre-construction estimate of average wind speed across all turbines at hub-height (132m)
Wind Energy	170.2	GWh/a	Pre-construction estimate of P50 ten year average
Global Horizontal Irradiation	2281	kWh/m²	Pre-construction estimate of GHI based on measured data
Solar	43.5	GWh/a	Pre-construction estimate of P50 ten year average
Energy Park	213.7	GWh/a	Pre-construction estimate of P50 ten year average

TABLE 7 RESOURCE FORECAST & ELECTRIC OUTPUT FORECAST (TABLE B – ITEM 10 & 17)

Activity[8]	No of Regional Jobs	Value (Region + QLD)	Value (Other Australia)	Comments/Notes
Construction Employment	~30	TBD		The EPC Contractor (Quanta & Vestas) sees a an opportunity for substantial involvement of the local community during the construction phase. There is a track record of solar installation and experienced personnel in the area due to the Hughenden Sun Farm nearing completion. It will be beneficial to both the local community and the EPC Contractor to utilise local labour where possible. It is envisaged that around 30 local personnel may be utilised during the PV installation phase.
Subcontracting			TBD[9]	A range of subcontracts have or will be awarded to local businesses. Examples include geotechnical and survey works, earthworks, fencing, regional transport, waste management, security and small scale plumbing and electrical works (eg site establishment). These have not been let to date as the project is in design and procurement phase. Site works are currently entering planning stage. The above contracts are likely to be tendered and awarded through Q4 2017 and Q1 2018.
Site Services				A range of site and town services will be required, including provision of catering, cleaning, accommodation, fuel supply and consumables. As above, these services are in early stages of planning.

TABLE 8 FORECAST LOCAL EMPLOYMENT BENEFIT

[8] Project contact information has been published on the council website and social media accounts, and communicated to employees working at local solar project. Web based information portals are available to contact Quanta for project opportunities.

[9] As at 22nd November 2017 – the JV has awarded contracts valued at approximately $300k to local and QLD based subcontractors and $250k to other Australian based subcontractors. The numbers do not include the EPC Contractor self-performance tasks. Contracts awarded to-date include civil design, geotech, various testing activities (e.g. water, piling, site survey) and other site based services.