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Harvesting photons using High Ground Coverage Ratio approaches.

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Bifacial modules are gaining increasing market interest due to enhanced electrical yield from a given number of modules. Maximising the advantages require several field design modifications compared to a standard ground mount system. One such modification is that bifacial installations need a lower ground coverage ratio (GCR) to achieve high bifacial gains – that is more land to install the same area of solar panels. This design trade-off is likely to become even more difficult in some countries as land gets more expensive, solar installations compete more and more with other land-use activities, and as the PV modules get cheaper. Other companies are taking a nearly opposite approach to this challenge by focusing on low cost high GCR technologies such as East / West arrays. This study focus on the design trade-off and challenges with solar farms from a land use perspective with specific consideration of the high-GCR deployment approach developed by Sydney company 5B.

Background

High GCR approaches such as the East West array have already been shown in some studies to have a higher energy yield per unit land area than conventional approaches [1], although published data on the relative energy costs of this approach are not so readily available. The economic trade-off for land cost and bifacial gain was considered by Stephans at the 2018 Bifacial Workshop [2] and is shown repeated in Figure 1. This shows that assumptions about panel costs and the relative cost of deploying high and low GCR approaches is crucial to an optimal system design, and the trade-off changes quickly as module prices drop and land values change.

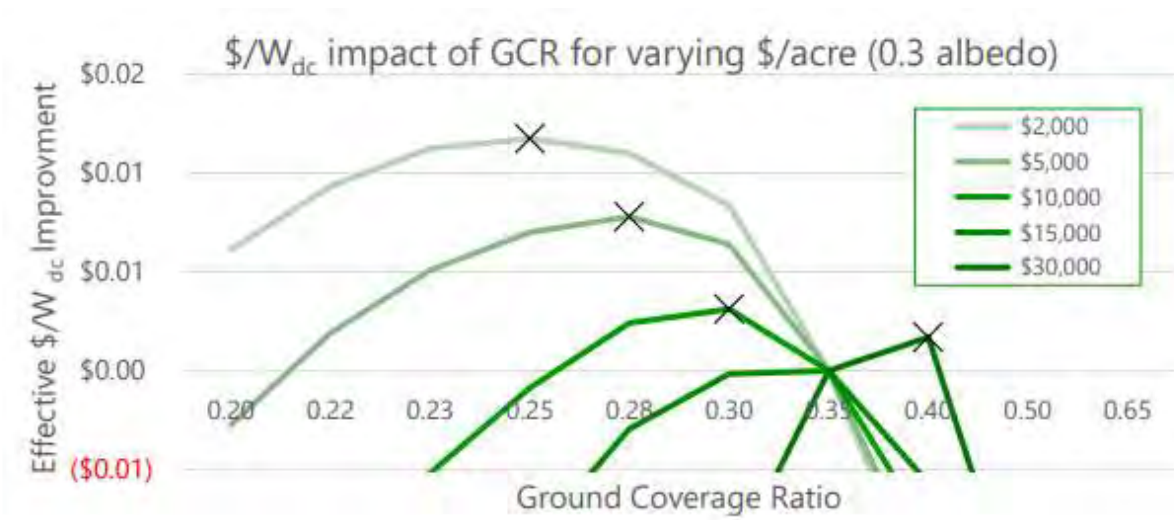

Figure 1. Cost benefits of a bifacial system as a function of land price in US$, from [2]

The specific high GCR technology explored here is one developed by 5B and marketed under the product name “Maveric“ [3]. Maverick is an engineered, pre-fabricated solar array, meaning that assembly of the array takes place in the relatively controlled conditions of a factory. This helps to minimise cost and deployment quality. The array is shipped to site and deployed rapidly in a concertina-style fashion with a telehandler / forklift arrangement. This product will be used as a case study of the low cost, high CGR approach.

Methodology

This study will be primarily designed to examine the sensitivity of land, module and deployment costs to the ultimate yield and LCOE of a theoretical solar farm. The study starts with a fixed size piece of land, estimating costs and yields as a function of GCR for a conventional and bifacial module approach.This is compared to estimates of yields and costs for the 5B high CGR approach. The study will use a common industry accepted yield modelling packages and will be done for an equatorial and high latitude location as this will result in key differences between the two approaches.

Results

No preliminary results are available at the time of writing the abstract. The final presentation will examine yield and LCOE and sensitivity to the key factors discussed.

Significance

It is very important and timely to have a discussion and an optimisation study of large scale solar installations from a perspective of land use outcomes. Solar installations are increasingly comping into conflict with other land use activities at high value grid connection points [4]. When understood from a perspective of the energy density of land use, it will also be shown that photovoltaics is competitive with thermal coal mining, which is an important understanding in an Australian context. The presentation will include an initial study of these aspects.

References

[1] Gurupira, T., Rix, A. J. 2017 “Constrained optimisation of photovoltaic (PV) module layouts” IEEE Africon 2017 Proceedings.

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