Adapting Renewable Energy Concepts to Irrigated Sugarcane Production at Bundaberg

Milestone Report No: 4

Australian Government
Australian Renewable Energy Agency

ADAPTING RENEWABLE ENERGY CONCEPTS TO IRRIGATED SUGARCANE PRODUCTION AT BUNDABERG

MILESTONE REPORT No: 4

Funding Agreement Details

Recipient Name	Bundaberg Regional Irrigators Group (BRIG)
Project Commencement Date	02/01/2017
Project Completion Date	15/09/2020
Project Partners/ Participants/ Sub-contractors	*Bundaberg CANEGROWERS Ltd* *Bundaberg Sugar Services Ltd* *Killer Family Holdings Pty Ltd*
Primary Contact Name	Dale Holliss
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Milestone Summary

Milestone Number	4		
Report Dates	Due: 11/1/2019	Submitted: 11/1/2019	Reporting period: 13/07/2018 to 11/01/2019
Comments if report is late			

Technical Delivery of Milestone

1. Provide a technical report of the milestone activities.
The solar pump system has now completed 993 hrs during its first full year of operation and the data gathered indicates that the new solar/grid irrigation system used approximately 77% less grid supplied kWh over the 12 month period than would have been the case with the previous all grid system. Farm operational management strategies have been steadily amended to increase utilisation of the potential savings. The 2018-19 farm irrigation program commenced in the early spring period as opposed to the historical practice of holding off to the later months of spring. The holding off of irrigation practice is driven by the fear of annual electricity expense budget overruns if the summer season is dry. This is often the case in Bundaberg. Early commencement of watering in the current season is showing success with current crop status showing very good prospects. The project weather station equipment is providing reliable data on factors effecting crop response to irrigation and daily solar energy potential. The field moisture monitoring equipment is effectively illustrating the soil water balance in line with the irrigation program, rainfall and crop root system development. Monitoring of summer crop growth rates (stalk elongation) will recommence in January 2019 when the crop has reached the point where the height of all stalks is consistently greater that 100cm.

Technical delivery (Table 1)

Milestone (3) activity / deliverable *Activities to be completed for this milestone (as set out in Schedule 2 of the funding agreement*	**Completed**
D3.1 Provide a report to ARENA clearly outlining the data recording for the 2018-19 (last 6 months) crop including the: Irrigation program (Attachment A)	<u>Irrigation program</u> The irrigation trial area increased from 38.5 ha to 55 ha of sugarcane which is irrigated by the new solar pumping system. The increase in irrigated area is the result of a section of the cropping area that had carry over crop (unharvested crop due to wet weather in the 2017 harvest) now returning to the normal

	rotational program. For the 2019 season the irrigated area contains 25 adjoining fields which will increase the daily demand on the pumping system and impact on the day night operational ratio. This will create managerial challenges for the farm manager but will also further test the limits of system capacity. During this trial, one field is monitored (with a Sentek Enviroscan probe) to compare soil moisture variation with rain fall and irrigation. Crop growth rates are measured to gauge response to moisture availability during the intense growth summer/ autumn period (January to April). Progressive evaluation of irrigation demand and the soil water balance for the 2019 crop which includes the period July to December 2018 is provided in Attachment A. This data includes calculations of daily crop water demand based on reference evapotranspiration data (Et) determined by the onsite weather monitoring equipment and estimated crop leaf area factors to determine average crop evapotranspiration (Etc) as mm/day. The Etc data is averaged across the irrigated area of each crop class to create a farm daily crop water demand. When interpreting this data it should be taken into account that this method is used to calculate a simple whole of farm daily water balance and it is realised that some of the farm fields will be irrigated during each monthly period and some not due to variation in crop harvest date and subsequent crop size. The data shows that a significant rainfall event occurred in October 2018 (141mm) and minor events occurred during November 2018 (39

	mm) and December 2018 (59 mm). The water balance for the review period indicates that the total volume of moisture required by the crop was slightly more (+2.7%) than that supplied via recorded rainfall and applied irrigation. When irrigation application and rainfall efficiencies are taken into account the deficit is estimated to be about 22%. This deficit should not be seen as a serious matter in the context of the time of year as most of the discrepancy occurred when the crop root system was underdeveloped and only drawing moisture from the surface profile.
Climate data (rain ,solar radiation, reference evapotranspiration (Et) (Attachment B)	<u>Climate data</u> Rain, solar radiation and reference evapotranspiration (Et) and max temperature data for the period July 2018 to end December 2018 is provided in Attachment B. This information contains the full data base from the weather station for each month and graphic illustration of the main elements per month.
Irrigation/crop growth response data (Attachment C)	<u>Irrigation/crop growth response data</u> Development of early season crop growth response in the late winter / early spring is less aligned to the total soil moisture content and is generally influenced by a combination of soil temperature and moisture available to the shallow developing root mass. The irrigation, crop growth and soil moisture relationships for the monitored field illustrated in Attachment C shows limited root activity to 30 cm prior to October and continuous

	development to 60 cm post October. Photographic evidence of crop development from late August to end of December 2018 is also shown in Attachment C.
Energy availability verses consumption data (solar versus grid) and water applied (ML/HA) Attachment D Attachment E	<u>Energy availability verses consumption data (solar versus grid)</u> Solar energy availability data as provided by the onsite weather station indicates for this review period 1 July to 31 December 2018 (184 days) there were a total of 2369 hrs of sunshine with 1111 hrs of sunshine with intensity above the threshold required to provide full power to the pumping system. Recorded pump day time hours for the period were 416 or 37% of the potential. The weather conditions over the review period featured long periods of dry weather with limited cloud and consistent solar production. Other factors such as the limited demand for water by the crop meant that a greater proportion of the program was conducted in day light hours which subsequently increased energy utilisation from the solar system. Utilisation of solar energy and water use data are shown in Attachment D. A chart showing the operational threshold and the relationship between the threshold and the limiting points of solar radiation is also included. The energy blending capability of the Eco drive system fitted to this trial allows for a portion of the power demand to be accessed from the solar array even when the solar output is below the deemed operational threshold. This drive is also a demand management system

	which results in a significant reduction in grid demand before the solar input is effective. The combined effect of the new system has been an 81% reduction in mains supplied energy over the current 6 month review period when compared to the previous pumping unit operated over the same schedule. Outcomes from these system features are illustrated in Attachment E.
D3.2 Provide a report on crop production D3.3 Provide evidence – energy efficiency relationship between monitored irrigation crop data and energy consumption solar/grid (Attachment F)	<u>Crop production</u> A progressive estimate of crop yield (potential 45 tc/ha at the 31st December 2018) indicates that with a dryer weather pattern over the review period (as opposed to the corresponding period last year when flooding and crop water logging occurred) has allowed the crop to develop in a more normal manner. With the managerial and financial freedoms that the trial equipment has enabled there is an increase in grower optimism and this is showing in the yield potential for the 2019 harvest. <u>Evidence of energy efficiency</u> Data illustrated in Attachment F shows that for the previous all grid demand pumping system the average hourly use was 39 kWh and for the new solar/grid pumping system the average hourly grid demand was 11.6 kWh during the milestone 3 review period (January – June 2018). This saving can be attributed to a reduction in grid demand as a result the VSD drive and motor/pump upgrade (-13.8 kW/h) and the solar array (-13.6 kW/h). Subsequent data for milestone 4 shows that grid demand further reduced from July to December 2018 (from11.6 kW/h to 7.24 kWh). The extra

	saving for this period can be attributed to the VSD drive and motor/pump upgrade (-11.7 kW/h) and the solar array (-20.1 kW/h). The value of the savings for the period from July to December 2018 was $ 4,998 which equates to a reduction in irrigation cost over the period from the original pumping system $2.48 per tonne of cane to the current pumping system $0.46 (-$2.02) per tonne of cane. Since the commissioning of the new pumping system the total value ($) of energy savings for the calendar year 2018 is $ 7,882.62.

2. Provide a statement as to whether the timeframes for the project are being met and an explanation of any delays that have occurred.
Project timeframes are being met. Future delays are not anticipated.

3. Are there any proposed changes to the project, including to scope, personnel or partners? If yes, please outline below.
No

4. Have there been any changes to the risk management plan (including changes to actual risk & risk ratings)? If yes, please provide a copy of the updated risk management plan.
No

5. Comment on progress toward achieving each of the project outcomes listed in Schedule 3.	
Project Outcomes	**Achieved / Not achieved (comment)**

List project outcomes as set out in the funding agreement.	
D2.1.Provide a report to ARENA clearly outlining data recording for the 2017/18 crop including 1. Irrigation Program 2. Climate Data 3. Irrigation/crop response data 4. Energy availability versus consumption data	Achieved
D2.2. Provide Evidence - energy efficiency relationship between monitored irrigation/crop data and energy consumption solar/grid)	Achieved
D2.3.Provide minutes from the Activity Steering Committee Meeting	Activity Steering Committee did not formally meet during this milestone period and as such there are no minutes.
D2.4. Provide a milestone report and associated items in accordance with item 1 of schedule 3 and schedule 5	Achieved

6. Provide details of any published patents that have arisen out of or been contributed to by the project.
Not Applicable

7. Provide confirmation of the number of researchers (calculated on a full time equivalent basis) that are involved in the utilisation of the Grant Funds.
Not Applicable

Knowledge Sharing

8. Provide details of any knowledge sharing activities, including published reports, promotional material, media publicity or other documentation relevant to the project.

The aims and objectives of the project have had extensive coverage and publicity through media and industry communications. Photos, tweets and documents relevant to the project are on the website www.brig.org.au.

The entire Board of Energy Queensland, their CEO and senior executive staff travelled to our latest knowledge sharing field day held on 22 November:

This has had enormous positive impact for irrigated agriculture as the leaders of the largest network and retail electricity supplier in regional Qld got a firsthand look at the project. The presentation that was prepared for the day is in attachment G and is also on the website.

Mr Alistair Perkins, Digital Content Producer & News Editor, Corporate Affairs (ARENA) is sending a videographer to Bundaberg to create a short film about this project. This will occur in February 2019.

Media articles include (Attachment G):

- The Australian CANEGROWER (5 November 2018). This article also received extensive coverage in a number of Rural Press publications and resulted in an enquiry from Casino NSW.
- Bundaberg CANEGROWERS December Newsletter

Financial Reporting

9. Provide a statement of the Grant Funds, Recipient/Grantee Contributions (cash) and Other Contributions (cash) received and spent as identified in Schedule 4, 5 and 6 of the Funding Agreement.

See attachment 1A for:
A statement of income and expenditure for the project covering the period from commencement to the completion of milestone 3.

i. All cash income for the project
ii. All cash expenditure for the project
iii. There are no unspent grant funds available for use in the next reporting period.

10. Provide a statement of the Grantee/Recipient Contributions (in-kind) and Other Contributions (in-kind) provided (refer to items 3 and 4 of Schedule 2).

See attachment 1 B for details of in kind contributions made for the reporting period. (Milestone 4)

11. Provide confirmation that the project is proceeding in accordance with the Budget, including grantee contributions and other contributions.

The project is within budget and on track.

12. List of Attachments to the report

Please identify any relevant information that is attached to this report. Documentary evidence that is required for the milestone should be included in this list.

Attachment A – Milestone D4.1 – Review of Irrigation program
Attachment B – Milestone D4.1 – Climate Data – July to December
Attachment C – Milestone D4.1 – Irrigation and crop growth response
Attachment D – Milestone D4.1 – Energy availability and consumption
Attachment E – Milestone D4.1 – Crop and energy efficiency
Attachment F – Milestone D4.3 – Evidence of energy efficiency
Attachment G – Knowledge Sharing Activities

Certification

I Dale Holliss being a person duly authorised by the Grantee/Recipient hereby certify that:

- The milestone described above has been completed by 11/01/2019
- The information provided above is accurate, complete and not misleading.
- The risk management plan for the project is up to date and being implemented.
- I am aware of the Grantee's/Recipient's obligations under the Funding Agreement, including the need to keep ARENA informed of any circumstances that may impact on the objectives, completion or outcomes of the agreed project.

Signed: *Dale Holliss* Date: 11/01/2019