Adapting Renewable Energy Concepts to Irrigated Sugarcane Production at Bundaberg

Milestone Report No: 7

Australian Government
Australian Renewable Energy Agency

ADAPTING RENEWABLE ENERGY CONCEPTS TO IRRIGATED SUGARCANE PRODUCTION AT BUNDABERG

MILESTONE REPORT No: 7

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.*
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Milestone Summary

Milestone Number	7		
Report Dates	Due: 15/05/2020	Submitted: 15/05/2020	Reporting period: 11/01/2020 to 15/05/2020
Comments if report is late			

1. Provide a technical report of the milestone activities.

The solar pumping trial located on the Killer Family farm has now operated for 3085 hrs of the past two years and five months (January – December 2018 to May 2020).

Rainfall at the trial site shown in Attachment A improved dramatically over the bleak picture presented in the January 2020 milestone.

The evidence of salinity issues and the development of the peanut program noted in the previous milestone continued and the outcomes of the program are shown in Attachment A.

During the period since the commissioning of the project the system has completed 3085 hrs of irrigation operation and based on data from the pre redevelopment pump audit this indicates that 3085 hrs at 39 kW.h would have consumed 120,315 kWh of grid energy supply at a value of $29,575.

Comparative analysis of the running cost for the previous all grid powered system to the Solar/VFD/Grid trial shows a reduction in operational cost of $22,825 which comprised $14,150 attributable to the solar array and $8673 to the motor and pump efficiency improvements, including the Variable Frequency Drive (VFD) and the remaining energy supply valued at $6,768 which was accessed from the grid supply.

Milestone (x) activity / deliverable *Activities to be completed for this milestone (as set out in Schedule 2 of the funding agreement*	**Completed**
D 7.1 Provide a report to ARENA clearly outlining the Data recording 2019 -20 (last 5 months) crop including the: • Irrigation program Attachment A Attachment B	***Irrigation Program*** Evaluation of potential crop irrigation demand for the 2019-20 spring, summer and autumn periods is shown in Attachment A. Data illustrates potential monthly reference evapotranspiration (ET_0) determined from the onsite weather station. Calculated daily crop evapotranspiration (ET_C) is determined from potential crop size factors relative to the recorded ET_0. When daily crop data is referenced against rainfall an irrigation demand for the period January to May 2020 and the historical average demand, it is apparent that the irrigation requirement for the current reporting period was briefly reduced due some welcome rainfall in January and February. The impact of seasonal conditions experienced

	compared to average seasonal conditions shown in the extended rainfall review period from September 2017 to May 2020 which is illustrated in Attachment B. The irrigation trial area for the last 5 months of the 2019-20 period (January 2020 – May 2020) is based on 55 ha which is irrigated by the solar trial pumping system. Difficulties with salinity and crop die back noted in milestone 6 and conversion to production of peanuts on 20 ha of the irrigated area proceeded as planned and evidence of the peanut crop is illustrated in Attachment B. The irrigation application to the trial site during this current review period (January – May 2020) was 48 ML which was mainly applied to peanuts.
• Climate Data (rain, solar radiation, evapotranspiration E^{T}_{0}, temperature) Attachment C	***Climate data*** Rain, solar radiation, reference evapotranspiration (ET_0) and temperature data for the last five months of the crop year (January 2020 to May 2020) is provided in attachment C. This information contains the full daily data provided by the weather station at the trial site for each month of the review period. Weather conditions featured an easing of the drought conditions with heavy rainfall occurring during January and February; solar radiation was interrupted by cloudy weather and rainfall events which is also evident in the corresponding temperature and ET_0 data. The period of wet weather assisted crop growth, however the long dry over the period prior to December with hot windy conditions had taken toll on many crops and response to the rainfall was not as strong as might be normally expected.
• Irrigation/crop growth response data Attachment D	***Irrigation/crop growth response data*** The soil moisture graph showing the impact of low rainfall prior to December 2019 and a welcome wet period in January and February

	2020 is illustrated in Attachment D. This monitoring indicates that at the monitored field, the crop had not developed sufficiently by December to provide clear water extraction trends. The loss of moisture over time shown is linked to diurnal influences and small amounts of utilisation which is sustaining the plant in a semi stressed state. While irrigation events prior to December maintained a slow growth rate there was insufficient crop canopy to conduct crop response monitoring prior the late January 2020. With onset of a wet season in late January the crop growth progressed to a harvestable stalk height of 1.6m. The rate of crop growth is also illustrated in Attachment D.
• Energy availability verses consumption data (solar verses grid) and water applied (ML/ha) Attachment E D 7.2 Provide a report on crop production	Solar energy data from the onsite weather station indicates that during the last five months of the 2019-20 period (January to May 2019 - 110 days) there were 1563 hours of sunshine including 653 hours with sufficient radiation to maintain the threshold (400 w/m^2) required to provide full power to the pumping system. Forty-two (42%) percent of the available hours within the threshold were utilised. This outcome is lower than previous reports and is due to the impact of wet weather and the lack of need for irrigation. Pump day time hours were 328 which is 67% of the total pump operational hours (486) utilised within the period. Utilisation data for solar energy and water supply is shown in Attachment E. A chart illustrating the relationship between the daily solar intensity and the pump operational threshold is also included. <u>Crop production</u> A progressive estimate of crop yield (potential 45 tc/ha at the 10th May 2020) indicates the

	seriousness of the pre December drought. Summer rainfall post December has provided some relief which enabled production of an estimated 1575 tonne sugarcane crop for the 2020 harvest. The irrigation program was mainly directed to the peanut crop product post December which is estimated to yield 100 tonne with a potential gross return of $130,000.
D7.3: Provide evidence – energy efficiency relationship between monitored irrigation crop data and energy consumption solar/grid Attachment F	<u>Evidence of energy efficiency</u> Details of crop production and irrigation utilisation are outlined in Attachment F. Over the course of the project unprecedented drought conditions have brought on the issues of soil salinity which have impacted heavily on crop production however the ratio of cost to yield has for most of the period shown a significant reduction compared to the original pumping system. The previous all grid demand pumping system average hourly use was 39 kW/h and for the new solar/grid pumping system the average hourly grid demand for the first 2 years of this trial (January 2018 to December 2019) was 8.3 kW/h. In the latter months of the trial during the January – February 2020 wet weather period, storm activities caused a fault to occur in two strings of the solar array reducing capacity by 20%. Delays in acquiring replacement parts ensured that the system operated in this 80% mode from January to May and the data shown in Appendix F illustrates that the grid demand increased from 8.3 to14.66 kW/h.
D 7.4 Provide desktop analysis (transferability of data to other applications Attachment G	Desktop Analysis is provided in Attachment G
D 7.5 Provide a report outlining the financial	Activity Steering Committee members Maurie

business case of the project in a format suitable for both internal and external use Attachment H	Haines and Georgina Davis prepared a peer reviewed paper for the Australian Society of Sugar Cane Technologists whic was to be presented at the conference in Bundaberg. Due to Covid 19 restrictions the conference was cancelled however the paper has been accepted and there will be opportunity to present at the rescheduled conference when this is announced.

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?
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)**
D7.1 Update the Milestone 6 (D6.1 report) clearly outlining the Data recording 2019-20 (Last 5 months) crop including the: • irrigation program • climate data (rain, solar radiation, ET) • irrigation/crop growth response data energy availability versus consumption data (solar versus grid) and water applied (ML/ha)	Achieved
D7.2 Provide a report on crop production – estimated 2020 crop yield (tonnes cane/ha)	Achieved

D7.3 Provide evidence – energy efficiency relationship between monitored irrigation crop data and energy consumption solar/grid	Achieved
D7.4 Provide desktop analysis (transferability of data to other applications	Achieved
D 7.5 Provide a report outlining the financial business case of the project in a format suitable for both internal and external use	Achieved
D 7.6 Provide a Milestone Report and associated items in accordance with item 1 of Schedule 3 and Schedule 5 (Knowledge sharing)	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.

During this Milestone period the dedicated project Facebook, Twitter and website social media sites were used to promote the projects achievements in reducing dependence on grid supplied electricity for sugarcane production. Data on these social media systems is presented in Attachment I.

Established lines of communication utilised by Bundaberg CANEGROWERS and Bundaberg Sugar Services provided information to the Bundaberg irrigation community via our extension staff and industry infrastructure.

Project Manager Mr Dale Holliss was invited to describe the project in a session titled from *"Stuck to Solution"* at the Energy Consumers Australia Foresighting forum held in Sydney in February 2020.
Click this link for Dale Holliss' input:

https://youtu.be/n9UPDVIM1ik?start=755&end=1170

Links to a selection of the media from that event is also contained in Attachment I

Q&A - Forethought – SMEs

Due to Covid 19 social distancing requirements the planned presentation by activity steering committee members Maurie Haines and Georgina Davis for the Australian Society of Sugar Cane Technologists scheduled for 22 April 2020 was cancelled. (The Paper is in attachment H.

Similarly the planned attendance and promotion of the project at the AGROTREND Field days for 8th and 9th of May did not go ahead.

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 date to the completion of Milestone 7. i All cash income for 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 1B for details of in kind contributions for Milestone 7.

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
Attachment A – Milestone D 7.1 – Crop water use Attachment B – Milestone D 7.1 – Rainfall History Attachment C – Milestone D 7.1 – Climate Data Attachment D – Milestone D 7.1 – Irrigation/rain and crop response data Attachment E – Milestone D 7.1 - Energy Availability vs Consumption data Attachment F – Milestone D 7.3 - Crop and Energy efficiency relationships Attachment G – Milestone D 7.4 – Desktop Analysis re Transferability of data Attachment H – Milestone D 7.5 – Report outlining financial Business case Attachment I – Milestone D 7.6 – 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 15/05/2020
- 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  Date 15/05/2020