AMRCCE RENEWABLE ENERGY PROJECT

DAIRY FARMERS CONSULTATION REPORT

September 2018

Table of Contents

EXECUTIVE SUMMARY

The Dairy Farmers consultation aimed to identify and document current practices in waste management; infrastructure and concerns; and gauge farmers´ interest in supplying their dairy waste to an aggregated biogas waste facility proposed by Augusta Margaret River Clean Community Energy.

Broad participation ensured results are representative and reliable. Sixty eight percent (68%) of the target farms representing 83% of the milking herd participated in the consultation.

Scott River catchment participation, where the larger farms and greater run-off concerns exist, was excellent with 8 of 9 farms and 92% of the catchment herd participating in the study. Of the total herd captured by the study 70% was in the Scott River and 30% in the Blackwood River.

Current waste management practices were acknowledged as deficient but the cost of upgrading was seen as prohibitive. There was concern across the board that regulatory intervention could impose costs and threaten their viability.

Farmers had a clear preference for a solution that removed the effluent from their property rather than continuing current practices of on farm waste management. However, any removal process would need to be low cost, practical on a day to day basis with a sound prospect of continuity to secure their participation.

INTRODUCTION

This Consultation was conducted to establish some key elements of the viability of an aggregated biogas facility using dairy waste from dairy farms within the Blackwood (BW) and Scott River (SR) catchments. It is one aspect of a feasibility study for the biogas component of the grid connected renewable facility in the Scott River region (near the Beenup Substation) being spearheaded by Augusta Margaret River Clean Community Energy (AMRCCE).

The consultation aimed to identify and document current practices, infrastructure, concerns of dairy waste management and gauge farmers´ interest in supplying their dairy waste to the proposed aggregated biogas facility. The study was conducted with funding from the Department of Water and Environmental Regulation (DEWR).

Farmers and decision makers of 19 farms (BW 10/SR 9) with an estimated combined milking herd of 12,100 (BW 4,420/SR 7,680) in the two catchments were invited to participate in the consultation and 13 (68%) of the farms with a combined milking herd of 10,050 (83%) participated. The participation by the Scott River catchment farms was greater (8 of 9 farms and 92% of the catchment herd) than the Blackwood River catchment farms (5 of 10 farms and 67% of the catchment herd). Seventy percent (7,080) of the herd for the participating farms was located in the Scott River catchment with the remaining 30% (2,970) in the Blackwood River Catchment.

Six farms (32%) representing 2,050 (17%) of the estimated total milking herd did not participate. The reasons for not participating were exiting or winding down operations (2), owners on holidays (2), owners unavailable for personal reasons (1) and no response to various requests (1).

The consultation was carried out by means of a structured interview by professional consultants with expertise in agriculture together with a representative of AMRCCE. In the majority of cases the interview was carried out at the dairy farm itself and there was an opportunity to view the facilities. In the case of farms under management, both the fund manager(s) and farmers in charge were interviewed to obtain the necessary information. In cases where a farmer owned more than one farm, only those matters that differed between the farms under their management were sought after the first interview. In one case, part of the interview was carried out by phone and in another the owner was unavailable for interview but returned a completed survey.

A flyer describing the AMRCCE project and explaining this study was prepared and used as an introduction when seeking the interview with farmers. The flyer explained the purpose of the consultation, the context, and other steps involved in the feasibility study, such as the need to determine the energy content of the cow waste of the participating farms. It also provided contact details should they have had any questions. **(Attachment 1)**

The consultation used a uniform survey instrument developed with input from a range of stakeholders. The survey instrument consisted of 62 questions in a total of 12 sections covering the following topics **(Attachment 2):**

1. herd size and practices
2. waste quantities
3. land use
4. fertilizer use
5. runoff
6. supplementary feed digester feedstocks
7. energy use and costs
8. capital investment
9. incentives
10. managing effluent
11. level of interest

During the interview, each topic was introduced with an explanation as to the purpose for seeking the particular information so as to put the farmers at ease and give some context to questions that may otherwise appear to seek information that may be seen as commercially sensitive.

FINDINGS - OVERVIEW

Tables 1(a; b &c): Overview

1 (a) Participation in study of farms by catchment						
	Blackwood River		Scott River		Totals	
Participated	5	50%	8	89%	13	70%
Did not Participate	5	50%	1	11%	6	30%
Totals	10		9		19	

1 (b) Participation in study of herd size by catchment						
	Blackwood River		Scott River		Totals	
Participated	2,970	70%	7,080	90%	10,050	83%
Did not Participate	1,250	30%	800	10%	2,050	17%
Totals	4,220		7,880		12,100	

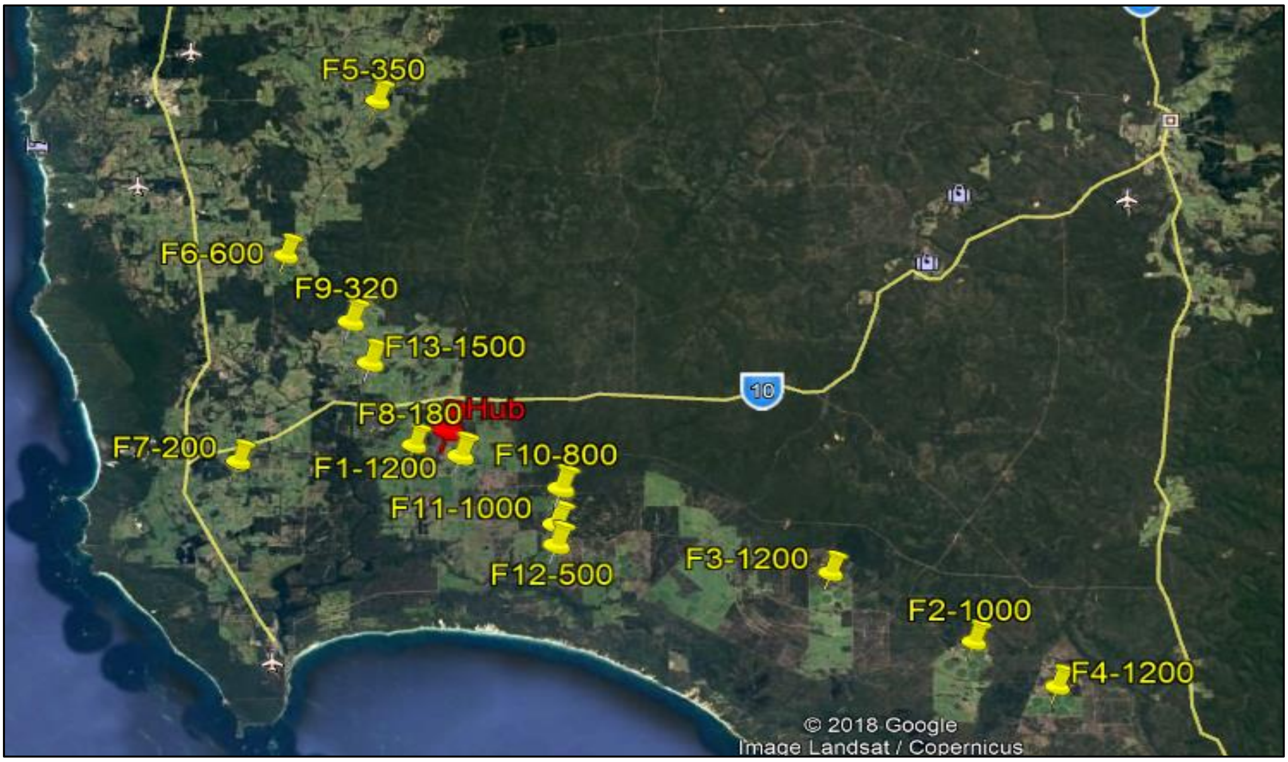
1 (c) Overview of Findings					
# cows milked daily	Average Time Spent in dairy	Average % of day in dairy	Annual Volume of waste water	0-120 days of Waste storage capacity in ponds	interest in supplying waste
10,050	4.6 hours	19%	315,000m3	9 farms	9 farms

As indicated above Table 1 (a), 13 dairy farms in the Blackwood and Scott Rivers were consulted for this study. Table 1 (c) above summarizes the main findings. A map indicating the locations of the farms is included in Figure 1 below. What the map depicts is that farms cluster into 2 distinct areas based on proximity to the Beenup Substation. In terms of distance from the proposed aggregated biogas plant, they range from some that are very close up to a farm more than 50 kms by road from the site.

Table 2: Distances by Road from the Beenup Substation

kms by Road	0-7	16-20	20-30	34-60
No of Farms	3	4	2	4
Proportion of Herd	19%	36%	8%	37%

Figure 1 – General Distribution of the Main Dairy Farms in Scott and Blackwood Region in Relation to the Proposed Energy Hub at the Beenup Substation



1 PARTICIPATING HERD SIZES

The total size of the milking dairy herd in the catchments participating in the study was 10,050, 7,080 (70%) in the Scott River catchment with the remaining 30% (2,970) in the Blackwood River Catchment.

Most farms carried between 500 and 1,200 cows all of which were milked twice daily. The size of the herd is shown in the breakdown below.

Table 3 – Participating Herd Sizes

Size of herd	Up to 400	400-800	800-1,000	1,000-1,500	Total
Number of cows	1,050	1,900	2,000	5,100	10,050
Number of farms	4	3	2	4	13
Proportion of the total herd	10.4%	18.9%	19.9%	50.8%	100%

2 WASTE QUANTITIES

The volume of waste available is determined by:

- the time the herd spends in the dairy, and;
- the amount of water used in the washdown process.

The estimated time a cow spent in the dairy varied between farms, ranging from 2.5 hours to 7 hours, with an overall weighted average time per animal per day of 4.6 hrs.

The total annual volume of waste water varied between farms, ranging from 3 000 m3 to 73 000 m3 and the aggregate volume was over 315 000 m3/yr. (There was no response to this question from one of the largest farmers in the area so an assumption was made based on similar sized farms.) The breakdown of time spent in the dairy and washdown volume is shown below in Table 4.

Table 4: Average hours spent in the dairy with washdown volume

Average hours per day in Dairy	3	4 – 4.5	5	7	Total
Number of cows	1,800	3,070	4,380	800	10,050
Number of Farms	2	5	2	1	13
Washdown volume per year (m3)	47,500	65,441	198,840	3,285	315,066

Infrastructure for dairy waste – the purpose of this question was intended to gain an understanding of how waste is currently handled.

Table 5 below offers a breakdown of the approximate storage volumes in terms of "days containment" available on each farm with the total number of cows in each category. The categories were selected to indicate which farms would not have sufficient storage in winter (< 60 days and 60-120 days), and those who were marginal (120-365 days) and those with more than a year's storage.

Table 5 Existing Effluent Containment Volumes

Days Storage in Effluent Ponds	0-60 days	60-120 days	120-365 days	>365 days	Total
No of dairies per category	7	2	2	2	13
No of Cows	6,000	2,400	530	1,120	10,050

Very few farmers had anything other than a standard 'weeping wall' and 2 or 3 pond settling system. None of the observed 'weeping walls' appeared to be operating properly as all were blocked by effluent. It is worth noting that the study was conducted from the middle to the end of winter.

There were few instances where efficient use was made of the effluent by pumping it onto pasture via irrigation sprinklers or centre pivots.

All the farmers said that there were no real problems with the waste in summer, but problems arose in winter as irrigation was not required and the additional volume from rainwater often caused an overflow.

A few of the farmers managed their sludge ponds by clearing them once every one or two years, but others extended this interval to four years and some of the smaller farms were unsure of when they had last cleaned them. Of those that did clean them out there was no detailed knowledge of its chemistry or overall value.

Farmers did not report having many problems as such in dealing with the dairy waste. Of the challenges they mentioned, the most common seems to have been the issue of the added volume of water from rain in winter. The other issue mentioned related to the challenges of the spreading the waste from the ponds.

3 LAND USE

Table 6: Land Use and Irrigation by Dairy Size (Small, Medium, Large)

Dairy Size (no of Cows)	0-499	500-999	>1000	Totals/Average
No of Farms	4	2	7	**13**
No of cattle	1,050	1,400	7,600	**10,050**
Cattle per ha	1.45	1.75	1.28	**1.40**
Area under irrigation	0	320	1,512	**1,832**

Total land area occupied by the herd - (ha) – This varied from 1.28 cows/ha to 1.75 cows per ha, with an average of 1.40. All of the larger farmers had irrigation to varying extents and none of the smaller farmers did.

Land area for irrigation - (ha) – A total of 9 farms irrigated their pastures, generally applying to an area of between 200 and 300 ha (average 262 ha) most often by centre pivot but also with sprinklers. Only 5 farms had facilities to pump their effluent onto the land. Of the 4 farms that did not irrigate, all grew winter hay or similar feed crops and ensiled what they could for use in the summer.

Vol of water for irrigation (Gl) - For those farmers who did irrigate, the average water license was around 1.6 Gl per year. It was generally sourced from bores. Water was regarded as a precious asset and most farmers said that they would take more if they could acquire a license.

4 FERTILIZER USE

Table 7: Use of Dairy Waste by Irrigation

Dairy Waste Use	Farm 1	Farm 2	Farm 3/4/5
Dairy Size (no of Cows)	1,200	600	3000
Area applied (ha)	20	10	40
Irrigable Area (ha)	210	100	560
Percent of Irrigable Area Using Dairy Waste	10%	10%	7%

Area of land currently fertilized with dairy waste (ha). Of the 5 farms that irrigated with their dairy waste the area of land was not great – of the order of 7%-10% of irrigable area. They did so in order to get rid of it knowing that it was generally beneficial but without specific knowledge of its value. However, this practice was known to be problematic because of system blockages which led to irregular distribution. At least one farmer noted that salt was an issue arising from use of the effluent.

Cost of using dairy waste as a fertilizer. The cost of spreading the solid (sludge) waste was generally considered as high enough as to negate much of its value and reliable information on its value was not available. Only those that used the liquid waste via the irrigation systems believed that it was worthwhile.

Consideration of the use of digestate as a fertilizer. Virtually all the farmers said that they would be interested, in principle, in using digestate as a fertilizer but it would depend on its effectiveness and the economics of its application.

5 RUN OFF

Table 7: Awareness of Run Off Issues

Knowledge or Run Off Problem	Well Aware	Aware	Unaware
No of Farmers	6	4	1

Awareness of amount of nutrient run off.
For the most part, farmers were aware and concerned about nutrient run off. They described three potential causes of runoff – leaching from ponds, pond overflow and from fertigation of pastures. Specific knowledge of run-off from leaching and fertigation was lower than that of overflow. Almost all Scott River farmers described periodic overflow of the ponds due to high winter rainfall at a time when no reticulation was required so pond levels were not being drawn down and overflowed.

Farmers knew that lined ponds were used in other countries to control run-off from leaching, but understood the cost was significant and unlikely to be an economic solution.

6 SUPPLEMENTARY FEED

Supplementary feedstocks (t) – All farmers used grain supplements in the dairy during milking time as well as supplementary hay and some silage depending on the yields achieved from their own land. Two farmers had other land that they were using for dry land fodder generation despite owning water rights. A number of the farms advised of regular loss of significant proportion of their crops to kangaroos and emus.

Table 8: Interest in Supplementary Energy Crops

Interest in Growing Energy Crops	Interested - has Land and Water	Interested if Water Available	Insufficient Land
Number of Farms	6	2	5

Interest in growing an energy crop. As it is estimated that additional substrates would be required for biogas generation using dairy waste, farmers were asked about their interest in growing a crop(s) for this purpose. There was general interest in growing a supplementary energy crop but only if the needs of the dairy herd were served first. Availability of water and land were potential problems as well as potential loss of crops due to the predations of kangaroos and emus in certain localities.

7 ENERGY USE AND COSTS

Table 9: Energy Expenditure by Farm Size

Electricity Expenditure	<$100 000 pa	$100 000-$200 000 pa	>$200 000 pa	Total
No of Farms	5	4	4	**13**
No of Cows	1,650	3,800	4,600	**10,050**

Electricity Cost and Consumption. Power costs were not divulged in detail. A number of farmers reported being quite successful in managing their consumption to off-peak times thus reducing their cost to closer to 12c/kWh. Those that were not able to do so incurred an average cost of closer to 21c/kWh. The latter were open to any proposals that would help reduce costs with minimal effort.

Standby generator set availability and usage. There were 11 of the 13 farmers who operated standby generators which ranged from 375 kVA down to 50 kVA. The reliability of the Western Power supply was considered reasonably good in the region with most famers using their generators less than 5 times per year for less than 10 hours. Only two were used for more than 100 hours or suffered more than 5 outages per year.

8 CAPITAL INVESTMENT

Use of concrete pads for feeding. Only two farmers said they were considering installing concrete feed pads and one was already using one. Another two of the smaller dairies were considering expanding their dairies, but no specific details were offered.

9 INCENTIVE SCHEME

There was a general awareness of the effluent management incentive scheme, particularly among the larger dairies in the Scott River catchment. A number were considering the opportunity, but to-date none had taken up the incentive. The basic reasons for the lack of take-up were a perception of complexity and cost, with comments including "too complex", "too inflexible" and benefits "too small" relative to the high capital cost imposed on the farmer.

10 MANAGING EFFLUENT

Table 10: Preference by location, farms and herd proportion

Preferred Options	On – Farm	On – Farm, but consider removal	Removed from Farm
Number of Farms	1	2	10
Proportion of herd	6%	10%	84%

Preference for a third party to remove the effluent.
Three of the farmers stated that they believed effluent was valuable and preferred to manage it on farm. Two of the three would consider removal if paid for it. The other 10 farms, representing

84% of the herd preferred removal so as to eliminate the problem entirely, subject to reliability and cost.

Potential for future Government Regulation.
Current and potential future regulation was identified as an influence on the preferred means of managing the effluent.

The level of regulation in WA was recognized as being less than many other parts of the world and many referenced New Zealand as an example of greater regulation. While greater regulation was seen as inevitable, there was significant concern this could impose costs that would threaten the viability of individual dairies as well as the overall industry.

11 LEVEL OF INTEREST

Table 10: **Level of Interest in supplying dairy waste to the proposed aggregated biogas facility.**

Level of Interest	High	Medium	Low
No of Farms	10	2	1
Proportion of the total herd	84%	10%	6%

Almost all the farmers and decision makers were interested in the concept and would offer their support to the extent that they were able. The only reservations were expressed by farmers concerned by the practical viability of the concept in the region, and as one commented, it would be "Good if practical on a day to day basis".

CONCLUSION AND COMMENTS

A key objective of the study was to establish the level of farmers' interest in releasing their dairy waste as it was considered a pre-requisite to undertaking further evaluation of an aggregated biodigester capable of disposing of the effluent problem on a sustainable basis, while contributing to the AMRCCE's goal of establishing a fully dispatchable component to its power hub.

The level of interest among the farmers is high, subject to the solution being practical, low cost and reliable, and this finding supports moving to the next stages of using the information gained from the survey to evaluate the viability of the proposal.

Valuable other information was also collected by the survey that will assist evaluation of the proposed bio digester as summarized above.

As indicated, there was good participation of farms in the two catchment areas in the study and particularly among those in the Scott River where the larger farms and greater run-off concerns exist.

In general, farmers' clear preference was to avoid harm to the environment and an acknowledgment that nutrient runoff was likely to be reduced through improvements to current practices and infrastructure upgrades. However, the associated costs of addressing this on a farm by farm basis were perceived as high, with a low or negative return on scarce capital. There was a general awareness of the REI effluent management incentive scheme, but a barrier to take up appeared to be the perception that it was too small relative to the high capital cost imposed on the farmer, as well as needing greater flexibility in design.

All farmers considered the likelihood of additional regulation as being inevitable and were concerned about the potential impact on viability, which may have been an influencing factor in the support levels for the potential removal of the effluent from the farms.

The annual volume of waste water is significant at an estimated 315,000m3 and sampling analysis from representative farms will be required to establish the potential energy content. However, it is expected some form of separation of solids and liquids will be necessary so as to reduce transport, capital and operational costs.

A key matter will be finding consistently available streams of bio digester feedstocks (substrates) to combine with the dairy waste to increase its energy production.

The survey data collected, together with analysis of waste samples from representative farms will now allow a reliable estimate of the potential energy volume available from the effluent alone. The sampling analysis will allow optimization studies to assess the additional energy that can be achieved through supplementing the effluent feedstock with other fuel stocks.

A nominal energy output of 2 MW has been chosen as an appropriate size for the biogas power contribution to the AMRCCE hub, but It will now be possible to assess other options, including individual on farm digesters and smaller scale aggregations.

After the effluent analysis and optimization studies are completed, the major challenges will be determining the economics of:

1. Separating the energy component from the high volume of waste water;
2. Rendering the residual waste water to an environmentally friendly state that no longer poses a threat to the waterways;
3. Whether the processes required to achieve 1. and 2. should take place:
    a. at the individual farms before transport;

   b. at the aggregation site after transport;
   c. at the farm, but only the separated energy component is transported to the aggregated site and the residual waste water is treated on farm.
4. Transport to the site.

All of the above will determine the size and type of Anaerobic Digester, which will inform the capital and ongoing operational costs required for a reliable cost benefit analysis.
Next steps should include:

- Sampling analysis of effluent from representative farms to estimate total energy potential and volume of digestate;
- Identifying feedstocks suitable for co-digestion that would optimize the total energy potential and the volume of digestate;
- Determining availability of the identified feedstocks, particularly other local waste streams;
- Determining costs and logistics of acquiring and transporting the component feedstocks;
- Identifying economic options for separating the energy component (solid fraction) from the high volume of waste water;
- Identifying economic options for lowering the organic and nutrients levels (particularly P) in the effluent in the waste water after separation of the energy component (solid fraction).

ILLUSTRATIONS

Standard Dairy Entry and Exit Race

Typical Effluent Pond and Pump

Similar Typical Effluent Pond and Pump

Effluent Pond with Choked Weeping Wall

Overgrown Effluent Ponds

ACKNOWLEDGEMENTS

Augusta Margaret River Clean Community Energy, in association with AgGrow Energy Resources Pty Ltd, wish to acknowledge the following entities and individuals who participated and assisted with this Survey:

1. Brad Boley
2. Marty Campbell
3. Tim Crimp
4. Jaco Diedricks (Lactanz 4)
5. Barbara Dunnet
6. Marcus Elgin – CEO, Australian Agribusiness Group /Lactanz Group
7. Brian Elson
8. Nick McNamara (Asset Manager, Australian Agribusiness Group/Lactanz Group)
9. Ian Noakes
10. David Payne
11. Hayden Russell (Lactanz 2)
12. Chris Smith (Lactanz 4)
13. Danie van Wyk (Lactanz 1)
14. Ross Woodhouse
15. Joanna Wren – Lower Blackwood Land Conservation District Committee